VoTeR Center

UConn Center for Voting Technology Research

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Report on the NIST/EAC Future of Voting Systems Symposium

The National Institute of Standards and Technology (NIST)

Gaithersburg, MD, February 26-28, 2013

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1 Introduction

The University of Connecticut VoTeR Center and the Connecticut Secretary of the State Office submitted a poster for presentation at the *NIST/EAC Future of Voting Systems Symposium* hosted by NIST (Gaithersburg, MD) on February 26-28, 2013. The poster presents our work on the development of the Audit Station, the project that is funded by EAC (attached file: Poster-EAC-NIST-2013-4.pdf). The submission was accepted for presentation and Tigran Antonyan was asked to represent the team at the symposium and present the poster.

The symposium was webcast live. An archive of the webcast is available at http://www.nist.gov/itl/csd/ct/future-voting-webcast.cfm. The symposium program is attached (file: NIST-EAC-Future-Voting-Systems-Agenda.pdf) and is also available at http://csrc.nist.gov/groups/ST/voting2013/NIST_EAC_Future_Voting_Systems_Agenda.pdf. This document summarizes the proceedings. (TA: Several post-symposium thoughts are included in this report in parenthesis, beginning with "TA:".)

2 Day 1: Trends in Voting Systems

During the welcoming remarks the speaker mentioned that there is no status update on EAC.

2.1 Opening Remarks: "Framing the Discussion on the Future of Voting System"

Brian Hancock (Director of Testing and Certification, EAC) talked about the certification process of a voting system (VS). He mentioned that there are many levels to a certification:

- First Party: Self Certification – the VS manufacturer's certification

- Second Party: Industry Certification.

- Third Party: EAC Certification

Mr. Hancock noted that the voting unit tested in their lab is the only machine that is actually certified. We then rely on the manufacturer's word that what they deploy is made to the same hardware/software specifications as the unit that was sent to EAC.

There are some changes to the certification process that he offered for debate:

- Random sample testing.

- Batch testing: test a random sample from each batch.

- Manufacturer-only testing and certification.

There are currently two documents dealing with the standards for voting systems: Help America Vote Act (HAVA) and Voluntary Voting System Guidelines (VVSG). The current version of VVSG is rev. 1.2. A newer version 2.0 (about 590 pages) is just back from public discussion.

2.2 Keynote: "An Overview of the Election Technology Landscape"

Dr. Michael Alvarez (California Institute of Technology) was the keynote speaker, who was invited to talk about saving votes that are lost due to machine malfunction and voter registration problems. Millions of votes are estimated to have been lost in the year 2000 elections.

Dr. Alvarez is a member of Caltech / MIT Voting Technology Project (VTP) that has the focus on: (1) Reliability, (2) Security, (3) Performance standards and evaluation, and (4) Sustainable business models.

1. Improving Reliability:

    - In Florida during the 2000 elections too frequently the voter intent was not recorded on the ballot due to the known punch card problems.
    - Residual Votes (discrepancy between the number of ballots cast and the number of votes counted for an office):
        - Difference between the number of voters and votes for a given office should not depend on the voting equipment used.
        - In 2000 the national rate of residual votes was 2% (for the presidential race)
        - Residual votes were correlated with voting technology used (higher for punched cards)
        - Improvements in procedures and technology led to the residual vote of about 1% in 2006 and 2008 elections.
    - The Future: Cause for concern is the increasing reliance on voting by mail in many states – this might cancel out the improvements made on residual votes.

2. Improving Security:

    - Initial focus in the aftermath of the 2000 Florida recount was not on voting system security
    - Significant concerns arose after Kohno et al. (2004)
    - Verifiability
        - Voter verification: Voter verified paper audit trail – paper based (OS systems).
        - Software Independence: changes/errors in voting system software must not cause undetectable changes/errors in election outcomes

  – End-to-End Voting Systems: number of E2E systems are in development
  – Auditing: Post-election ballot audits, whole system audits, performance audits. Helps with transparency and confidence of the voting process.

