VVSG Scope & Structure

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Together...Making It Happen

NIST
NASED
EAC
FVAP
IEEE

High-level, plain language principles

Election Process

Goals

Military/Overseas Voters

Common Data Format

Common Threads

Constituencies
- Technical Approach
- Implementation Details
- Testing Processes

WG's
- Election Processes
- Election Functions
- Technology Solutions

EOs
- Pre-Election
- Election
- Post-Election

Experts

U & A
Cybersecurity
Interoperability
Testing

BoA SB

Standards
- IEEE
- ANSI
- ACCESS Board

Requirements -> verified code

Legal Requirements Accessibility

Verified Code
Reaching Consensus on VVSG Scope

Election WGs

Pre, Election, and Post

Election Process Models

• TGDC
• EAC/NIST
• PWG Chairs

Use Case Scenarios

• Standards Board
• Board of Advisors
• NASED

- Electronic Pollbooks
- Ballot Marking
- Ballot Delivery

- Ballot-on-Demand
- Auditing
- Election Night Reporting
Towards a New VVSG Structure

NASED Recommendations to EAC / NIST

EAC Roundtable / Public Meetings

TGDC Adoption

HIGH LEVEL
Principles

LOW LEVEL
Test Assertions
Timeline: Late 2017/Early 2018

Revise VVSG Structure: Flexible standards, COTS, Innovation
VVSG Structure
Revising the VVSG Structure

- New, more usable, flexible structure
  - Based on high level principles (NASED, NIST)
  - EAC future VVSG goals
  - Level of detail depending on the audience
- Initial focus on Usability and Accessibility (U&A)
  - Five principles
  - Each principle has a set of goals called “guidelines” which are tied to requirements
  - Created format and initial baseline content based on human factors analysis
Proposed Structure

- Principles
  - High level system design goals
- Guidelines
  - Broad system design details for election officials
- Requirements
  - Technical details for design and development by vendors
- Test Assertions
  - Technical specification for testing by test labs
Chapter Overview & Principles

- Each chapter opens with introductory text to explain the scope, topics, and legal context.
- All of the principles are also listed at the beginning of the chapter. All voting systems must meet these.
- This information is an overview for everyone.
Expanding Each Principle

- Click on a guideline and you see a list of all of the requirements that systems must meet. They are summarized in an easy-to-read list.

- This page is helpful for those already familiar with the VVSG.

- For some roles, you will not need to read any further.
Detailed Requirements

- Dive down one more level, and you get to the detailed test-able requirements. These pages are the largest group in each section.

- Each requirement has:
  - Number
  - Short title
  - Requirement text
  - Accessibility link
  - Test assertion links
  - Discussion notes
Analysis: Emerging Technologies

- Core U&A requirements still relevant (e.g., color, contrast, audio, tactile controls), but:
  - New devices, beyond kiosks
    - E.g., tablets, remote ballot marking systems
  - New interfaces
    - E.g., small form factor (screen size, ballot layout, page orientation), representing ballot selections (QR codes)
  - New interactions
    - E.g., touchscreen gestures, personal assistive technology, eye-tracking
Analysis: Research & Standards

- EAC Accessible Voting Technology Initiative (AVTI)
- Web Content Accessibility Guidelines (WCAG 2.0)
  - Legal implications
- Integrate U&A requirements with
  - Security
  - Software/hardware
  - Interoperability
  - System-specific guidelines (by election or device)
Principle 1: Equivalent and consistent
All voters have access to mark and cast their ballot as intended, regardless of their abilities, without discrimination.

- 1.1 Provide voters with a consistent experience of the voting process in all modes of voting.
- 1.2 Provide voters with equivalent information and options in all modes of voting.
**Principle 2: Cast as marked**

Ballots are cast as marked, both secretly and privately.

- **2.1** The voting process shall preserve the secrecy of the ballot.
- **2.2** The voting system must ensure that ballot selections, interface options, voter identity and information about voters are kept private.
- **2.3** The voting system supports the voter in marking the ballot accurately
- **2.4** The voting process helps voters avoid errors that invalidate their ballot, including blank ballots, undervotes, overvotes, and marginal marks.
Principle 3: Marked as intended
Ballots are presented in a clear, understandable way, and is operable by all voters.

- **3.1 Perceivable** - The default system settings for displaying the ballot work for the widest range of voters, and voters can adjust settings and preferences to meet their needs.

- **3.2 Operable** - Voters and poll workers must be able to use all controls accurately, and all ballot changes are made with the direct control of the voter.

