

Generalized Protocol for Certifying E-Voting Systems

State Certification Testing of Voting
Systems National Conference

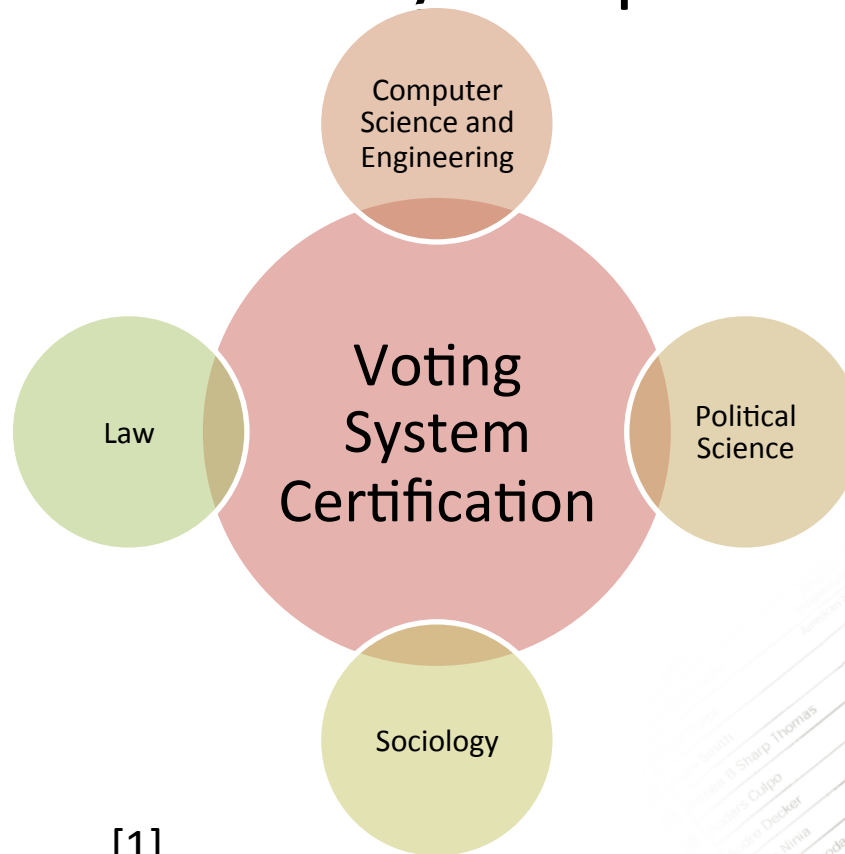


Indianapolis, Indiana • June 14-15, 2012

Jay Bagga
Joshua Franklin
Jessica Myers

Introduction

- Voting System Certification = Art & Science
- It intersects with many disciplines



[1]

Voting System Certification Today

- State election codes and regulations vary.
- High turnover for election officials.
- Federal requirements and certification practices are different from state requirements.
- Some states require federal (EAC) certification, while some others conduct their own extensive tests. Still others rely on tests done by federally certified testing labs (VSTLs).

Our Motivation

- To abstract from all the complexities of voting system certification
- Provide guidance for new election officials
- Encourage reciprocity
- Protocol is general - Yet practical
- Applies to all levels (e.g., fed, state, local)
- Aggregates best practices
- Can be continually revised

Examples – Hoosier Hospitality!

