

Open Source Voting

State of the Art Briefing

City and County of San Francisco  
Open Source Voting System (OSVS)  
Project

# Introduction

## Purpose and Organization of this Document

This document provide state-of-the-art research on the current state of open source voting.

## How to Navigate this Document

**History and Industry Trends:** Public election voting transparency and oversight demands have escalated over the years. Various public and private organizations have tried different solutions to solve the problem.

**Objectives and Methods of Research:** Overview of the attributes of a successful open source and non-commercial project.

**Detailed Comparison and Qualitative Analysis:** Detailed analysis of 8 non-commercial voting system projects

## History and Industry Trends

- 2003 The Condorcet Internet Voting System is published by the Cornell Computer Science Department
- 2005 The concept of more transparent, secure voting starts being discussed in public news articles and academic white papers
- Travis County Clerk publicly researches options to improve the efficiency and security of voting systems.
- 2007 City and County of San Francisco Department of Elections signs a contract for an election voting system with Sequoia Voting Systems
- 2008 City and County of San Francisco creates the Voting Systems Task Force (VSTF) to provide the City with recommendations on voting systems and related matters
- 2009 Multiple public discussions and projects start to research transparent, secure voting
- Code for America is founded to minimize the gap between public and private organizations use of technology and design
- Voting Systems Assessment Project (VSAP) project is formed by the Los Angeles County Registrar-Recorder/County Clerk (RR/CC) to gather baseline data to shape the strategy for voting system modernization.
- 2010 Dominion Voting Systems acquires Sequoia Voting Systems and assumes City and County of San Francisco's contract
- 2011 City and County of San Francisco VSTF issues its final report on "Recommendations on Voting Systems for the City and County of San Francisco"
- Code for America Civic Commons and Open Plans launch USAspending.gov which is considered a major milestone for government transparency and open data efforts to date
- 2013 Travis County partners publish at the Usenix Electronic Voting Technology Workshop, "STAR-Vote: A Secure, Transparent, Auditable, and Reliable Voting System." Many elections departments across the US take notice and start researching STAR-vote.

- 2014 Open Source Election Technology Institute (OSET) publishes a voter-facing technology framework. The framework represents a voting system architecture. OSET claims 12 states are collaborating on The Trust the Vote, VoteStream project part of the architecture. Their open source software is made available through the OSET Public License

Some older voting machines using a simple smart card as the voting identification device were easily defeated and exploited. This flaw was well publicized, and these voting systems were taken out of service. This led to additional public and private calls for more election process transparency.

18F is started as a federal government project to improve and modernize federal government technology with a focus on using open source to promote transparency and collaboration between federal agencies. This is considered innovative as 18F is acting more like a technical consultancy within the federal government.

San Francisco Board of Supervisors passes Resolution No. 460-14, "Supporting the Creation of Open Source Voting Systems - Studying New Models of Voting System Development" and requesting the San Francisco Local Agency Formation Commission (LAFCo) conduct a feasibility study.

- 2015 City and County of San Francisco Local Agency Formation Commission (LAFCo) publishes its final report, "Study on Open Source Voting Systems"

City and County of San Francisco Elections Commission passes an "Open Source Voting Systems Resolution"

- 2016 Travis County Clerk puts the STAR-Vote project out to bid with an RFP. There is considerable focus on open source voting machine software, commercial off the shelf hardware, third party auditable security, and end-to-end election process transparency.

18F becomes part of the Technology Transformation Services (TTS) General Services Administration (GSA)

VSAP becomes a viable project with their Phase III contract with IDEO to create the voting system product design

2017 City and County of San Francisco Elections Commission creates the Open Source Voting System Technical Advisory Committee (OSVTAC) to “provide technical guidance, ideas, and support to the Elections Commission (‘Commission’) on ways to improve and help ensure the success of the City and County of San Francisco’s open source voting system project.”

City and County of San Francisco Department of Elections issues an RFP (REG RFP #2017-01) to “prepare a business case for developing an accessible, open source voting system.”<sup>1</sup>

IDEO publishes the VSAP product design with a finalized prototype of the Ballot Marking Device

Travis County Clerk ends the STAR-Vote project due to lack of viable open source based commercial RFP bids

2018 VSAP Tally central vote tabulator is certified by the California Secretary of State for use in elections

It is publicly published that the Dominion ImageCast Evolution voting machine has a physical design flaw that could allow a ballot to be over-printed. However, for this flaw to be utilized, it would require the voting machine to be exploited and the voter to under-vote or the ballot would spoil. The device continues to be certified for use in the State of California.

Slalom publishes the City and County of San Francisco Department of Elections commissioned Open Source Voting Business Case

Los Angeles RR/CC signs a contract for VSAP Phase IV-V with Smartmatic USA Corporation for manufacturing hardware, software, and custom-designed ballot marking devices for the VSAP project to be available for the 2020 election cycle.

Travis County Clerk approves an election voting systems contract with Election Systems & Software (ES&S) abandoning their previous STAR-Vote project which featured open source and third-party auditable security requirements.

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<sup>1</sup> “Request for Proposals for Preparing a Business Case for Developing an Accessible, Open Source Voting System,” City and County of San Francisco, 22 May 2017, [https://osvtac.github.io/project/files/DOE/REG\\_RFP\\_2017-01\\_Business\\_Case.pdf](https://osvtac.github.io/project/files/DOE/REG_RFP_2017-01_Business_Case.pdf)

## Methods, Analysis Used to Identify Open Source, Non-Commercial Voting System Projects

GitHub provides a wealth of information regarding the public project activity and status. From the GitHub statistics, the most important statistic is the number of pull requests. Each pull request represents a contributor requesting to merge a change to the code base. A pull request requires a documented conversation of what the change represents, why it should be merged, and the project leader's interest in the change.

In general, the attributes that determine the viability of a public project are:

- Software code contributions to a public code repository
- Multiple Individual and commercial contributors
- Public project strategy
- Public discussions on code changes
- Public milestones along with project revisions
- Public software pipeline
- Public technical leadership
- Public community, where questions can be asked and discussions on topics can happen

The projects that have been analyzed below are non-commercial. Non-commercial means that the organization funding the voting system development will not have a product to sell to customers. Rather the voting system development purpose is to improve the election process through one or many components. Most of this type of technology development would be publicly licensed with an open source license. For non-commercial, non-open source projects, there generally is no public statistics on development.

It can be difficult to measure statistics on all of these tools and attributes. Statistics for what can be measured are found below.

## Non-Commercial Voting Systems Quantitative Comparison

Using the methods from above, each of the projects below was analyzed using a combination of the number of healthy public project components, commits, pull requests, contributors, published strategy, published plans, and published milestones. While the first ranked project can be considered the best option, the choices from second on become less clear. For example, the Condorcet Internet Voting System (CIVS) can be considered a better choice than the STAR-Vote project. However, CIVS is a simple, online voting system that cannot support a US county election like the STAR-Vote project was intended to. CIVS is ranked higher as the project continues to be a healthy, ongoing effort, while the STAR-Vote project was cancelled in 2017.

Status	Name	Location	Date	Complete	License	Technology
Healthy	Los Angeles Registrar Reporter County Clerk Voting System for All People Project	Los Angeles, CA, US	2019	60-70%	N/A	Contracted hardware and Go, Android, Angular, CSS, HTML5 software, Cassandra, Kafka
Healthy	Galois Free & Fair ColoradoRLA	Portland, OR, US	2018	30%	AGPLv3, GPLv3	Java, Haskell, C
Healthy	Democracy Earth Sovereign	San Francisco, CA, US	2018	30-50%	MIT	Blockchain compatible online voting
Healthy	Cornell Computer Science Department Condorcet Internet Voting System	New York, NY, US	2018	100%	Free, retaining copyright	Perl, python, JavaScript based online voting system
Healthy	Open Source Election Technology Trust the Vote Online Voter Registration	Palo Alto, CA, US	2018	N/A	OSET v 1.2	Ruby, Java, PHP
Healthy	Voting Works Helios Server	Redwood City, CA, US	2018	N/A	Apache v2	Python, JavaScript
Cancelled	Travis County STAR-vote	Austin, TX, US	2017	0%	GPL	N/A
Stale	FollowMyVote	Virginia, US	2014	0%	MIT, Unlicense	N/A

1. Los Angeles RR/CC VSAP. The Voting Systems Assessment (VSAP) Project started September 16, 2009, and since renamed Voting System for All People (VSAP) Project. The vision of the project is to use a transparent process to develop and implement voting solutions that focus on the needs and expectations of current and future County voters. This human-centered approach is guided by the VSAP General Voting System Principles. The Los Angeles RR/CC VSAP 8-year planning



period allowed the team to fully vet multiple avenues of product design and community interest before embarking on designing the voting system. There were claims that the project was to be “open source.”<sup>2</sup> They have since corrected the statement to be using open source tools while the software code will be proprietary. The software may be shared with other municipalities at a future date. VSAP election operations may not be publicly auditable and independently verifiable. The lack of independently verifiable elections will not break their stated voting principles, but it will cause some public concern. While VSAP has no public code repository, it has published strategy and architecture, plans, and milestones. There also have been commercial and academic contributors to the strategy and architecture. Even without publicly licensed software, this project has the best transparency, contributions, and momentum of the options available.