- **3.3 Understandable** - Voters can understand all information as it is presented.

- **3.4 Robust** - The voting system’s hardware and accessories support usability and accessibility requirements while protecting voters from harmful conditions.
Principle 4: Tested for usability
Meets performance standards for usability and accessibility.

• 4.1 Summative usability tests are conducted using a wide range of voters and poll workers, including those with and without disabilities.

Principle 5: Meets web accessibility standards
Browser-based systems meet web accessibility standards in addition to voting standards.

• 5.1 When a voting system uses standard web software platforms (HTML or native apps), the voting system meets all requirements in WCAG 2.0 Level AA any applicable requirements in the VVSG.
U&A Baseline

- Created U&A structure based on our principles and guidelines
- Used the emerging technologies and standards analysis to identify:
  - Core U&A requirements
  - Requirements for removal
  - Gaps that can be addressed with existing research and standards
  - Gaps that require research
  - Test assertions that still are valid

Next Steps: Input on scope and content
Example: Ballot Marking System

**Scenario:** The Election official would like to procure new ballot marking system. He will use the new voting systems standard to guide his analysis.

- Commercial tablet
- System needs to be usable and accessible by all voters
- Check each principle, drilling down as needed
EO Walkthrough of Human Factors Principle 3: Example subset for EBM tablet

3.1 Perceivable
- Look at font, color, & contrast requirements
- Is there an audio interface?
- Can low vision voters find tablet controls?

3.2 Operable
- If tablet is mounted, are controls within voters' reach?
- Can voters use visual and audio controls?

3.3 Understandable
- Are there clear instructions on using the tablet?
- Can voters access all information on the ballot without swiping or scrolling?

3.4 Robust
- What personal assistive technology does the tablet support?
- What can be adjusted in the tablet display?
- Can voters use visual and audio controls?
- If tablet is mounted, are controls within voters' reach?
Additional Tablet Requirements

- The tablet must also meet other requirements
  - Hardware
  - Software
  - Interoperability
- Tablets for other election applications
  - E.g., e-pollbooks
  - Core (not ballot specific) U&A requirements for voters and pollworkers also apply
Use Case Scenarios
Electronic Pollbooks (EPBs)
Electronic Pollbooks (EPBs) Scenarios

**WHAT** | Manage voters during election

**HOW** | **Scenarios:** check-in voter, activate voter ballot via

**Typical-offline:** standalone, offline data from VR, activating voter ballots

**Online:** Case #1, but via online connections (e.g., online connection to a VR)

**Connect to other sites**
EPB to EPB communication between vote centers

**Multi-function:** Includes cases #1 and #2, but also supports any additional functions (BoD, BM, Ballot activation, etc.)
Lookup voter information, verify voter information, ballot generation / activation

**EPB as Election Technology Integration Platform**
Ballot Delivery (BD)

**Use Case Scenario** | **Description**
--- | ---
**BDₜ** | Ballot delivery (**blank** ballot) to voter before voting
**BDᵥ** | Ballot delivery (**voted** ballot) from voter after voting
Ballot Delivery (BD) Scenarios

WHAT | Deliver appropriate ballot via appropriate ballot transportation mechanism

HOW | Scenarios

Blank ballot delivery: from EO to voter

Voted ballot return: from voter to EO

Multiple ballot representations: e.g., QRCode'd + human-readable ballot content (list of choices)

Ballot conversions for ballot delivery mechanisms: e.g., convert electronic to paper QRCode, deliver via secure physical transfer, convert to electronic QRCode, print on-demand
**Ballot on Demand (BoD)**

### Use Case Scenario

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BoD&lt;sub&gt;B&lt;/sub&gt;</strong></td>
<td>Ballot generation (blank ballot; ballot on demand) to voter before voting</td>
</tr>
<tr>
<td><strong>BoD&lt;sub&gt;V&lt;/sub&gt;</strong></td>
<td>Ballot generation (voted ballot; ballot on demand) from voter after voting</td>
</tr>
</tbody>
</table>

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**Diagram Description**

- **BoD<sub>B</sub>**
  - *generate* Ballot
  - *convert* Ballot

- **BoD<sub>V</sub>**
  - *generate* Ballot
  - *convert* Ballot
  - *print* Ballot
  - *verify* Ballot
  - *cast* Ballot