B23		IC 3-11-7-11.5	IC 3-11-7.5-10	IC 3-12-1-1.7	IC 3-12-1-7.5			
	A	B	C	D	E	F	G	
1	Functionality Testing	IC Code Requirement	Lab Documentation	On site Test	Pass	Fail	Incomplete	
2	Define Vote	IC 3-12-1-1.2						
3	OP SCAN-Stray marks/mutilation	IC 3-12-1-3						
4	OP SCAN-Counts marks left cand name/ques.	IC 3-12-1-5 IC 3-12-1-6						
5	OPSCAN-Disqualify erasure identification	IC 3-12-1-4b						
6	Establish voter intent	IC 3-12-1-1.2						
7	Count votes accurately	IC 3-11-7.5-15 IC 3-11-7.5-13						
8	Vote for candidate	IC 3-11-7.5-9						
9	Vote for public question	IC 3-11-7.5-9						
10	Vote for party	IC 3-11-7-4 IC 3-11-7.5-9 IC 3-12-1-7						
11	Vote for candidates from more than 1 party	IC 3-11-7-4						
12	Vote for or against public question	IC 3-11-7.5-9 IC 3-11-7-3						
13	Vote for candidate nominated by petition	IC 3-11-7.5-10 IC 3-11-7-3						
14	Vote for party or independent ticket electors	IC 3-11-7.5-10 IC 3-11-7-3						
15	Display Candidate name and designation	IV 3-11-15-13.1						
16	Demonstrate over votes/allow voter correction (DRE)	IC 3-11-15-13.7 US 42, sec. 15481 a(1) (A) (B)						
17	Inform voter of overvote and provide written instructions to correct (OPSCAN)	IC 3-11-13-4.5						
18	Proper functioning hardware and software	IC 3-11-15-14						
19	Perform machine diagnostics	IC 3-11-15-15 IC 3-11-15-17						
20	Record votes accurately	IC 3-11-15-20						
21	Maintain record of normal/abnormal events	IC 3-11-15-25						
22	Produce accurate vote counts	IC 3-11-7.5-13 IC 3-11-15-20						
23	Accept write in votes	IC 3-11-7-11.5 IC 3-11-7.5-10 IC 3-12-1-1.7 IC 3-12-1-7.5						
24	Allow single party primary voting	IC 3-11-7.5-12 IC 3-10-1-13						
25	Allow vote formore than one candidate where allowed	IC 3-11-7-3 IC 3-11-7.5-10						
26	Secrecy	US 42 Sec 15481 a(1) ©						
27	Accessibility for disabled	IC 3-11-15-13.6 US 42 Sec 15481 (a) (3)						
28	Detection of operation after machine secured	IC 3-11-7.5-14						
29	System ID number verification	IC 3-11-7.5-18						
30	Ballot label protection	IC 3-11-7.5-19						
31	Security against tampering while votes being recorded	IC 3-11-7.5-16						
32	Prevention of voting outside polling hours	IC 3-11-7.5-17						
33								
34								

Defining Voting System Certification

- Most definitions are user or location specific(e.g., Franklin State BoE)
- For our purpose we define voting system certification as:

“formal approval by an authorized government agency or certification authority that a voting system complies with the applicable laws, policies, standards, requirements, or guidelines.”

Before we Jump the Gun

- Prerequisites exist (e.g., Voting 101):
 - Voting Technology Education
 - Election Administration
 - Election Law
- Setting up a Certification Program:
 - Policies
 - Procedures
 - Documentation

Voting 101 – Elect from the following!

Valuable sources of educational materials:

- Test Plans and Test Reports
 - EAC, state, and local websites
- Voting Conferences & Organizations
 - ACCURATE, EVT/WOTE, Evoting.CC
- Voting and Elections - Website by Douglas W. Jones
- Election Administration and Technology blogs.

Our Generalized Protocol

Six Phases

1 - Requirements Gathering

2- Application Review

3 - Testing

4 - Test Results Review

5 - Certification

6 - Post-certification Activities

Phase 1 - Requirements Gathering

Phase 1 - Requirements Gathering

- Spans the entire certification process
- Compile a list of requirements for the voting system manufacturers.
- Include:
 - Federal Laws/Policy (e.g., Accuracy and Accessibility requirements from the Help America Vote Act, Language Requirements from the Voting Rights Act)
 - State Laws (Election Code), Policy (e.g., federally certified systems, or portions of the system), and Directives
 - Local Laws (Election Code) and Policy
- The list of requirements will become the *Requirements Document*

OHIO VOTING SYSTEM REQUIREMENTS MATRIX

FOR USE BY THE BOARD OF VOTING MACHINE EXAMINERS' EXAMINATION OF VOTING SYSTEMS SUBMITTED FOR A
CERTIFICATION IN OHIO ELECTIONS