2. Galois, Free & Fair project. This is a professional team that has worked on open source elections implementations, sponsored by Galois, a computer science company. Strategy, funding, and contributors from a commercial software development organization is an important milestone for an open source project. They have 35 public GitHub repositories. This organization has one healthy repository, ColoradoRLA with 3164 commits, 424 pull requests, 23 branch, and 7 contributors. They have a published strategy, published plans, and published milestones. They have multiple commercial contributors to their project. They have transparency, contributions, and momentum, but lack clear product they are working towards.
3. Democracy Earth Foundation. The organization claims future compatible with Ethereum blockchain for online voting. This appears to be a viable organization, but the commercial support is not strong. The Foundation behind the organization is searching for funding. They have 21 GitHub repositories. This project has one healthy code repository Sovereign, with 2516 commits, 92 pull requests, 31 branches, and 24 contributors. They have a published strategy, published plans, and published milestones. There are multiple commercial contributors. They have transparency, contributions, and momentum, but lack a clear product roadmap and consistency of direction.
4. Condorcet Internet Voting System (CIVS), 15-year-old voting system project that has hosted over 15,000 polls and 400,000 votes. This is the system that OpenStack and many other organizations use year over year to run ranked choice polls. CIVS is simple, stable project and implemented product with a long successful track record. They have 864 commits, 7 pull requests, 1 branch, and 7 contributors. The Cornell Computer Science Department has a published project strategy, plans, and milestones. They have a few commercial contributors over the past 10 years. This project has transparency, few contributions, and steady momentum. CIVS is a simple online public voting system using sophisticated algorithms.
5. Open Source Election Technology (OSET), Trust the Vote project. OSET started their project with a voting system architecture that with collaboration could be the basis of an open source voting system. OSET has built a few prototypes from the architecture. It is likely OSET has held back publishing some of the architecture designs while searching for funding. They have 39 GitHub repositories. This project has one healthy repository, Online voter registration that has 3093

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<sup>2</sup> “Los Angeles County's new 'open source' vote tallying system isn't open source just yet,” State Scoop Benjamin Freed, 23 August 2018, <https://statescoop.com/los-angeles-countys-new-open-source-vote-tallying-system-isnt-open-source-just-yet/>

commits, 97 pull requests, 49 branches, and 8 contributors. The OSET organization has a published architecture and strategy. But is lacking a project strategy, plan, or milestones. There do not appear to be any commercial contributors. There is some transparency, some contributions, and no momentum to the work completed. This organization needs a commercial partner to implement their strategy.

6. Voting Works. Voting Works may not be a viable organization as there does not appear to be a viable product related to the open source work. This is holding back contributions and limits momentum. All of the publicly facing work is located in Ben Adida's GitHub organization with 44 GitHub repositories. This project has one healthy repository, Helios Server. There are 835 commits, 81 pull requests, 19 branches, and 16 contributors. There is some Voting Works published strategy. No project strategy, some planning, and no real milestones. There have been a few commercial contributors over the years. There exists some transparency, few contributions, and no momentum to this project.
7. STAR-Vote. Travis County attempted to find vendors to build an open source voting system STAR-Vote. In the end they did not find a vendor that was interested in the open source development and had to change their approach. Project was cancelled in 2017. The project had no public code repository. STAR-Vote had published a governance strategy and broad architecture. But there was no project strategy, plan, or milestones to back it up. There were commercial and academic contributors to the STAR-Vote published design documents. There was transparency, but no code contributions, and no momentum to this effort. It is not clear why the STAR-Vote project did not pool their contributors and develop the project as they had planned.
8. FollowMyVote. FollowMyVote completed a Blockchain proof of concept, which was demonstrated at several events. In 2014, the project joined the California Association of Voting Officials (CAVO). They have no healthy repositories. No strategy, plan, or milestones. No commercial contributors. This project appears to be a stalled effort.

# Los Angeles Registrar Reporter County Clerk's Voting Solutions for All People Project

## Overview

The Voting Systems Assessment Project (VSAP) started September 16, 2009, in response to the Los Angeles County's increasing unhappiness with the number of available commercial voting system options available. Their current voting system was considered effective but outdated with obsolete technology. VSAP started with public engagement and research, which allowed VSAP to establish a baseline for what the voting public and election poll workers preferences and requirements were. They considered this to be a human-centered approach, guided by the VSAP General Voting System Principles, which were adopted in 2011 "to ensure the needs of County voters remained a top priority throughout the life of the program." A commercial voting system solution was considered, but then dismissed, as the City of Los Angeles voting system RFP received 7 bids that did not meet the city's voting system requirements and principals. The VSAP project was rebranded as the Voting Solutions for All People (VSAP) in the Fall 2017.

## Governance

The project is run under the supervision of the Los Angeles Registrar Reporter County Clerk (RR/CC). Los Angeles RR/CC is retaining the Intellectual Property (IP) of VSAP. Los Angeles RR/CC has stated that they intend other jurisdictions to benefit from the VSAP voting system, although there are no specifics on how that benefit would be bestowed. Los Angeles RR/CC is considering various open source licensing options along with a possible independent non-profit organization to manage the VSAP IP.

## Organization

The VSAP project is run by the Executive Steering Committee (ESC) which consists of the Los Angeles RR/CC Department head, its Chief Deputy and Assistant RR/CC clerks. The Los Angeles RR/CC ESC manages strategy, budget, cross department dependencies, and partner relationships. It also represents the project before the Los Angeles County Board of Supervisors.

VSAP has a 13-member Technical Advisory Committee and a 17 Advisory Committee which provide a forum for advice and guidance, but without any decision-making authority. In addition, there have been 40+ community meetings since 2010 with over 3,700 people attending to communicate the VSAP design and then gather feedback. The VSAP project utilizes the commercial partners Smartmatic, IDEO, and Digital Foundry that provide services and technical leadership.

## Funding / Budget

Los Angeles RR/CC contract #18-003 with Smartmatic USA Corporation (Smartmatic) for manufacturing hardware, software, and custom-designed ballot marking devices (BMDs) for the VSAP project to be available for the 2020 election cycle. The VSAP project contract runs 12 Jun 2018 through 31 Mar 2027 with three, 2-year optional extensions through 31 Mar 2033 for a maximum of \$282M including extensions. The VSAP contract can be increased by the RR/CC with simple 2-week prior notice the Los Angeles County Board of Supervisors. At least 31K BMDs will be developed, manufactured, implemented, certified, warrantied, with maintenance and support.

## Technology

In 2018, Los Angeles RR/CC took their first step towards their new VSAP system by California state certification and implementation their centralized Tally vote tabulating software. Tally supports ballot

level auditing while capturing and storing ballot images along with the voter's signature. Tally supports VSAP Vote By Mail (VBM) in this first revision. It is not clear where will Tally will store the ballot audit trail. Adjudication process is not documented.

As the VSAP VBM ballot becomes available to voters, the VSAP Interactive Sample Ballot (ISB) also becomes available online. The ISB is accessible through a website from any computer or mobile device. When the voter makes their selections on the ISB, the voter can then print out their ISB vote choices and/or save their choices on their mobile device. "... The voter will be provided next steps to complete casting the vote, information on interacting with the BMD using the ISB at the polling place, and an area for the voter to write down the address of their desired vote center."<sup>3</sup> The saved ISB includes an QR code, which is an encoded computer readable pattern holding the voter's ISB vote choices and voting ballot style. This QR code is then scannable at any VSAP Voting Center. The BMD will then display the voter's ballot style and the voter's ballot selections. The voter can then make any changes before casting their ballot. Most voting system designs require a sample voter's ballot choices to be manually transferred to the voter's official ballot, making VSAP ISB an improvement over systems.

VSAP plans to utilize NoSQL, in-memory store, and object store to build out its platform middleware. It is likely that the middleware will be run out of a Los Angeles RR/CC data center on their privately-owned hardware. VSAP Tally is a similarly managed Docker implementation. The platform middleware is using open source software such as Cassandra and Kafka. It is likely that Los Angeles RR/CC or Smartmatic will contract with a third party to manage the open source software as part of an enterprise product. VSAP makes reference to wanting to securely transport ballot images over a network. If this is part of the design, the network and data transfer details are unknown.

VSAP supports accessibility voting features to vote using audio jack with headphones, arrow button selection panel, and the ISB QR code to pre-populate the voter's ballot. Voters have the flexibility to interact with the ISB using a preferred assistive device, such as a screen reader. Each VSAP BMD also includes a ballot printer. The VSAP BMD is designed to be an all in one voting solution for any possible voter and the best accessible voting machine available. No information is available on their auditing or adjudication features.

## Schedule

Phase I: Public Opinion Baseline Research (2009 – 2010)

VSAP gathered baseline data to shape the strategy for voting system modernization. Data gathered from election stakeholders and subject matter experts including voters, poll workers, advocates, key community organizations, and election staff through research and engagement activities. This included evaluating the current voting system and experience, and learning what

Phase II: Process Assessment (2011)

Phase III: System Design and Engineering (2012 – 2017)

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<sup>3</sup> "Study on Open Source Voting Systems, Final Report," San Francisco Local Agency Formation Commission, 23 October 2015, <http://www.cavo-us.org/PDFS/Final%20-%20Study%20on%20Open%20Source%20Voting%20Systems.pdf>

VSAP partnered with design-firm IDEO to develop an intuitive, user-centered voting system. This phase lasted 17 months and will culminate with a finalized prototype of the BMD. IDEO is working with VSAP primarily to create a BMD from industrial hardware components as opposed to commercial off the shelf components and has not yet begun the discussion around the software architecture. However, they suggest they are leaning towards a Linux operating system. (from LAFCo 2015)

#### Phase IV: Manufacturing and Certification (2016 – 2019)

- Design Validation Testing and Results for BMD Hardware June 2019
- ISB Mar 2019
- BMG Mar 2019
- BMD Application Layer Software Mar 2019
- DVT Jun 2019
- PVT Nov 2019
- Implementation Plan Feb 2019
- BMDs for California Secretary of State Certification June 2019
- BMDs for Full Rollout Nov 2019
- User Guide Documentation Jun 2019
- Final Acceptance Report Feb 2020

#### Phase V: Phased Implementation (2020)

The full rollout of 31K BMD is planned in preparation for the 2020 election.

