

Elections, Computer Security, and Electronic Voting

**CS161 4/19/2010
David Wagner**



For Delegate to Congress.
FRANCIS GEHON.
For Representatives.

John Frostow
S. S. Lathrop

For County Commissioners.

Amos Walcott
John Morford

For Treasurer.

John Higgins

For Surveyor.

Cyrus Sanders

For Assessor.

L. B. Mulholland

For Coroner.

John Hawthens

For Constable.

John Royal
Dorise Lippert
Sherriff
A. D. Stephen

REPUBLICAN TICKET.

For Mayor,
M. F. FAIRCHILD.

For City Solicitor,
J. P. DOLLIVER.

For City Assessor,
L. G. SPRING.

For City Treasurer,
BETH VINCENT.

For Councilman—4th Ward,
A. H. JOHNSON.

REPUBLICAN TICKET.

STATE TICKET.

For Governor,
WILLIAM LARRABEE,
Of Fayette County.

For Lieutenant Governor,
JOHN A. T. HULL,
Of Polk County.

For Judge of the Supreme Court,
GIFFORD S. ROBINSON,
Of Buena Vista County.

For Superintendent of Public Instruction,
HENRY SABIN,
Of Clinton County.

County Ticket

For Senator Thirty-sixth District,
J. P. PATRICK.

For Representative Seventieth District,
W. W. GOODWIN.

For Auditor,
JULIUS H. BUHLMAN,
For Treasurer.

For Sheriff,
WILLIAM WELLMAN.
For County Superintendent,
JAMES W. WYATT.

For Supervisor,
PATRICK COSTIGAN.

For Coroner,
L. L. RENSHAW.

For Surveyor,
SANFORD L. PECK.

Township Ticket.

For Trustee,

For Constable,

For Road Supervisor District No.

10th District.

ADMINISTRATION UNION TICKET

For Mayor,
CALEB T. FAY

For County Judge,
THOS. W. FREELON

For District Attorney,
CHARLES H. PARKER

For County Clerk,
JOHN A. MONROE

For Sheriff,
THOMAS J. POULTERER

*For Recorder, to fill the vacancy for the unexpired
term of G. W. Rock, resigned.*

GEORGE B. REEVE

For County Recorder,
GEORGE B. REEVE

For City and County Treasurer,
ASA T. LAWTON

For City and County Assessor,
THOS. D. MATHEWSON

For City and County Surveyor,
REED BIGLER

For Coroner
DR. B. A. SHELDON

For Harbor Master
CAPT. N. PROCTOR SMITH

For Superintendent of Common Schools
JOHN H. BREWER

For Supervisor STEPHEN C. STORY
For School Director J. M. BUFFINGTON
Inspector of Election J. B. F. DAVIS
Judge of Election J. M. KEARNEY

Fifth Townsman.
Justice of the Peace GEO. T. BOLDEN
Constable PHINEAS HOWARD, JR.

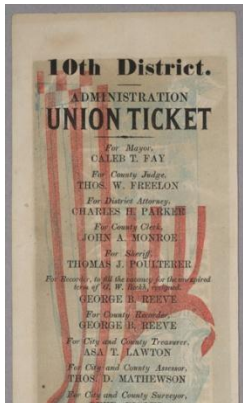
"Subscription of Three Hundred Thousand
Dollars, to the San Francisco and San Jose Rail-
road Company." YES.

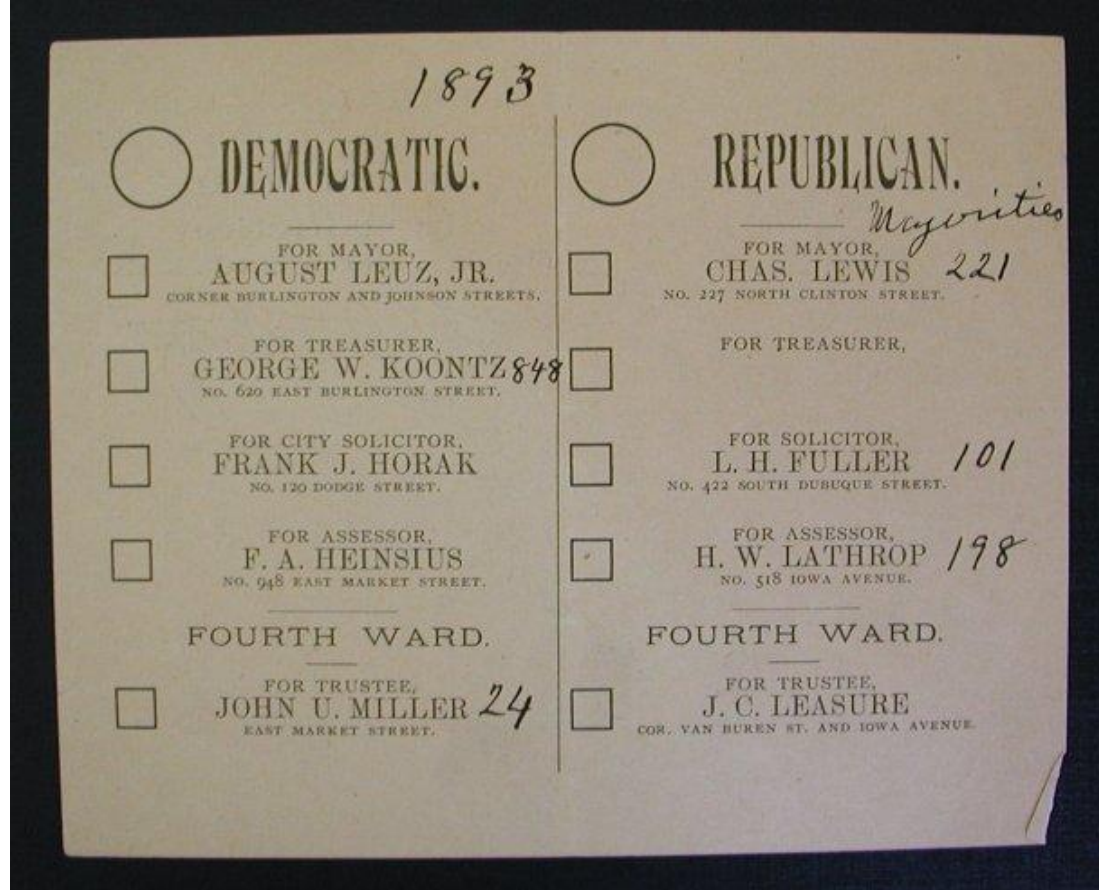
Polls—Brick Building westerly side of Third,
between Folsom and Harrison streets.



Security Goals for an Election

- Integrity: No election fraud
- Transparency: Everyone - especially the loser - must be able to verify that the election was conducted appropriately
- Privacy: No one learns how the voter has voted
- Secret ballot: Voter cannot prove how she voted





Breakthrough! — the Australian secret ballot.

Ballot printed by govt. Ballot boxes monitored by observers. Ballots counted, by hand, in public. Competing interests keep each other honest.



