Open Source Voting

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Outline

• Concept
• In-Precinct Architecture
• Central Tabulating System
• Central Reporting System
• Bulk Scanning
• In-Precinct Scanner
Concept

• Secret Ballots Talled in Public incompatible with Voting Machines and Tabulators whose inner workings are Trade Secrets

• Open Voting Consortium created to promote Public Software for Public Elections
In-Precinct Architecture

Voter Signs In

Voter Makes Selections on Electronic Voting Machine

Electronic Audit Trail (Transferred When Polls Close)

Voter Verifies Ballot

Blind or Reading-Impaired Voter Verifies Ballot

EVM Prints Ballot

Voter Casts Ballot by Placing in Ballot Box

Paper Ballots are Tallied and Reconciled with Electronic Audit Trial

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Open Source Voting
Voter Sign-in Station

- Voter signs in.
- Poll worker gives voter a token enabling one vote for the correct ballot type (party/precinct).
- Token does not reveal voters identity.
- Token could be:
  - Pre-printed ballot stock, smart card,…
Electronic Voting Station

• Commodity PC in secure enclosure.
• Boots off Knoppix (Linux) CD-R, containing all software and data.
• Printer for the “official” paper ballot.
• Produces an electronic audit trail, kept on flash RAM and written in random order to same CD-R for reconciliation and archive.
• Touch screen, mouse, keyboard, or ATM-style buttons.
• Multiple language support.
• Electronic Ballot Printer (EBP).
Sample User Interface
Reading Impaired Interface

- Auditory and visual output of ballot choices and selections made.
- Additional input modes.
- Universal design.
- Multiple language support.
Paper Ballot

• Electronic Voting Station prints a paper ballot.
• Paper ballot must be *cast* to be tallied.
• Voter can verify paper ballot by reading or listening to paper ballot.
• Contains security markings to avoid forgeries or ballot stuffing.
• Includes a barcode for easy computer reading. Will also use OCR font.
## Sample Ballot

### President
- Thomas Jefferson
- Harry S. Truman

### Vice President
- Clarence Darrow

### Senator
- Lillian Hellman

### U.S. Representative
- Linus Torvalds

### Treasurer
- Dewitt Clinton

### Attorney General
- Richard Stallman

### Commis. of Education
- Martin Luther

### State Senate
- No preference indicated

### State Assembly
- Yes

### Transportation Initiative
- Yes

### Health care initiative
- No

### Term limits
- Oprah Winfrey
- Steven Spielberg

### Cat Catcher
- 1 - Steve Jobs
- 2 - William Hewlett
- 3 - David Packard
- 4 - Gordon Moore

### County Commissioner
- 1 - Steve Jobs
- 2 - William Hewlett
- 3 - David Packard
- 4 - Gordon Moore
Privacy Folder

- Hides human readable portion of ballot after voter prints ballot until it is cast.
- Allows barcode to be scanned by Ballot Verification Station while still in folder.
- Voter hands privacy folder with ballot to poll worker, who removes ballot (face down) and places it in ballot box.
Ballot Box

• Physically secure container.
• Ballots must be cast in ballot box to be counted.
• Ballot boxes opened in view of public for tallying.
Ballot Verification Station

- Scans ballot barcode.
- Speaks ballot choices for verification by reading-impaired.
- Can display ballot choices for anyone else.
Ballot Reconciliation Station

• Reconciles printed ballot against electronic audit trail.
• Reads CD-R from Electronic Voting Stations.
• Scans paper ballots.
• Compares them.
• Reconciles spoiled ballots and count of provisional ballots.
Alternatives for Ballot Reconciliation System

• Could do all scanning at the end of the day.
• Could scan ballots incrementally through day to ensure they are readable.
• Could also scan optical scan (opscan) ballots.
  – Good way to transition from existing system.
  – Supports hand marked ballots.
  – Also supports Electronic Ballot Marker (EBM) design (e.g., AutoMark).
Box for Spoiled Ballots

- If voter spoils a ballot, ballot is marked spoiled and placed in box for spoiled ballots.
- Spoiled ballots are reconciled along with cast ballots against electronic audit trail.
Box for Provisional Ballots

• Voter may cast a provisional ballot.
  – If voter not on voter roll, or if voter was sent an absentee ballot.

• Voter given a distinctive voter token to identify ballot to be provisional.

• When voter is ready to cast ballot, paper ballot is placed in a sealed envelope that lists the details necessary to determine whether the ballot should be counted.
Absentee and Manual Polling-Place Ballots

• Use paper optical-scan system.
Central Tabulating System

• Reliable, secure, auditable voting machines are not enough.

• We also need reliable, secure, auditable canvassing (counting) systems used centrally.
Central Architecture

- Results from Precincts
- Paper Ballots
- Bulk (Optical) Ballot Scanner
- Central Tabulator
- Unofficial Results (Periodically after polls close)
- Unofficial Results Web Server
- Election Management System
- Internet Display of Unofficial Results
- Internet
Central Tabulating System

• Vote Tabulator.
• Election Management System.
• Official Reporting System.

• Unofficial Reporting System.

• Central Opscan Ballot Reader.
Vote Tabulator

- Database of every vote, anonymously.
- Log of all access by user and time.
- Production-quality database.
- Supports ranked preference voting (e.g., IRV, STV).
- Could replace Vote Tabulator for Diebold, ES&S, Sequoia,....
- Full logging of use, support for recounts.
- IEEE 1622-compliant.
Election Management System

- Database of candidates and measures (contests and choices), jurisdictions, precincts, parties, primary info.
- Provides election data for electronic voting machines, precinct tabulators, central tabulators.
- Full logging of use.
- IEEE 1622-compliant.
Official Reporting System

- Reports official results for election officials and certification process.
- Does not release results (other than counts of voters) before polls close.
- Full logging of use.
- Support for recounts.
- IEEE 1622-compliant.
Unofficial Reporting System

• Periodically after polls close, central tabulation system burns CD or DVD with updated summary results.
• CD or DVD is physically carried (“sneaker net”) to unofficial reporting system and loaded in.
• Unofficial reporting system provides web access to election results, including:
  – Precinct-by-precinct totals.
  – Regular votes vs. absentee and provisional ballots.
  – Report of which provisional and which absentee votes are counted.
  – Allows reconciliation of totals posted at precinct with totals in tabulation system.
• IEEE 1622-compliant.
Central Opscan Readers

- Batch scans absentee ballots, provisional ballots, opscan or OVC-style ballot.
- Reads image of ballot.
- Determines where the marks are without knowing what they mean.
- Logs location of all the marks on a ballot.
- Interprets marks based on election management system data to create electronic ballot image.
- Supplies electronic ballot image to central tabulator.
- Full logging and support for automated recounts.
- IEEE 1622-compliant.
Current Status

• Prototype built of precinct-based system.
• Demonstration covered on TV, radio, and newspapers.
• Available on Source Forge as EVM2003.
Roll-out plan

• Develop prototype of central tabulator.
• Develop production version of central tabulator, election management system, and reporting systems.
• Develop production quality version of central optical scan ballot reader.
• Develop production quality version of precinct-based optical scan ballot reader.
• Develop OVC Electronic Ballot Printer system.
Conclusion

- Give election officials more choices.
- Enable best-of-breed voting systems.
- Enable competition in services and follow-on support.
- Build open source voting systems vendors can adopt.
- Cheaper, more reliable and secure, auditable, and more trustworthy.