

O'REILLY®

8<sup>TH</sup> ANNUAL **OSCON**<sup>™</sup> OPEN SOURCE  
CONVENTION

# Open Source Voting

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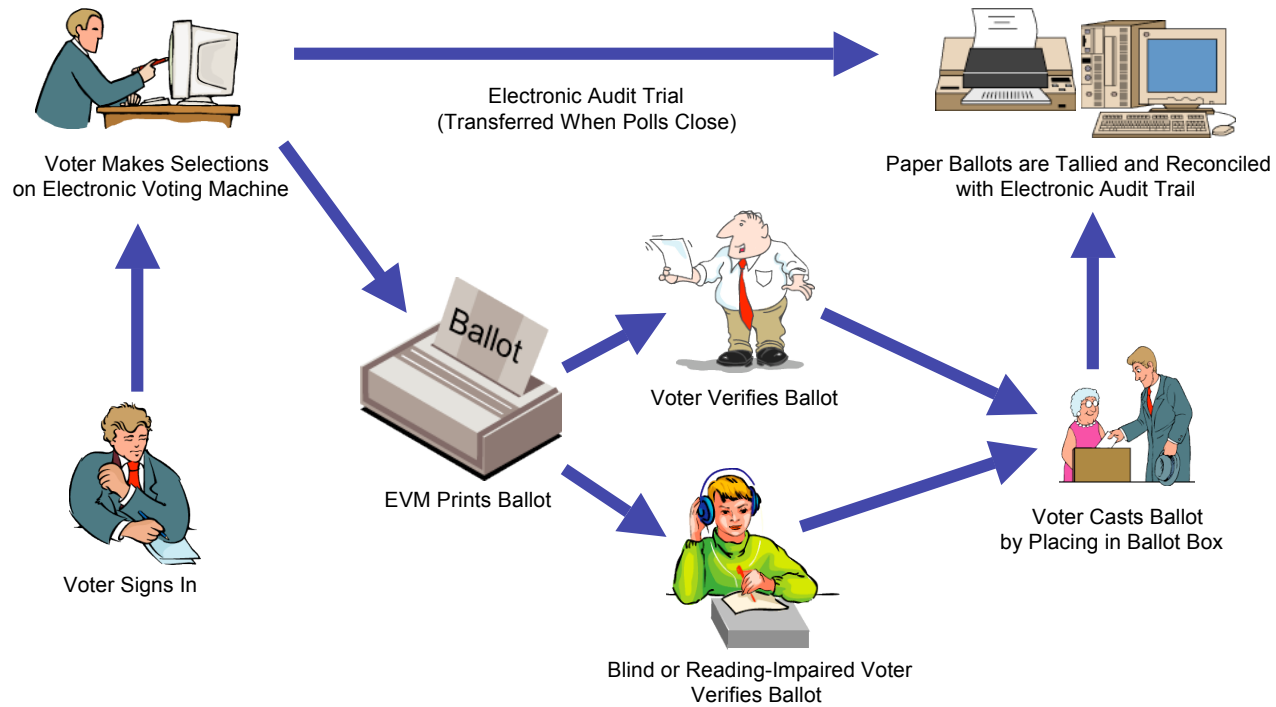
## Outline

- Concept
- In-Precinct Architecture
- Central Architecture
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- Voter-Verifiable Audit Trail
- Conclusion

## Concept

- Secret Ballots Tallied 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



# Sample User Interface

**GENERAL ELECTION • SANTA CLARA, CA • NOVEMBER 7, 2000 • PRECINCT 2216**

TO VOTE, MAKE YOUR SELECTIONS BY POINTING ON YOUR CHOICES (OR POINTING AND CLICKING IF USING MOUSE). TO DE-SELECT, POINT AGAIN.