COLLECTOR FOR
OFFICE OF THE
COUNTY CLERK

OFFICES OF

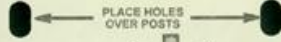
- A
- B
- C
- D
- E
- F
- G

 **HANDICAPPED
ACCESS MACHINE**
ASK AN INSPECTOR FOR
ASSISTANCE IN LOWERING
THE VOTING PANEL
FOR EASIER ACCESS

MAGWAY
MAGWAY
MAGWAY

 **Sevier
County
Board of
Elections**

ABSENT VOTER BALLOT
STUB A No. 7720



INSERT CARD THIS SIDE UP



STUB B No. 7720
ABSENT VOTER BALLOT

**IMPORTANT
DO NOT
DETACH STUB**

.	.	39	58	77	96	115	134	153	172	191	210
1	20	40	.	.	116	.	135	154	173	192	.
2	21	41	60	79	98	117	136	155	174	193	212
3	22	42	61	80	99	118	137	156	175	194	213
4	23	43	62	81	100	119	138	157	176	195	214
5	24	44	63	82	101	120	139	158	177	196	215
6	25	45	64	83	102	121	140	159	178	197	216
7	26	46	65	84	103	122	141	160	179	198	217
8	27	47	66	85	104	123	142	161	180	199	218
9	28	48	67	86	105	124	143	162	181	200	219
10	29	49	68	87	106	125	144	163	182	201	220
11	30	50	69	88	107	126	145	164	183	202	221
12	31	51	70	89	108	127	146	165	184	203	222
13	32	52	71	90	109	128	147	166	185	204	223
14	33	53	72	91	110	129	148	167	186	205	224
15	34	54	73	92	111	130	149	168	187	206	225
16	35	55	74	93	112	131	150	169	188	207	226
17	36	56	75	94	113	132	151	170	189	208	227
18	37	57	76	95	114	133	152	171	190	209	228
19	38	.	.	.	.	.	.	.	.	.	.

TO BE FILLED IN BY ELECTION BOARD ONLY
PRECINCT NO. WRITE-IN NO.

INSERT
CARD
HERE



SPECIAL BALLOT
GENERAL ELECTION
NOVEMBER 7, 2000

OFFICIAL BALLOT
GENERAL ELECTION
NOVEMBER 7, 2000

FOR PRESIDENT AND VICE PRESIDENT
OF THE UNITED STATES
(Vote for ONE GROUP)

FEDERAL

3 →	(REPUBLICAN) GEORGE W. BUSH - PRESIDENT DICK CHENEY - VICE PRESIDENT
5 →	(DEMOCRATIC) AL GORE - PRESIDENT JOE LIEBERMAN - VICE PRESIDENT
7 →	(LIBERTARIAN) HARRY BROWNE - PRESIDENT ART OLIVER - VICE PRESIDENT
9 →	(GREEN) RALPH NADER - PRESIDENT WINDONIA LADUKE - VICE PRESIDENT
11 →	(SOCIALIST WORKERS) JAMES HARRIS - PRESIDENT MARGARET TROWE - VICE PRESIDENT
13 →	(NATURAL LAW) JOHN HAGELIN - PRESIDENT NAT. GOLDBERGER - VICE PRESIDENT

← 4	(REFORM) PAT BUCHANAN - PRESIDENT EZOLA FOSTER - VICE PRESIDENT
← 6	(SOCIALIST) DAVID McREYNOLDS - PRESIDENT MARY CAL HOLLIS - VICE PRESIDENT
← 8	(CONSTITUTION) HOWARD PHILLIPS - PRESIDENT J. CURTIS FRAZIER - VICE PRESIDENT
← 10	(WORKERS WORLD) MONICA MOOREHEAD - PRESIDENT GLORIA La RIVA - VICE PRESIDENT

WRITE IN CANDIDATE
To vote for a write in candidate, follow the
directions on the long stub of your ballot card

g turn back
page

"Butterfly Ballot"

Palm Beach County



Confusion at Palm Beach County polls

Some Al Gore supporters may have mistakenly voted for Pat Buchanan because of the ballot's design.

Although the Democrats are listed second in the column on the left, they are the third hole on the ballot.

Punching the second hole casts a vote for the Reform party.

ELECTORS FOR PRESIDENT AND VICE PRESIDENT	
(REPUBLICAN) GEORGE W. BUSH - PRESIDENT DICK CHENEY - VICE PRESIDENT 3 →	(REFORM) PAT BUCHANAN - PRESIDENT EZOLA FOSTER - VICE PRESIDENT ← 4
(DEMOCRATIC) AL GORE - PRESIDENT JOE LIEBERMAN - VICE PRESIDENT 5 →	(SOCIALIST) DAVID McREYNOLDS - PRESIDENT MARY CAL HOLLIS - VICE PRESIDENT ← 6
(LIBERTARIAN) HARRY BROWNE - PRESIDENT ART OLIVIER - VICE PRESIDENT 7 →	(CONSTITUTION) HOWARD PHILLIPS - PRESIDENT J. CURTIS FRAZIER - VICE PRESIDENT ← 8
(GREEN) RALPH NADER - PRESIDENT WINONA LaDUKE - VICE PRESIDENT 9 →	(WORKERS WORLD) MONICA MOOREHEAD - PRESIDENT GLORIA La RIVA - VICE PRESIDENT ← 10
(SOCIALIST WORKERS) JAMES HARRIS - PRESIDENT MARGARET TROWE - VICE PRESIDENT 11 →	WRITE-IN CANDIDATE To vote for a write-in candidate, follow the directions on the long stub of your ballot card.
(NATURAL LAW) JOHN HAGELIN - PRESIDENT NAT GOLDHABER - VICE PRESIDENT 13 →	

(A vote for the candidates will actually be a vote for their electors.)
(Vote for Group)

Another anomaly during the 2000 election

From: Lana Hires

Subject: 2000 November Election

I need some answers! Our department is being audited by the County.

I have been waiting for someone to give me an explanation as to why Precinct 216 gave Al Gore a minus 16022 when it was uploaded. Will someone please explain this so that I have the information to give the auditor instead of standing here "looking dumb".





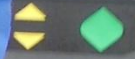
09/07/2004



VOTE

You have already checked the maximum selections in this contest.
If you wish to select a different selection in this contest, you must first de-select a previous selection.

Return to ballot

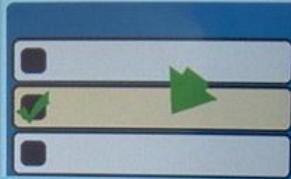


VOTE

Voting on an iVotronic is as easy as 1, 2, 3

1 Make your selections

Touch the candidate on the screen to make your selection.



Use the Next and Back buttons to view the ballot pages.



2 Review your selections

Touch the contest or the candidate on screen to make changes.



3 Cast your ballot

Press the Vote button at the top of the voting machine when it begins to flash OR press the "Cast your ballot now" when it appears on screen.