### Accomplishments

The VSAP project has had a methodical start with 7 years of idea and plan development. After the hiring of IDEO to create the VSAP product design in 2017, the project has been focused and moving in a steady progression. The VSAP product design was published in 2017 as the latest generation of voting systems, including commercial options. With the establishment of the 2018 Smartmatic contract, Los Angeles will become one of the few Counties in the United States building and owning their election voting system.

### Challenges

The claim of the VSAP project being an open source project was widely regarded as incorrect and a misunderstanding of the term. A few news articles pointed out that the VSAP project may be using open source tools and code to make their voting system function, but it was not going to be publishing VSAP code that is open source licensed. After the article's publication, the VSAP project put out a statement clarifying that the software and hardware may be available as "disclosed source" to municipalities. However, Los Angeles was retaining the copyright to the intellectual property and would not be publicly licensing any part of the software or hardware.

### Risks

The Los Angeles RR/CC VSAP 8-year planning period allowed the team to fully vet multiple avenues of product design and community interest before embarking on designing the voting system. It has bought them some time to work out their claims of transparency and open source during the build and implementation of VSAP through 2020. Transparency of the voting and election process (operations) remains highly desired by the public, but not implemented with any voting systems using paper ballots.

It is likely that VSAP election operations will not be publicly auditable and independently verifiable through a third party. The lack of third-party verifiable elections will not break their stated voting principles, but it will cause some public concern.

### Lessons Learned

The VSAP project has had a slow start, but always focused on communicating with the public. This made their slow start less a problem and more of a positive, methodical approach to understanding their voting customer. Early in the planning process, VSAP established both community meetings and advisory committees, which both served as the project communication focus. This form of transparency has aided the voting system effort well.

While some municipalities may not have hundreds of millions of dollars and a decade to dedicate to updating their voting systems, they can learn from the VSAP detail focused approach to the product development. Early on, the project was broken up into multiple phases and gave generous amounts of time for milestones. While this meant the project would go slow, it also meant that it was on schedule.

Once the decision was made to develop a product design, the VSAP project put together a project management team that has organized itself well (as seen from the outside.) The Phase IV-V contract highlighted the VSAP project team's attention to detail both in deliverables and milestones. While the project is still in progress, we have not been able to get any additional information on their ability to deliver so far.

# Galois' Free & Fair Project

## Overview

Galois, is a Portland, Oregon, computer science company that “develops technology to guarantee the trustworthiness of systems where failure is unacceptable.”<sup>4</sup> Galois claims to “apply cutting edge computer science and mathematics to advance the state of the art in software and hardware trustworthiness.” Galois has shared 10 staff members with their Free & Fair project. Free & Fair is a professional software development team that has worked on open source elections implementations.

## Governance

There is no public information on the how Free & Fair is run or governed. It is likely it continues to be a Galois supported project that remains dependent on its parent organization for administrative budget and staff.

## Organization

All of the Free & Fair staff are shared with their sponsor, Galois. There are 10 people identified as part of the Free & Fair project. 2 Business Developers, 1 Marketer, 1 Project Manager, and 6 Computer Scientists. Galois has spun off a side business before and likely would do the same with a successful Free & Fair in the future.

## Funding

There is no public information on the Free & Fair funding or budget. It can be assumed that Galois wholly subsidizes the Free & Fair product development and implementation.

## Technology

Free & Free has 5 products and 35 public repository projects. The products are the Risk-limiting Audit System, Supervised Voting System, ePollbook, Qubie the poll monitor, and Tabulator. There is one healthy public project ColoradoRLA or Colorado Risk Limiting Audit which implements the OpenRLA project as a product.

## Risk-limiting Audit System

Free & Fair created their own risk-limiting audit (RLA) system that was first used 2017 in Colorado. Based on the same risk limiting concepts spearheaded in the Travis County STAR-Vote project. This project aims to verify elections through a statistical comparison audit. The work is derived from the Linderman and Stark 2012 Gentle paper.<sup>5</sup> A random sample of paper ballots are compared to their digital versions to verify the audit and/or adjudication of the voter's intent is valid.

RLA determines the number of ballots that need to be compared by the calculated risk of an election having an outcome-changing error and by the number of ballots cast. Greater risk and/or a larger election means a greater number of ballots that need to be compared. RLA would need to be

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<sup>4</sup> “Current Opening, Principal Computer Scientist,” Galois Careers, February 2019, <https://galois.com/careers/principal-computer-scientist/>

<sup>5</sup> “A Gentle Introduction to Risk-limiting audits,” Mark Lindeman and Philip B. Stark, 16 March 2012, <https://www.stat.berkeley.edu/~stark/Preprints/gentle12.pdf>

implemented at the central tabulation center and utilize the voting center/precinct adjudication audit data.

This is a change from the random precinct or voting machine audits typically implemented to verify election results.

The ColoradoRLA product appears to be an implementation of the original OpenRLA project. This is claimed to be the first RLA performed in a US statewide election.

There is no roadmap available for future features or implementations.

### Supervised Voting System (SVS)

Stated to be based on the STAR-Vote Usenix 2013 presentation. Designed to provide polling place check-in, ballot casting, election management, and tabulation. Intended to use commercial off-the-shelf (COTS) hardware, but it is likely to follow the similar path of the existing voting system vendors with a mix of COTS and specialized Ballot Marking Devices (BMD). The example of “Hashchain-based integrity” to secure network transactions within the polling place is given providing the ability to audit the election process.

Specific examples of what the SVS product features are or intend to include are missing. There is no roadmap available for future features or implementations.

### EPollbook

Designed to provide voter registration and election management system with mobile COTS hardware and operating systems. Intended to include customizable statistics and reporting.

Specific examples of what the EPollbook product features are or intend to include are missing. There is no roadmap available for future features or implementations.

### Qubie the poll monitor

Anonymous mobile phone monitoring using low-cost COTS computer hardware and open source software. Provides a simple reporting data that can be used by polling place officials to monitor the effectiveness of the election location. The reports can be automatically published providing the voter the lowest voting center wait times.

This product has gone through research and development and has well established features. It has been deployed in Shasta County, CA. There is no roadmap available for future features or implementations.

### Tabulator

Designed to record the voter’s intent through the ballot image. It supports image output from another voting system scanner or a COTS scanner. Adjudication would be digitally supported by identifying write-in candidates and hesitation marks. Election managers would make adjudication decisions based on the ballots identified. Adjudication data would be logged, “hashchain-based” encrypted to secure the election process. The tabulator would be supported by an open source project.

This product identifies several features, but there does not appear to be a roadmap or implementation. No accessibility features or products are published.



## Schedule

The most recent product activity is in 2017.

There were multiple GitHub project releases in 2018 from various repositories. It is not known if any of these releases made it into a product.

There does not appear to be additional development or implementations planned for 2019.

## Accomplishments

In 2016, Qubie was implemented in Shasta County at 10 polling places. Over 30K Wi-Fi identifiers were logged. No information on where the data set is published or available.

In 2017, The Colorado Department of State awarded a contract to Free & Fair to implement RLA to support audits in the 2017 election. The election audit results have been publicly published for review. The ColoradaRLA software continues to be used.

## Challenges

There appears to be only two implementations with components of the Free & Fair voting system, with last one in 2017.

## Risks

The Supervised Voting System (SVS) and the Tabulator products have overlapping features where it comes to supporting the tabulation process at the polling place. There may be an unpublished architecture and/or product roadmap that makes this clearer.

The strategy or product roadmap for the Free & Free voting system for 2019 is not clear as most of the work appears to have been completed in 2017.

## Lessons Learned

Free & Fair has put a considerable amount of effort into their 5 products and 35 open source projects. They committed thousands of code changes over the years. The organization identified business, project, and engineering employees from their parent company Galois to work on Free & Fair. As recently as 2017, Free & Fair was considering working with the Travis County STAR-Vote project which showed promise as a viable voting system design. Unfortunately, it appears that the work on Free & Fair stalled around the same time the STAR-Vote project was cancelled in 2017. While the Free & Fair work seems to have stopped, it is likely the Galois team has unpublished voting system architecture and plans that can be revived for a new opportunity.

# Democracy Earth's Sovereign Project

## Overview

The Democracy Earth Foundation (democracy.earth) has a stated goal to reduce government corruption through use of blockchain for voting and contracts. They have a specific focus on South America.

Democracy.earth started from yCombinator funding in 2015 after the forming of the Partido del a Red DemocracyOS project in Argentina. Focus of democracy.earth has been the intersection between democracy and blockchains. Based on the experience from getting involved in Argentinian politics, they developed the philosophy of making a new technology model that makes the corruption of the existing election systems obsolete.

Since 2015 democracy.earth has been developing their main product Sovereign. Sovereign is an open source "liquid democracy" platform that has been tested in many different contexts. Research has been completed with Alphabet and University California Berkeley to understand the opportunities and limitations of the product.