- **BoD<sub>B</sub>**
  - *deliver* Ballot

- **BoD<sub>V</sub>**
  - *edit* Ballot

- **BoD<sub>B</sub>**
  - *cast* Ballot

- **BoD<sub>V</sub>**
  - *count* Totals

- **Audit**
  - *audit, report* Report
Ballot on Demand (BoD) Scenarios

**WHAT** | Create an appropriate ballot for a voter at the same time when they request it.

**HOW** | Scenarios

**Blank ballot creation**

**Typical-offline:** ballot printing, paper ballots, at polling place

**Absentee:** ballot printing, paper ballots, at home

**Alternative-ballot-representations, paper:** ballot printing QR codes

**Alternative-ballot media:** electronic ballot generation

**Voted ballot creation**

**Typical-offline:** ballot creation & marking, paper ballots, at polling place

**Absentee:** ballot creation & marking, paper ballots, at home

**Alternative-ballot-representations, paper:** ballot printing QR Codes

**Alternative-ballot media:** electronic ballot generation

**Multiple equivalent ballot representations:** e.g., QRCoded ballot and human-readable ballot content (list of choices)
Ballot Marking (BM)

- Ballot
- Voter
- Vote
- Totals
- Audit
- Report
- EPB
- BoDB
- BM
- BoDV
- BDV

Deliver → edit → cast → capture → count → audit, report

Blank Ballot → Voter → BM

- edit
- mark
- print

Cast → Cast Ballot
Ballot Marking (BM) Scenarios

**WHAT | Validly mark ballot**

**HOW | Scenarios:**

- **Typical-offline, paper:** Voter marks paper ballot
  - Direct marking, mechanical: via pen
  - Indirect marking, electronic: via BMD

- **Online, electronic:** Voter marks online/remote ballot
  - Interfacing device: via touchscreen, tablet, smart phone

BM - Ballot - Voter - Vote

Location

Ballot Representation

edit → mark → convert
Auditing

Use Case Scenario | Description
--- | ---
Audit | Post-election auditing

**Election Process Information**
- Voted Ballots
- Audit Logs
- Election totals
- Other process information

**Verification**
- Election outcome
- Election Process

**Auditing Approach**

**Voter** votes on **Voting System** generates audits produces **Auditing Approach**
## Auditing Scenarios

<table>
<thead>
<tr>
<th>WHAT</th>
<th>Verify election results</th>
</tr>
</thead>
</table>

**HOW | Scenarios**

- **Typical-offline, manual:** Fully, manually all voter-verified and cast ballots

- **Risk-limiting**
  - Single-ballot auditing
  - Multiple-ballot (batch) auditing

- **Other auditing types ...**

### Diagram

- **AUDIT**
  - **audit**
  - **Vote**
  - **EO**
  - **Totals**
Election-Night Reporting (ENR)

Ballot ➔ Voter ➔ Vote ➔ Totals ➔ Report

deliver ➔ edit ➔ cast ➔ capture ➔ count

Audit ➔ Report

Results
Loaded Results
Unofficial Results
• update
• certify

Official Results

Stakeholder
(Voter, EO, media, ...)

Report

Votes ➔ Results ➔ ENR

[INPUT RESULTS]

[REPORT RESULTS]

aggregates
report
transmit
upload
translate

Tabulator
EMS
VR

access
report
Election-Night (ENR) Reporting Scenarios

**WHAT** | Report election results during election

**HOW** | Scenarios:

**Offline:** standalone, offline data from VR and EMS, uploading, updating, publishing, reporting

**Online:** Case #1, but via online connections

- **Connect to other systems**
  - VR, EMS, Tabulator systems

- **Distributed, Cloud**

- **Multifunction:** Additional functions (filtering, report customization, report-printing, voter-specific queries, specific data channels (to media, stakeholders)

- **Alternative results data representations and conversions:** CDF, XML, CSV, ...

![Diagram showing ENR report flow with connections to totals and reports]
We need your expertise

- Join the NIST/EAC public working groups and Twiki
  - http://vote.nist.gov
  - vvsg@eac.gov
- Provide feedback.
- Contribute to white papers
Related NIST Work

- “Roadmap for improving usability and accessibility guidance for next generation elections”
  - Draft http://civicdesign.org/projects/roadmap/
- “Organizing Requirements by Principles: Exploring a revised structure for usability and accessibility in the VVSG:
  - Draft http://civicdesign.org/projects/roadmap/
- “Principles for remote ballot marking systems”
  - Draft http://civicdesign.org/projects/remote-ballot-marking/