View Ballot



COUNTY NAME, STATE
ELECTION DATE

COUNTY CLERK

BALLOT STYLE

Best Automobile Manufacturer Vote For ONE

<input type="checkbox"/>	BMW
<input type="checkbox"/>	MERCEDES
<input type="checkbox"/>	GENERAL MOTORS
<input checked="" type="checkbox"/>	HONDA
<input type="checkbox"/>	FERRARI
<input type="checkbox"/>	JAGUAR
<input type="checkbox"/>	FORD
<input type="checkbox"/>	VOLVO
<input type="checkbox"/>	Write-In

Best Vocal Artist (Vote for Not More Than TWO)

<input type="checkbox"/>	FRANK SINATRA
<input type="checkbox"/>	ELVIS
<input type="checkbox"/>	PATSY CLINE
<input type="checkbox"/>	JANIS JOPLIN
<input type="checkbox"/>	BUDDY HOLLY
<input checked="" type="checkbox"/>	BARRY WHITE
<input type="checkbox"/>	BILLIE HOLIDAY
<input type="checkbox"/>	STEVIE RAY VAUGHAN
<input type="checkbox"/>	"MAMA" CASS ELLIOT
<input checked="" type="checkbox"/>	PA
<input type="checkbox"/>	Write-In

01 / 02



Next



Summary Ballot Instructions

Press the candidate name or contest title to return to a contest.

Vote button will light up when you may cast your ballot.

Press here to cast your ballot now

Best Automobile Manufacturer Vote For ONE



FORD

Best Vocal Artist (Vote for Not More Than TWO)



FA

No selection made.

Best Ice-Cream Flavor Vote For ONE

No selection made.

Proposition 1

No selection made.

Proposition 2

No selection made.



Back

01 / 01



Question: How do election security goals apply to touchscreen (DRE) electronic voting machines?

1. Machine must allow each authorized voter to vote exactly once; must prevent tampering with votes after they are cast.
2. Machine should be verifiably trustworthy.
3. Machine must randomize the order in which votes were cast.
4. Machine must not give voter a "receipt".

☞ Security Goals for an Election:
Integrity, Transparency, Privacy, Secret ballot

Nov 4, 2002:

State of Georgia votes on Diebold DREs.

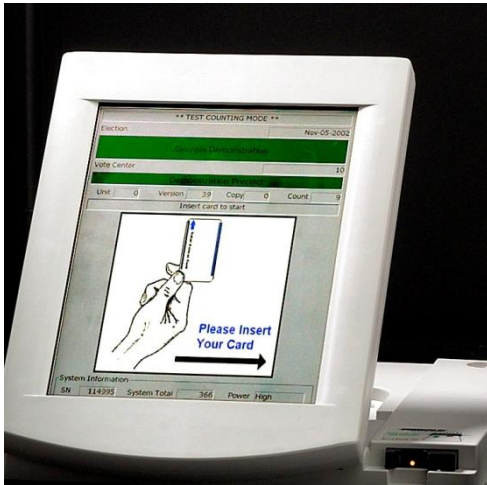
March 18, 2003:

Diebold source code leaks.

July 23, 2003:

Tadayoshi Kohno, Adam Stubblefield, Avi Rubin, Dan Wallach, "Analysis of an Electronic Voting System".

The voter authorization protocol



QueryStatus



ACTIVE (0x01)



(record vote)



SetStatus CANCELED (0x08)



Status = CANCELED

Succeeded



The voter authorization protocol



QueryStatus [Are you a valid card?]

ACTIVE (0x01) [Yup.]

(record vote)

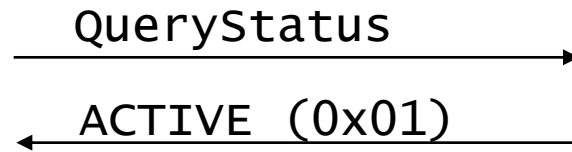
smartcard

[Please cancel yourself.]
SetStatus CANCELED (0x08)

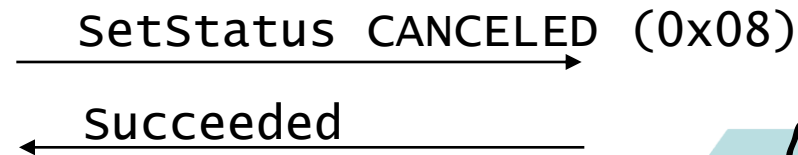
Status = CANCELED

Succeeded [Ok.]

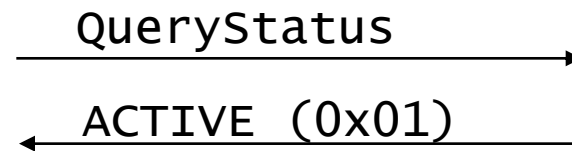
Attack!



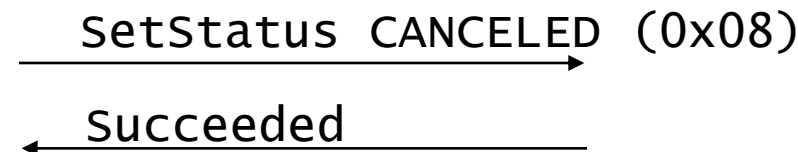
(record vote)



*malicious
smartcard*



(record another vote)



Authenticating election officials

What kind of card are you?

An administrator card.



What's the secret PIN?

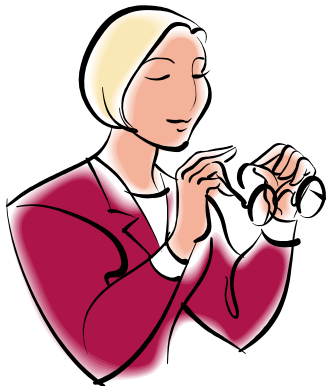
2301



What's the secret PIN?

2301

Ok, you have admin access.



Source code excerpts

```
#define DESKEY ((des_key*)"F2654hD4")
```

```
DESCBCEncrypt((des_c_block*)tmp,  
(des_c_block*)record.m_Data, totalSize,  
DESKEY, NULL, DES_ENCRYPT);
```

Source code excerpts

```
// LCG - Linear Congruential Generator -  
// used to generate ballot serial numbers  
// A psuedo-random-sequence generator  
// (per Applied Cryptography, Bruce Schneier)  
  
int lcgGenerator(int lastSN) {  
    return ((lastSN*1366) + 150889)%714025;  
}
```

*“Unfortunately, linear congruential
generators cannot be used for cryptography.”
— Applied Cryptography, p.369*

More than 4,500 North Carolina votes lost because of mistake in voting machine capacity

JACKSONVILLE, N.C. (AP) — More than 4,500 votes have been lost in one North Carolina county because officials believed a computer that stored ballots electronically could hold more data than it did. Scattered other problems may change results in races around the state.

Officials said UniLect Corp., the maker of the county's electronic voting system, told them that each storage unit could handle 10,500 votes, but the limit was actually 3,005 votes.