The organization has outlined their strategy in "The Smart Social Contract,"<sup>6</sup> now translated in 7 languages. In it they explain their strategy for future development and its alignment with their beliefs in government.

They are focused on design and code to change what democracy means in the 21st century.

## Governance

Listed as a non-profit charitable organization, with three officers as of 2016. The organization received one small grant with the donor name unlisted. Funded in 2015 through 2016 by Y Combinator and Fast Forward.

## Organization

Democracy Earth has published 10 employees on their site. Founded the political party, Partido de la Red (Peers Party), that ran for its first election for the Buenos Aires, Brazil City Congress in 2013. In October 2016, they piloted the Sovereign platform in a digital plebiscite enacting a symbolic vote among the 6 million expatriate citizens regarding a Columbian peace referendum. As a result of the use of Sovereign, the Colombian government's Centre for Digital Public Innovation (CDPI) is investigating the viability of blockchain voting.

In 2017, democracy.earth moved from San Francisco to New York.

## Funding

2015 Foundation funding from yCombinator of \$100K

2016 reported \$25K grant to develop the Democracy OS org website

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<sup>6</sup> "The Smart Social Contract," Santiago Siri, 25 January 2018, <http://paper.democracy.earth/>

## Technology

Democracy.earth has 21 public GitHub repositories. This organization has one healthy code repository Sovereign. The project claims future compatibility with Ethereum blockchain for online voting. This appears to be a viable project, but the commercial contributions are not strong.

They have the strategy of creating a blockchain based coin called Vote. They also have published that they are focusing on using Bitcoin for programable money and Ethereum for smart contracts. This could be a rebranding use of Bitcoin for their future product Vote. However, the voting system is loosely defined and not a complete solution for public elections. There is considerable attention to auditable voting and verification.

The organization has also created DemocracyOS which supports public comments and online voting. It appears that DemocracyOS has spun off as a separate team, but there may be some overlapping contributions on the open source projects.

## Schedule

YCombinator funding in 2015 after the forming of the Partido del a Red DemocracyOS project in Argentina

Colombia Peace in 2016 was a key Sovereign pilot for the referendum where there was 10K expats voting on a crucial peace agreement. From the voting, it was found out that giving political rights to the FARC was a deal breaker. This success led to democracy.earth joining the Natural Resource Security Council of the World Economic Forum.

Democracy.earth has explored how to integrate their tech with Bitcoin. As the Bitcoin market became popular in 2017, they found a growing community of hackers and activists willing to help on their projects.

In 2018 they released their web3 & beta software on testnet.democracy.earth. They held a private token sale for supporters. They publicized their partnership with Blockstack to focus on the strategy of providing governance to crypto networks.

Their product launch is scheduled for the first quarter of 2019.

## Accomplishments

The organization got its start in 2015 through Ycombinator funding, forming their foundation and board. Their first work was creating DemocracyOS.

They followed up with running Sovereign in Columbia 2016.

Published in 2017 their strategy paper outlining how their product works in the marketplace.

Private token sale for supporters of the Vote coin in 2018.

Democracy.earth has participated in conferences all around the world as the crypto industry became aware of the relevance of governance. Especially notable Blockstack's Berlin conference where they urged the crypto community to fight dictators.

## Challenges

The proof of identity implementation provided as part of the organization strategy is based on the use of Bitcoin to hold the hashed proof of identity. This technique is not recommended by the Bitcoin community as it is considered an “irresponsible” use of the blockchain to store arbitrary data. Bitcoin is meant to provide a financial transaction record. The proof of identity becomes massively-replicated in the blockchain and increases the cost of supporting the primary purpose of financial transactions. The most recent use of this technique to post indecent images is especially troubling.

## Risks

The democracy.earth strategy to reduce government corruption through use of blockchain for voting and contracts will likely receive push back from the government organizations they want to influence. This both provides greater benefits for successes in areas when government corruption is a problem, but also increases the risk of running afoul of the organizations which they are working to reform. Democracy.earth is based in New York, NY, US while affiliated with South American political parties and non-profits. This geographic separation may limit their exposure to political and financial risks.

## Lessons Learned

While the Sovereign project has good momentum, democracy.earth’s core voting product does not have a specific use case published for supporting US public elections. In fact, it is likely impossible to adapt their technology to support key requirements such as paper ballots. There are quite a few applications for various parts of election voting systems from what democracy.earth has presented. In order to gain marketplace acceptance, they need to match their enthusiasm with commercial applications to fund further development.

# Cornell Computer Science Department's Condorcet Internet Voting System Project

## Overview

Condorcet Internet Voting System (CIVS), 15-year-old free online Internet voting service that makes it easy to conduct elections that has hosted over 15K polls and 400K votes. Each voter ranks a set of possible choices. Individual voter rankings are combined into an anonymous overall ranking of the choices. This is the system that OpenStack and many other organizations use year over year to run ranked choice polls. CIVS is simple, stable project and implemented product with a long successful track record.

## Governance

The Condorcet Internet Voting Service has been run since 2003 by Andrew Myers at the Cornell Computer Science Department. The voting service is available for free, public use. No guarantees can be made that the service will be correct or available. Donations are requested to support the free service.

## Organization

Andrew Myers at the Cornell Computer Science Department is the main code contributor and project manager. The software is provided with permission to use, copy, modify, and distribute for any purpose while retaining the copyright.

## Funding

There is no information available on funding amounts over the years. Andrew Myers does allow tax-deductible donations to support the Cornell Computer Science Department that operates CIVS.

## Technology

The CIVS GitHub project has currently 864 commits with multiple releases. The latest release being 2.18.2 published 02 December 2017. The software is developed using Perl, Python, and JavaScript.

The ballot provides for a standard user interface. Standard accessibility functionality that is available for any well-formatted webpage.

The tabulation of the votes is executed at the end of the election period and then available by html and email. "Condorcet election methods use the voters' rankings to compare every candidate (alternative) against every other in head-to-head contests. Intuitively, it would not make sense if the winner of an election would lose a head-to-head contest with some other candidate. Condorcet methods aim to prevent such an outcome."<sup>7</sup> CIVS currently supports five rules for Condorcet completion: Minimax-PM (the default rule), Schulze (also known as Beatpath Winner or Cloneproof Schwartz Sequential Dropping), Maximize Affirmed Majorities (MAM), a deterministic variant of MAM called CIVS Ranked Pairs, and a runoff-based Condorcet algorithm called Condorcet-IRV.

CIVS allows anyone viewing the results of an election can see what the results would have been with each of the five completion rules. It is recommended when running an election to decide on a rule

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<sup>7</sup> "CIVS completion algorithms – Condorcet Internet Voting Service," Cornell University, publication date unknown, <https://civs.cs.cornell.edu/rp.html>

ahead of time and include it in the election description. Remarkably, election results with any the Condorcet completion rules usually agree with each other. Providing this capability delivers a unique way of auditing the election results.

Other than the software that provides the html, not much is known of the platform that presents the CIVS webpages.

## Schedule

2003 created and published SaaS CIVS online

Release 2.7, improved completion algorithm

Release 2.8, code improvements for adding new completion algorithms

January 2008 Release 2.9, security and documentation improvements

August 2008 Release 2.10, election feedback and write-in features added

December 2008 Release 2.11, standardized completion methods added

November 2009 Release 2.12, drag and drop UI feature added

February 2010 Release 2.13, general improvements

May 2010 Release 2.14, localization improvements

February 2011 Release 2.15, localization improvements

September 2012 Release 2.16, HTML voting code feature added

May 2014 Release 2.17, bug fixes and general improvements

December 2017 Release 2.18, general improvements

No set schedule for Release 2.19, documentation updates, command line improvements

## Accomplishments

CIVS has been used for more than 15K polls over the past 15 years, with more than 400K votes cast. It is currently used by many major organizations such as Google, Yale University, OpenStack Foundation, Linux Foundation, and Canonical. At any one time, there are more than 30 online polls currently underway using the CIVS SaaS implementation.

## Challenges

Without any commercial support, Andrew Myers has been supporting the development and operations mostly by himself over the past 15 years. Most of his help has come through Cornell University professors and students. Some contributions have been through code contributions directly through the CIVS GitHub repository.

## Risks

This product has little risk associated with it since it has been in stable release for over 5 years.

## Lessons Learned

CIVS is a simple, online Internet election tool. It provides a Condorcet ranked choice voting service for anyone that needs to use it. It is a reliable tool as it does one thing and does not attempt to expand outside that scope. Projects that clear define a reasonable strategy and stick to it, are generally successful.

# Open Source Election Technology Institute's Trust the Vote Project

## Overview

The Trust the Vote project organized by the Open Source Election Technology Institute (OSET), published ElectOS, a voter-facing technology framework. The framework represents a voting machine architecture.

## Governance

OSET is registered 503(c)(3) non-profit corporation. It has 7 corporate directors (2 of them full time), 8 board members, and 22-members of the Strategic Advisory Board. There is no public information on board meeting agendas or results of votes.

Open source software is available through the OSET Public License.

## Organization

OSET claims 12 states are collaborating on the VoteStream project, which a component of the ElectOS architecture.

In 2016, OSET had 2 full time corporate directors

In 2018, OSET published information on 2 board advisors and 4 employees. There may be more people involved in the organization.

## Funding

2015 \$265K, \$115K spend on software development

2016 \$387K, \$254K spent on software development

2017 unknown funding

2018-2019 Reported by OSET that they have \$500K in grant commitments

## Technology

This organization has 39 GitHub repositories representing their ElectOS architecture. There is one healthy repository, the Online voter registration. OSET started their project in 2015 with a voting system architecture that with collaboration could be the basis of an open source voting system. OSET has built a few prototypes from the architecture. It is likely OSET has held back publishing some of the architecture designs while searching for funding.

