Open Source Voting
COIT Budget Request

Department of Technology &
Department of Elections

Open Source Voting

CCSF Open Source Election Goals

Accuracy of the Participation and Vote
Privacy
Transparency of the Process
Security in the Process
Equity and Accessibility
Tax Dollars Spent Effectively

Project Objective

- With a recognition that open source systems can improve the transparency of election systems and offer a non-commercial choice, CCSF is evaluating the feasibility and piloting development of an open source election system.
- Leveraging open source technology can: improve the quality and transparency of election voting, enable the sharing of the open source code with the elections community, deploy robust reporting capabilities, and drive improvements in Election Systems through participatory system development and agency cooperation.

Open Source Voting- Problem Definition

Current State	• Election systems are provided by commercial providers with limited transparency on the software processing and tabulation of results. • Open source technology would allow the public to investigate and evaluate the quality and processing of election results if a system used such tools. • Voting for the 94,000 residents with disabilities could be improved with secure in-home, secure voting. • Build confidence in the voting process with Risk Limiting Audits.
Future State	• City leverages existing open source projects and partners to construct an open source voting system. • Partners assist the City in support of the election system. • The Open Source Election system is used by other cities and counties for their election system. • In-home voting for disabled residents. • Automating voting integrity with Risk Limiting Audit software and program

Open Source Voting

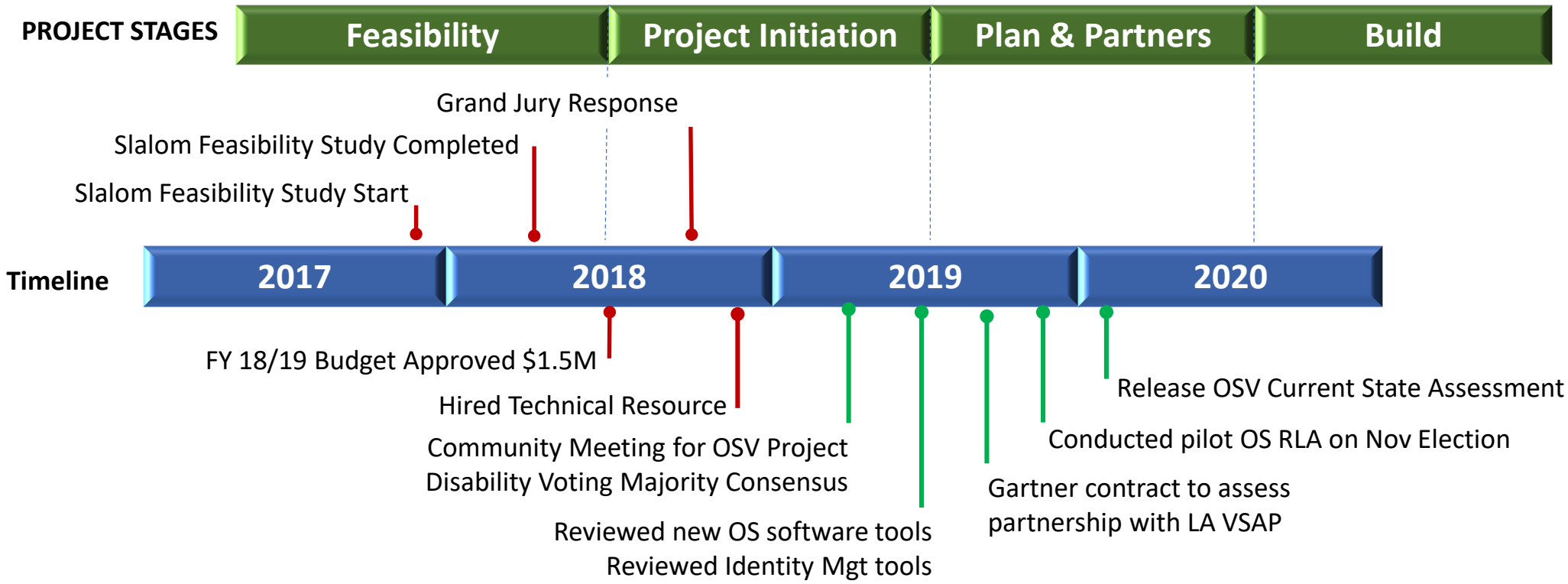
Primary Users

- Department of Elections

Major Stakeholders

- The Public, candidates running for office, the Elections Department

Open Source Voting – Activities to Date



Open Source Election Plan

PHASE	DATES	DESCRIPTION
Phase 1	6/2018 – 7/2019	Build project team. Review all past and existing open source voting projects. Plan and draft Request for Proposal to gain a partner for the development of the system.
Phase 2	8/2019 – 6/2020	Conduct community engagement meeting to understand support for open source election systems. Research into partners – Gartner Consulting. Pilot RLA for election vote validation (see Appendix 1). Design in-home identity management for voting.
Phase 3	7/2020 – 6/2021	Build the program and training for conducting RLA for elections. Engineer and pilot Vote by Mail identity management. Enter into feasibility discussion with LA on partnership for VSAP. (Appendix 3) Release RFP for vendors or teams to build the OSV.

Open Source Project Request FY 20/21

Project 1: Risk Limiting Audit Program (see appendix for project slides)

- Phase I:
  - Standardize on languages
    - Transition out of Jupyter notebook
  - Migrate from files to an RDBMS
    - JSON is ill-suited for a system that has a natural entity-relationship model
  - Build a test suite above and beyond unit tests
  - Document
- Phase II:
  - Support for Multi-Contest auditing
  - Integrate non-VBM Ballot auditing
  - Enhance the UI
  - ShangRLA is engineered to support various forms of contest beyond RCV
    - …but “official support” may require further development and testing

Open Source Project Request FY 20/21

Project 2: Project Partnership

- The City desires a partnership with other jurisdictions or vendors to share the cost and maintenance of open source election systems. The partnership would describe roles, responsibilities and governance for any software system deliverables.

Project Plan:

- Contract with Gartner Consulting to assess the feasibility of partnering with LA VSAP project. This open source based election software system has been certified by the state and could be an opportunity for a partnership. Gartner will identify gaps, alignment issues and the format for an agreement.
- Based on the Gartner Feasibility work create a work plan for building a partnership and the contract between the agencies.
- If the VSAP project is not a feasible solution, advertise an RFP for other teams or partners to propose solutions to the City.

Open Source Project Request FY 20/21

Project 3: In-home Voting for Residents with Disabilities

- In July 2019, a community workshop was held to get public feedback about voting concerns including open source voting. A primary concerns identified by participants was how to effectively integrate mandatory accessibility guidelines for people with disabilities into our voting system development.
- In addition to Open Source voting accessibility concerns, the Mayor's Disability Council also heard about accessibility concerns pertaining to Remote Accessible Vote by Mail which was implemented in San Francisco recently as part of mandated State legislation. The platform itself appears to meet current accessibility guidelines, but there are still barriers to completing the voting process for people with disabilities.

Project Plan:

- Design and engineer the integration between Identity and Access Management and in-home vote by mail using accessibility software tools
- Research software or hardware identity management tools to determine the most viable solution that will support the maximum number of residents

Open Source Project Request FY 20/21

Project 4: Open Source Voting System Development

- With a recognition that open source voting systems can improve the transparency of election systems and offer a non-commercial choice for a voting system, design and build and open source software system.
- Proceed with Gartner recommendations on partner strategies that can assist with the development and who can contribute/share costs.
- The estimated timeline for designing, building, testing and certifying the system is 7-9 years

Project Approach:

- Fund the project at the estimated level of an average $29M over 7 years ($4.2M/yr) and release funding as project milestones are completed.
- Develop agreement with partner agency (see Gartner description of LA VSAP in Appendix 3)
- Procure needed project resources
- Establish develop methodology, functional design and workplans

References: Feasibility Study for Open Source Voting (Slalom) and State of the Art for Open Source Voting

Open Source Voting- Financials

Current and Planned Project Expenditures

Prepared 2/2020	*Project Initiation*	*Plan & Design*	*Build & Implement*
PROPOSED SOURCES	**FY18-19**	**FY19-20**	**FY20-21**
COIT Funding	$ 300,000	$ -	$ -
BOS Add-back	$ 660,000	$ 595,000	$ -
Fund Balance	$ 125,000	$ 748,000	$ 853,000
State Matching Funds		$ -	
Total Sources	**$ 1,085,000**	**$ 1,343,000**	**$ 853,000**
USES	**FY18-19**	**FY19-20**	**FY19-20**
Salary & Fringe	$ 250,000	$ 120,000	$ 120,000
Professional Services - OnStrategy	$ 20,000	$ 40,000	$ 40,000
Professional Services - RLA	$ -	$ 50,000	$ 230,000
Professional Services - Partnership		$ 250,000	$ 150,000
Professional Services - IAM		$ 30,000	$ 170,000
Hardware	$ -		$ -
Operating Expenses	$ -	$ -	$ -
Total Uses	**$ 270,000**	**$ 490,000**	**$ 710,000**
Remaining Fund Balance	***815,000***	***853,000***	***143,000***

Open Source Voting- Financials

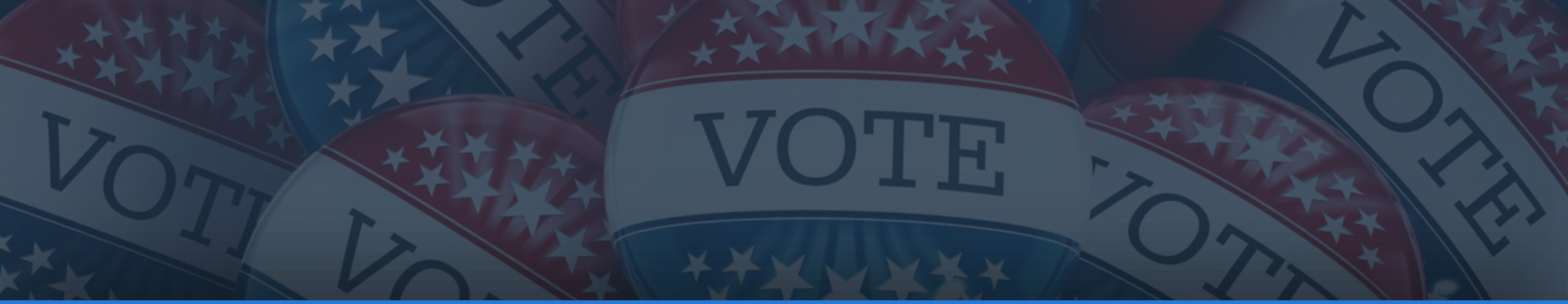
All Project Expenditures FY 19-24

COIT PROJECT BUDGET	FY19-20	FY20-21	FY21-22	FY22-23	FY23-24
Project Mgt and Strategy	$160k	$160k			
Project 1 – Risk Limiting Audits	$50k	$230k			
Project 2 – Project Partnership	$250k	$150k			
Project 3 – In-home Disability Voting	$ 30k	$170k			
Project 4 – Large OSV System Build		$4.1M	$4.1M	$4.1M	$4.1M
Project Costs	**$490K**	**$4.18M**	**$4.1M**	**$4.1M**	**$4.1M**
COIT Request		**$3,927,000**	**$4,100,000**	**$4,100,000**	**$4,100,000**