3. Improving Standards and Evaluation

   - Federal voting system standards process has stagnated recently
   - Should there be a federal voting system standards, or a strong set of state standards?
   - Should standards focus on security and system testing, or should we focus on auditing election outcomes?

4. Improving The Business Model

   - In 2001 VTP concluded that the biggest challenge to the future development of voting technologies was the industry's business model.
   - Is there a future stronger business model for private industry? Or a robust state and local technology and development process (e.g. LA County's Voting Systems Assessment Project)?

Emerging Technology Issues

- There are many:

  – Technology of voting registration systems
  – Improving system accessibility
  – Voter authentication technologies
  – Metrics for evaluation of technology and election administration
  – Solutions for contingencies and natural disasters

- Still long lines for vote-in-person voters

  – Issues in 2012
  – Charles Stewart III (MIT) "2012 Survey of the performance of Elections in America": 200 respondents per state.
  – 35% did not wait at all (in 2008: 42%)
  – 13% waited over 30 minutes (in 2008: 14%)
  – Longer lines for early voters: average of 20 min. vs. 13 min. for election day

- Who Waited Longer Chart (by Charles Stewart III) shows average wait time by state. VT had the shortest: 3 min., FL had the longest: 40 min, CT is below average with less than 10 min. average wait times.

- Another slide shows charts by county population density and race and ethnicity

What can be done:

- People & Process: Procedures that slow voters down; long ballots

- Investments: Number, size and location of polling places; voting systems

- New Technologies: Disseminate real-time information about long waits – especially early voting, a web feedback

2.3   Panel: "Trends in Voting Systems"

The moderator Matt Masterson (Deputy Elections Administrator, Office of the Ohio Secretary of State) showed some charts of costs for elections for different sized counties in Ohio. The costs vary greatly: $26K (about 8,700 voters), $80K (about 154,000 voters), $450K (about 564,000 voters), and $700K (about 928,000 voters)

Stephen Trout (Director of Elections, Oregon Secretary of State) noted that the single most important part of the election process is to have simple language and processes for voters and election officials.

Dean Logan (Registrar-Recorder / County Clerk, Los Angeles County) talked about simply converting their older punch card machines into optical scan systems. They still use the same IBM style punch cards, but the voters now fill in the area that would have otherwise been punched out. The LA county needs to move to a better solution, but there is no help from the state and there is a limited market for voting technologies. They started the Voting Systems Assessment Project (VSAP) to develop their own voting system. Handout outlining the VSAP is attached (file: VSAP-LAC.pdf). More information can be found at www.lavote.net. Mr. Logan thinks that the certification process is just the floor and not the ceiling for voting system requirements. Also he noted that the election process is very politicized.

Dana DeBeauvoir (County Clerk, Travis County, Texas) also thinks there is no competition in voting technologies. Innovation is not succeeding due to the current business environment in voting systems. It is too costly to purchase, store and maintain the "bulky, specialized and proprietary hardware." She questioned why the big name companies (such as Microsoft, Apple, Adobe, Sony) do not get involved in voting systems competition. She would like to see an open source voting systems with OTC hardware. She worked with academia (Dan Wallach (Rice), Philip Stark (UC Berkeley), and others) to develop STAR system. She believes that it is the election officials' job to tell the vendors what they need. She provided handouts describing the STAR-Voting system (attached, file: STAR.pdf).

Whitney Quesenbery (WQusability) called for one system for all voters: not having a separate system for accessibility, instead all voters are able to use the same system to cast their votes.

2.4   Panel: "Web-Based Technologies Supporting Elections"

David Wagner (UC Berkeley) moderated this panel; he did not make a statement, but mainly posed questions to other panelists.

Some of the suggested web-based tools to aid the process were:

- Polling place lookup

- Ballot layout finder

- Registration status checking

- Having a nationwide domain (e.g., elections.gov) and each town can be represented via a sub-domain (e.g., mansfield.ct.elections.gov), and educate the voters on finding the relevant election information online.