All steps required by OAC 111:3-2-06 using Primary and/or General Election ballots per Secretary of State Directives 2008-18 and

EXAMINER'S NAME:	DATE:	SYSTEM BEING EVALUATED:		
		SIGNATURE: _____		
CRITERIA	ACCEPTABLE OR "YES"	UNACCEPTABLE OR "NO"	COVERED IN EAC TEST REPORT/VSTL TEST MATERIALS	QUESTIONS / COMMENTS
System Overview:				
Display and discuss all manuals, including poll worker instructional manuals.				
Equipment has received a federal certification number issued by the U.S. Elections Assistance Commission (R.C. 3506.10(H)(4)(a)).				
Equipment has been certified by an independent testing authority as meeting or exceeding the minimum requirements of the federal election commission voting system standards (OAC 111:3-3-01(C)(15)).				
Election Management - System Setup and Configuration – General Election				
Demonstrate actual ballot set up, using the following races and questions and issues: <ul style="list-style-type: none"> • The 2008 Presidential Election ballot, including all write-ins; • The 2008 15th Congressional district race; • A city council race where a voter can vote for two of five or seven candidates; 				

CRITERIA	ACCEPTABLE OR "YES"	UNACCEPTABLE OR "NO"	COVERED IN EAC TEST REPORT	QUESTIONS / COMMENTS
Election Management - System Setup and Configuration – Primary Election				
Ability to create and read a primary election ballot with six (6) political parties and issues only ballots (R.C. 3506.10(G), OAC 111:3-3-01(C)(7)).				
Ability to create and read a primary election ballot in which a 17 year old may vote for candidates only and not on any question or issue.				
Ability to create and read a primary election ballot in which voter does not declare party but votes a question and issues ballot only (R.C.3506.10(G), (H); OAC 111:3-3-01(C)(8).				
Ability to create and read nonpartisan candidates only ballot (R.C. 3506.10(G)).				
Capable of primary election ballot with write-in for each partisan ballot (R.C. 3506.10(D), OAC 111:3-3-01(C)(4)).				
Ballots accommodate facsimile signatures (R.C.3505.08).				
Construction and Security of Voting Machine – Hardware Construction, Hardware Test Results, and Security Measures				
Counter or other device visible from the outside, which will show, at any time, the number of electors who have voted (R.C. 3506.10(I), OAC 111:3-3-01(C)(9))				
Protective counter, or other device, the register of which cannot be reset, which will record the				

Divide & Conquer

Phase 1 - Requirements Gathering

- May be useful to divide requirements into different “classes” and functionality of voting systems
 - Classes = DRE, OpScan, BMD
 - Functionality = Full face ballot, Voter Verified Paper Audit Trails (VVPAT)
- Finally, include a catch-all requirement when possible.

Phase 2 – Application Review

Phase 2 – Application Review

- Require a *System Overview* document, which should:
 - Provide a detailed list of components and a description of the voting system
 - Identify all versions of the voting system
 - Explain any differences and "family history" a voting system (i.e., how it is related to similar voting systems in other states)
 - Technical information such as photographs, technical diagrams, and possibly source code (in a different deliverable)
 - All previous testing conducted on the system and documentation including Test Cases, Test Plans, Test Reports
- The application may require an accompanying fee and costs for certification as stipulated by law.

Technical Data Package

Before evaluation can begin, the vendor must submit to the evaluation agent a Technical Data Package. Each item in the package must be clearly identified; if the TDP is incomplete or the items in the package are not clearly identified, the entire package may be returned to the vendor and the evaluation of the voting system rescheduled.

The *Technical Data Package* must contain the following items, if they were not included in the TDP submitted to the VSTL:

1. *Hardware Schematic Diagrams.* Schematic diagrams of all hardware.
2. *Hardware Theory of Operations.* Documentation describing the theory of operation of the hardware.
3. *Customer Maintenance Documentation.* Documentation describing any maintenance that the vendor recommends can be performed by a customer with minimal knowledge of the system.
4. *Operations Manual.* Operations documentation that is normally supplied to the customer for use by the person(s) who will operate the equipment.
5. *Recommended Use Procedures.* Specific election administration procedures recommended for use with the system.
6. *Software License Agreement.* The software license agreement must be perpetual. An annual renewable support fee may be included as an option.