Note: Project 4 expenditures of $4.1M will continue to FY2027

Open Source Voting

Appendix 1 – Risk Limiting Audit Pilot Project



Project ShangRLA

An Overview of ballot-comparison audit on Ranked-Choice Voting City and County of San Francisco

November 20th, 2019

SAN FRANCISCO
DEPARTMENT OF
TECHNOLOGY

Introducing a few firsts

- FIRST: Open Source project sponsored by CCSF/DT
- FIRST: Implementation of a Risk-Limiting Audit on a Ranked-Choice Voting contest
- FIRST: Independent validation of Dominion's RCV Tabulation

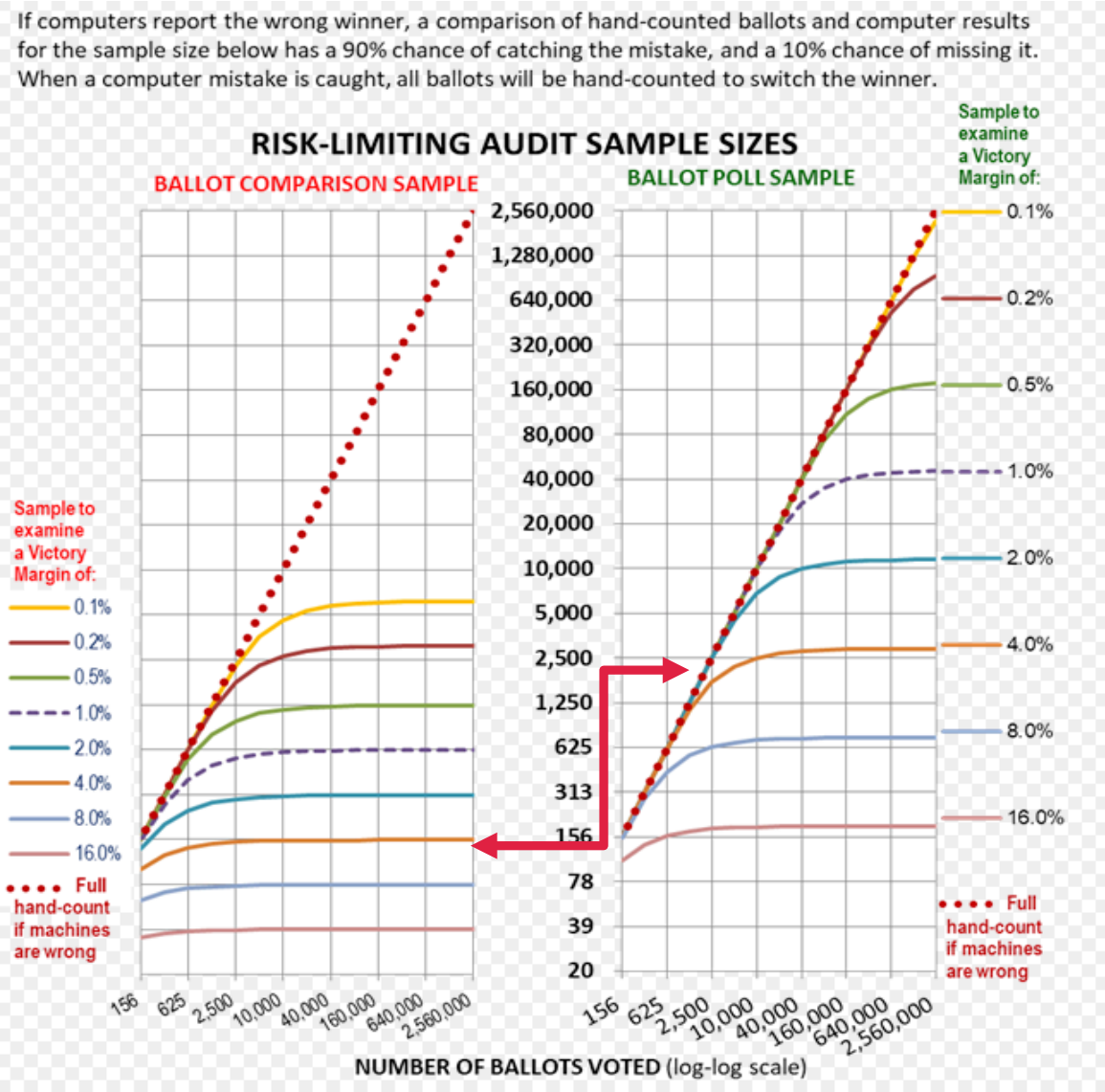
What is a Risk-Limiting Audit?

- A Risk-Limiting Audit (RLA) offers a statistical guarantee:

  "If a full manual tally of the paper ballots would show that the reported election outcome is wrong, an RLA has a known minimum chance, the RLA limit, of leading to a full manual tally" – Philip B. Stark

  "As with other elections audit, the goal is to identify not only intentional alterations of ballots and tallies, but also bugs in election machines, such as software errors, scanners with blocked sensors or scanners skipping some ballots. " –Wikipedia

What is a Ballot-Comparison audit ?



Two main types of RLA:

- **Ballot Polling**: Humans count a random sample of ballots and report any difference between manual percentage and computer percentage
- **Ballot Comparison**: Election system provide a Cast Vote Record(CVR). Humans check physical ballots in a random sample of ballots. RLA system check results of human count against machine count.
  - Ballot comparison is more efficient than ballot polling due to its smaller sample size, and, arguably, less error-prone on an RCV.

Anyone is welcome to check the math

```
audit-irv(C, B, c_w, α[, γ])
1   audits ← ∅
2   F ← ∅ ▷ F is a set sequences to expand (the frontier)
3   LB ← 0
    ▷ Populate F with single-candidate sequences
4   for each(c ∈ C \ {c_w}):
5       π ← [c]
6       h ← FindBestAudit(π, C, B, α[, γ])
7       hy[π] ← h ▷ Record best hypothesis for π
8       ba[π] ← π ▷ Record best ancestor sequence for π
9       F ← F ∪ {π}
    ▷ Repeatedly expand the sequence with largest ASN in F
10  while(|F| > 0):
11      π ← argmax{ASN(hy[π]) | π ∈ F}
12      F ← F \ {π}
13      if(ASN(hy[ba[π]]) ≤ LB):
14          audits ← audits ∪ {hy[ba[π]]}
15          F ← F \ {π' ∈ F | ba[π] is a suffix of π'}
16          continue
17      for each(c ∈ C \ π):
18          π' ← [c] ++π
19          h ← FindBestAudit(π', C, B, α[, γ])
20          hy[π'] ← h
21          ba[π'] ← if ASN(h) < ASN(hy[ba[π]]) then π' else ba[π]
22          if(|π'| = |C|):
23              if(ASN(hy[ba[π']]) = ∞):
24                  terminate algorithm, full recount necessary
25              else:
26                  audits ← audits ∪ {hy[ba[π']]}
27                  LB ← max(LB, ASN(hy[ba[π']]))
28                  F ← F \ {π' ∈ F | ba[π] is a suffix of π'}
29                  continue
30          else:
31              F ← F ∪ {π'}
32  return audits with maximum ASN equal to LB
```

Overview

- SHANGRLA is an Open Source RCV-RLA project sponsored by CCSF
  - https://github.com/pbstark/SHANGRLA
  - Implementation of academic research on RCV-RLA
  - Six key contributors across the globe on the project
    - We have yet to meet each other and we all spoke different languages:
      - *English, American, Australian, Java, C++, Python, JSON, CSV, and Statistics*
- SHANGRLA pilot is NOT an RLA
  - It is a ballot-comparison audit of Vote By Mail ballots (~68% of total)
  - A full RLA would require inclusion of all ballots casted
    - And a separate audit method for non VBM Ballots

Acknowledgements - CCSF -

CCSF would like to acknowledge the gargantuan efforts of the team:

CCSF Team:

Linda J. Gerull CCSF, City CIO & Executive Director, Dept of Technologies
Members of the San Francisco Dept of Elections

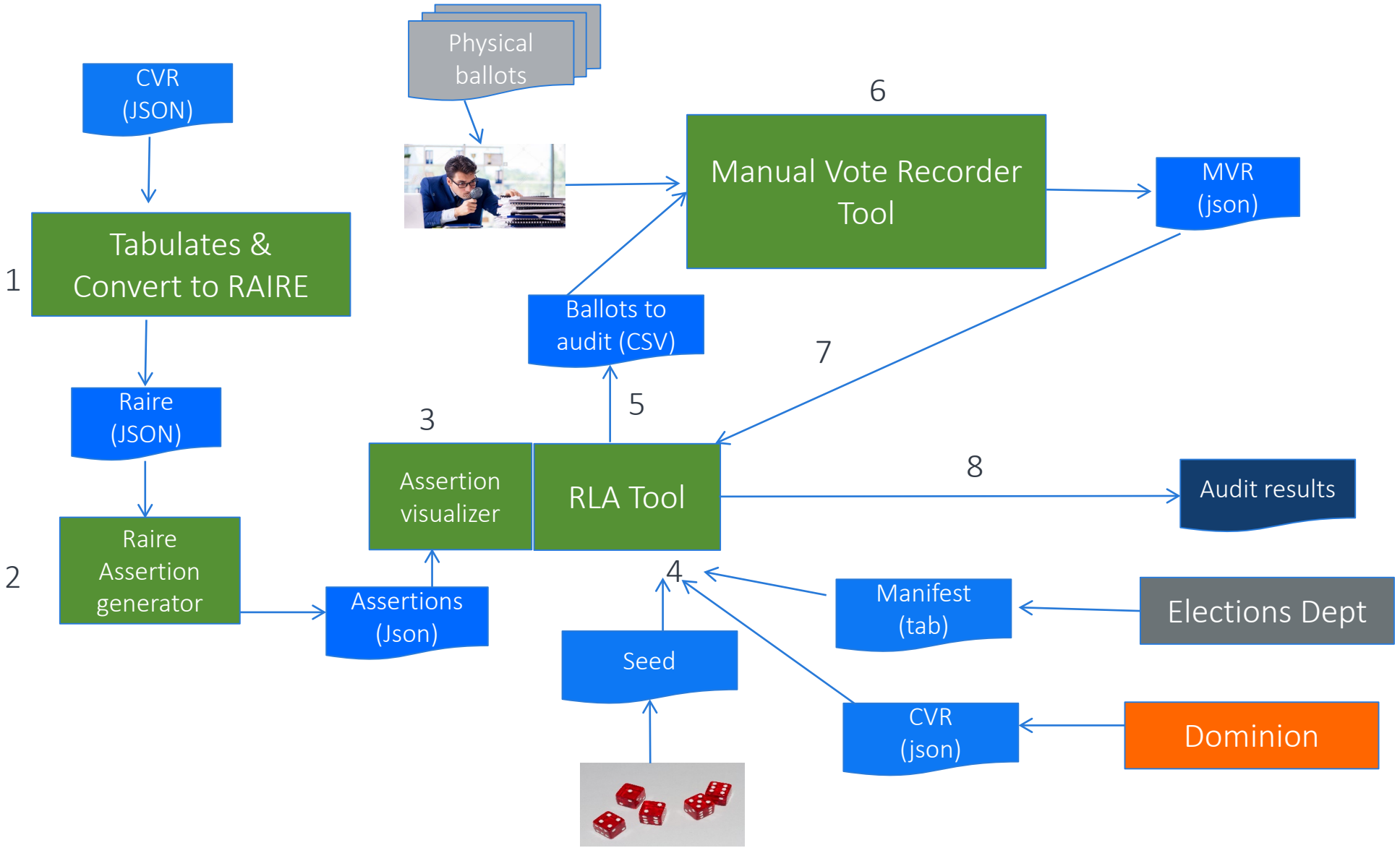
RCV Team:

Dr. Michelle Blom:
Research Fellow, School of Computing and Information Systems, The University of Melbourne, Australia
Dr. Andrew Conway:
CEO, Silicon Econometrics Pty. Ltd., Australia
Peter Stuckey:
Professor, Data Science & AI, Monash University, Melbourne, Australia
Vanessa Teague:
Associate Professor, School of Computing and Information Systems, The University of Melbourne, Australia

RLA Team:

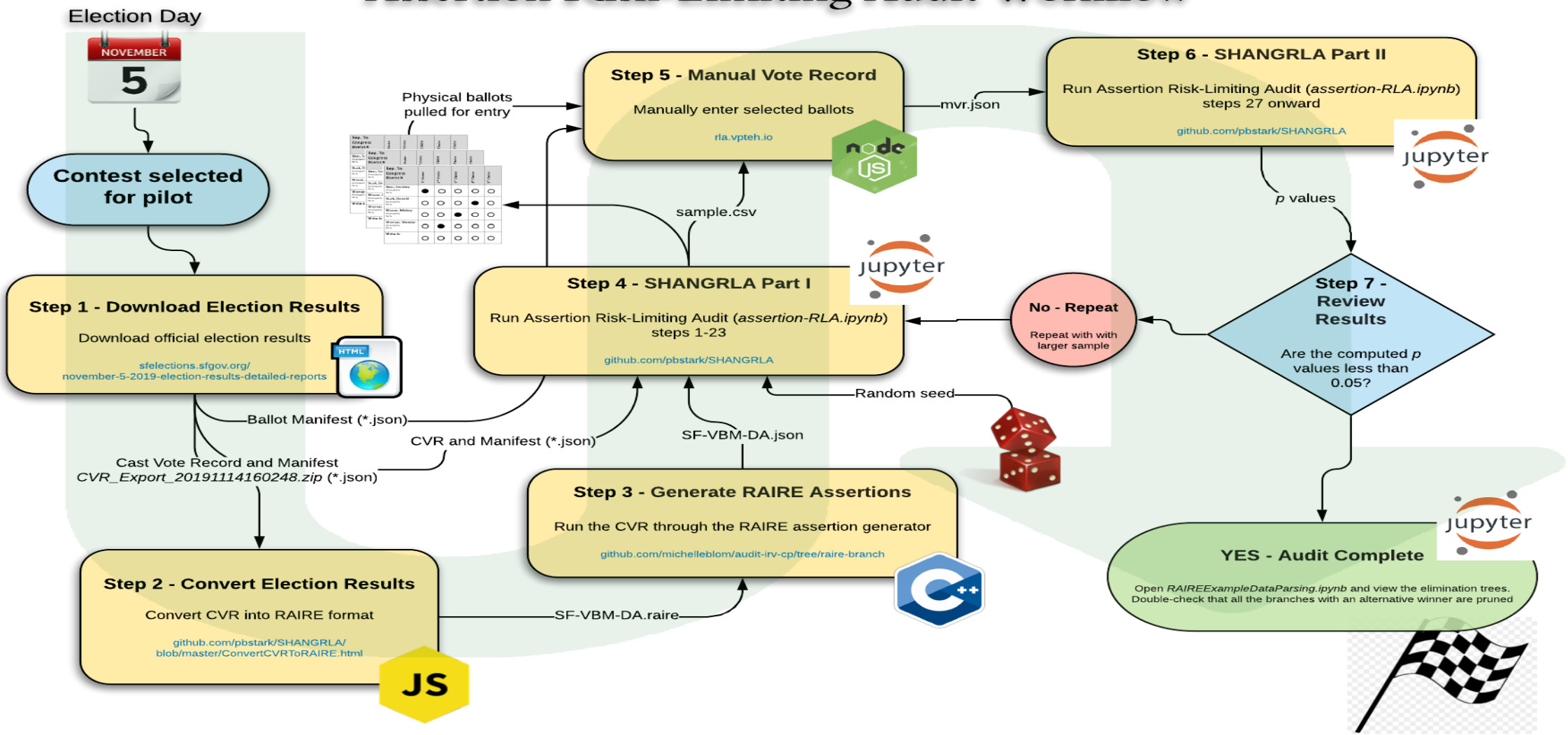
Dan King:
CCSF Dept of Technology Consultant, CEO ViewPoint Technology, San Diego
Philip B. Stark:
Professor of Statistics, Associate Dean, Division of Mathematical and Physical Sciences , Regional Associate Dean (Interim), College of Chemistry and Division of Mathematical and Physical Sciences, University of Berkeley, CA

ShangRLA flow overview



RLA Pilot – November 2019

Assertion Risk-Limiting Audit Workflow



RAIRE Tabulator/Converter – Andrew Conway - Aus

Independent verification of Dominion's tabulation

RAIRE Tabulator (Report 8)

Report 8	Round 1	Round 2	Round 3
Loftus	59,762	66,228	83,511
Dautsch	26,901		
Tung	37,161	46,403	
Boudin	68,145	72,860	85,950

DOE Report (Report8)

City and County of San Francisco

Candidate	Round 1			Round 2			Round 3		
	Votes	Percentage	Transfer (Elimination)	Votes	Percentage	Transfer (Elimination)	Votes	Percentage	Transfer
SUZY LOFTUS	59,762	31.13%	6,466	66,228	35.70%	17,283	83,511	49.28%	0
LEIF DAUTCH	26,901	14.01%	-26,901	0	0.00%	0	0	0.00%	0
NANCY TUNG	37,161	19.36%	9,242	46,403	25.02%	-46,403	0	0.00%	0
CHESA BOUDIN	68,145	35.50%	4,715	72,860	39.28%	13,090	85,950	50.72%	0
Continuing Ballots Total	191,969			185,491			169,461		

Assertions Generator – Michelle Blom - Aus

Many of the the 29 audits steps can be found here:

michelleblom

Follow

michelle.blom@gmail.com

Block or report user

Overview | Repositories 7 | Projects 1 | Stars 0 | Followers 0 | Following 0

Popular repositories

audit-irv-cp
Code for generating and running ballot-level comparison audits for IRV elections.
C++ ★ 2

audit-irv-bp
Code for generating and running ballot polling audits for IRV elections.
C++ ★ 1

margin-irv
Margin computation for IRV elections
C++

NSW2015
Data files for use with a range of code available in my repositories. Can be used with: audit-irv-bp; audit-irv-cp.

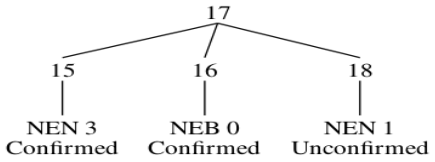
STV-manipulator
An implementation of two heuristics for computing candidate manipulations of Single Transferable Vote (STV) elections. These manipulations provide an upper bound on the margin of victory for such e...
C++

AZUL
Framework to support policy learning for the boardgame AZUL. The purpose of this framework is to allow students to implement algorithms for learning AI players for the game and evaluate the perform...
Python

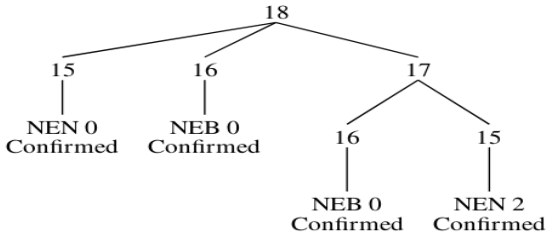
Assertion Visualizer - Vanessa Teague – Aus.

[2]:

Pruned tree in which 16-LEIF DAUTCH wins.



Pruned tree in which 17-NANCY TUNG wins.



Pruned tree in which 18-CHESA BOUDIN wins.

Trees showing how other winners are excluded.

Now print all the assertions. This gives you an explanation of the meaning of each one.

[3]:
```
printAssertions(WOLosers,IRVElims)
```

```
Not-Eliminated-Before assertions:
Confirmed:   NEB  0: Candidate 15 cannot be eliminated before 16.


Not-Eliminated-Next assertions:
Confirmed:   NEN  0: Candidate 15 cannot be eliminated next when {'16', '17'} are eliminated.
Unconfirmed: NEN  1: Candidate 18 cannot be eliminated next when {'16', '15'} are eliminated.
Confirmed:   NEN  2: Candidate 15 cannot be eliminated next when {'16'} are eliminated.
Confirmed:   NEN  3: Candidate 15 cannot be eliminated next when {'16', '18'} are eliminated.
```

RLA – Philip B. Stark – Berkeley

Philip B. Stark
pbstark

Follow

Faculty at UC Berkeley / Consultant
United States
stark@risklaw.org
www.stat.berkeley.edu/~stark

PRO

Block or report user

Overview | Repositories 22 | Projects 0 | Stars 0 | Followers 50 | Following 0

Popular repositories

Padova15
Materials for a 30-hour course in Statistics for Engineers, given at University of Padova
CSS ★13 2

MX14
Short course on nonparametric inference in auditing and litigation, XXIX Foro Internacional de Estadistica, Puebla, MX
Jupyter Notebook ★12 5