Paul Lux (Supervisor of Elections, Okaloosa County, FL) stated that over 20% of his county's voters are military voters (there is a large Army and Air Force base). He is very interested in exploring online voting products to aid the oversees voters (from 45 different countries). He helped creating an easy to follow website for his county's election division (both PC and mobile versions).

Helen Purcell (Maricopa County Recorder, Maricopa County, AZ) manages over 900,000 voter registrations. They have an online voter registration system that saves them about 80 cents per

voter. The voter fills up a form, is given a confirmation number, prints and sends the form to the registrar. Her office is required to do some manual checks before confirming the registration. About 90% of voter registrations come in online.

Jeremy Epstein (SRI International) objects to any voting-related activities online – he cited number of hacked websites. Some things perhaps might be acceptable if used with other means of verification (such as USPS).

Linda Lamone (State Administrator of Elections, MD) reported that they have a statewide election management and centralized registration. In 2012 over 12,000 electronic ballots were returned by mail. A barcode was used to compare the duplicated ballots (produced in state).

2.5   Panel: "Voting System Manufacturers Look to the Future"

Most vendor representatives mentioned moving to common logs and reports, and developing more audit-ready machines. Most of them also mentioned supporting or implementing "Risk-limiting Audit" (TA: an approach to auditing advocated by Phillip Stark) in their next version of voting systems (TA: not clear how this would work).

Ian Piper (Dominion Voting Systems) said that their most recent optical scan system saves the ballot image and interpretation of that ballot so that it can be used with "Risk-Limiting Audits" (TA: again not clear). He reported that there is an ongoing effort to create a Common Data Format for voting systems – IEEE P1622. He also said that "vendors will create what market demands."

McDermot Coutts (Unisyn) encouraged moving to machine marked ballots (ballot markers) as well as electronic ballots.

Michelle Shafer (SOE Software, a Scytl Company) talked about the online voting solutions that they offer and some countries are using. There are some customers in the US, but not in high stake elections.

Craig Reines (Everyone Counts) talked about providing Software-as-a-Service for election systems. A different approach on how to solve problems: election officials should not be burdened by aging software that can be easily managed with reasonable costs. They offer a large variety of customized software options to aid the election process.

Eddie Perez (Hart) said that he is a very happy and proud employee of Hart. He talked about a new system that they are working on (TA: without much details) that will become a "reboot point" for their company and their customers.

3   Poster/Demonstration Session

Our poster was setup in the demonstration room (Portrait Room) in a designated area. This section describes the encounters (throughout the symposium) dealing with our poster and Audit Station.

There was a general interest in our approach to post-election audits and visitors seemed to be interested while I was presenting our work. Most questions dealt with the speed and comparison to the other two post-election audit systems in the room, namely David Wagner's OpenCount and Larry Moore's ClearBallot. I've informed the observers that our system's current objective, although it could be easily changed, is to help with post-election hand count audit process and therefore might be slower in comparison to the other two and especially ClearBallot's advertised 64,000 ballots per hour speed (TA: apparently using multiple scanners in parallel). A major difference in our approach is that we intentionally do not save images of ballots, instead we focus on making each ballot available in real-time as it is being analyzed by auditing officials. Another difference and advantage of our approach is of course that with Audit Station the user is in total control of the process. (TA: Another potential benefit of our approach is that Audit Station can be used to assist in conducting Philip

Stark's "Risk-limiting Audits," while the approaches that weakly-couple or even de-couple ballots and ballot images apparently are incompatible with that auditing strategy.)

Mark S. Earley, C.E.R.A. (Supervisor of Elections, Leon County, FL) and two other persons from his office were interested in post-election audit system that can be used with their tens of thousands of early voting and absentee ballots immediately after the polls are closed to boost confidence in the election-night reporting. The early voting centers do accept all voters from the county, thus there are many ballot types in each of the early voting ballot boxes. They were also asking if the system can be used to certify the elections. They seem to be impressed with the ClearBallot system at the moment as it promises very high speeds.