Machine error gives Bush 3,893 extra votes in Ohio

By John McCarthy, Associated Press

COLUMBUS, Ohio — An error with an electronic voting system gave President Bush 3,893 extra votes in suburban Columbus, elections officials said.

Franklin County's unofficial results had Bush receiving 4,258 votes to Democrat John Kerry's 260 votes in a precinct in Gahanna. Records show only 638 voters cast ballots in that precinct. Bush's total should have been recorded as 365.

Broward Vote-Counting Blunder Changes Amendment Result

POSTED: 1:34 pm EST November 4, 2004

BROWARD COUNTY, Fla. -- The Broward County Elections Department has egg on its face today after a computer glitch misreported a key amendment race, according to WPLG-TV in Miami.

Amendment 4, which would allow Miami-Dade and Broward counties to hold a future election to decide if slot machines should be allowed at racetracks, was thought to be tied. But now that a computer glitch for machines counting absentee ballots has been exposed, it turns out the amendment passed.

"The software is not geared to count more than 32,000 votes in a precinct. So what happens when it gets to 32,000 is the software starts counting backward," said Broward County Mayor Ilene Lieberman.

That means that Amendment 4 passed in Broward County by more than 240,000 votes rather than the 166,000-vote margin reported Wednesday night. That increase changes the overall statewide results in what had been a neck-and-neck race, one for which recounts had been going on today. But with news of Broward's error, it's clear amendment 4 passed.



Broward County Mayor Ilene Lieberman says voting counting error is an "embarrassing mistake."



<http://denvervoice.org>



California Top-to-Bottom Review

In 2007, California Secretary of State Debra Bowen commissions a review of California's voting systems.

43 experts (led by David Wagner & Matt Bishop) examine voting systems used nationally.



THE SECRETARY
Bowen opens the public hearing in Sacramento.

Technical findings of the CA TTBR

All voting systems examined have serious security problems:

- None followed sound engineering principles expected of security-critical systems.
- All were vulnerable to viral attacks: one outsider could subvert all voting machines countywide

Example flaw (Premier system)

Bug: The code that reads data off the memory card has buffer overrun vulnerabilities.

Attack:

1. Attacker writes malicious code onto 1 card
2. When central PC reads votes off card on election night, it gets infected
3. Infected PC writes malicious code onto all cards used in the next election, infecting entire county

Quotes from the reports

"We found pervasive security weaknesses throughout the Sequoia software. Virtually every important software security mechanism is vulnerable to circumvention."

"Our study of the Diebold source code found that the system does not meet the requirements for a security-critical system. It is built upon an inherently fragile design and suffers from implementation flaws that can expose the entire voting system to attacks."


"The Hart software and devices appear to be susceptible to a variety of attacks which would allow an attacker to gain control of some or all of the systems in a county. [...] Many of these attacks can be mounted in a manner that makes them extremely hard to detect and correct. We expect that many of them could be carried out in the field by a single individual, without extensive effort, and without long-term access to the equipment."

Outcome of the CA TTBR

Bowen decertifies most DRE voting systems and imposes strict new procedural protections.

Result: Most Californians now vote on paper ballots.

OFFICIAL BALLOT
ALAMEDA COUNTY, CALIFORNIA
NOVEMBER 4, 2008 GENERAL ELECTION

INSTRUCTIONS TO VOTERS: USE BLACK OR BLUE BALLPOINT PEN ONLY. To vote for a candidate of your choice, complete the arrow  to the right of the candidate's name. To vote for a qualified write-in candidate, PRINT the person's name in the blank space provided and complete the arrow. To vote on any measure, complete the arrow after the word YES or NO.

PRESIDENT OF THE UNITED STATES	CITY OF BERKELEY	MEASURES SUBMITTED TO THE STATES
PRESIDENT AND VICE PRESIDENT	FOR MAYOR	STATE
Barack Obama Michelle Obama	Sheley Dean Mark DeSantis	
FOR MEMBER OF CITY COUNCIL		
CYNTHIA WORKMEYER for Member of City Council	FOR MEMBER OF CITY COUNCIL	
ALAN AZEVEDO for Member of City Council, District 1	STAN WENIGER for Member of City Council, District 1	
DAVID BENDER for Member of City Council, District 2	FRANKIE BROWN for Member of City Council, District 2	
MATT GONZALEZ for Member of City Council, District 3		
BRADLEY GRUBBS for Member of City Council, District 4	FOR NEXT STATION BOARD COMMISSIONER	
JOE BARR for Member of City Council, District 5	LAURENCE WILSON for Commissioner, District 1	
WILLIAM A. BOOT for Member of City Council, District 6	JOFF SHELTON for Commissioner, District 2	
JOHN MCCANN for Member of City Council, District 7	JACK HANCOCK for Commissioner, District 3	
SARAH PALM for Member of City Council, District 8	REBECCA GRANE for Commissioner, District 4	
	PAULIE KELLY for Commissioner, District 5	
	BOB TRIGGIAN for Commissioner, District 6	
UNITED STATES REPRESENTATIVE	ALISE TURNERTY for Representative, District 1	
5TH CONGRESSIONAL DISTRICT		
THOMAS LEE for Representative, District 5		
CHARLES LAMARQUE for Representative, District 5		
JAMES M. CHER for Representative, District 5		
STATE SENATOR	FOR SCHOOL DIRECTORS	
5TH STATE SENATE DISTRICT	FRISCELLA BIRCH for School Director, District 1	
JOHN BARRON for Senator, District 5	JOHN J. BELMONT for School Director, District 2	
LIAM WILSON for Senator, District 5	DEBBY LEVY-CENTERS for School Director, District 3	
CLAUDIA ROSENBERG for Senator, District 5	TOTAL GROUP for School Director, District 4	
MEMBER OF THE STATE ASSEMBLY	DISTRICT	
16TH ASSEMBLY DISTRICT	ALTHEA BRY for District Director, District 1	
MARCY BERNIERI for Assembly Member, District 16	ELI COHENSON (CHAIR) PREPERS for District Director, District 2	
	EAST BAY REGIONAL PARK DISTRICT DIRECTOR	
JUDICIAL	ROSEAN LA FORCE for District Director, District 3	
SUPERIOR COURT JUDGE	RENEEY SCOTTON for District Director, District 4	
16TH JUDICIAL DISTRICT		
FRANCOIS for Judge, District 16		
FRANCOIS for Judge, District 16		

CA91-1-20180-9-889 VOTE BOTH SIDES BT-009 (9/01)

Trojan Horses and the Insider Threat



Ronald Dale Harris

Employee, Gaming Control Board, 1983-1995

Arrested, Jan 15, 1995

Convicted, Sept 23, 1997, for rigging slot machines

Attempted Trojan Horse in Linux Kernel

```
...
    schedule();
    goto repeat;
}
if ((options == (__WCLONE|__WALL)) && current->uid = 0))
    retval = -EINVAL;
retval = -ECHILD;
end_wait4:
current->state = TASK_RUNNING;
...
```



Trojan Horses and Voting Machines

Malicious logic hidden by an insider might, e.g., record votes incorrectly to favor one candidate. How would we defend a voting system against this kind of insider threat?