Checking the Application

Phase 2 – Application Review

- Check the application for correctness and sufficiency
- Prepare an *Application Check Sheet*
- Compare application information with the *Requirements Document*.
- Use the *Application Check Sheet* to determine if this system is ready for testing.
- If a method or feature is not allowed in your state or jurisdiction, you may want to **eliminate the system from consideration**.

Phase 3 – Testing

Phase 3 – Testing

- Sound testing requires a pre-determined series of actions to achieve repeatable results
- Develop general and specific test cases and scripts for unique features of the system under test
- Test the voting system against general pass/fail test cases or scripts created for all voting systems.

Test Case Identifier: 02 – 25 P.S. § 3031.7(2) Selection of Candidates and Questions by Voter (Regular/ADA)		
PA ST 25 P.S. § 3031.7 Requirement:		<i>(2) Provides facilities for voting for such candidates as may be nominated and upon such questions as may be submitted.</i>
Test Objective: To determine if a voter has the ability to select candidates and questions.		Test Configuration: Precinct tabulation device configured as described for normal election day operation by Pennsylvania procedures and/or the device manufacturer.
Test Equipment:		None
Special Procedural Requirements:		None
Assumptions:		An election is loaded on the device and the polls are open, ready for voting.
Step	Description	
1000	<p>Activate a ballot for voting.</p> <p><i>Expected:</i> The ballot is presented and vote selections can be input.</p> <p><i>Actual:</i></p>	
1010	<p>Select the first candidate in the first partisan contest excluding a straight party contest.</p> <p><i>Expected:</i> The precinct tabulation device displays or provides an indication of a vote selection for the first candidate in the first partisan contest excluding a straight party contest.</p> <p><i>Actual:</i></p>	

Criteria for Evaluation of the Test Results: The intended selections input above are recorded, stored, and reported as input by the tester.

Test, Modify, Document – *ad nauseum*

Phase 3 – Testing

- Use test results to modify the next test cases that are planned.
- Document the results of each test
- Review and use federal and state Test Reports when available

Phase 4 – Test Results Review

Phase 4 – Test Results Review

- Review all results and documentation generated from the test campaign.
- Discuss the test results with other election officials with similar systems.
- Review the *Requirements Document* again.
- Deficiencies will arise and more testing may be required prior to granting certification.

Phase 4 – Discussion

Phase 4 – Test Results Review

- This is another time to **consider failing the system and not moving forward.**
 - If the system does not meet the *Requirements Document* or if alarming situations arose, seriously consider this option.

The certification authority accepts a large amount of the risk by certifying a voting system.

Phase 5 – Certification

Phase 5 – Certification

- When all requirements are satisfied it is time to decide whether or not to certify the voting system.
- If the decision is made to move forward with certification, approval documentation is created and issued.

How do I know what “certified” is?

Phase 5 – Certification

- Create a *Scope of Certification* including:
 - All versions of hardware, software, and firmware
 - Names and unique identifiers of all COTS products
 - Titles of all documents certified with the system, including the technical data package
 - The approved configuration(s) of the voting system
 - System limits
 - Any other items of note



United States Election Assistance Commission

Certificate of Conformance

Unisyn OpenElect 1.0.1 (Modification)



The voting system identified on this certificate has been evaluated at an accredited voting system testing laboratory for conformance to the 2005 *Voluntary Voting System Guidelines (2005 VVSG)*. Components evaluated for this certification are detailed in the attached Scope of Certification document. This certificate applies only to the specific version and release of the product in its evaluated configuration. The evaluation has been verified by the EAC in accordance with the provisions of the *EAC Voting System Testing and Certification Program Manual* and the conclusions of the testing laboratory in the test report are consistent with the evidence adduced. This certificate is not an endorsement of the product by any agency of the U.S. Government and no warranty of the product is either expressed or implied.