S157F17
Statistics 157, Fall 2017, UC Berkeley
Jupyter Notebook ★10 10

Nonpar
Teaching materials for nonparametric statistics
CSS ★7 3

pseudorandom
Jupyter Notebook ★5

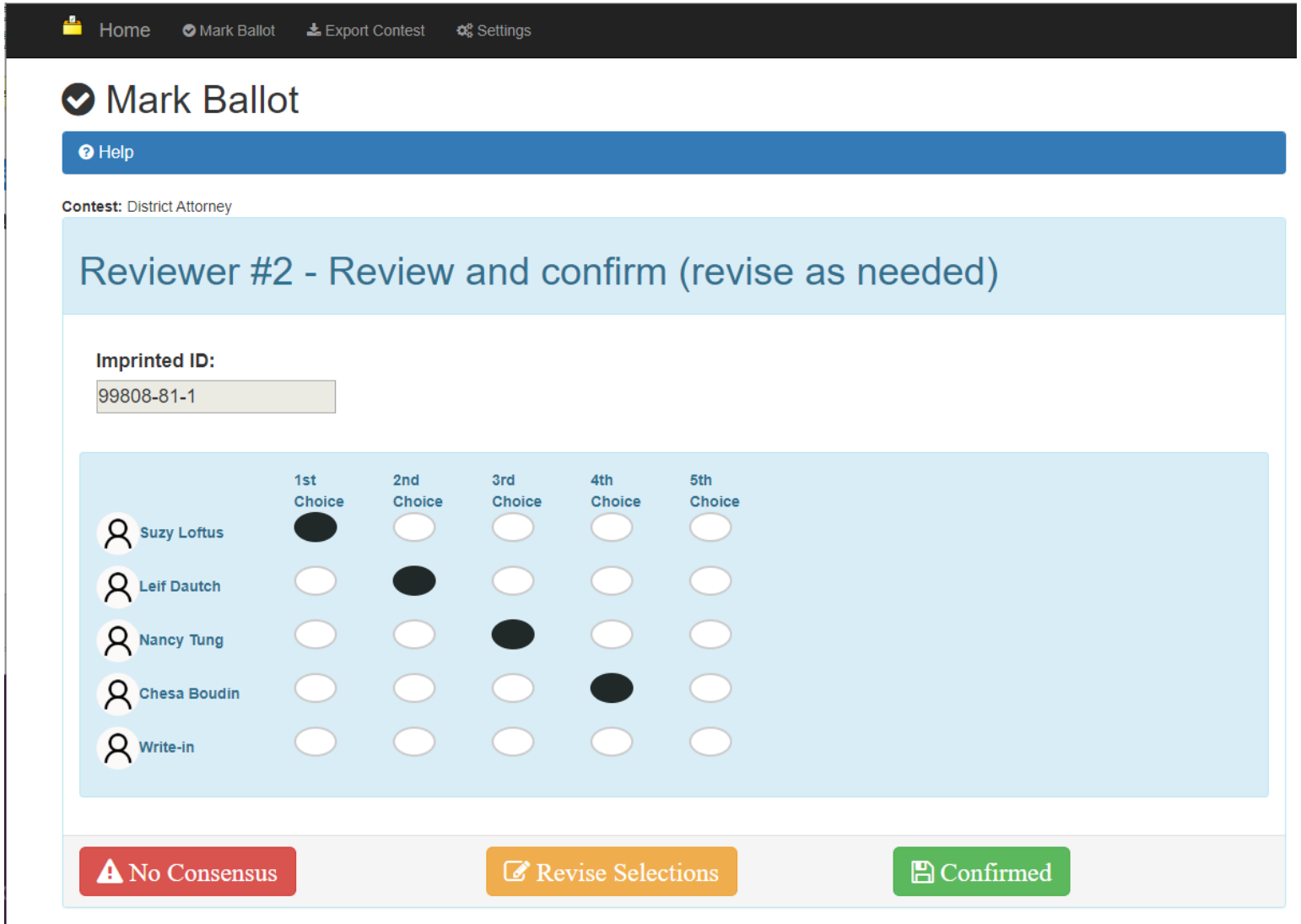
CORLA18
theory and code for RLAs: Colorado and San Francisco
TeX ★3 4

95 contributions in the last year

- Inventor of RLA
- Has participated in dozens of RLA
- His work is the basis for CORLA
- ShangRLA is a substantial update to CORLA's methods

Was "busy" in November

Auditor Tool - Dan King - CCSF/San Diego



Next Step: Taking ShangRLA from pilot to product

- Phase I:
  - Standardize on languages
    - Transition out of Jupyter notebook
  - Migrate from files to an RDBMS
    - JSON is ill-suited for a system that has a natural entity-relationship model
  - Build a test suite above and beyond unit tests
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- Phase II:
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  - Integrate non-VBM Ballot auditing
  - Enhance the UI
  - ShangRLA is engineered to support various forms of contest beyond RCV
    - …but “official support” may require further development and testing

Open Source Voting

Appendix 2 for

Open Source Voting System Development with a Partner

A Report for

City and County of San Francisco

Los Angeles County Voting Solutions for All People (VSAP) Overview

December 2019
Engagement: 330059599

Gartner®

Table of Contents

Gartner

1.0 Introduction

This Overview of the Los Angeles County Voting Solutions for All People (VSAP) system is provided to the City and County of San Francisco (CCSF) as part of the Open Source Voting Partnership Strategy Project. This document provides an overview of the history and timeline of the VSAP Program, along with a depiction of the overall VSAP architecture and a description of its components. This document is intended to assist the CCSF team get a better understanding of the VSAP solution as the team considers partnership opportunities during the Open Source Voting Partnership Strategy Project.

2.0 History

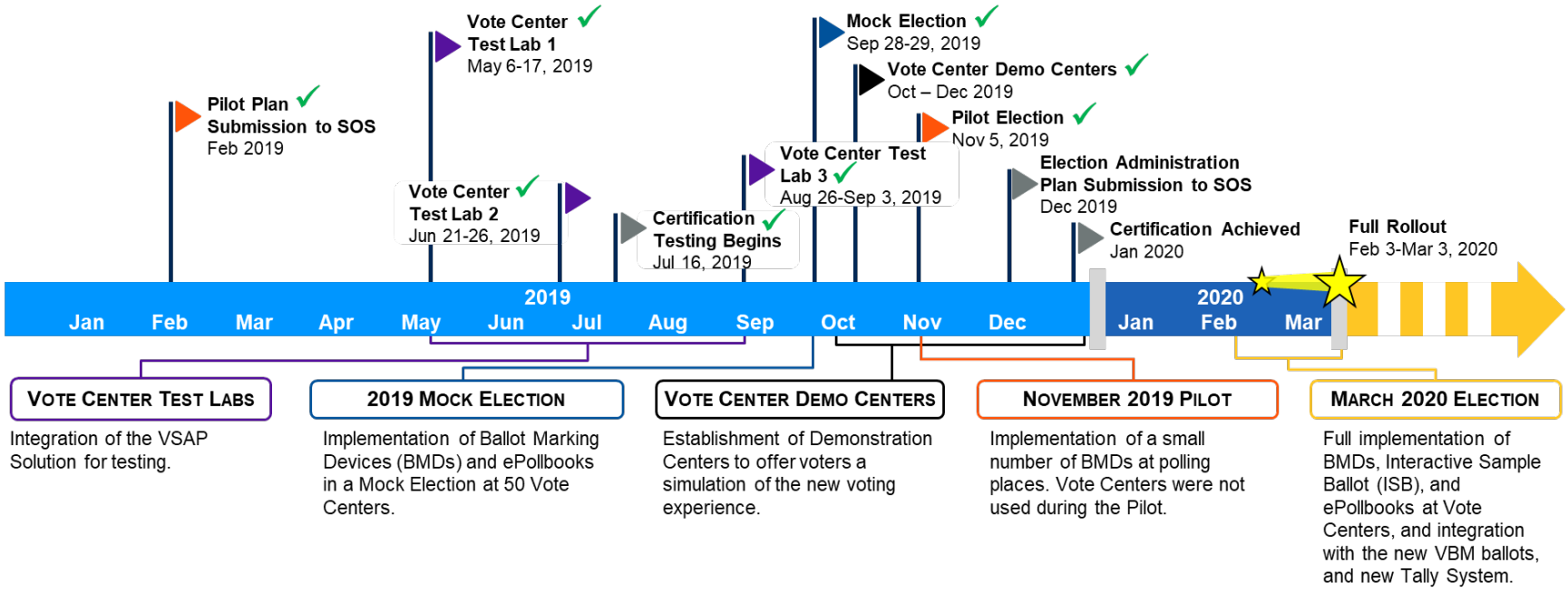
Launched in September 2009, VSAP was developed in response to the growing voting system needs and challenges faced by the County. Through public engagement and research, VSAP established a strong foundation of baseline data regarding voter and poll worker preferences and requirements. The Department also engaged with partners to gather data on the current funding, regulatory and voting systems market, and participated in a Request for Proposals (RFP) issued by the City of Los Angeles (City) in search of federally certified and state approved voting systems. None of the seven (7) voting systems evaluated met the City's requirements. The extensive research of voter behavior and the limited voting systems market, coupled with the size and diversity of the County, brought the Department to conclude that it was impossible to reasonably consider an existing commercial off-the-shelf (COTS) voting system solution. Any voting system solution would entail a significant development or customization process in order to satisfy the County's needs, VSAP General Voting System Principles and technical requirements.

In response to these needs and challenges, VSAP has taken an unprecedented and comprehensive approach at modernizing the County's voting system. The vision of the project is to implement a voting solution using a transparent process that focuses on the needs and expectations of current and future County voters.

The intent of VSAP is to transform and modernize the voting experience in a manner that is responsive to the needs, desires and behaviors of its electorate. After several years of research, design and engineering (Phases 1 through 3), the County is now executing Phase 4 and Phase 5 with respect to system engineering, manufacturing and certification as well as a phased implementation of the new voting experience model. More details on the five-phase approach are provided in the Appendix.

The County seeks not only to provide the new voting experience and system to its voters, but to develop them in a manner that allows other jurisdictions to adopt the same designs, or purchase the same solution, and provide similar voting systems and experiences to their constituents. Part of this vision is to retain ownership of the IP developed so that, under license, other jurisdictions may have systems manufactured for their use.