Potential solutions:

- Verify that the software is free of Trojans and will work correctly on all future elections.
(beyond the state of the art)
- Assume sw might contain Trojans. Verify that sw worked correctly in this particular election.
(voter-verified paper records + random audits)

Voting on Satan's computer.



Touch the Print Next Page button to print and verify the next page.
OR
Touch the Reject Ballot button to go back and make changes.
NOTE: you may reject your printed ballot a maximum of two times, after which you will no longer be allowed to make changes and printing your ballot will cast your vote. Contact a pollworker if you are experiencing difficulty with this process.

- PRESIDENT (Vote for One)
MIRIAM LERVEN
- POET LAUREATE (Vote for One)
CARL SANDERIS
- COMMISSIONERS FOR NATIONAL PASTIMES (Vote for Two)
No Vote Cast
No Vote Cast
- COMMISSIONER OF AMERICAN LITERATURE (Vote for One)
No Vote Cast
- MINISTER OF TRANSPORTATION (Vote for One)
CHECK YAGER
- MINISTER OF COMIC RELIEF (Vote for One)
CAROL BURNETT
- MINISTER OF ART (Vote for One)
ALEXANDER CALDER
- AMBASSADORS OF THE AMERICAN

← Reject Ballot Print Next Page →

Water Access C Voter Access Card

1	ABC	2	DEF	3	
GHI	4	JKL	5	MNO	6
PQRS	7	TUV	8	WXYZ	9
*	0	#			

Presidential Election of 2008
PRECINCT 1

PRESIDENT
[X] MIRIAM LERVEN (01)
POET LAUREATE
[X] CARL SANDERIS (01)
COMMISSIONERS FOR NATIONAL PASTIMES
[] No Vote Cast (01)
[] No Vote Cast (01)
COMMISSIONER OF AMERICAN LITERATURE
[] No Vote Cast (01)
MINISTER OF TRANSPORTATION
[X] CHECK YAGER (01)
MINISTER OF COMIC RELIEF
[X] CAROL BURNETT (01)
MINISTER OF ART
[X] ALEXANDER CALDER (01)
AMBASSADORS OF THE AMERICAN
[] No Vote Cast (01)

**COMMISSIONERS
FOR NATIONAL PASTIMES**
(Vote for Two)

- JIM THORPE
- BILL RUSSELL
- JOE DIMAGGIO
- PEGGY FLEMING
- Write-in
- Write-in

**COMMISSIONER OF
AMERICAN LITERATURE**
(Vote for One)

- ERNEST HEMINGWAY
- WILLIAM FAULKNER
- JOHN STEINBECK
- SINCLAIR LEWIS
- Write-in

A paper copy of your ballot, which may be used for recount or auditing purposes, will be printed before your vote is cast.

Touch the **Print Ballot** button to print and verify your ballot.

OR

Touch the **Back** button or one of the races on this screen to go back and make changes.

PRESIDENT
(Vote for One)

ABRAHAM LINCOLN

POET LAUREATE
(Vote for One)

CARL SANDBURG

**COMMISSIONERS
FOR NATIONAL
PASTIMES**
(Vote for Two)

No Vote Cast

No Vote Cast

**COMMISSIONER OF
AMERICAN
LITERATURE**
(Vote for One)

No Vote Cast

**MINISTER OF
TRANSPORTATION**
(Vote for One)

CHUCK YEAGER

**MINISTER OF
COMIC RELIEF**
(Vote for One)

CAROL BURNETT

MINISTER OF ART
(Vote for One)

ALEXANDER CALDER

**AMBASSADORS OF
THE AMERICAN
MUSICAL COMEDY**
(Vote for One pair)

GEORGE GERSHWIN and
IRA GERSHWIN

QUESTION

Do you favor a National Lottery Administered by the Federal Government?

No Vote Cast

QUESTION

Shall the City of Anytown, USA issue and sell its General Obligation Bonds not to exceed \$150,000,000; YES

Back

Instructions

Page
2 of 4

Summary

Next

Back

Print Ballot

Touch the Print Next Page button to print and verify the next page.
OR

Touch the Reject Ballot button to go back and make changes.

NOTE: you may reject your printed ballot a maximum of two times, after which you will no longer be allowed to make changes and printing your ballot will cast your vote. Contact a pollworker if you are experiencing difficulty with this process.

PRESIDENT

(Vote for One)

ABRAHAM LINCOLN

POET LAUREATE

(Vote for One)

CARL SANDBURG

**COMMISSIONERS
FOR NATIONAL PASTIMES**

(Vote for Two)

No Vote Cast

No Vote Cast

**COMMISSIONER OF
AMERICAN LITERATURE**

(Vote for One)

No Vote Cast

**MINISTER OF
TRANSPORTATION**

(Vote for One)

CHUCK YEAGER

**MINISTER OF
COMIC RELIEF**

(Vote for One)

CAROL BURNETT

MINISTER OF ART

(Vote for One)

ALEXANDER CALDER

AMBASSADORS OF THE AMERICAN

← Reject Ballot

Print Next Page →

Famous Names Demonstration Ba...
PRECINCT 1

1

PRESIDENT

[X] ABRAHAM LINCOLN <NP>

POET LAUREATE

[X] CARL SANDBURG <NP>

COMMISSIONERS FOR NATIONAL PA...

[] No Vote Cast

[] No Vote Cast

COMMISSIONER OF AMERICAN LITE...

[] No Vote Cast

MINISTER OF TRANSPORTATION

[X] CHUCK YEAGER <NP>

MINISTER OF COMIC RELIEF

[X] CAROL BURNETT <NP>

MINISTER OF ART

[X] ALEXANDER CALDER <NP>

AMBASSADORS OF THE AMERICAN P...