INSTRUCTIONS	CONGRESSIONAL	LEGISLATIVE	COUNTY
<p>a. TO VOTE FOR a candidate whose name is on the ballot, point or click on the name.</p> <p>b. TO VOTE FOR a write-in candidate, select "WRITE-IN CANDIDATE" and proceed to enter letters from the on-screen typewriter.</p> <p>c. CHECK YOUR SELECTIONS on the screen then select "PRINT MY BALLOT." If the printout looks incorrect, take it to a poll worker for disposal and return to make a new one. If the printout is the way you want it, proceed to the ballot box to deposit your ballot and sign out on the roster.</p>	<p><b>UNITED STATES SENATOR</b> (Vote for One)</p> <p><input type="radio"/> FRANCES E. WILLARD GREEN</p> <p><input type="radio"/> LUCY STONE LIBERTARIAN</p> <p><input type="radio"/> KARL MENNINGER DEMOCRAT</p> <p><input type="radio"/> JANE ADDAMS WORKERS</p> <p><input type="radio"/> CLARENCE DARROW SOCIALIST</p> <p><input type="radio"/> WILLIAM LLOYD GARRISON LABOR</p> <p><input type="radio"/> SIDNEY HILLMAN REPUBLICAN</p> <p><input type="radio"/> [ ] WRITE-IN</p> <p><b>U.S. REPRESENTATIVE</b> <b>TENTH CONGRESSIONAL DISTRICT</b> (Vote for One)</p> <p><input type="radio"/> IGNACE PADEREWSKI DEMOCRAT</p> <p><input type="radio"/> LILLIAN HELLMAN REPUBLICAN</p> <p><input type="radio"/> [ ] WRITE-IN</p>	<p><b>STATE SENATOR</b> <b>FIRST SENATORIAL DISTRICT</b> (Vote for One)</p> <p><input type="radio"/> ROBERT INGERSOLL DEMOCRAT</p> <p><input type="radio"/> MARTIN LUTHER REPUBLICAN</p> <p><input type="radio"/> BARBARA JORDAN GREEN</p> <p><input type="radio"/> [ ] WRITE-IN</p> <p><b>STATE ASSEMBLY</b> <b>THIRD ASSEMBLY DISTRICT</b> (Vote for One)</p> <p><input type="radio"/> DON LEE REPUBLICAN</p> <p><input type="radio"/> LANGSTON HUGHES DEMOCRAT</p> <p><input type="radio"/> [ ] WRITE-IN</p>	<p><b>PROPOSED COUNTY CHARTER AMENDMENT</b> <b>CHARTER AMENDMENT</b> <b>REFERENDUM NO. 1</b></p> <p><b>TWO TERM LIMIT FOR COUNTY COMMISSIONERS</b></p> <p>Shall the Santa Clara County Charter be amended to add Article II, Section 2.2 A provisions limiting Commissioners to two terms?</p> <p><input type="radio"/> YES for Approval</p> <p><input type="radio"/> NO for Rejection</p> <p><b>CAT CATCHER</b> (Vote for up to Three)</p> <p><input type="checkbox"/> REGIS PHILBIN</p> <p><input type="checkbox"/> OPRAH WINFREY</p> <p><input type="checkbox"/> HOWARD STERN</p> <p><input type="checkbox"/> CHARLIE ROSE</p> <p><input type="checkbox"/> ROSIE O'DONNELL</p> <p><input type="checkbox"/> CARRIE FISHER</p> <p><input type="checkbox"/> STEVEN SPIELBERG</p> <p><input type="checkbox"/> QUEEN LATIFAH</p> <p><input type="checkbox"/> EDDIE MURPHY</p> <p><input type="checkbox"/> [ ] WRITE-IN</p>