2.1 VSAP Program Implementation Timeline



Gartner

3.0 VSAP Components and Architecture

Figure 1. High-Level Ecosystem of the VSAP Solution

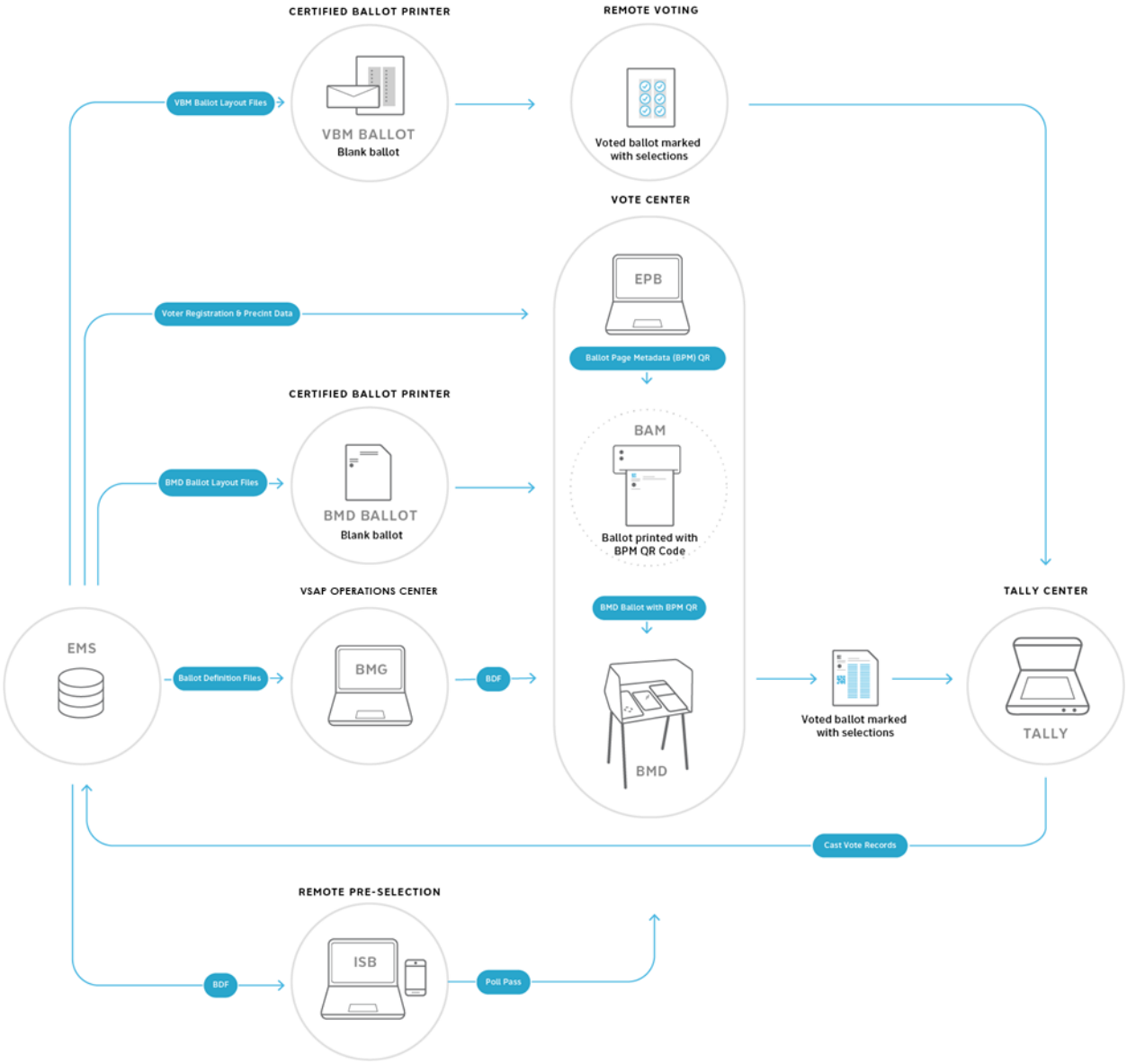
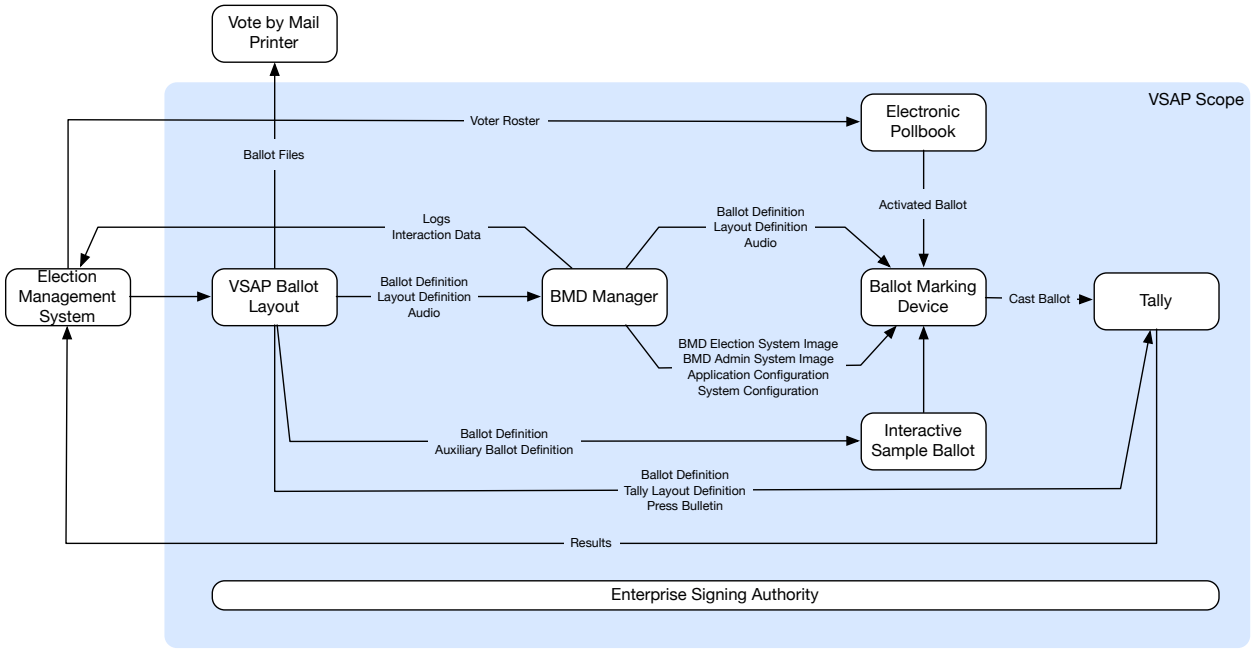


Figure 2. Overview of VSAP Architecture



3.1 VSAP Ballot Layout (VBL)

VBL is responsible for generating election data and ballot layouts, as well as application configurations for other component solutions. It generates election data and ballot layouts, and Vote by Mail (VBM) ballot files. VBL also generates Logic and Accuracy Tests for both BMD and VBM ballots.

3.2 BMD Manager (BMG)

The BMG is a centralized management tool for BMDs. It allows operators to manage data and software configurations simultaneously on as many BMDs as necessary. Software updates and assessments should not require physical access, although some diagnostics (e.g., scanner and printer diagnostics, which require paper) will require manual intervention.

BMG uses REST service endpoints to enable communication with other applications in the VSAP solution, with a mechanism to import and export data. Additional REST APIs communicate between the BMG and the BMD.

The BMG network is a completely standalone, self-contained, air-gapped network. It uses the network architecture to map exact locations of BMD devices within the warehouse, through a series of switches.

The application is based on Java/Spring Boot with a React JavaScript user interface. It operates in a secure server environment.

3.3 Ballot Marking Device (BMD)

The Ballot Marking Device (BMD) is the primary touchpoint for the voter and the hub of the new voting system. Voters can use touchscreen or audio with tactile controller to make selections,

print selections on a paper ballot in both human and machine-readable formats, and cast the paper ballot.

The BMD uses a custom-built Ubuntu Linux OS to run three applications:

1. BMD-Vote is an electoral desktop application that enables voters to vote and cast their ballots.
2. BMD-Diagnostic is a desktop application to enable hands-on diagnostic tests to verify that a BMD is fully functional and runs at the warehouse.
3. BMD-Admin enables communication with the BMG at the warehouse

BMD-Vote and BMD Diagnostic are developed with Electron JavaScript. A set of custom C++ libraries interact with BMD device hardware used by the application layer. BMG-Admin is a Node application that exposes REST service endpoints to integrate with the BMG.

3.4 Electronic Pollbook (EPB)

The Electronic Pollbook is the initial point of the voting experience in a vote center. It is a tablet-based e-roster that poll workers use to check in a voter. The EPB provides networked access to the database of all registered voters in the County. This access enables voters, who otherwise would be limited to voting at their assigned precinct, to vote at any vote center throughout the County. The VSAP solution uses the KNOWiNK PollPad. The PollPad is connected to a Brother printer which prints the ballot activation QR code on the ballot before the ballot is given to the voter.

3.5 Interactive Sample Ballot (ISB)

The Interactive Sample Ballot (ISB) supports core voting operations by enabling voters to review and pre-mark election materials at their own pace using a computer or mobile device.

The ISB supports:

1. A digital means of presenting highly engaging and accessible sample ballot material.
2. Allowing users to pre-mark their selections and generate a QR code that may be used at the vote center to transfer their selections to the BMD.
3. Enabling voters with disabilities to privately and securely access, mark, and print a Remote Accessible Vote by Mail (RAVBM) ballot on their personal devices, which may be returned with their VBM packet.
4. Enabling military and overseas voters to vote and print an electronic Uniformed and Overseas Citizens Absentee Voting Act (UOCAVA) ballot, and a privacy waiver signature form, which may be signed and faxed in.

The ISB consists of:

- A responsive web client application to support voter/address-based initiation, a ballot loader, session management, ballot marking/review and Poll Pass generation. It also supports marked ballot and Oath Sheet printing for UOCAVA and RAVBM ballots.
- A preprocessor to support ballot definition parsing, precinct/ballot style mapping, content delivery network (CDN) connectivity and ballot preview/proofing. The preprocessor places parsed ballot style JSON files into an AWS S3 bucket that is accessible through the CDN by the client application.

- Lookup services for voters and addresses, using a Google connector for display of voter address on a map and a vote center lookup.

ISB is developed with React.js.

3.6 Tally

The Tally system is responsible for capturing and processing ballot images so that voter selections from paper ballots (including both BMD and VBM ballots) can be digitally counted. Tally contains these main Tally processes:

- Scanning and creation of ballot images.
- Conversion of ballot images to cast vote records (CVR).
- Tabulation of cast vote records.
- Export of election results from tabulation for reporting and audit.

Tally runs on CentOS and uses Docker images for specific functions. The code is developed with Golang. The different stages are managed through Kafka.

There are four stages for each ballot that is scanned:

1. Receiver – collects the ballot image from the scanner
2. Recognizer – interpret the voter intent by:
    a. Decoding the QR on BMD-generated ballots
    b. Decode the marked areas on VBM ballots through Marksense
3. Verifier – verify the digital signature of the BMD that generated the ballot
4. Refine – create the cast vote record (CVR)

Once the CVRs is generated, the tabulation process tallies the results and creates the result report.