[X] GEORGE GERSHWIN and I <NP>

SAMPLE BALLOT

<p style="text-align: center;">N.C. STATE SENATE DISTRICT 25 You may vote for ONE</p> <p><input type="radio"/> WILLIAM R. (BILL) PURCELL DEM</p> <p><input type="radio"/> _____</p>	<p style="text-align: center;">DISTRICT COURT JUDGE DISTRICT 20 You may vote for ONE</p> <p><input type="radio"/> HUNT GWYN</p>	<p style="text-align: center;">AMENDMENT II</p> <p>Constitutional amendment to provide that the General Assembly may place the clear proceeds of civil penalties, civil forfeitures, and civil fines collected by a State agency in a State fund to be used exclusively for maintaining free public schools.</p> <p><input type="radio"/> FOR</p> <p><input type="radio"/> AGAINST</p>
<p style="text-align: center;">N.C. STATE HOUSE DISTRICT 69 You may vote for ONE</p> <p><input type="radio"/> PRYOR GIBSON DEM</p> <p><input type="radio"/> HILDA L. MORTON REP</p>	<p style="text-align: center;">DISTRICT COURT JUDGE DISTRICT 20 You may vote for ONE</p> <p><input type="radio"/> LISA BLUE THACKER</p>	<p style="text-align: center;">AMENDMENT III</p> <p>Constitutional amendment to provide for the first term of office for magistrates of the General Court of Justice to be two years and for subsequent terms to be four years.</p> <p><input type="radio"/> FOR</p> <p><input type="radio"/> AGAINST</p>
<p style="text-align: center;">REGISTER OF DEEDS You may vote for ONE</p> <p><input type="radio"/> JOANNE S. HUNTLEY DEM</p>	<p style="text-align: center;">DISTRICT COURT JUDGE DISTRICT 20 You may vote for ONE</p> <p><input type="radio"/> TANYA WALLACE</p>	
<p style="text-align: center;">NON PARTISAN OFFICES</p> <p>Non partisan offices are not included in Straight Party voting and must be voted separately to be counted.</p>	<p style="text-align: center;">DISTRICT COURT JUDGE DISTRICT 20 You may vote for ONE</p> <p><input type="radio"/> W. DAVID McSHEEHAN</p> <p><input type="radio"/> JOSEPH J. WILLIAMS</p>	
<p style="text-align: center;">ASSOCIATE JUSTICE OF SUPREME COURT You may vote for ONE</p> <p><input type="radio"/> SARAH PARKER</p> <p><input type="radio"/> JOHN M. TYSON</p>	<p style="text-align: center;">NON PARTISAN OFFICES</p> <p>Additional instructions to Voter</p> <p>If you wish to write in a name for any of the following offices, write the name in the blank space provided and completely fill in the oval to the left of the name in order for your vote to count.</p>	
<p style="text-align: center;">ASSOCIATE JUSTICE OF SUPREME COURT You may vote for ONE</p> <p><input type="radio"/> RONNIE ANSLEY</p> <p><input type="radio"/> RACHELLEA HUNTER</p> <p><input type="radio"/> HOWARD E. MANNING, JR.</p> <p><input type="radio"/> BETSY McCRODDEN</p> <p><input type="radio"/> FRED MORRISON, JR.</p> <p><input type="radio"/> PAUL MARTIN NEWBY</p> <p><input type="radio"/> MARVIN SCHILLER</p> <p><input type="radio"/> JAMES A. WYNN, JR.</p>	<p style="text-align: center;">BROWN CREEK SOIL AND WATER CONSERVATION DISTRICT SUPERVISOR You may vote for ONE</p> <p><input type="radio"/> JOHN C. SPRINGER</p> <p><input type="radio"/> _____</p>	
<p style="text-align: center;">JUDGE, COURT OF APPEALS You may vote for ONE</p> <p><input type="radio"/> LINDA McGEE</p> <p><input type="radio"/> BILL PARKER</p>	<p style="text-align: center;">STATE OF NORTH CAROLINA CONSTITUTIONAL AMENDMENTS</p>	
<p style="text-align: center;">JUDGE, COURT OF APPEALS You may vote for ONE</p> <p><input type="radio"/> WANDA G. BRYANT</p> <p><input type="radio"/> ALICE C. STUBBS</p>	<p style="text-align: center;">AMENDMENT I</p> <p>Constitutional amendment to promote local economic and community development projects by (i) permitting the General Assembly to enact general laws giving counties, cities, and towns the power to finance public improvements associated with qualified private economic and community improvements within development districts, as long as the financing is secured by the additional tax revenues resulting from the enhanced property value within the development district and is not secured by a pledge of the local government's faith and credit or general taxing authority, which financing is not subject to a referendum; and (ii) permitting the owners of property in the development district to agree to a minimum tax value for their property, which is binding on future owners as long as the development district is in existence.</p> <p><input type="radio"/> FOR</p> <p><input type="radio"/> AGAINST</p>	
<p style="text-align: center;">JUDGE, COURT OF APPEALS You may vote for ONE</p> <p><input type="radio"/> BARBARA JACKSON</p> <p><input type="radio"/> ALAN THORNBURG</p>		
<p style="text-align: center;">DISTRICT COURT JUDGE DISTRICT 20 You may vote for ONE</p> <p><input type="radio"/> CHRIS BRAGG</p>		
<p>TURN OVER TO CONTINUE VOTING</p>		

Accu-Vote

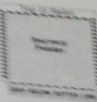


PLACE BALLOT INSIDE TO KEEP VOTING SECRET

INSTRUCTIONS TO VOTERS

After Voting is Completed:

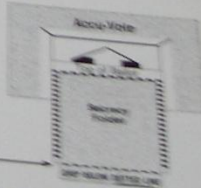
1. Center ballot inside this secrecy folder



