

## **Do Paper Trails fail to secure e-Voting?**

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Some sectors of the industry have proposed that cryptology techniques such as those used by “True Vote” and others are superior to software independent solutions that can use verified paper ballot records in combination with computerized ballot tallying.

NIST in the latest 2007 EAC Voluntary Guidelines for voting systems define *software independent* solutions very clearly, having worked very hard over the past two years to clarify and investigate all aspects of the processing required, and to couch these in terms that are as non-technical as possible. The details are as follows.

*Software Independence:* voter verifiable records exist to provide a separate record of the voter's choices, which can be used to verify the correctness of the electronic record produced by the voting device **without exposing voter privacy**. A voting system is software-independent if an undetected change or error in its software cannot cause an undetectable change or error in an election outcome.

### **1.2-A Direct verification by voters**

Independent voter verifiable systems shall create records that voters can verify without software or other technology with the exception of assistive technology.

### **1.2-B Direct review by election officials**

Independent voter verifiable systems shall create records that election officials and auditors can review without software or other technology.

### **1.2-C Support for hand auditing**

Independent voter verifiable systems shall create records that election official can use without software or other technology to verify the correctness of reported electronic totals. The records must support a hand audit that uses no technology to read or interpret the records. The hand audit may provide a statistical basis for other larger audits or recounts performed using technology (such as OCR).

### **1.2-D Use in recounts**

Independent voter verifiable systems shall create records that election officials can use to reconstruct the full set of totals from the election. This requirement addresses the completeness of the records, rather than their technology independence.

### **1.2-E Durability**

Independent voter verifiable systems shall create records that are remain readable and unchanged for 22 months unaffected by power failure, software failure, or other technology failure.

### **1.2-F Tamper Evident**

Independent voter verifiable systems shall create records that once written upon show evidence of having been changed.

### **1.2-E Public format**

Independent voter verifiable systems shall create records that are written in a non-proprietary, public format that can be read by anyone without special knowledge of confidential or proprietary or trade secret information without any kind of intellectual property restrictions.

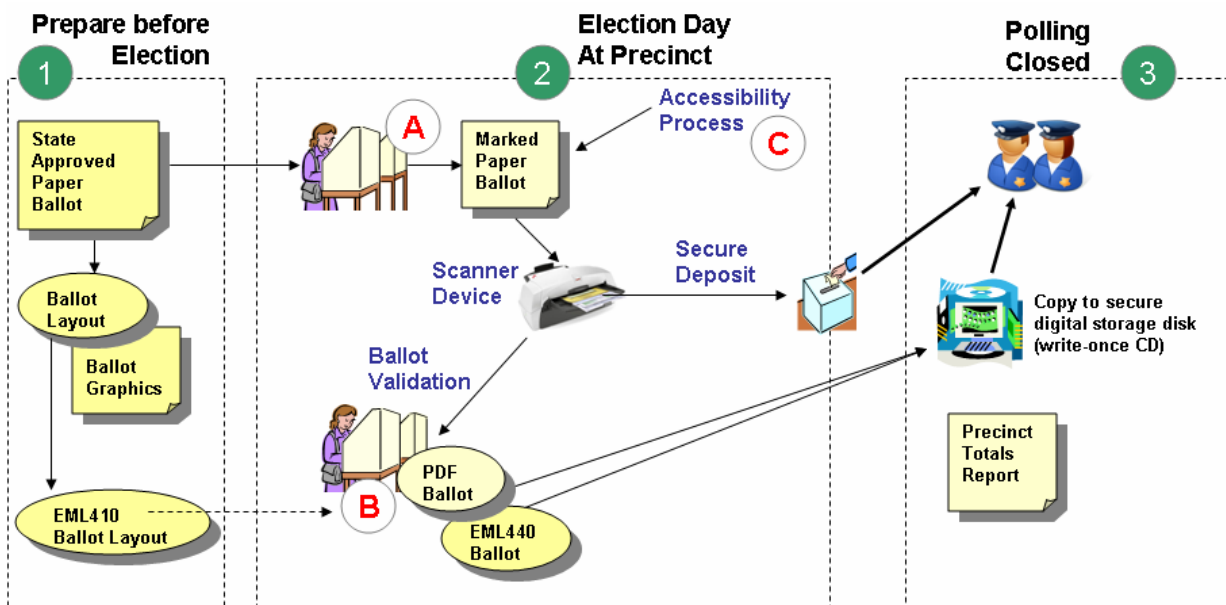
## **2.2 The need for software independent approaches**

“One should strongly prefer any approach where the integrity of the election outcome is not dependent on trusting the correctness of complex software. Voter verified paper audit trails (VVPAT) provide the most prominent (albeit ad hoc) approach available today in the market”. (from <http://vote.nist.gov/SI-in-voting.pdf> by Ronald L. Rivest (MIT), John P. Wack (NIST) )

What does a *software independent* process and architecture look like? The diagram below shows the simple system approach developed by Open Voting Solutions and implemented as public open source. Simplicity is crucial to ensuring transparency and ensuring that the operations can be verified and rigorously tested without prohibitive costs to certification.