3.7 Enterprise Signing Authority (ESA)

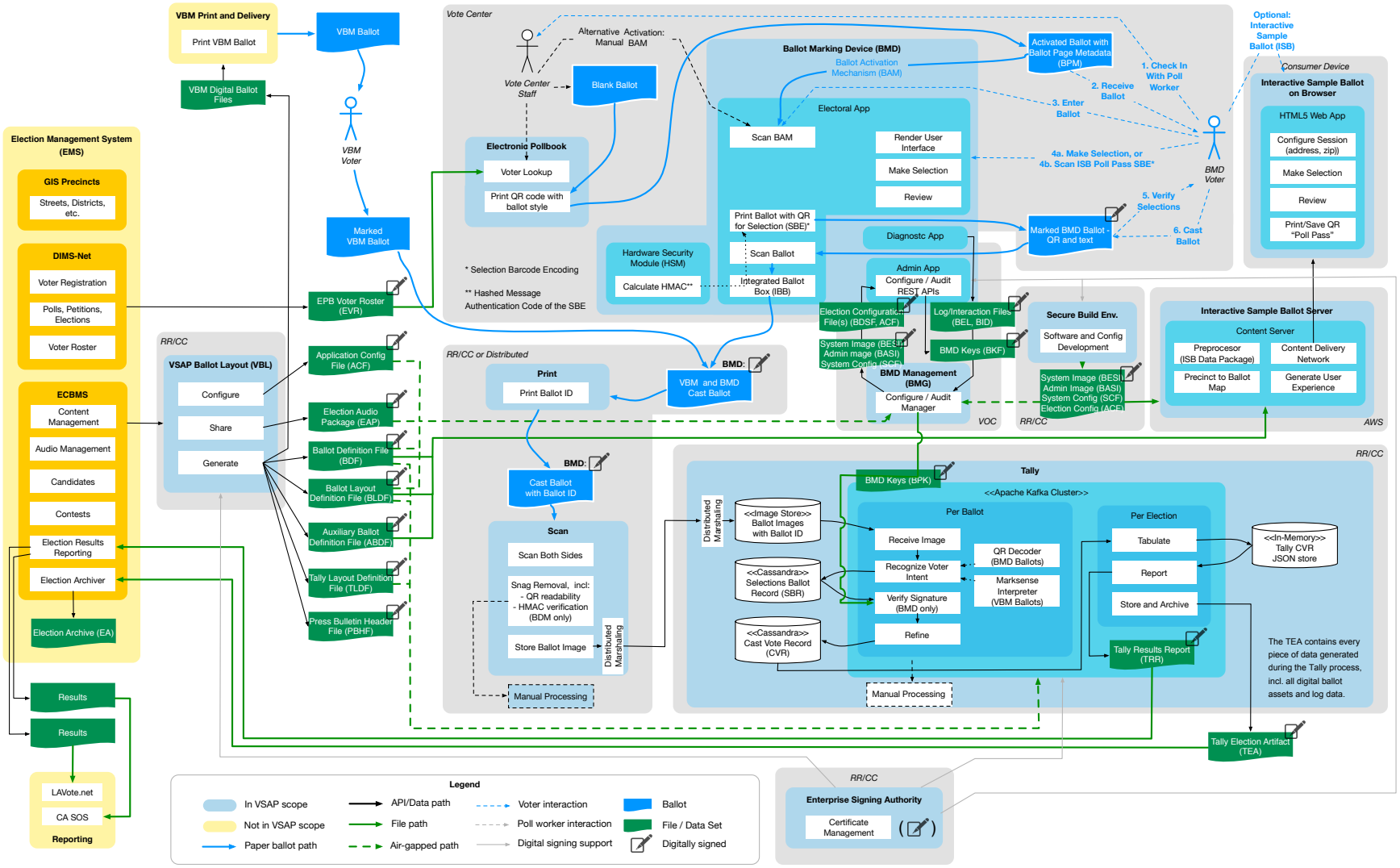
The ESA is used to secure the communications between the VSAP components. The VSAP architecture is loosely coupled by design, while some components (BMG, BMD, Tally) are air-gapped. Configuration is managed through file exchanges, where source components export specific files and file formats to garget components. The ESA secures these file exchanges, and ensures that files can only be processed if they are proven to come from a trusted source.

The ESA uses a hardware security module (HSM) compliant with FIPS 140, to generate a public/private key pair.

The ESA is deployed to a custom-built Ubunto Linux OS with a C++ library to interact with HSM device hardware. The ESA-UI desktop application enables ESA authorized users to execute the different functionalities that are available in the ESA. The ESA-Maintenance application enables hands-on diagnostic tests to verify that an ESA Hardware is fully functional.

The ESA incorporates mechanisms to keys from the ESA location to VSAP solution components within the secure ecosystem.

Figure 3. VSAP Architecture and Ballot Flow



4.0 Licensing

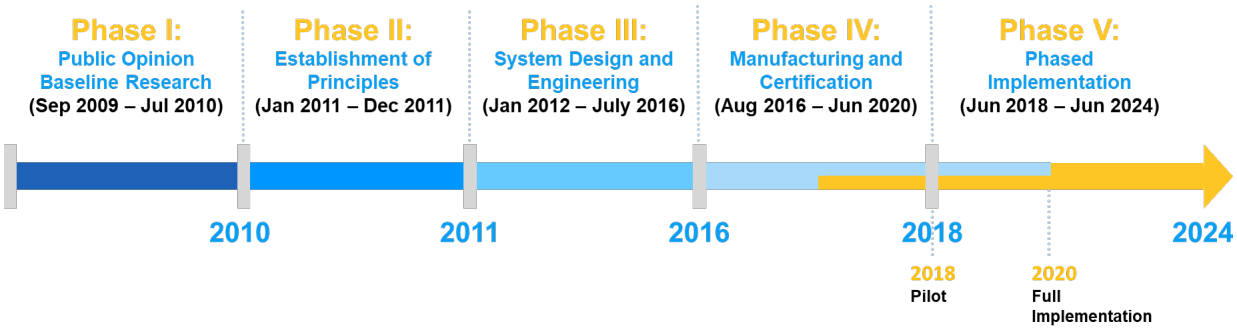
The County retains intellectual property (IP) ownership rights of the VSAP Solution, except for IP created for certain component hardware such as the thermal printers. This intention of IP ownership is not made to enter the market as a vendor, but to ensure public ownership of the rights to manage the use and transparency of the voting systems developed to ensure public trust and protect public interest. At present, the County is considering several different open source license options under which to make the VSAP Solution software available for use by other jurisdictions and entities. The County is also considering how an independent non-profit organization could serve as the repository, administrator and license holder of the resulting VSAP IP, recognizing that examples of successful open source technology solutions have had strong communities of users and developers that were supported by sound institutional structures and resources.

Appendix

Five-Phase Approach

VSAP is a five-phase plan to modernize the County's voting system and the voting experience through a voter-centered approach. The County is currently executing Phase 4 and Phase 5 in parallel.

Figure 4. Five-Phase Approach Timeline



Phase 1: Public Opinion Baseline Research

In Phase 1 of the project, VSAP partnered with CalTech and MIT's Voting Technology Project to gather an array of baseline data that would shape the overarching strategy for voting system modernization. This data was gathered from election stakeholders and subject matter experts including voters, poll workers, advocates, key community organizations and elections staff through a variety of research and engagement activities. This research focused on evaluating the current voting system and experience, and learning what users expect of the future voting system. The research revealed that users expect more than just an upgrade in voting technology, and modernization efforts are needed to improve the entire voting experience.

Phase 2: Establishment of Principles

Building on the research and lessons from Phase 1: Public Opinion Baseline Research, the VSAP Advisory Committee (AdCom) was established to ensure the voice of the voter continued to guide the voting system design process. The AdCom is a formal engagement body composed of stakeholders and advocates in elections that represent different communities in Los Angeles County. As its first task, the AdCom took the results from the research conducted in Phase 1: Public Opinion Baseline Research and used that data to create and adopt the General Voting System Principles, which acts as a guide for voting system modernization. These principles ensure the new voting system meets the diverse needs of County voters.

Following the development of the General Voting System Principles, the Department began its search for a new voting system by assessing the voting systems market and regulatory environment in which these systems are implemented. The Department also evaluated the acquisition models by which it could acquire a new voting system that would meet the needs of the County and its voters. The Department collaborated with a research team of graduate students from the UCLA Luskin School of Public Affairs to conduct research on regulations governing voting systems testing and certification and the impact on the County's goal to implement a new voting system. The research found that without changes to the regulatory environment, it would be very difficult for the Department to meet its goals of acquiring and implementing a new voting system consistent with the adopted principles. These factors along with feedback from the AdCom made a strong case for the Department to acquire a new voting system by engaging in a voting system development project.

Phase 3: System Design and Engineering

Phase 3 of the project marked a major transition from voting system research to the design and development of the new voting system, including a ballot marking device and related components. The work in Phase 3: System Design and Engineering of the project was spread across three (3) distinct and coordinated efforts: voting system design, stakeholder engagement and proactive legislative action.

In order to continue engaging stakeholders and incorporating the expertise needed in voting system design, the VSAP Technical Advisory Committee (TAC) was established. The TAC was established to provide VSAP with the necessary technical expertise in voting technology, security, transparency and accessibility during voting system design. The TAC is a diverse group composed of subject matter experts from a variety of industries and fields. The expertise and guidance provided by the TAC has been an invaluable component to the completion of Phase 3. In addition to engaging the members of the TAC, communication and outreach efforts engaged the public and kept them informed about project developments.

To begin to envision and design a new voting system and to remain aligned with VSAP values of transparency and citizen participation, VSAP launched an “Open Design Search” in January 2012. Utilizing sound data, the Open Design Search engaged, through an online crowdsourcing platform, a broad range of experts, designers and the general public to begin to gather ideas for the design of an innovative voting system to meet the unique needs of the County’s large and diverse electorate. There were two (2) primary components to the Open Design Search: 1) Open Innovation Challenge and 2) Voter Experience Brainstorming Workshops. This Open Design Search was conducted in partnership with the Information Technology Innovation Foundation’s Accessible Voting Technology Initiative, Election Verification Network, OpenIDEO, and with funding from the Election Assistance Commission, and resulted in over 150 concepts for improving the voter experience for County voters.

In 2013, the Department identified and engaged IDEO, a global design and innovation firm specializing in human-centered design, to begin analyzing all the data and concepts gathered since project kick-off and to begin translating that information into refined designs. This work produced design and engineering specifications for a new voting experience which consisted of a new BMD, an improved Vote by Mail (VBM) ballot, an innovative ISB and a Tally System based on modern scalable technologies. Each of these components was the product of extensive research, stakeholder engagement, the human-centered design process, iterative prototyping and consultation with the VSAP AdCom and VSAP TAC. Together these components will provide voters with an improved and contemporary voting experience that is more accessible, reliable, secure and transparent.

Phase 4: Manufacturing and Certification

The County is in progress with Phase 4: Manufacturing and Certification. In October 2016, the Department engaged Gartner Inc., an information technology advisory firm, to develop a sourcing strategy and to provide guidance on implementation strategies through a readiness assessment. Development of the sourcing strategy entailed conducting research into the vendor landscape to better understand the current products and services available in the marketplace. This was further complemented through the County’s release of a Request for Information (RFI) in April 2017 to hear directly from vendors about their interest in potentially partnering with the County to bring the VSAP vision to fruition.

Part of Phase 4: Manufacturing and Certification also includes the completed RFP Phase 1 and this RFP Phase 2, by which the County entered into a contract with Smartmatic as the Prime

Contractor who is developing, manufacturing and helping implement the VSAP Solution. During this phase, the VSAP Solution will achieve successful completion of the testing and certification process by the California Secretary of State, adhering to California Elections Code, Section 19000 et seq. ("**Elections Code**"), Certification of Voting Systems. At the end of this phase, the VSAP Solution will be ready for production in quantities to meet full rollout in the County no later than 2020.

Phase 5: Phased Implementation

In parallel to Phase 4, the County is implementing VSAP (Phase 5) in multiple phases in a manner that can best balance the implementation risks with the risks in continuing to conduct elections with the current, aging voting systems. The VSAP phased implementation timeline is as follows:

- **November 2018 Election (VBM and Tally 1.0) —** Implementation by the County of the new VBM ballots, which includes associated software modifications to the ECBMS, and new Tally System (for all VBM ballots).
- **2019 Vote Center Test Lab Testing 1 (May 2019) —** Integration of the VSAP Solution for testing by the County to assess the functionality and capacity of the VSAP Solution to support anticipated election processes in Vote Centers at scale. This test did not include the public.
- **2019 Vote Center Test Lab Testing 2 (June 2019) —** Integration of the VSAP Solution for further testing by the County, based on the learnings from 2019 Vote Center Test Lab Testing 1. This test did not include the public.
- **2019 Vote Center Test Lab Testing 3 (August - September 2019) —** Integration of the VSAP Solution for further testing by the County, based on the learnings from 2019 Vote Center Test Lab Testing 2. This test did not include the public.
- **2019 Mock Election (September 2019) —** Implementation of Ballot Marking Devices (BMDs) and ePollbooks in a Mock Election at 50 Vote Centers.
- **October - December 2019 Vote Center Demonstration Centers —** Establishment of Demonstration Centers to offer voters a simulation of the new voting experience.
- **November 2019 Pilot —** Implementation of a small number of BMDs at polling places. Vote Centers were not used during the Pilot.
- **March 2020 Election (Full Rollout) —** Full implementation of BMDs, Interactive Sample Ballot (ISB), and ePollbooks at Vote Centers, and integration with the new VBM ballots, and new Tally System.