OSET has focused on various components of their ElectOS architecture over the past few years. One of the security components the Device Manager, using "trusted boot"<sup>8</sup> and "hardware attestation,"<sup>9</sup> OSET has collaborated with Silicon Valley Blastwave on. Another component they named Vanadium aims to use Blockchain's immutable ledger technology to strengthen voter registration rolls. Accenture and DXC Technology are talking with OSET about opportunities to work together on the Blockchain technology initiative Vanadium. OSET has an existing 3-year old corporate alliance with Amazon Web Services.

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<sup>8</sup> "2018 OSET Institute Year-End Review – TrustTheVote," Gregory A. Miller and E. John Sebes, 31 December 2018, <https://trustthevote.org/blog/2018/12/31/2018-oset-institute-year-end-review/>

<sup>9</sup> "2018 OSET Institute Year-End Review – TrustTheVote," Gregory A. Miller and E. John Sebes, 31 December 2018, <https://trustthevote.org/blog/2018/12/31/2018-oset-institute-year-end-review/>



Another component, VoteStream, OSET asserts that 12 states are collaborating on. VoteStream can report elections results for every contest for every precinct in the country. It also makes available the performance and participation data needed for systematic analysis of elections.

OSET analysis in 2017 of the US E.A.C. 2016 EAVS data discovered that millions of voter registrations were denied or removed. The VoteReady project conceived to alert a mobile device any time there was a change to the voter record. The VoteReady project is expected to start crowd-funding, development in 2019, and launch in 2020.

None of the products have a roadmap. One prototype implementation of VoteStream is online. The ElectOS architecture is a roadmap for the organization but lacking a schedule or plan behind it.

### ElectOS Architecture

1. Reporting:
    - a. VoteStream
  2. Managing: Election Office
    - a. Election Data Manager
    - b. Ballot Design Studio
    - c. Device Manager
  3. Managing: Registrar of Voters' Office
    - a. Registrar
    - b. Digital Poll Book Manager
    - c. Vanadium
  4. Managing: Central Counting Place
    - a. Central Ballot Counter
    - b. Tabulator
  5. Open Data Standards (derived from Voting Information Project data format, US National Institute of Standards and Technology, IEEE 1622 working group emerging standards, OASIS international election data standard)
    - a. DL-VRR Voter Record
    - b. DL-BS-E Extended Ballot Specification
    - c. DL-JED Jurisdiction and Election Definition
    - d. DL-BS-B Basic Ballot Specification
    - e. DL-JED-GIS GIS Extensions of DL-JED
    - f. DL-JED-TBM Tabulation Manifest
    - g. DL-VTL Voter Transaction Log
    - h. DL-JED-ERT Tallying Device Records
    - i. DL-JED-ER Basic Election Result
    - j. DL-CVR Cast Vote Records
    - k. DL-VDR Voter Demographic Record
  6. Registering
    - a. Voter Services Portal
    - b. BusyBooth: polling place wait tracker
    - c. Balloteer
  7. Voting: Voting Place
-

- a. Digital Poll Book
- b. Voter Kiosk
- c. Accessible Ballot Marker
- d. Precinct Ballot Counter

## Schedule

There does not appear to be any product release schedule

## Accomplishments

OSET has worked since 2015 to become a publicly recognized subject matter expert in election cybersecurity working with NBC News and several media companies. There has been some collaboration and/or work with POLITICO, Transatlantic Commission on Election Integrity, Democratic National Institute and International Republican Institute but that is less clear.

As of 2018, OSET has started several alliances with Fortune 500 technology companies with commitments of support exceeding \$500K.

In Ontario, Canada, OSET established a set of design guidelines and principles for next generation voter services personalization including support for digital identity. It is not clear how this work complemented their ElectOS architecture.

In Pennsylvania, OSET rolled-out pure paperless mobile online voter registration service including data and network integration. It is not clear how this work complemented their ElectOS architecture.

In Virginia, OSET enhanced 3rd party online voter registration technology platform including extensive security review for NIST SP 800-53 security controls compliance. It is not clear how this work complemented their ElectOS architecture.

## Challenges

None that can be found

## Risks

None that can be found

## Lessons Learned

OSET is an organization focused on improving the public's understanding of the best voting system technology available. They have taken on a few partnerships with election related organizations over the past few years. Early on they published an architecture that can be used as a roadmap for different pieces of future development. What is missing is a sense of purpose to build a complete public election capable voting system.

# VotingWorks Project

## Overview

We are assuming VotingWorks is a continuation of the work that was started with Ben Adida's other projects Helios Voting and Helios Server. Helios Server started from Ben's Helios paper published in 2008 when he was a student at Harvard. Helios Server is not intended for public elections, rather online elections. The project specified that their software is not recommended for public elections. There has been some work done on this product over the last few years. But most of the work has stalled. The documentation references 2010 release date for the next version.

## Governance

VotingWorks is using the Center for Democracy & Technology (CDT) as their host organization while they work on their non-profit.

Ben Adida previously started Helios Voting, which seems to have been abandoned. There were 6 advisors for this previous venture. No information on if these advisors are involved with VotingWorks.

## Organization

Two published employees Ben Adida and Matt Pasternack as co-founders. Assumed that CDT provides some administrative functions while VotingWorks builds the organization.

VotingWorks is working with CDT on operations.

## Funding / Budget

VotingWorks can now accept tax-deductible donations by way of CDT.

## Technology

Ben Adida's GitHub organization has 44 GitHub repositories. Helios Server is the one healthy repository. VotingWorks is a new organization without a viable product directly related to the open source work. This is holding back contributions and limits momentum.

VotingWorks claims it will develop voting equipment that:

- embodies the state-of-the-art in usability, security, design, and development
- are affordable to maximize any benefit to all sizes of election jurisdictions
- allow speedy, efficient voting processes
- that is extensible to the needs of all types of localities
- and all of this will be developed in the open for the public good

Their partnership CDT could allow them to establish a product and roadmap for customers to get engaged.

## Schedule

Voting Works as a company is a new venture. There is no published product roadmap.

Helios Server releases

10 August 2010 version 3.0.0

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04 March 2011 version 3.1.0

The most recent release is from 10 March 2011 version 3.1.4

Issues and pull requests have continued to be created, collaborated on, and closed 2011 through 2018. Not known why releases stopped in 2011.

### Accomplishments

The open source core Helios Server project behind VotingWorks has been forked (copies of the source code made) 170 times and has had 84 pull requests (change recommendations by people outside the VotingWorks organization). This shows the project to be interesting and possibility showing that a product based on the project could be successful.

### Challenges

The work behind VotingWorks has gone through many interactions, without any explanation. T

### Risks

The work leading VotingWorks so far is more similar to a pilot project or prototype.

### Lessons Learned

Ben Adida has created a small community following around public election technology.

## FollowMyVote Project

### Overview

Follow My Vote's mission is to promote truth and freedom by empowering individuals to communicate effectively and implement non-coercive solutions to societal problems. The organization wants to improve the integrity standards of voting systems used in elections worldwide. Their focus is on developing an online open source voting platform that provides transparency into election results. Their version of ultimate transparency is to provide voters the ability to independently audit the ballot box.

### Governance

Follow My Vote is a nonpartisan US public benefit corporation founded in 2012.

### Organization

5 people are published as employees, include the 3 co-founders. The organization lists 3 advisors, who appear to be focused on helping with business strategy.

Their current office is listed as Longmont, CO with their previous Blacksburg, VA publicly listed as closed.

### Funding

No information is publicly available. However, it appears that the organization is targeting broadcast events and student organizations as potential customers.

### Technology

Follow My Vote claims development of open source end-to-end verifiable blockchain voting software for auditable online voting. The organization has the vision of supporting government-sponsored elections worldwide. They believe by using Blockchain, they can implement election security and transparency, while protecting each voter's right to privacy.

Follow My Vote completed a Blockchain proof of concept, which was demonstrated at several events. In 2014, joined the California Association of Voting Officials (CAVO).

### Schedule

There is not a published, public product development or implementation schedule.

### Accomplishments

There does not appear to be any public implementations or funding rounds for Follow My Vote.

### Challenges

Due to lack of project or product momentum, it will be difficult for Follow My Vote to gain traction with potential customers.

### Risks

Without product proven features, the Follow My Vote project will not evolve into a product with features that customers are willing to subscribe to.

### Lessons Learned

As with most great ideas, it is difficult to move beyond the idea phase. Finding customers that are willing to pay for features is the next step.

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# Travis County Clerk's STAR-Vote Project

## Overview

Travis County, Texas wanted to replace their aging, but functional voting systems with a modern replacement. With years of planning and public communication, they appeared to be ready to find a commercial partner to their idealism and transparency election plans. Unfortunately, their 2016 voting system RFP attracted bids that did not meet their goals of open source software and third-party auditable security. In the end, they did not find a vendor that met their requirements and had to change their approach. The STAR-Vote project was publicly announced as cancelled in 2017. A year later, the Travis County Clerk adopted a commercial ES&S voting system to replace their existing voting mechanisms.

## Governance

The project was led by the Travis County Clerk and their office throughout its existence. However, the organization and advisors envisioned a future non-profit entity where the STAR-Vote project could be administered from. In a gesture of transparency, when the STAR-Vote RFP was published, a Statement of Intent outlining their governance strategy was also released.