2. Take ballot and secrecy folder to Accu-Vote machine



3. Feed ballot straight into machine while holding onto the area below dotted line



When inserting ballot into Accu-Vote Machine,

GRIP BELOW



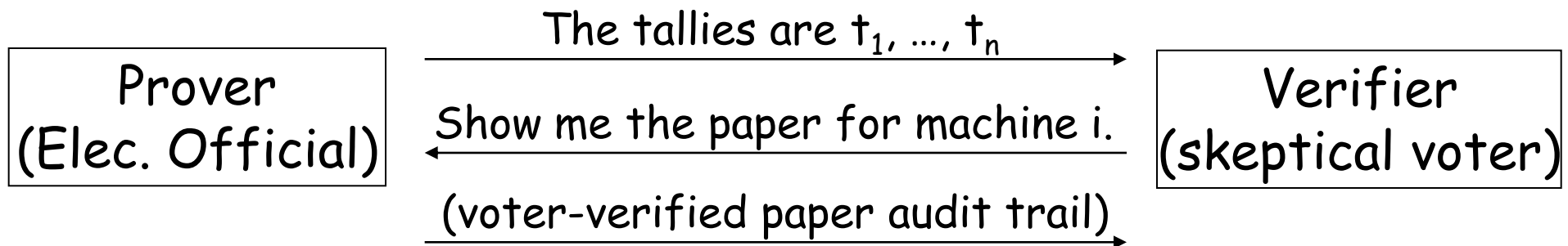
DOTTED LINE





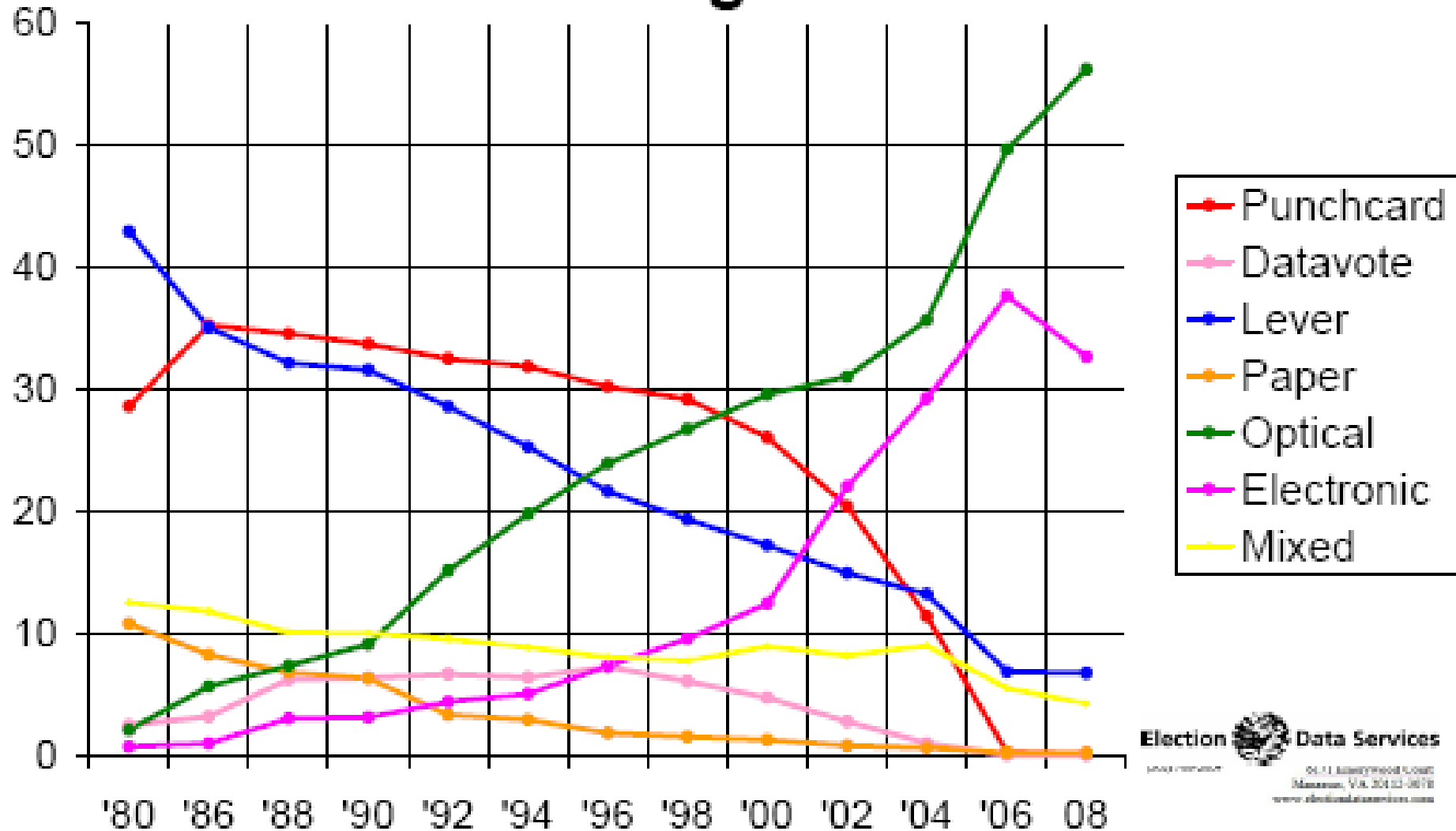
Statistical audit

- After election, randomly choose 1% of machines and manually recount the paper records on those machines. If paper count \neq electronic count, there was fraud.
- If $\gg 100$ machines cheat, detection is likely. Consequently: If paper count = electronic count, then no more than ~ 100 machines cheated.

