How to Vote

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This review of various voting systems, neither detailed, technical nor exhaustive, is purely introductory in purpose. It omits some systems intentionally: the colonial "stand by your man" system, for its lack of privacy; and lever machines for their weight, their clunkiness, their abandonment by manufacturers and their lack of a voter verifiable paper trail. As there is no perfect system, our common problem is to discover or invent the best system we can afford.

1. Paper ballots marked and counted by hand. The voter uses pencil or pen to fill in bubbles on a paper ballot. Many advanced western nations still use paper ballots marked and counted by hand. They include Canada, Great Britain, France and Switzerland. Illegible marking can be a problem. One available solution, an expensive one, is a machine with pushbuttons that prints out a perfectly legible ballot, verifiable by the voter. A widely used alternative solution employed at the counting stage is to follow a specific set of rules for discerning voter intent. Users of this system tend to accept the inevitability that a small percentage of ballots will be discarded as unreadable.
Most of the other systems discussed below require a routine audit of the machines used to count or record the vote. This system does not. All it requires is a recount, should an outcome be challenged.

The chief costs are those of printing the ballots, renting and staffing the numerous polling places, and training poll workers. The use of machines to print out voter verifiable ballots would entail significant additional costs of acquisition, maintenance and training. Note that Switzerland minimizes polling-place costs by means of paper ballots mailed to a municipal center and counted there by hand.

2. Paper ballots marked by hand but counted by optical scanner.
This system is also susceptible to the legibility problem (see 1. above).

a. Precinct optical scanners. At the voting precinct the completed ballots are fed into the scanner one at a time. If this is done before the voter leaves the premises, an illegible ballot can be detected and corrected on the spot.
This system requires routine random audits, because the scanners are subject to the same problems of security and reliability as DRE (direct recording electronic) machines.
The chief costs are those of acquiring and maintaining the scanners ($4-5 thousand each), printing the ballots, renting and staffing the polling places, and training the poll workers.

b. Central high-speed scanner for the entire county.

(1) Ballots are marked at precincts but transported to a central location for batch-counting by a high-speed scanner. At $40-$50 thousand for such a scanner, this would be significantly cheaper in terms of both acquisition and maintenance than a scanner for each of our 70 plus precincts ($4-5 thousand each). As ballots are batch processed,the

system is faster and less laborious than the precinct optical scanner system, but requires routine random audits of a comparable scope. Equipment and maintenance costs aside, the costs are comparable to those of the precinct optical scanner system. Some object to this kind of system on the theory that centralization endangers security. The idea is that the ballots are vulnerable to meddling in the course of their transportation to the counting center, where their concentration also makes them more vulnerable. The theory implies that this system would be less secure than precinct optical scanners. The theory should not be dismissed, but there appears to be no solid evidence for the notion that centralization endangers security.

(2) All ballots are distributed and returned by mail. This is the Oregon system, which dispenses with polling precincts and their associated costs. For an excellent video description of the Oregon system, visit www.mcelections.org and link to the video.

The county's principal costs come from the printing and mail distribution of ballots, acquisition and maintenance of the scanner, and the processing of returned ballots. (In Oregon the voter can return the ballot directly instead of mailing it.) The centralized system costs significantly less than one dependent on a large number of scattered polling precincts. Because the election process is stretched out about three weeks between the mailing out of the ballots and their return, this system avoids many of the time pressures characteristic of other systems.

Some critics contend that mail ballots endanger security. The Oregon experience suggests otherwise, but pertinent evidence is sparse. This system too needs routine random audits of the optical scanners, and many activists in Oregon are rightly disturbed over the lack of mandatory audits in their state.

The adoption of an all-mail ballot would require enabling legislation by our state. The Indiana House of Representatives passed such legislation in a recent session, but the measure received little support in the Senate.

Note: The Swiss use an all-mail ballot counted by hand, plus experimental Internet voting. The Swiss system is described in more detail at the end of this report.

3. DRE (Direct Recording Electronic) with Voter Verifiable Paper Trail. This system employs DRE machines equipped or retrofitted with printers. The print capability allows the voter the opportunity to verify that the machine has printed a paper record that is an accurate reflection of the voter's choices. The paper record, in turn, can and should be used to audit the electronic count of the ballots.

The viability of this kind of system depends on the reliability of the printer and the quality of the paper record that it produces. The frequency of such problems as paper jams and impermanent records will depend on the quality of the printers and the paper, which remains to be seen. Random audits are essential, given the insecurity and unreliability of DRE machines. The principal expenses include the considerable cost of acquiring new machines already equipped with printers, or retrofitting our present DREs with printers. Other major expenses are the cost of maintaining the machines, renting and staffing polling places, and the cost of training poll workers.

Like many of the other systems discussed here, this one would be classified as a hybrid--the most expensive kind we know, as it employs more than one kind of ballot. It would use a paper mail-in ballot for absentee voters; a paper or machine ballot for early voters; and a machine ballot for those who vote at their regular precincts on election day.

4. Voter verified electronic system. Voting takes place over an existing computer network. Complete privacy is ensured, both in the casting of one's ballot and in verifying that one's vote was counted correctly. This system may be unique in the ease with which it allows one to check on the count of one's vote. The system permits one to change one's vote before the close of the election, and totals the results automatically the moment the election closes. It uses no special voting machines, no paper ballots and no optical scanners--merely ordinary computers in an existing network. Disabled voters might require special assistance, and special polling stations would be needed for voters not connected to the Internet.

This may be the cheapest, quickest, easiest way to conduct an election available at present. In addition to reliability, the big question about this kind of system is security, specifically its vulnerability to hackers.

My understanding is that it is already used on a small scale to conduct elections in private organizations. On a larger scale, in the most recent French election, which offered Internet voting as a means of casting absentee ballots, 60% of the voters chose to use it rather than the usual mail ballot, and voted from all over the world with ordinary computers connected to the Internet. The Swiss are testing Internet voting in a large-scale experiment begun in 2003. Its use in Indiana might well require enabling legislation from the state. One such system was described in 2005 by Halina Kaminski, Lila Kari, and Mark Perry in a paper entitled "Who counts your votes?" It appeared in the Proceedings of the 05 Conference on E-tech, Hong Kong, 2005, EEE pp. 598-603. The authors are members of the Computer Science Department, University of Western Ontario, London, Ontario, Canada. You can download a copy of their paper, which spells out many details of the system, at www.csd.uwo.ca/~markp/htmls/HK_LK_MP.pdf.

How the Swiss Vote

The Swiss value ease of use, because their voters face frequent referenda that may require them to vote as many as five times a year. They use an all-mail hand-counted ballot supplemented by an experimental Internet system.

No special voter registration is required, because all residents must register with the municipality within two weeks of the time they move there. Thus, the authorities know the addresses of all residents. Two months before an election the municipalities send their voters a letter that contains an envelope, a booklet about the election, a ballot and a return envelope. The voter marks the ballot, puts it into the return envelope and mails it in. Alternatively, the voter may drop the ballot in person at a designated polling place, but few voters have done so since the adoption of the mail-in option.

In 2003 three major cantons--Geneva, Neuchatel and Zurich--began experimental tests of internet voting. The Zurich experiment began in controversy because it seemed to violate a Swiss law that permitted the citizen to check on how the vote was recorded. The courts ended by permitting citizens to examine the source code.

The system under test has many similarities to the one created by Kaminski, Kari and Perry. For a general description of the Geneva system, see

www.geneve.ch/evoting/english/welcome.asp . This site provides a link to a prize-winning video account of the system. You can gain direct access to the video at ftp://ftp.geneve.ch/evoting/evoting_video.mov.