Creation of the non-profit entity from a legal standpoint was estimated to take a year. Travis County Clerk's office planned to interview interested organizations that would become founding members. Bylaws, management structure, operating procedures, budgets, and open source licensing were all expected to be completed as part of the process of creating the corporate non-profit. However, there was some confusion about overlapping open source development, the entity creation, and open source contribution standards. It is expected that the confusion would have ironed out rather quickly with good advice from experienced partners.

Travis County planned that it would be responsible for the non-profit startup costs. The founding members of the non-profit were to pick up the additional costs to keep the organization running into the future. The non-profit entity was expected to require outside funding for its first 5 years of existence after which it would become self-sustaining.

## Organization

The STAR-Vote paper published August 2013 in the USENIX Journal Election Technology and Systems (JETS) listed 6 Travis County Clerk employees, 5 university professors, and 3 independent advisors as co-authors. It is assumed that the co-authors were all actively involved in the STAR-Vote project.

At the time of the 2016 Travis County Clerk's STAR-Vote RFP; 6 Travis County Clerk Office employees, 24 Election Study Group participants, and 8 Technical Consultants were listed. It is assumed that all of these people listed were actively involved in the STAR-Vote project.

## Funding

2001 \$6M, Slate system by Hart Intercivic

2005 –2011 Budget is not publicly available

2012 Research and design for the project is published as \$300K

2013 – 2016 Budget is not publicly available

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October 2016 Travis County Clerk planned on contributing \$4M to the foundation of a STAR-Vote non-profit entity. They estimated that an additional \$15-25M in commitments from STAR-Vote Founding Members would allow the new organization to operate for 5 years. As all the RFP responses were rejected, none of the proposed STAR-Vote funds were gathered.

2017 The project was cancelled, so likely no funds were budgeted

2018 ES&S contract to supply Travis County with voting machines for \$9.7M

## Technology

STAR-Vote references the need for an audit trail, but focuses on reducing the risk of a full hand vote, rather than describing how ballot level auditing operations would function. STAR-vote's closest ballot audit description is their preference for the SOBA risk-limited protocol, which would anonymously post-election ballot data. Not clear if this process would publish anonymized ballot images as well as this is proposed as an option. The Galois Free & Fair project published a working Risk Limiting Audit (RLA) partly based on the STAR-Vote work.

STAR-Vote references their desire to use commercial-off-the-shelf (COTS) hardware and commodity components. STAR-Vote describes the desire to use security stripped Linux with buffer overflow secure Java or C# to develop the software. STAR-Vote has various encryption techniques that could be used to protect the identity of the voter and their ballot, while supporting voter transparency. STAR-Vote voting centers will only electronically transmit election data through one of the private county satellite Receiving Substations to the Central Counting Station, thus insuring election network security.

The 12-year Travis County STAR-Vote project had a significant focus on open source development and transparency, which is also the published reason given in 2017 why the project failed. No vendor was able to meet all of the STAR-Vote project objectives. The project considered developing the software themselves and dismissed the option as too challenging. STAR-Vote inaccurately assumed that hardware and software open source development would be less expensive in the short term than the commercial alternatives, which contributed the absence of practical bids and the project failure.

The STAR-Vote project was meant to replace and increase the number of the standalone Disabled Accessibility Units currently in use in Travis County. Unfortunately, the accessibility design never progressed farther than requiring support for VVSG 1.1, which details the Federal Election Assistance Commission voting machine accessibility requirements. The design work to replace the existing accessibility supporting voting machines was never started.

## Schedule

2012 Travis County Clerk starts active research and design on a voting system

13 August 2013 Usenix Electronic Voting Technology Workshop, STAR-Vote: A Secure, Transparent, Auditable, and Reliable Voting System <https://www.usenix.org/conference/ewtvote13/workshop-program/presentation/bell>

09 October 2016 Travis County Clerk publishes RFP #P1609-008-LC, for STAR-Vote: A New Voting System for Travis County, Texas [https://osvtac.github.io/recommendations/files/star-vote/RFP\\_STAR-Vote\\_Unofficial\\_Copy.pdf](https://osvtac.github.io/recommendations/files/star-vote/RFP_STAR-Vote_Unofficial_Copy.pdf)

26 September 2017, the Travis County Commissioners Court rejected all RFPs based on the STAR-Vote voting project. No vendor could meet the requirements of open source software and audit enabling encryption.

28 September 2017, Travis County Clerk ends the STAR-Vote project.<sup>10 11</sup>

### Accomplishments

The people behind the STAR-Vote project were focused on creating an open source based voting system. They used the best information available to them and developed a plan to accomplish their objectives. Being true to their goals, they published their governance strategy along with their RFP design requirements. This is the only attempt to date of a government organization proposing a comprehensive open source voting system plan.

The STAR-Vote research and plans are still publicly available and can be used as reference guides for future work in this field.

### Challenges

Travis County attempted to find vendors to build an open source voting system STAR-Vote. In the end they did not find a vendor that was interested in the open source model and had to change their approach. The new ES&S voting system will be at least \$2M-\$6M cheaper than the original STAR-Vote cost estimate.<sup>12</sup>

### Risks

This project has been cancelled.

### Lessons Learned

From the documentation available, the STAR-Vote project followed a known commercial open source project development plan. There was a small, but loyal group of supporters that had contributed a considerable amount of time and energy to make the project a reality. However, there was a critical misunderstanding of who and how the software was going to be developed. The Travis County Clerk assumed that with enough community support, that a single commercial voting system vendor would step forward and take responsibility for the software development. The problem being that none of the existing election voting system vendors have any experience with open source software development. Generally, most inexperienced software developer organizations see open source licensing and collaboration as a liability, not benefit. As a result of this misunderstanding, the Travis County Clerk did not receive any positive responses to their RFP and they terminated their long-standing commitment to the project.

The Travis County Clerk STAR-Vote design and governance strategy while not perfect, remains a solid starting point for any organization willing to pick up where the Travis County Clerk left off.

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<sup>10</sup> "STAR-Vote - A Change of Plans," Dana DeBeauvoir, 28 September 2017, <http://www.traviscountyclerk.org/eclerk/Content.do?code=star-vote-a-change-of-plans>

<sup>11</sup> "STAR-Vote – A Change of Plans," STAR-Vote and Travis County, 28 September 2017, [https://osvtac.github.io/recommendations/files/star-vote/STAR\\_Vote\\_Final\\_Report.pdf](https://osvtac.github.io/recommendations/files/star-vote/STAR_Vote_Final_Report.pdf)

<sup>12</sup> "Travis County approves purchase of \$8M paper-trail voting system," Taylor Goldenstein, 26 September 2018, <https://www.statesman.com/news/20180808/travis-county-approves-purchase-of-8m-paper-trail-voting-system>



# Los Angeles Registrar Reporter County Clerk's (LA RR/CC) Voting Solutions for All People (VSAP) Project

- Vision to use a transparent process to develop and implement voting solutions that focus on the needs and expectations of current and future voters
- Developed with contractors and owned by the Los Angeles RR/CC
- VSAP product design published in 2017 as the latest generation of voting systems, including commercial options
- Even without publicly licensed software, this project has the best transparency, contributions, and momentum
- Full implementation by November 2020

# Galois' Free & Fair Project

- Professional team that has worked on open source elections implementations
- Two implementations with components of the Free & Fair voting system, with last one in 2017
- Appears that the work on Free & Fair stalled around the same time the STAR-Vote project was cancelled in 2017
- Transparency, contributions, and momentum, but lack clear product they are working towards
- Likely unpublished voting system architecture and plans that can be revived for a new opportunity

# Cornell Computer Science Department's Condorcet Internet Voting System Project

- Simple, online Internet election tool
- 15-year-old voting system project that has hosted over 15,000 polls and 400,000 votes
- This project has transparency, few contributions, and steady momentum
- Simple, stable project and implemented product with a long successful track record

# Open Source Election Technology Institute's (OSET) Trust The Vote Project

- Voting system architecture that with collaboration could be the basis of an open source voting system
- Few prototypes from the architecture
- None of the products have a roadmap
- Some transparency, some contributions, and no momentum to the work completed
- Missing a sense of purpose to build a complete public election capable voting system

# Travis County Clerk's STAR-Vote Project

- County led open source voting system
- Did not find a vendor that was interested in the open source development and project was cancelled in 2017
- Published a governance strategy and broad architecture. But there was no project strategy, plan, or milestones to back it up
- Transparency, but no code contributions, and no momentum to this effort
- Not clear why project did not pool their contributors and develop the project as they had planned

# Additional Non-Commercial Voting Systems

- **Democracy Earth’s Sovereign Project**
  - Future compatible with Ethereum blockchain for online voting
  - Transparency, contributions, and momentum, but lack a clear product roadmap and consistency of direction
- **Voting Works Project**
  - Intended for online elections and not recommended for public elections
  - Some transparency, few contributions, and no momentum to this project
- **FollowMyVote Project**
  - Blockchain proof of concept, which was demonstrated at several events
  - No strategy, plan, or milestones. This project appears to be a stalled effort.

## Appendix: Startup Commercial Voting Systems

Not certified for the State of California. These are typically online, digital only voting systems. They provide similar results to CIVS. Some claim by using block chain encryption, that the quality and transparency of the election process is better than the alternatives.