Open Source Voting

Appendix 3 for

Access to Vote by Mail for Residents with Disabilities

Mayor's Disability Council

Nicole Bohn
Director

Denise Senhaux
Co-Chairs

October 10, 2019

Dear Director Gerull:

Based on the public feedback that the Mayor's Disability Council (MDC) has received, we request that the City and County of San Francisco consider using available funding to research how the City can continue to improve election access for those with disabilities.

As you know, In July 2019, a community workshop was held to get public feedback about voting concerns, including open source voting. One of the primary concerns identified by participants in this forum was how to effectively integrate mandated accessibility guidelines for people with disabilities into our voting system development.

In addition to the open source voting accessibility concerns, the MDC has also heard about accessibility concerns pertaining to Remote Accessible Vote by Mail, which was implemented in San Francisco recently as part of mandated State legislation. Although the platform itself appears to meet current accessibility guidelines, there are still barriers to completing the voting process for people with disabilities using this method. Specifically, this process, while allowing some who have never had voting privacy to vote independently for the first time, still requires the voter to print, sign, and mail in a hard copy of their ballot. This can be especially difficult and often impractical for people with disabilities, especially those who are blind, low vision or who have certain physical or dexterity disabilities. The MDC recommends that the City research potential digital solutions to this problem.

For instance, incorporating a digital identity verification system with the current web based system could increase accessibility and voter participation among the 94,000 people with disabilities in San Francisco. Available funding can be used to research and report on methods, techniques, systems, and vendors that could provide a digital signature and identify verification maintain security, and improve accessibility.

We believe that this research will promote much needed full participation and inclusion for people with disabilities in San Francisco's voting process.

Thank you for your time and consideration in this matter, and please do not hesitate to reach out to us if you have questions about this request.

Respectfully,

Denise Senhaux, Co-chair Mayors Disability Council

Cc: Department of Elections Voting Accessibility Advisory Committee (VAAC)
John Arntz, Director, Department of Elections
Nicole Bohn, Director, Mayor's Office on Disability
Jennifer Johnston, Office of the City Administrator

CITY AND COUNTY OF SAN FRANCISCO

Open Source Voting July 31, 2019 Session Notes

August 6, 2019

PRODUCED BY

OnStrategy

EXECUTIVE SUMMARY

On July 31, 2019, the City and County of San Francisco hosted a public meeting on Open Source Voting. Approximately 41 people attended and participated in exercises to provide their input on the problem OSV should solve, a vision of success for open source voting, the potential benefits and beneficiaries of OSV, and the key considerations for CCSF as it explores OSV.

VISIONS OF SUCCESS FOR OPEN SOURCE VOTING IN SAN FRANCISCO

In small groups, participants of the OSV Community Project Meeting composed the following statements to describe success for OSV:

Group 1
San Francisco's open source / paper ballot voting system is more accurate, secure, affordable, and trusting causing adoption of open source and improvement of elections throughout the country.

Group 2
We've created a fully accessible, transparent, and accountable voting system that engages the entire voting population.

Group 3
At lower cost over time than using proprietary software, voters are registered in greater numbers and feel more confidence in accuracy of vote counts. The fully replicable open source software is adopted by numerous other counties at much lower cost and the state requires all counties to adopt open source voting systems. Crowdsourced language translation systems allow more veining in more languages, no more hacking occurs.

Group 4
SF is fully operational with an open source paper ballot voting system with consistent verification of accuracy, that leads to wide dissemination of the system. Through this, there is increased confidence in the system which leads to higher voter turnout.

Group 5
San Francisco leads the state and nation to safe and secure, verifiable and auditable open source paper ballot elections.

PROBLEMS OPEN SOURCE VOTING SHOULD SOLVE

Participants identified the problems Open Source Voting should solve (numbers represent the number of mentions by individual participants):

- Security of voting systems and counts (10)
- Accessibility for people of all abilities (7)
- Building trust in the voting process (5)
- Transparency (4)
- Equity & equality (4)
- Accuracy (2)

- Cost savings / affordability (2)
- Verifiability (2)
- Prevent intentional manipulation / hacking (2)

BENEFITS OF OPEN SOURCE VOTING

Participants identified potential benefits of OSV; consistent themes were:

- Increased and more scrutinized security to prevent hacking.
- A more affordable system that results in cost savings.
- Increased trust and confidence of the system by voters.
- Transparency of code and operation.

BENEFICIARIES OF OPEN SOURCE VOTING

Session participants identified the following segments as potential beneficiaries of OSV:

- Voters
- Technology providers
- Other counties / municipalities
- Taxpayers

Those Who May Not Benefit from Open Source Voting

Session participants identified the following themes segments who may not benefit / may be harmed by OSV:

- Election interferers (e.g. Russia).
- Private companies that provide current voting systems.

KEY CONSIDERATIONS FOR CCSF REGARDING OPEN SOURCE VOTING

Participants felt that the following are the most important potential pitfalls to consider regarding the OSV:

Group 1	Group 2	Group 3	Group 4	Group 5
Funding	Failure to deliver, project not finished	Fragmentation of infrastructure among counties Certification challenges	Nonconcrete funding plan by Nov ’19 by CA Clean Money Campaign and San Francisco	Sustainable maintenance [The project] Cannot fail

OTHER QUESTIONS & FEEDBACK

At the conclusion of the structured exercises, participants were provided the opportunity to ask questions or provide additional input—most questions generated discussion among the participants; their questions and comments are below.

Implications of OSV for the disabled

- Will open source voting work for people with disabilities such as those with mobility impairment and the blind / deaf? Although they are the smallest population to vote, they are still a large community with a large interest in voting. We need to ensure they can navigate to the polling systems.
    - New Hampshire implemented an OSV system for the blind and it has been endorsed by the National Federation of the Blind.
    - State law requires voting systems to be accessible by all.

Open source voting timeline

- What is a realistic time frame to implement OSV?
    - 5 years projection seems realistic.
    - A trial for the 2022 election and full implementation by 2024 is considered realistic.

Open source funding process

- When is the next funding process for OSV?
- Will the taxpayers of SF fund OSV?
- Will funding happen at a city or state level?
- Who are potential funding partners (other cities – LA, or industry partners)?
- Can we bring together different perspectives (coders, activist, government, lobbyists) to determine the funding plan of SF and California Clean Money Campaign?
- CCSF Response: $1.5M has currently been funded.

Coordinating with State Government

- How is SF going to work with the state to implement the new process?
    - The secretary of state does not think there are any roadblocks to prevent OSV implementation.

Certification Process

- Will SF adopt a new certification process?
    - CCSF Response: There is currently a certification process and each stage of the project will be required to go through the process.
    - If there is the same regulatory environment, change will never be implemented.
    - California is liberated from the federal certification process and can do as it pleases.

TABLE OF CONTENTS

DETAILED REPORT

PURPOSE

The purpose of the Open Source Voting (OSV) Project Community Meeting is to inform the community about the OSV initiative, approach and methods that will be used to support the project activities as well as gain consensus on the drivers, opportunities and priorities.

DATE & LOCATION

The OSV Project community meeting was held on July 31, 2019 from 2:30 – 5:00 PM at 1 South Van Ness, San Francisco, CA.

AGENDA

I. Open Source Voting Purpose, Summary & Project Plan
II. Introductions
III. Problem Statement
IV. Small Groups
    a. Benefits & Beneficiaries
    b. Key Considerations
    c. Success Factors & Vision of Success for OSV
V. Next Steps / Closing

METHODOLOGY

The City and County of San Francisco, Department of Technology hosted a public meeting facilitated by OnStrategy. Approximately 40 citizens attended to provide insights regarding the topic of Open Source Voting. The majority of the content produced in the session and summarized on the following pages was generated by randomly selected small groups of approximately 6 people per group.

WHAT IS THE PROBLEM OPEN SOURCE VOTING SHOULD SOLVE?

Attendees were asked to answer the above question individually either via a live text poll or in writing (responses were collected in-session). Responses were either themed or noted as a single mention below.

What is the problem Open Source Voting should solve?

Multiple responses themes:

- Security of voting systems and counts (10)
- Accessibility for people of all abilities (7)
- Building trust in the voting process (5)
- Transparency (4)
- Equity & Equality (4)
- Accuracy (2)
- Cost savings / affordability (2)
- Verifiability (2)
- Prevent intentional manipulation / hacking (2)

Single Mentions

- Need partisan public control of our elections
- To wipe out proprietary election system vendors
- Open source so everyone can look at the code and find vulnerabilities
- Auditability
- Increase participation
- Embed RLA in all 9000 US voting jurisdictions
- Make it as simple as you can, easy to vote
- Efficiency
- Fairness
- Boost public confidence
- Boost public confidence
- To create an alternative that can be used by other cities and states
- Compromised elections in which no one knows how votes were counted, and paying too much for elections
- Control or significant interference for big money grants who are the enemies of democracy by the people
- Paper-based

BENEFITS OF OPEN SOURCE VOTING

In the small groups of approximately 6 people each, participants were asked to brainstorm the potential benefits of open source voting. Across the five groups were the following, consistent themes:

- Increased and more scrutinized security to prevent hacking.
- A more affordable system that results in cost savings.
- Increased trust and confidence by voters of the system.
- Transparency of code and operation by voters.

Themes are color-coded in the table below.

Detailed Responses

BENEFITS OF OPEN SOURCE VOTING				
Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**
• Accuracy • Verifiable results • Examine code / transparent • Scrutinized security • Efficiency • Cost is less • Results published sooner • No self interest in promoting open source • Increased trust in electoral system • No profit motive • More flexible / adaptable • No vendor lock-in • Share the code with other counties / municipalities • Shared costs and development • Publicly owned • Can tell if its been hacked	• People trust the voting system • Transparency of operation • Innovation • Security • Sharing of ideas / scalability • Cost savings and time savings • Civic engagement • Democratic voting systems • Many eyes (peer review), many developer with greater involvement, increased governance • Transparency • Many eyes on the street • Paper trail • Every county will be able to access the system • Secure elections	• Accurate vote count • Encourage voting • Ability to verify votes • Vote anytime • Reduces Costs • Not dependent on a single vendor (lock in) • Transparent code • Non-tech verification • Prevent foreign hacking • Physical ballots • Building /benefitting from existing open source systems • Trust by voters • Opens more participation in the process	• Nonpartisan control of voting systems • Other jurisdictions can benefit • People know how votes are counted • Security (previous elections are unsecure) • Proprietary vendors are out of business because of sales revenue • Increase quality of code by the OSV community • Many eyes on software = more security • Restored confidence in voting • Cheaper • More competition in providing voting systems • Voting systems are easier and more accessible • Strong grassroots support in SF for it • Code contributions benefit SF	• System security • Confidence • Lower costs • Share-ability • Flexibility • Transparency • Demonstrability • Verifiability • Accessibility • Equity • Sustainability • Affordability • Red hat? • Non-proprietary • Better • Easier • Inclusive • Traceability (x2) • Auditability (x2) • Certification • Background check on codes

POTENTIAL BENEFICIARIES OF OSV

In the same small groups, participants were asked to identify who stands to benefit from Open Source Voting. Across the groups were the following themes:

- Voters
- Technology providers
- Other counties / municipalities
- Taxpayers

Themes are color-coded in the table below.