One of the organizers (with NIST) and Pamela Smith (VerifiedVoting.org) asked for the PDF version of the poster and I have emailed it to them.

Overall about thirty participants came to our booth and I have talked to almost all of them to insure no one leaves without their questions answered.

I visited the OpenCount booth and David Wagner did a quick demo of their system. It is somewhat too complicated and not very intuitive to use compared to ours. Dr. Wagner also proudly stated that they use "Risk-Limiting Audits," although admitted that such audit only aims to answer a simple question of which candidate (or proposition) has most votes with some probability and is not a recount or voting system audit.

I also visited ClearBallot booth and talked to a few (what seemed to be) employees. Their system is hard-coded to scan ballots at 200dpi and in grayscale mode. The advertised speed seems to be for 11 inch ballots only. They did not tell me how long it takes to set up a ballot definition per ballot type. They claim that their system can work with multiple ballot types (needed to process absentee and early voting ballots). They had a Fujitsu scanner there and ran a small batch of 11 inch ballots (that were fed sideways) to demonstrate the speed. I approximated the scanning speed to be about 100 ballots per minute.

4   Day 2: "Standards, Testing, and Certification"

4.1   Invited talk: "Challenges in the Current Voting System Standards and Certification Process"

Mark Skall (Technical Reviewer, EAC) talked about standards. He pointed out that at times it is hard to achieve good standards as there are requirements that usually collide: standards should be precise (e.g., mathematical type definitions), but also readable and understandable (e.g., approximating a natural language).

What makes a good standard?

- One that gets used. That is used correctly. Implemented in consistent manner

- One that defines:

    - What/who needs to implement the standard
    - Normative vs. informative
    - What needs to be implemented (Mandatory vs. Optional)

- Modular with minimal redundancy

- Adaptable as things change

- Independent of technology and design

History of Voting System Standards:

- Voting industry created first Voting Systems Standard (VSS) – 1990 VSS

- VSS updated and issued – 2002 VSS

- After 2000 elections, 2002 Help America Vote Act (HAVA) was passed to address voting system integrity, usability, and security concerns

- VVSG 2005 (1.0) developed by NIST/TGDC/EAC was an update on 2002 VSS

- VVSG 2.0 sent to EAC by TGDC in 2007 – a total re-write of the VVSG 2005, has not yet been promulgated

- VVSG 1.1 out for public review in 2012 – integrates some VVSG 2.0 requirements into VVSG 1.0

Mr Skall stressed that "standards are worthless unless they are implemented."

The speaker noted that most of the time the voting systems are not ready when sent to EAC; he thinks that some vendors are using the EAC certification process as a kind of "beta testing."

4.2   Invited talk: "Overview of Product Conformity Assessment and Examples of Various Approaches to Certification"

Gordon Gillerman (NIST) gave an overview of product conformity assessment and some examples of certification approaches.

In general, Conformity Assessment is "demonstration that specified requirements relating to a product, process, system, person, or body are fulfilled" –ISO/IEC 17000.

Mr. Gillerman stressed the fact that "Confidence is very expensive!" and that we should buy it wisely (not speaking specifically about voting systems).

4.3   Panel: "Overview of Standards Development Processes"

Belinda Collins (former NIST senior advisor for voting standards) moderated this session that dealt with standards development.

Anne Caldas (senior director, procedures and standards administration, ANSI) talked about ANSI – a private 85 year old company. The handouts are attached (file: ANSI.pdf).

David Baquis (U.S. Access Board and an independent federal agency) talked about the rulemaking process; there are less than 30 employees in his agency.

David Wollman (NIST) talked about the NIST role in the Smart Grid project.