Voatz	Boston, MA, US	2018	Active	?	Commercial	Blockchain online voting
ClearBallot	Boston, MA, US	2019	Active	?	Commercial	N/A
Intelivote	Dartmouth, NS, CA	2018	Active	?	Commercial	Online voting
Votem	Cleveland, OH, US	2018	Active	?	Commercial	Mobile online voting
Scytl	Barcelona, Catalonia, SP	2018	Active	?	Commercial	Online voting
VoteWatcher	N/A	2017	Stale	?	Commercial	Blockchain
Boule	N/A	2017	Stale	?	Commercial	Blockchain

1. Voatz
  - a. ...
2. Clear Ballot – Boston, MA, certified in WA and Oregon, vote counting, \$18M 2015-2017, uses ballot scanning, being certified at the national level, elections management, auditing Forbes article: <https://www.forbes.com/sites/rebeccaheilweil/2017/12/02/eight-companies-that-want-to-revolutionize-voting-technology/#3b4e1c0c12c1>
  - a. No open source repositories
3. Intelivote – Canadian Municipal Elections, voter list management, elections in UK and US as well
  - a. No open source repositories
4. Votem
  - a. ...
5. Scytl – Barcelona, \$126 million raised, new voting cryptographic protocols, auditability
  - a. No open source repositories
6. VoteWatcher, uses Blockchain, working with State of Maine legislation on use of blockchain for voting <http://votewatcher.com>
  - a. No open source repositories
7. Boule’ – blockchain, looking to commercialize, ready by 2020 <https://www.boule.one/>
  - a. No open source repositories

## Appendix: California Approved Commercial Voting Systems

Voting Systems Approved for use in California as of September 27, 2018

Source <https://votingsystems.cdn.sos.ca.gov/cert-and-approval/vote-sys-appr-in-ca-2.pdf>

Company	Approval Date	Software and Other Components	Scanner Hardware Components	Accessibility Hardware Components
Hart Intercivic 15500 Wells Port Drive Austin, Texas, 78728	Approved November 16, 2018	Verity Voting 3.0.1 Verity Data version 3.0.1 Verity Build version 3.0.1 Verity Count version 3.0.1 Verity Election Management version 3.0.1 Verity Desktop version 3.0.1 Verity User Manager version 3.0.1 Verity Print version 3.0.1	Verity Scan version 3.0.1 Verity Central version 3.0.1	Verity Touch Writer version 3.0.1 Verity Reader version 3.0.1
Robis Elections Inc. 1751 S. Naperville Road, Suite 104, Wheaton, IL 60189	Approved November 15, 2018	AskED ePollbook with On- Demand Ballot Printing Version 3.4		
KNOWINK, LLC 2111 Olive Street Saint Louis, MO 63103	Approved May 22, 2018	Pollpad Plus V. 1.0		
Tenex Software Solutions 5402 W. Laurel Street Suite 207 Tampa, FL 33607	Approved May 22, 2018	Precinct Central e-Pollbook System V. 4.0		



Company	Approval Date	Software and Other Components	Scanner Hardware Components	Accessibility Hardware Components
Los Angeles County 12400 Imperial Hwy Norwalk, CA 90650	Approved August 21, 2018	VSAP Tally v1.1.2.2	IBML ImageTrac v. 6400	
Dominion Voting Systems 1201 18th street Suite 210 Denver, Colorado 80202	Approved May 8, 2018	ImageCast Remote 5.2		
Election Systems and Software 11208 John Galt Blvd Omaha, NE 68137	Approved November 27, 2017	EVS 5.2.1.0 CA ElectionWare v 4.7.1.0 Election Reporting Manager v 8.12.1.0 Event Log Service v1.5.5.0 Removable Media Service v 1.4.5.0 VAT Previewer v 1.8.6.0 ExpressVote Previewer v 1.4.1.0 ExpressLink 1.3.0.0 PaperBallot v 4.6.1.0	Model DS850 Central Ballot Counter v1.0, Model DS200 Precinct Counter v1.3,	ExpressVote AutoMARK v1.0, 1.1, 1.3, & 1.3.1
Dominion Voting Systems 1201 18th street Suite 210 Denver, Colorado 80202	Approved October 16, 2017	Democracy Suite 5.2 Election Management System V. 5.2.17.1 Mobile Ballot Printing V. 5.2.18.2 Adjudication V. 5.2.1.16703	ImageCast Evolution ImageCast Central	ImageCast Evolution ImageCast ICX

Company	Approval Date	Software and Other Components	Scanner Hardware Components	Accessibility Hardware Components
Five Cedars Group 1500 NW Bethany Blvd Suite 200 Beaverton, OR 97006	Approved October 11, 2017	Alternate Format Ballot V. 3.4 Alternate Format Ballot Generator V. 1.5		
Democracy Live 2900 NE Blakeley Street Suite B Seattle, WA 98105	Approved October 11, 2017	Secure Select 1.0		
Election Systems and Software 11208 John Galt Blvd Omaha, NE 68137	Approved April 14, 2017	Unity 3.4.1.0 system	Model DS850 Central Ballot Counter v1.0, Model DS200 Precinct Counter v1.3, Model M100 Precinct Counter v1.3, Model M650 Central Counter v1.2	AutoMARK Voter Assist Terminal, v. 1.0  (A100) and v. 1.1 and v1.3 (A200)
Dominion Voting Systems 1201 18th Street Suite 210 Denver, Colorado 80202	Approved: April 29, 2015	Democracy Suite 4.14-A.1 Election Management System V. 4.14.2301 Adjudication v. 2.4.1.3201	ImageCast Evolution ImageCast Central	ImageCast Evolution
DFM10 Chrysler Irvine, CA 92618		BC Win, v. 2.0 - 3.0	Mark A Vote	

Company	Approval Date	Software and Other Components	Scanner Hardware Components	Accessibility Hardware Components
<p>Election Systems and Software  11208 John Galt Blvd  Omaha, NE 68137</p>	<p>Approved  June 30, 2008</p>	<p>UNITY Election Management System, v. 3.0.1.1  Election Data Manager, v. 7.4.4.0  ES&amp;S Image Manager, v. 7.4.2.0  Hardware Program Manager, v. 5.2.4.0  Election Reporting Manager, v. 7.1.2.1  Audit Manager, v. 7.3.0.0  Model 100 Optical Scan Precinct Counter, v. 5.2.1.0  Model 650 Central Ballot Counter, v. 2.1.0.0  AutoMARK Information Management System, v. 1.2.1.8  AutoMARK Voter Assist Terminal, v. 1.1.2258</p>	<p>Model 100 Optical Scan Precinct Counter, v. 1.3  Model 650 Central Ballot Counter, v.</p>	<p>AutoMARK Voter Assist Terminal, v. 1.0  (A100) and v. 1.1 (A200)</p>

Company	Approval Date	Software and Other Components	Scanner Hardware Components	Accessibility Hardware Components
	Original Approval April 21, 2006 Reapproval January 2, 2008	Unisyn Election Management System, v. 1.1, which includes: Ballot Generation, v.1.1 Election Converter, v. 1.1 Election Loader, v. 1.1	InkaVote Plus Precinct Ballot Counter with ADA unit, v. 1.10	InkaVote Plus Precinct Ballot Counter with ADA unit, v. 1.10
	Original Approval August 3, 2005 Reapproval December 6, 2007	UNITY Election Management System, v. 2.4.3 AutoMARK Information Management System, v. 1.0	Model 100, v. 5.0.0.0 Model 550, v. 2.1.1.0 Model 650, v. 1.2.0.0	AutoMARK Voter Assist Terminal, v. 1.0, with firmware v. 1.0
Los Angeles County 12400 Imperial Hwy Norwalk, CA 90650	Original Approval February 11, 2004 Reapproval January 15, 2008	MTS, v. 1.3.1	LRC 1000	

Company	Approval Date	Software and Other Components	Scanner Hardware Components	Accessibility Hardware Components
<p>HART InterCivic 15500 Wells Port Dr Austin, TX 78728</p>	<p>Original Approval September 22, 2006 Reapproval December 6, 2007</p>	<p>Ballot Now, v. 3.3.11 BOSS, v. 4.3.13 Rally, v. 2.3.7 Tally, v. 4.3.10 eCM Manager, v.1.1.7 SERVO, v. 4.2.10</p>	<p>eScan, v. 1.3.14</p>	<p>JBC, v. 4.3.1 eSlate/DAU, v. 4.2.13 VBO, v.1.8.3</p>
<p>Premier Election Solutions Approved under the name Diebold Election Systems 1253 Allen Station Parkway Allen, TX 75002</p>	<p>Original Approval February 17, 2006 Reapproval October 25, 2007</p>	<p>GEMS, v. 1.18.24 Key Card Tool, v. 4.6.1 VC Programmer, v. 4.6.1</p>	<p>AccuVote-OS (Model D), v. 1.96.6 AccuVote-OS Central Count, v. 2.0.12 AccuFeed</p>	<p>AccuVote-TSX, with Ballot Station, v. 4.6.4 AccuView Printer Module Vote Card Encoder, v. 1.3.2</p>
<p>Sequoia Voting Systems 7677 Oakport Street, Ste 800 Oakland, CA 94621</p>	<p>Approved October 14, 2008</p>	<p>WinEDS, v. 4.0.116 WinEDS Extended Services Software, v. 1.0.47 WinEDS Election Reporting Software, v. 4.0.44 Memory Pack Reader (MPR), v. 3.01</p>	<p>Optech 400-C/WinETP, v. 1.16.6 Optech Insight Plus, APX K2.16, HPX K1.44</p>	