Detailed Responses

POTENTIAL BENEFICIARIES OF OSV				
Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**
• Public • Minorities • People with disabilities • All levels of government • Communities at large • Taxpayers • Not for profits • Election officials • Ballot counters • Small businesses that can help build systems and support systems • Future generations • Paper product sellers • Security consultants	• Voters • Municipalities across the nation • Public officials, elected representatives • Taxpayers	• Counties (like SF) • Youth • Large open source service providers (like IBM) • Cloud providers • Other counties	• Our Democracy • All Voters • Providers of proprietary voting systems • SF taxpayers • State legislators • Consultants • 9,000 voting jurisdictions • Anywhere in the world who wants to use OSV	• Voters • Taxpayers • Candidates • Non-voters • Children • SW consultants • Other jurisdictions / countries

THOSE WHO MAY NOT BENEFIT FROM OSV

In small groups, participants were asked to identify who stands to NOT benefit from Open Source Voting. The majority of groups identified the following themes:

- Election interferers (e.g. Russia).
- Private companies that provide current voting systems.

Themes are color-coded in the table below.

Detailed Responses

THOSE WHO MAY NOT BENEFIT FROM OPEN SOURCE VOTING				
Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**
• Russian hackers • Proprietary corporations / for-profits who control 80% of the voting system business • No for profits • Existing election system vendors (Diebeld, PSS, etc) • Those who want to trash results of outcomes • Limits attorney's power to challenge outcomes • Those who want to restrict participation in results	• Adversaries of democracy (e.g. Russia) • Voting industry (private companies) • Disenfranchised (homeless, etc.) / non-voters	• Election crooks • Private mfrs. • Local service vendors • Seniors unable to touch buttons • Putin	• Providers of proprietary voting machines • Those invested in rigging elections • Foreign government hackers • Political interest groups who expect low voter turnout • Election officials who can't handle change • Counties who can't afford to change systems	• Vendors • Outside / inside interferers • Lobbyists

POTENTIAL PITFALLS – KEY CONSIDERATIONS

In the same small groups, participants were asked to identify the potential pitfalls of Open Source Voting. After brainstorming, participants individually identified the most critical considerations from the list of pitfalls generated by their group. Each person was provided the opportunity to vote 3 times (they could identify up to 3 considerations or they could choose to 'cast their votes' for 1 or 2).

Votes are indicated in (parenthesis) beside each consideration

Detailed Responses

POTENTIAL PITFALLS				
Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**
• Lack of funding (5) • People won't believe it will work so low turnout (2) • Excessive caution in moving forward (2) • Not built modulary-ly – monolithic design has high risk or failure (2) • Not doing iterative development (2) • Excessive unnecessary complexity (1) • Security implemented wrong (1) • Poor demonstration (1) • If doesn't work, may invalidate vote (1) • Technically challenging (1) • Still can be hacked – but now you know • Lack of volunteers for POC's • How do we gain trust of the public in the "new system" • Many obstacles to success • System crashing • Proofs of concept will reveal problems	• Failure to deliver, project not finished (4) • Subject matter experts won't be paid enough / lured away by private sector or other priorities system (3) • Sustainability, losing political interest (3) • Initial learning curve (2) • Manipulations (altering software to skew results) (2) • Setting up new governance process (1) • System hacking	• Fragmentation of infrastructure among counties (5) • Certification challenges (5) • Trust curve (3) • Lengthy development (3) • Who is responsible for maintaining code over time (2) • Inequity desperate resources among counties (1) • Licensing disputes (1) • Voter fraud • Increased costs	• Nonconcrete funding plan by Nov '19 by CA Clean Money Campaign and San Francisco (5) • No developing / implementing in stages (3) • Not budgeting enough funds for the system (2) • Aiming for perfection, rather than core goals (1) • Dependence on elected officials (1) • Difficult for other municipalities to adapt (1) • May only benefit 1 political party (perceived benefit) (1) • Transition from current to new OSV system (1) • The influence of special interest groups (1) • There must be a concrete plan for the state funding developed by November to ensure it's in the Governor's budget in January • Constant updating of technology • Too many studies delay the OSV process • Lack of development coherent development structure • Lack of quality control • Developing in person-OSV is more complex	• Sustainable maintenance (4) • Cannot fail (4) • Multi-jurisdictional governance + funding model (3) • Consistency (2) • Ownership / licensing (2) • Development cost (1) • Corruption (1) • Resistance to change (1) • Hacking target (1) • Financial support • Expertise to build + maintain + protect • Internal learning curve / education • Leg + regulatory changes • HW standards • Public education • Accessibility (inadequate) • Trust • Complexity (generally + rank choice)

SUCCESS FACTORS

Groups were asked, "If the headline on your newsfeed in 5 years is, '*San Francisco's Open Source Voting Considered a Resounding Success'* what would success look like?" Across most groups, common **success factors** were:

- CCSF's OSV technology is adopted by other municipalities.
- Open source voting results in an increase in voter turnout.

Themes are color-coded in the table below.

After brainstorming the individual success factors, each group was tasked with writing a **vision of success** statement (located above the themes and individual responses).

Bolded items represent the themes from commonly mentioned ideas (bulleted lists below each theme represent the theme's individual responses).

SUCCESS FACTORS				
Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**
Vision Statement of Success San Francisco's open source / paper ballot voting system is more accurate, secure, affordable, and trusting causing adoption of open source and improvement of elections throughout the country.	**Vision Statement of Success** We've created a fully accessible, transparent, and accountable voting system that engages the entire voting population.	**Vision Statement of Success** At lower cost over time than using proprietary software, voters are registered in greater numbers and feel more confidence in accuracy of vote counts. The fully replicable open source software is adopted by numerous other counties at much lower cost and the state requires all counties to adopt open source voting systems. Crowdsourced language translation systems allow more veining in more languages, no more hacking occurs.	**Vision Statement of Success** SF is fully operational with an open source paper ballot voting system with consistent verification of accuracy, that leads to wide dissemination of the system. Through this, there is increased confidence in the system which leads to higher voter turnout.	**Vision Statement of Success** San Francisco leads the state and nation to safe and secure, verifiable and auditable open source paper ballot elections.
True results to prevent contest claims • A better trusted government • Ends contested elections, no fall out after • Stops politicians from claiming "fixed" • Groups who interests / vote are often deliberately miscounted now count **OSV development is growing and ready to anticipate hackers** • Hackers finding and fixing flaws • OSV development responsive to fix problems / issues fast • Hackers getting foiled	**Hackers and suspicious activity are repelled** • Hackers were repelled • No suspicious of undetectable of election tampering – confidence in democratic process **Complete adoption and distribution of OSV systems** • Distribution is requested or implemented by other municipalities • 100% adoption of open source solutions **Increased trust in the voting system** • Widespread, deserved trust in the system • More people trusting their vote to be heard	**Increased voter turnout** • More people voted in the immediate last 5 years • Turnout increases because voters trust results **SF OSV voting used by other counties** • 20+ counties in California adopt SF-like OSV (100+ counties nationwide) • State of CA make SF OSV a state requirement **Cost savings by OSV software** • Costs will be much less than using proprietary software over the long run A dozen counties save $XM using SF's OSS voting system **Single mentions:** • Voters are happy	**A tested and verified open source systems** • Consistent verification of accuracy • SF OSCVS independently tested by 17 public agencies with results published • Code that works. Code that is tested. Code that has a clear structure of test, modify, test, deploy **Fully developed open source system developed in Sf** • In 5 years, fully developed OSV paper ballot system for elections that is shared across California • Use of open-source, paper back-up systems spread through-out Country	**Other jurisdictions use and adapt the OSV technologies** • Other state adapt the SF equipment • Top 10 large counties use OSV system developed by CCSF • Many jurisdictions adopt our solution and help make it better **A secure system that is well maintained and prevents intrusion** • Secure • Attempts at system intrusion detected and thwarted • System is secure and well maintained (e.g. countries to improve) **Increased voter participation across all diversities**

• OSV software growing and supported by many **SF technology is disseminated across the U.S.** • OSV used by many across the country • Interest in adopting throughout U.S. • Other jurisdictions adopt our technology • **Increased voter / citizen turnout** • People subsequently become more involved as citizens overall • Higher turnout • % of people voting increases significantly because trust process • More people vote **Single mentions:** • A better democracy for all • Election final results – faster • Election costs are lower • Business efficiencies • OSV trusted • We finally get a real honest president	**Large community of innovators to develop code** • 10,000 open source developers contributed with X millions of lines of code that passed the most stringent security Y test • Innovations in voting process • Large community of contributors **More accessible voting** • Voting is easy / accessible • Fully accessible voting system (disabled seniors - all manualized communities) **Increased voter turnout** • 95% of registered voters, vote!! • % of voters increased • Greater voter engagement **Single mentions:** • Verifiable accurate vote counting • Sustainable voting systems • Less money is spent buying and maintaining the system	• No foreign hacking detected • Safe, secure elections with results trusted by citizens • Voters feel greater confidence in accuracy of vote count • $100M ventured raised to invest in OS vendor startups • SF makes R.C.V. easy with customized voting system • For OSV, more easy for people to vote • Future generations are registering at greater rates to vote in future elections • Fully replicable set of software, policies and practices accessible online • Save the time to vote • Open source comments / pull requests provided to code base • Crowd sourced language translations of ballots allow voting in more languages • No need for pens	• System fully developed across San Francisco, replacing current proprietary system and lowering election costs for SF **A system code adopted by other municipalities** • Adopted by more cities / states • Source code adopted by other municipalities to be used in their own open source voting systems **Single mentions:** • Significantly higher voter turnout • SF voting systems provide the open source voting to have the source code needed • Higher confidence in voting process • Elected officials more tuned in to constituents • SF, not private companies run SF elections • Other counties hacked but not SF • SF hosts an open source voting convention (free) • SF saves money on election	• Increased turn-out • Increase participation across all economic and ethnic groups **Increased confidence in voting systems** • Increased voter confidence • Less people question election result • Less controversy on our voting system • Others give our system praise and recognition **Accurate election results** • Accurate, trusted elections • Accurate **Cost effective voting system** • Overall costs are reasonable and predictable • Costs of election security decrease over time and systems are secure in ongoing ways • Cost effective **Single mentions:** • Large partner invests to prove OSV • New OSV systems returns votes fast and no failures • Accessible • A clean election • Sustainable (OER time with changing threat, needs & HW)