Also through simplicity we empower the election and party officials to directly setup and verify the operations – shown in Step 1 in Figure 1. All this is done using approved international public voting standards known as OASIS Election Markup Language (EML) – that instructs how the ballot records must be recorded in the computer. Using a public open standard is vital to ensure that everyone can verify the operations being performed and the recording and counting – Step 3 in Figure 1. Instead in *software dependent* solutions, all this is done by a vendors own software programmers alone.

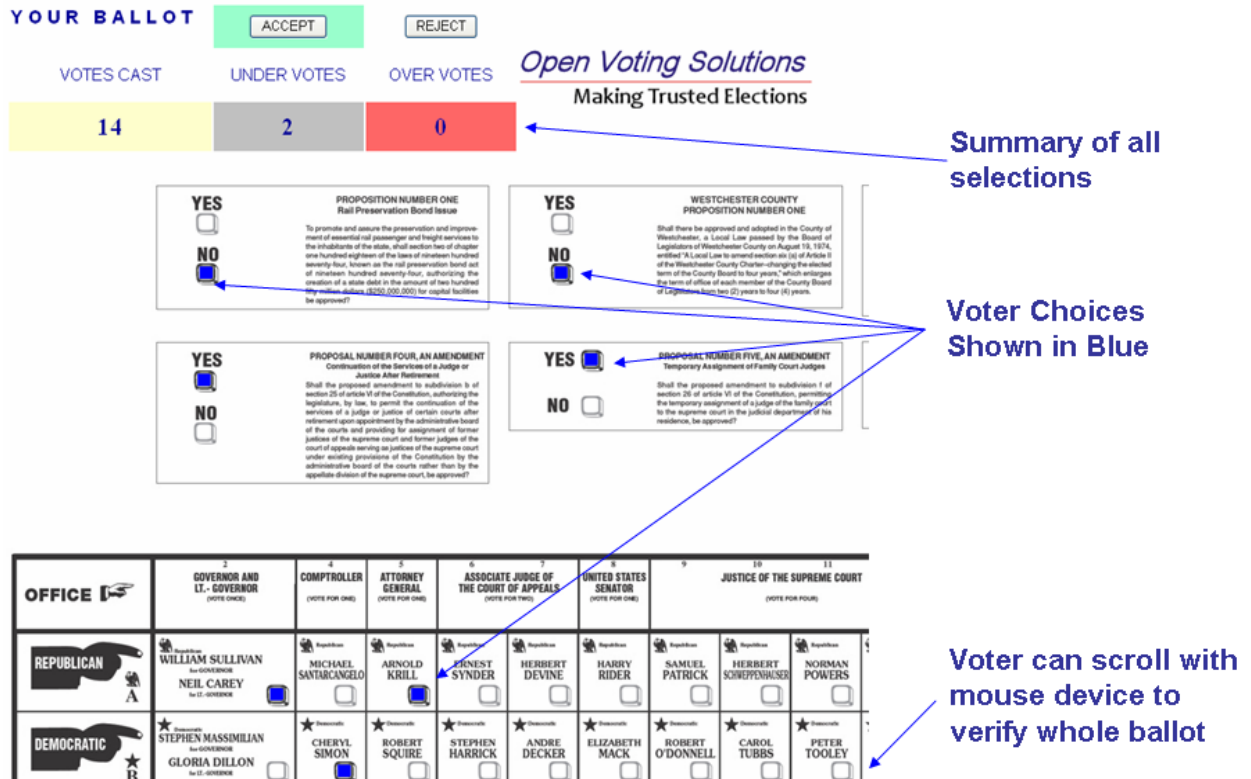
*Figure 1 – Software Independence via verified paper ballot voting*



The heart of the process is of course the voter. The critical part of the process above in Figure 1 is the Step B – Ballot Validation. In existing in-place voting systems deployed today – the voter presents the paper ballot to the scanner and minimal or no feedback is provided other than a simple “ballot accepted” confirmation. This is clearly totally inadequate.

Instead – the Open Voting Solutions approach puts the voter in complete control of the whole verification process allowing them to confirm exactly what the computer is doing on their behalf. Accepting or rejecting and correcting, until they are sure everything is accurate. In our testing this is not prohibitively slow, and most voters take only minimal additional time to operate the confirmation process. The figure on the next page shows these details.

Figure 2 – Voter Verification of Ballot Processing



The processing shown in Figure 2 allows the voter to confirm that the machine really has accepted their ballot as they intended (this example is for an actual New York ballot).

This process also provides an additional software independent step – as the scanning software that reads in the ballot and locates the vote marks is completely separate from the computer software that renders that interpretation as a form display (blue boxes) to the screen for voter to confirm (this same confirmation can also be provided via a headphones interface as audio for assisted voting needs).

The use of OASIS EML allows this form scanning to also be done without exposing the text of the candidates, proposals and parties inside the ballot handling software itself.

Also – the Ballot *Summary of selections* is another key - it provides color coded boxes showing the voting details as cast (for example in Florida in 2006 failure to have this feature resulted in 10,000 erroneously processed ballots).

### Conclusion

A well designed solution involving paper ballots combined with software independent techniques as outlined in the new 2007 EAC Guidelines, provide a secure, simple and transparent solution for voters. In addition the use of public open source software, public open specification standards (OASIS EML), off-the-shelf computer equipment from name brand suppliers (such as HP, Dell, Kodak) provide the optimum cost effective and publicly transparent and verifiable solution.