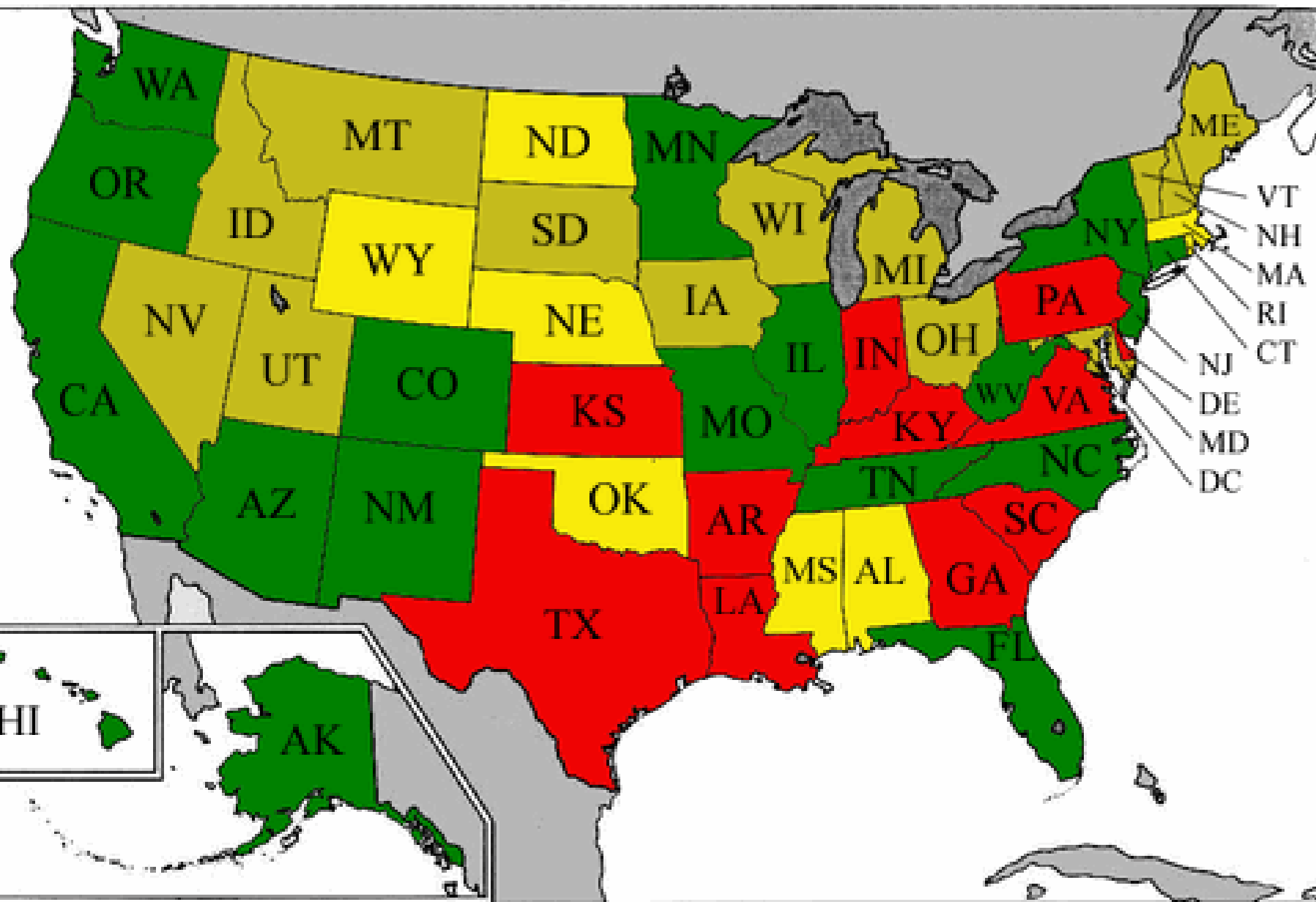


Trends in e-voting technology

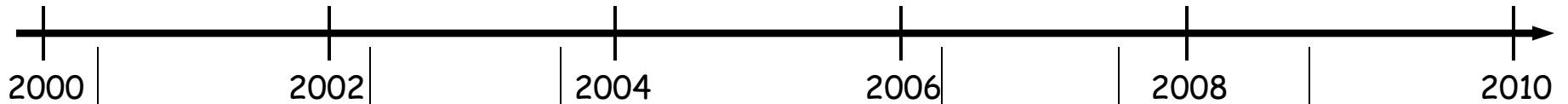
Percent of Registered Voters



Adoption of paper records + random audits



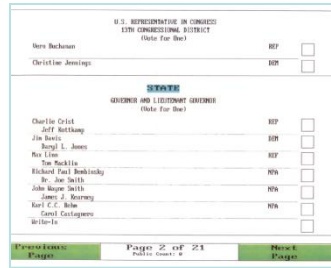
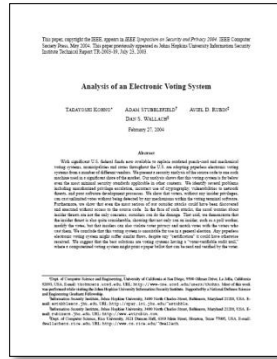
Timeline



Florida



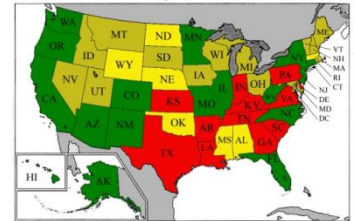
HAVA



Sarasota



TTBR



Conclusions

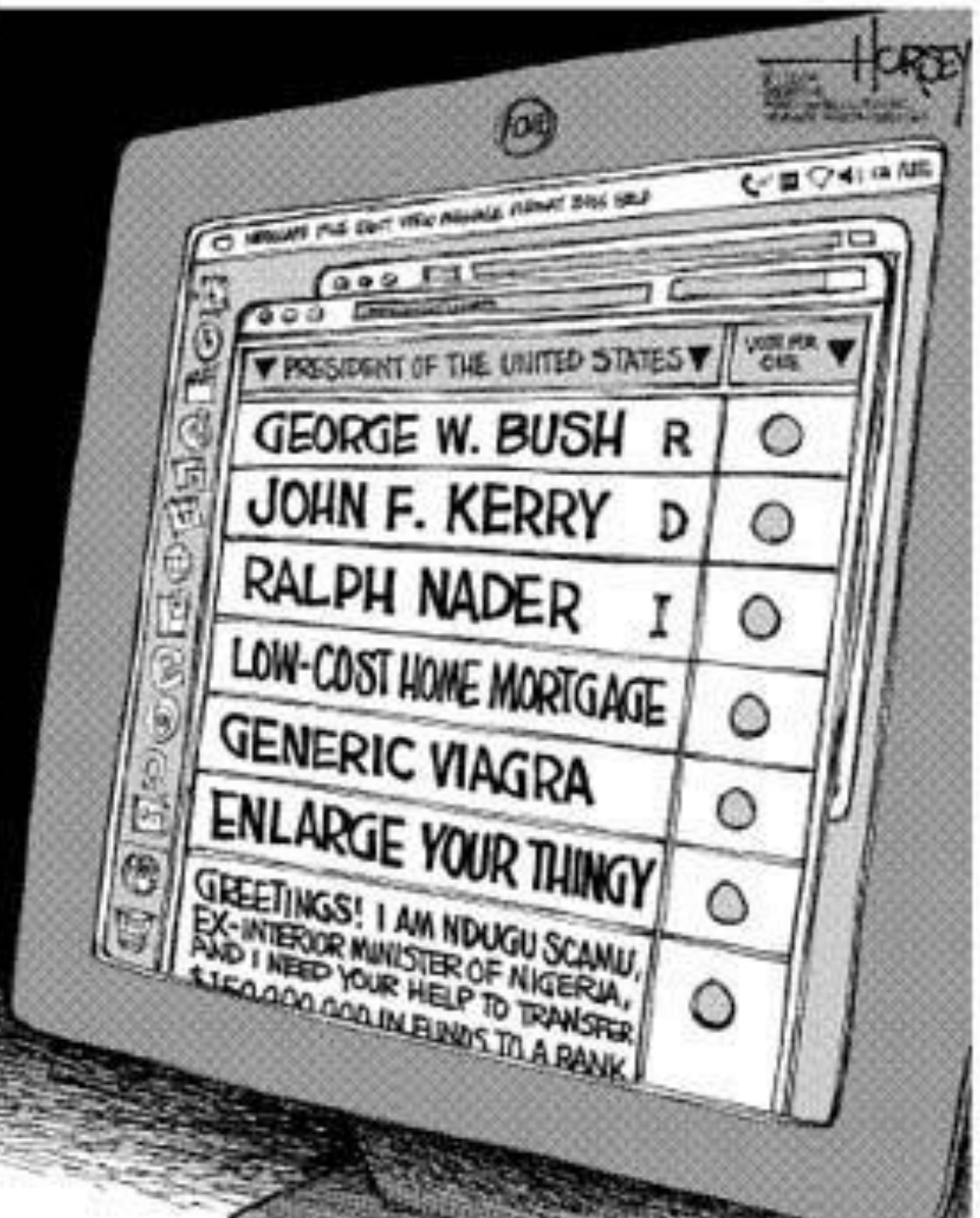
- E-voting security is hard, but...
- E-voting can be made secure and trustworthy, if it can be audited.

- Technical principles:
 - Two-person control, separation of duties
 - Statistical audit
 - Security against malicious insiders

Lessons

- Understand security requirements before you design & deploy an information system.
- Independent review is valuable.
- Sometimes technical threats can be handled through non-technical defenses.
- Seek independent, end-to-end checks that the system is working properly.
- Securing systems against malicious insiders is extremely challenging.
- Business structure determines the technology that is built & deployed. If buyers cannot measure how secure a product is, be prepared for market failures.

THE HAZARDS OF ONLINE VOTING...



▼ PRESIDENT OF THE UNITED STATES ▼

VOTE PER CLASS ▼

GEORGE W. BUSH R

JOHN F. KERRY D

RALPH NADER I

LOW-COST HOME MORTGAGE

GENERIC VIAGRA

ENLARGE YOUR THINGY

GREETINGS! I AM NDUGU SCAMU,
EX-INTERIOR MINISTER OF NIGERIA,
AND I NEED YOUR HELP TO TRANSFER
\$150,000,000 IN FUNDS TO A BANK.

HORSEY