Product Name: OpenElect

Model or Version: Version 1.0.1 (Modification)

Name of VSTL: Wyle Laboratories

EAC Certification Number: UNS10121966-OE-WI

Date Issued: July 21, 2011

Executive Director, U.S. Election Assistance Commission

Scope of Certification Attached

System Component	Software or Firmware Version	Hardware Version	Operating System or COTS	Comments
OVO	1.0.1	8033-93000 Rev. E	Linux CentOS 5.0	Hardware Version reflect the de-minimus changes approved by the EAC
OVI	1.0	8033-93003, Rev. F	Linux CentOS 5.0	
OVCS	1.0.1	Hardware v. 1.0	Linux CentOS 5.2	
Ballot Layout Manager (BLM)	1.0			+ Database amendment for font size – see EAC CCR0001
Election Manager(EM)	1.0			
Software Server(SS)	1.0			
Election Server(ES)	1.0			
Tabulator Client(TC)	1.0			
Tabulator(Tab)	1.0			
Tabulator Reports(TR)	1.0			
COTS Components				
Desktop		Dell Optiplex 755	Dell	PC, Intel Core2Duo 2.53 GHz or faster processor, 4 GB RAM, 250 GB hard drive (Mirrored), 16x DVD RW +/- drive, 3.5-inch drive, Super VGA (800x600) or higher resolution video adapter and monitor.

A Whip of the Pen

Phase 5 – Certification

- Create cryptographic hashes, or digital fingerprints, of each piece of software and document.
- Mandate system identification tools (software and documentation) to assist with system validation
- After all required documentation is received, formally certify the voting system.

Phase 6 – Post-certification Activities

Phase 6 – Post-certification Activities

- The certification authority's duties are not finished once a system is certified
- Compliance means continuous monitoring of the system
- Check back on a regular basis with users

It ain't over ...

Phase 6 – Post-certification Activities

- Monitor any updates and technical advisories from the voting system manufacturer.
- Continue discussing the certified system with other election jurisdictions, including other states using similar systems or configurations.

The Times They Are A-Changin'

Phase 6 – Post-certification Activities

- Be aware of potential risks to the voting system.
- Updates and changes to the certified system will be necessary, but any change to the system must meet the *Requirements Document*
- At times testing is necessary for larger changes, which may require recertification.

Wrap-Up

- Voting system certification is complex
- No system will be problem free.

1 - Requirements Gathering

2- Application Review

3 - Testing

4 - Test Results Review

5 - Certification

6 - Post-certification Activities

Some Assembly Required

- Voting system certification is continually evolving
- The protocol can be used as a foundation
- **Modifications to the process should be made**
- New methods of tests arise as best practices emerge from new research and the coordinated actions of election officials.

This means you

Outstanding Issues (Batteries not included!)

- Other important voting system certification issues include:
 - Commercial Off The Shelf (COTS) components
 - Engineering Change Orders (ECOs)
 - Large modifications of the voting system
 - Reuse of previous testing
 - Decertification practices (Right Jessica?)

Final Remarks

- Email us for the full paper with examples and templates.
- Hopefully, by using this protocol, election jurisdictions can begin to standardize on voting system certification to ensure reciprocity of certification.
- This can reduce costs while raising the bar of voting system integrity.

References

- [1] Prosser, Krimmer, Evote 2004
- [2] Ohio Secretary of State, Ohio Voting Systems Requirements Matrix
- [3] Virginia State Board of Elections, VA Certification Procedures
- [4] Pro V&V, Inc., Commonwealth of Pennsylvania Test Protocol for Re-examination of Hart Voting System 6.2.1
- [5] EAC, Certificate of Conformance, Unisyn 1.0.1
- [6] EAC, Scope of Certification, Unisyn 1.0.1
- [7] VSTOP, Indiana Certification Protocol

Generalized Protocol for Certifying E-Voting Systems

State Certification Testing of Voting
Systems National Conference



Questions?



Jay Bagga • jbagga@bsu.edu
Joshua Franklin • jfranklin@eac.gov
Jessica Myers • jmyers@eac.gov