John Wack (NIST) talked about the Common Data Format (CDF). It is a format based on the Extensible Markup Language (XML) that is designed around the needs of elections. The main goal is interoperability of data. CDF will be used to communicate among voting-related devices:

- Export from a voter registration DB to any ePollbook

- Export voted ballots from voting stations to any EMS

- Export tabulated results from any EMS

The benefits of CDF include:

- Anyone can build or sell a device – no manufacturer gets locked out of the market

- Election officials are empowered to buy whatever devices best suit their need

- Developers can write applications that make use of CDF

- Elections can be audited and analyzed more easily

- Device certification is possible

- Voting equipment testing is easier

- Transparency of the equipment is greater and there is more trust in the equipment

IEEE P1622

- Main goal: specify a standard or a set of standards for a common data format for election systems

- Sponsoring Society: IEEE Computer Society / Standards Activities Board (C/SAB)

- NIST is working with IEEE P1622 to develop a suit of CDF standards

- Based on an existing international standard, OASIS EML, but being adapted to specific US election needs

- Available free under IEEE sponsorship

Current Status:

- VOCAVA blank ballot distribution standard – January 2012

- Election results reporting draft – Spring 2013

4.4   Panel: "What we need in Voting System Standards"

Mary Brady (NIST) moderated this panel and opted for a Q & A session, inviting questions. The panelists were Matt Masterson (Deputy Elections Administrator, Office of the Ohio Secretary of State), Doug Jones (University of Iowa), Clayton Lewis (Coleman Institute for Cognitive Disabilities, NIDRR) and Jack Cobb (Pro V&V).

Matt Masterson noted that almost 50% of the testing and certification budget and efforts goes to the source code review, and the type of code review performed is mainly stylistic and largely ineffective. He recommends eliminating the code review from the certification process.

Luther Weeks (CTVotersCount.org) suggested that local election procedures should be a part of the standards.

There was a question/suggestion on why not allow "small" software updates after a voting system certifications. (TA: Because a single change can turn the entire system upside down.)

4.5   Panel: "Exploring Alternative Methods and Goals for Federal Testing and Certification"

Merle King (KSU Center for Election Systems) moderated this session/panel discussion, opening it by briefly talking about some of the challenges in testing and certifications of voting systems. He noted that in the future we may not be able to separate the consequence of poorly performing election systems from well performing voting systems, and he talked about our potential inability to distinguish between poorly performed election administration and poorly performing voting and election systems.

Brian Hancock (Director of Testing and Certification, EAC) reminded the audience that voting system certification document started from scratch and is improving.

Ed Smith (Vice President, Compliance and Certification, Dominion Voting Systems) also suggested to simply get rid of the source code review as it is an old (1970s) requirement, instead he proposed to spend the time and energy in logical testing.

4.6   Panel: "The Evolving Nature of State Certification"

Jessica Myers (Certification Program Specialist, EAC) moderated this session.

Joe Losco (Professor and Chair of Political Science, Ball State University) said that Indiana doesn't require the EAC certification. However, the "my state is so special" view (special and unique requirements that vary from state to state) does not help with uniform state standards. Indiana needs a legislative change to be able to use an electronic poll book.

Robert Warren (NY State Board of Elections) said that NY also doesn't require EAC certification and has State certification process that replaced all occurrences of "should" with "shall" to make the requirements document stronger. He also said that NY has a third party vendor (Nicetech?), that performs the security reviews and helps the State in developing test cases for voting systems. The NY state doesn't currently use electronic poll books, but they are looking into it.

Merle King (Center for Election Systems, Kennesaw State University) said that in his state (and perhaps in most) there is only a three month window for any change (equipment, procedure, etc.) to be performed. He called for testing and certifying all aspects of the election system, including the election officials and processes – an analog is FAA certifying the airplanes as well as the airports and pilots. He pointed out that even though some states don't use the EAC certification directly, there is a behind-the-scene dependence and benefit from the federal certification process. Mr. King also said that an election system is more elastic at the state level vs. federal level (where it is strictly "vote capture," or "vote tabulation").