<p><b>ELECTORS FOR PRESIDENT AND VICE PRESIDENT</b></p> <p>(A vote for the candidates will actually be a vote for their electors)</p> <p><b>REPUBLICAN</b></p> <p><input type="radio"/> GEORGE WASHINGTON, For President ABRAHAM LINCOLN, For Vice President</p> <p><b>DEMOCRAT</b></p> <p><input type="radio"/> THOMAS JEFFERSON, For President, HARRY S. TRUMAN, For Vice President</p> <p><b>GREEN</b></p> <p><input type="radio"/> RACHEL CARSON, For President, JOHN MUIR, For Vice President</p> <p><b>LIBERTARIAN</b></p> <p><input type="radio"/> SUSAN B. ANTHONY, For President, BETSY ROSS, For Vice President</p> <p><b>SOCIALIST</b></p> <p><input type="radio"/> V. I. LENIN, For President, KARL MARX, For Vice President</p> <p><b>REFORM</b></p> <p><input type="radio"/> MARTIN LUTHER KING, For President, JOHN ANDERSON, For Vice President</p> <p><b>WORKERS</b></p> <p><input type="radio"/> HELLEN KELLER, For President, AMELIA EARHART, For Vice President</p> <p><b>WRITE-IN CANDIDATE</b></p> <p><input type="radio"/> [ ] , For Vice President</p>	<p><b>STATE</b></p> <p><b>TREASURER</b> (Vote for One)</p> <p><input type="radio"/> TOM COSGROVE REPUBLICAN</p> <p><input type="radio"/> JOHN GALLAGHER DEMOCRAT</p> <p><input type="radio"/> [ ] WRITE-IN</p> <p><b>ATTORNEY GENERAL</b> (Vote for One)</p> <p><input type="radio"/> DEWITT CLINTON GREEN</p> <p><input type="radio"/> CHARLES PARNELL REPUBLICAN</p> <p><input type="radio"/> THOMAS P. O'NEILL JR. DEMOCRAT</p> <p><input type="radio"/> [ ] WRITE-IN</p> <p><b>COMMISSIONER OF EDUCATION</b> (Vote for One)</p> <p><input type="radio"/> CHRISTIAN DOPPLER REPUBLICAN</p> <p><input type="radio"/> CARL SAGAN DEMOCRAT</p> <p><input type="radio"/> [ ] WRITE-IN</p>	<p><b>PROPOSED CONSTITUTIONAL AMENDMENTS AND OTHER PUBLIC MEASURES</b></p> <p><b>NO. 1</b> <b>CONSTITUTIONAL AMENDMENT</b> <b>ARTICLE X, SECTION 19</b> (Initiative) <b>CALIFORNIA TRANSPORTATION INITIATIVE</b> <b>FOR STATEWIDE SOLAR POWERED</b> <b>MAGNETIC LEVITATION SYSTEM</b></p> <p>To reduce traffic and increase travel alternatives, this amendment provides for development of a high speed solar powered magnetic levitation system to run along Interstate 5. Construction to begin November 1, 2004.</p> <p><input type="radio"/> YES for Approval</p> <p><input type="radio"/> NO for Rejection</p> <p><b>NO. 2</b> <b>CONSTITUTIONAL AMENDMENT</b> <b>ARTICLE XII, SECTION 10</b> <b>CALIFORNIA UNIVERSAL HEALTH CARE</b></p> <p>To improve accessibility to quality health care and to reduce overall health care costs, this amendment provides for the establishment of a single payer Health Care System for all Californians. Implementation to take effect January 1, 2005.</p> <p><input type="radio"/> YES for Approval</p> <p><input type="radio"/> NO for Rejection</p>	<p><b>COUNTY COMMISSIONER</b> (Rank up to eight choices beginning with your first)</p> <p>1 2 3 4 5 6 7 8</p> <p><input type="radio"/> [ ] DAVID PACKARD</p> <p><input type="radio"/> [ ] WILLIAM HEWLETT</p> <p><input type="radio"/> [ ] STEVE JOBS</p> <p><input type="radio"/> [ ] STEVE WOZNIAC</p> <p><input type="radio"/> [ ] WILLIAM SHOCKELEY</p> <p><input type="radio"/> [ ] GORDON MOORE</p> <p><input type="radio"/> [ ] PHILIP KAHN</p> <p><input type="radio"/> [ ] [ ]</p> <p><input type="radio"/> [ ] WRITE-IN CANDIDATE</p> <p><input type="radio"/> [ ]</p>
			<p style="text-align: center;"><b>FINISHED!</b></p> <p style="text-align: center;"><input type="radio"/> PRINT MY BALLOT</p>