Company	Approval Date	Software and Other Components	Scanner Hardware Components	Accessibility Hardware Components
	Original Approval March 20, 2006 Reapproval October 25, 2007	WinEDS, v. 3.1.012 Card Activator, v. 5.0.21 HAAT Model 50, v. 1.0.69L Memory Pack Reader (MPR), v. 2.15	Optech 400-C/WinETP, v. 1.1.2.4 Optech Insight, APX K2.10, HPX Optech Insight Plus, APX K2.10, HPX K1.42	AVC Edge Model I, v. 5.0.24 AVC Edge Model II, v. 5.0.24 VeriVote Printer

### Legacy Voting Systems Certified Before January 1, 2005

Company	System Name and Software
DFM Associates 10 Chrysler Irvine, CA 92618	Mark A Vote BCWin V. 2.0-3.0
Los Angeles County 12400 Imperial Hwy. Norwalk, CA 90650	InkaVote ( <i>certified 11/1/02</i> ) MTS V. 1.2 ( <i>certified 1/16/98</i> ) MTS V. 1.3.1 ( <i>certified 2/11/04</i> )
Martin & Chapman 1951 Wright Circle Anaheim, CA 92806	Opto-Mark V. OV-OV-1

<p>Sequoia Voting Systems  7677 Oakport St., Ste. 800  Oakland, CA 94621</p>	<p>Datavote  Data Information and Management Systems  Advanced Ballot Count 4.0.3.1 (<i>certified 10/5/04</i>)  DFM BCWin  Sequoia Teamwork 6.0e and 8.1 (<i>certified 10/5/04</i>)</p>
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## Appendix: Additional Non-Commercial Voting Systems

1. Open Source Voting Technical Advisory Committee (OSVTAC). 10 GitHub repositories. This project has one healthy repository, OSV Results Reporting. <https://github.com/OSVTAC/osv-results-reporter> that uses an JSON input file and outputs html/pdf/xml/xls files are created. The Dominion Election Management System (EMS) supports a manual export of election data in JSON format while anonymizing voter identity data. This effort needs more contributions. The project being closely tied to political organization is likely holding back commercial collaboration. This means the project will not have momentum.
  - a. 419 commits, 0 pull requests, 1 branch, 3 contributors.
  - b. The OSCTAC organization has a published strategy. No project strategy, plan, or milestones.
  - c. No commercial contributors
  - d. Some transparency, few contributions, and no momentum
2. VotoSocial. 5 repositories. <https://github.com/votosocial>
  - a. No healthy repositories.
  - b. No strategy, plan, or milestones.
  - c. No commercial contributors.
3. Votem – Cleveland, Ohio, Mobile voting solutions, block chain, voter registration, ballot marking, mobile voting, , partner with block chain, and National Association of Secretaries of State, used in 2 million vote taken, <https://github.com/votem> is just some pdfs and forks
  - a. No healthy repositories.
  - b. No strategy, plan, or milestones.
  - c. No commercial contributors.
4. PretAVoter [https://en.wikipedia.org/wiki/Pr%C3%AAt\\_%C3%A0\\_Voter](https://en.wikipedia.org/wiki/Pr%C3%AAt_%C3%A0_Voter), <https://web.archive.org/web/20110131222243/http://www.tvsproject.org/>
  - a. No open source repositories
5. Scantegrity <http://scantegrity.org> , no activity since 2011
  - a. No healthy repositories.
  - b. No strategy, plan, or milestones.
  - c. No commercial contributors.
6. Votebox – <http://votebox.cs.rice.edu/>. No activity since 2008.
  - a. No healthy repositories



## Appendix: References from Government and Projects

### Federal Government

1. U.S. Election Assistance Commission (EAC) <https://www.eac.gov/> was established by the Help America Vote Act of 2002 (HAVA)  
[https://www.eac.gov/about\\_the\\_eac/help\\_america\\_vote\\_act.aspx](https://www.eac.gov/about_the_eac/help_america_vote_act.aspx)
2. HAVA established the Standards Board  
[https://www.eac.gov/about\\_the\\_eac/standards\\_board.aspx](https://www.eac.gov/about_the_eac/standards_board.aspx) and the Board of Advisors  
[https://www.eac.gov/about\\_the\\_eac/board\\_of\\_advisors.aspx](https://www.eac.gov/about_the_eac/board_of_advisors.aspx) to advise EAC., and the Technical Guidelines Development Committee (NIST chairs)  
[https://www.eac.gov/about\\_the\\_eac/technical\\_guidelines\\_development\\_committee.aspx](https://www.eac.gov/about_the_eac/technical_guidelines_development_committee.aspx) to assist EAC in the development of voluntary voting system guidelines  
[https://www.eac.gov/testing\\_and\\_certification/voluntary\\_voting\\_system\\_guidelines.aspx](https://www.eac.gov/testing_and_certification/voluntary_voting_system_guidelines.aspx)
3. National Institute of Science and Technology (NIST) voting guidelines  
<https://www.nist.gov/itl/voting>

### California State Government

1. Secretary of State Election Voting Machine standards <https://www.sos.ca.gov/elections/voting-systems/>
2. Elections Code <https://law.justia.com/codes/california/2005/elec/19250-19253.html>
3. CA Legislation SB-450 Elections: vote by mail voting and mail ballot elections (2015-2016)  
[https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB450](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB450)
4. AB-2252 Elections: remote accessible vote by mail systems.(2015-2016)  
[https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160AB2252](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB2252)

## Voting Solutions for All People (VSAP)

1. 2010 VSAP Phase I [https://www.lavote.net/Documents/vsap/vsap\\_project\\_report\\_070910.pdf](https://www.lavote.net/Documents/vsap/vsap_project_report_070910.pdf)
2. 2011 VSAP Phase II General Voting System Principles <http://vsap.lavote.net/principles/>
3. 2017 VSAP Phase III Design results <http://vsap.lavote.net/wp-content/uploads/2017/08/VSAP-Phase-III-Report.pdf>
4. 2018 VSAP Phase IV-V RFP Features in detail [http://vsap.lavote.net/wp-content/uploads/2018/01/RFP\\_PHASE\\_2.pdf](http://vsap.lavote.net/wp-content/uploads/2018/01/RFP_PHASE_2.pdf)
5. 2018 VSAP Phase IV-V RFP Licensing Attachment <https://sfgov.org/electionscommission/sites/default/files/Documents/meetings/2018/2018-01-17-commission/LA%20RFP%20Phase%202%20-%20Voting%20System%20License.pdf>

## 6. 2018 VSAP Phase IV-V Contract with Smartmatic

<http://file.lacounty.gov/SDSInter/bos/supdocs/123460.pdf>

## Free & Fair

1. Published Architecture detail <http://freeandfair.us/products/>
2. GitHub organization <https://github.com/FreeAndFair>

## Sovereign

1. The Social Smart Contract <https://github.com/DemocracyEarth/paper>
3. Published Architecture detail <http://sovereign.software/>
2. GitHub organization <https://github.com/DemocracyEarth/sovereign>

## Condorcet Internet Voting System (CIVS)

1. SaaS website <https://civs.cs.cornell.edu/>
2. GitHub repository <https://github.com/andrewcmymers/civs>

## Open Source Election Technology (OSET)

1. Published Architecture detail <http://www.dubberly.com/concept-maps/ttv-elections-technology-framework.html>
2. GitHub organization <https://github.com/TrustTheVote-Project>

## Helios

1. Published Architecture detail <http://www.uclouvain.be/crypto/electionmonitor/default/about>
2. GitHub organization <https://github.com/benadida/helios-server>

## STAR-vote

1. 16 March 2012 Risk Limiting Audits Gentle white paper <https://www.stat.berkeley.edu/~stark/Preprints/gentle12.pdf>
2. Aug 2013 Usenix Electronic Voting Technology Workshop, STAR-Vote: A Secure, Transparent, Auditable, and Reliable Voting System <https://www.usenix.org/conference/ewtvote13/workshop-program/presentation/bell>,
3. October 2016 Statement of Intent [https://osvtac.github.io/recommendations/files/star-vote/STAR-Vote\\_Statement\\_of\\_Intent.pdf](https://osvtac.github.io/recommendations/files/star-vote/STAR-Vote_Statement_of_Intent.pdf)
4. 09 October 2016 Travis County Clerk publishes RFP #P1609-008-LC, for STAR-Vote: A New Voting System for Travis County, Texas [https://osvtac.github.io/recommendations/files/star-vote/RFP\\_STAR-Vote\\_Unofficial\\_Copy.pdf](https://osvtac.github.io/recommendations/files/star-vote/RFP_STAR-Vote_Unofficial_Copy.pdf)
5. 28 September 2017, Travis County Clerk ends the STAR-Vote project [https://osvtac.github.io/recommendations/files/star-vote/STAR\\_Vote\\_Final\\_Report.pdf](https://osvtac.github.io/recommendations/files/star-vote/STAR_Vote_Final_Report.pdf)
6. 04 October 2017 Austin Monitor, STAR-Vote collapses <https://www.austinmonitor.com/stories/2017/10/star-vote-collapses/>
7. 27 Apr 2018 Post STAR-Vote ePollBook System RFP published <https://traviscountyclerk.org/eclerk/Content.do?code=new-epollbook-system>
8. 10 May 2018 Next phase of STAR-Vote <https://www.npr.org/2018/05/10/609979541/texas-works-to-create-a-more-secure-electronic-voting-system>

## FollowMyVote

1. Published Architecture detail <https://followmyvote.com/online-voting-technology/blockchain-technology/>
2. GitHub organization <https://github.com/FollowMyVote>