5   Day 3: Perspectives on Voting Systems

5.1   Keynote: "The Challenges of Balancing Usability and Security in Future Voting Systems"

Dana Chisnell (UsabilityWorks) opened her talk by showing a rank-choice ballot to the audience and asked to think how the votes are counted on such a ballot. She said that we need to think that "if it's not usable, it's not secure" when it comes to the election-related materials, including the official election (county, state, etc.) websites, ballots, etc.

Some of the towns/counties didn't have election information website.

Her research shows that "voters are ballot-centric," the main question that most voters have is "What is on the ballot?" – what offices and who is running.

She showcased some election websites where it is not very easy to find the answer to the question of "What is on the ballot?" (a sample ballot, or the list of offices/candidates, etc.). She showed a video of a person looking for a sample ballot on his county website and he was very confused by some of the labels and the website organization. Eventually, after finding a page promising that a sample ballot can be downloaded after filling up a form, he was shown a pdf file with 100 pages that was named a Sample Ballot. The words "Sample Ballot" means something different for election officials than for voters.

If the voters don't know what is on the ballot they will most likely go to a third-party sources, not necessarily a legitimate website. They are also less likely to go to the correct polling place and even turn out to vote.

The State of California had about 50% vote by mail, and there is no feedback for over/under voted ballots for such ballots.

She advocates "easy to use and understand" ballot and website designs, and she works with election officials to help bring the usability of the election process to the local elections.

Ms. Chisnell helped to design the Anywhere ballot that also had a poster presentation during this symposium.

She has some good usability materials at www.CivicDesigning.org.

5.2   Panel: "Academics and Technologists Look at the Future"

Moderator, Daniel Castro (Sr. Analyst at Information Technology Innovation Foundation, also a project director at ITIF) posed a few questions: how the technology is likely to progress and what impact this might have on future standards? He also asked what new challenges will arise from new technologies, and what are the major R & D initiatives that we need to look into in this area?

Josh Benaloh (Sr. Cryptographer, Microsoft Research) talked about his work on E2E verifiability and said that it is a property of an election. E2E is not so-called "voter verifiability." The main properties are that voters can check that their vote has been received (cast as intended) and that anyone can check that all records have been cast. Mr. Benaloh mentioned Scantegrity, VeriScan, Helios, and STAR-Vote as examples of E2E.

David Wagner (University of California, Berkeley) talked about "Single Ballot Risk-Limited Audits," and he called this "make the election audits both more effective and cheaper," noting that the support should exist in the voting system. Dr. Wagner calls for "Certify the elections, not machines." He said that certifications for usability, accessibility, etc. are still needed.

Juan Gilbert (Clemson University) agrees with Dr. Wagner's opinion on certifying the elections and not the machines. Dr. Gilbert talked about some of the work he was involved in, especially Prime III – "One Machine, One Vote for Everyone."

Prime III can work with either speech and/or touch screen of the system (multimodal: Microsoft Surface, Dell tables, etc.), will show a ballot with pictures of the candidates. After the selections are made, the system prints a filled ballot that can be cast (it can be a optical scan ballot if desired). One advantage of this system is that it is stateless and can be ran from a CD on a laptop without a hard drive.

The system is capable of working with "Balloting & Voting Times" system (also developed by them) that allows a voter to fill out the ballot online and receive a QR code (this code only contains the voting pattern, thus many voters will receive the same code). The voter can bring the QR code (print, save on the phone, etc.) to the polling place and scan it using Prime III, the voter is presented with an option to edit the choices on the ballot before it is printed. Dr. Gilbert thinks this will shorten the polling place lines.

Televoting lets remote voters vote via Prime III, a remote voter fills out the ballot online and is placed in a queue. When a poll worker (one that services the remote voters) is ready, they are connected via a video chat session and when both parties are ready, at a click of a button, the ballot is printed at the poll worker's location. The remote voter verifies the ballot (via webcam) and the ballot is placed into the ballot box.

Mr. Gilbert stated that Prime III is not a DRE (it is simply a ballot printing system) and the remote part of it is not an internet voting, instead it is a Televoting.

[End.]