# Sample Ballot

8859

8859

OFFICIAL BALLOT  
GENERAL ELECTION  
Santa Clara County, CA Precinct 2216  
2004-11-04

President	→	Thomas Jefferson
Vice President	→	Harry S. Truman
Senator	→	Clarence Darrow
U.S. Representative	→	Lillian Hellman
Treasurer	→	Linus Torvalds
Attorney General	→	Dewitt Clinton
Commis. of Education	→	Richard Stallman
State Senate	→	Martin Luther
State Assembly	→	No preference indicated
Transportation Initiative	→	Yes
Health care initiative	→	Yes
Term limits	→	No
Cat Catcher	→	Oprah Winfrey Steven Spielberg
County Commissioner	→	1 - Steve Jobs 2 - William Hewlett 3 - David Packard 4 - Gordon Moore

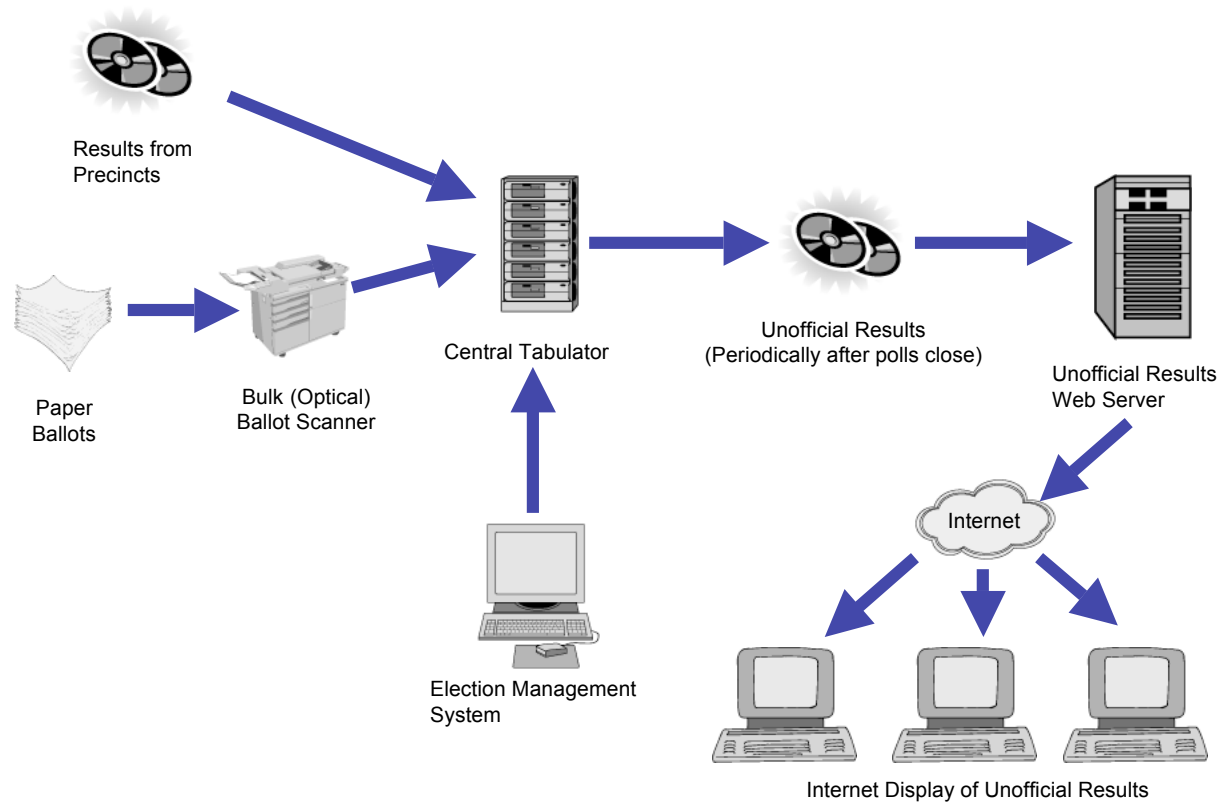
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# Central Tabulating System

- Reliable, secure, auditable voting machines are not enough.
- We also need reliable, secure, auditable canvassing (counting) systems used centrally.

# Central Architecture





## Current Status

- Prototype built of precinct-based system.
- Demonstration covered on TV, radio, and newspapers.
- Available on SourceForge as EVM2003.

## Rollout 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.
  
- Options: retrofit existing electronic voting hardware to use OVC Electronic Ballot Printer software.
- Eases adoption and saves money at cost of some security risk (far, far less than existing systems).

## Privacy Issues

- Open Source (published source, so *anyone* can inspect to ensure no hidden trap doors or covert channels).
- Secret ballot (voter must disclose identity but ballot must not identify voter). Potential risks of voting token.
- Printed ballot and Privacy Folder.
- Barcodes.
- Blind and reading-impaired voters.
- Languages.
- Random ballot IDs.
- Public vote tallying.
- Reporting results by precinct.
- Privacy and voter collusion (printed ballot ID, write-ins).

## Voter-Verifiable Audit Trail

- Helps ensure electronic ballot image is correct.
- Useful for recounts.
- Useful for audits (*if* and *when* they are done!)
- If not machine readable and tallyable, will be effectively used *only* when legally required.
- Reel-to-reel approach compromises voting privacy by maintaining order of ballots.
- ATM-style roll hard to count by machine.
- Use of airline-style cards could solve these problems by using known reliable printers.

## 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.
- Privacy should be added to evaluation standards along with reliability, security, and trustworthiness.

## For More Information

- See papers and talks at <http://www-db.stanford.edu/pub/keller> and click on “Electronic Voting.”
- Join the Open Voting Consortium at <http://openvoting.org>
- And contact Alan Dechert [alan@openvoting.org](mailto:alan@openvoting.org) to volunteer.