

This is Democracy?

Problems with Electronic Voting Machines

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The right to vote freely
for the candidate of one's choice
is of the essence
of a democratic society,
and any restrictions on that right
strike at the heart
of representative government.

Chief Justice Earl Warren
Reynolds v. Sims (1964)





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www.proquest.com

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www.shaw-walker.com

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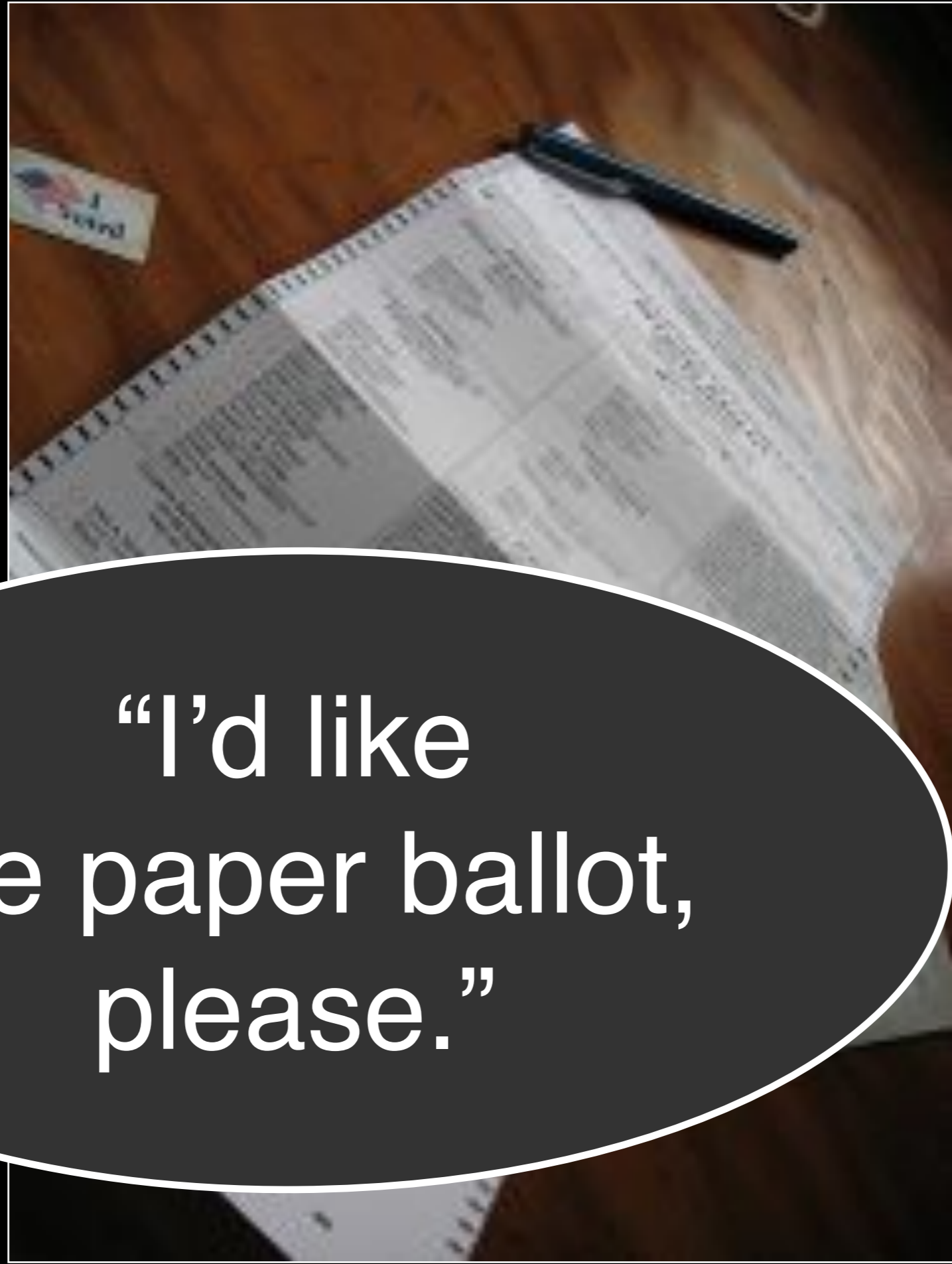
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Print Ball Paper

AVOID

POST-TEST
SUBJECT ROLL
POST-TEST PAGE





“I’d like
the paper ballot,
please.”

Voting

A voting system
has 4 required characteristics

1. Accuracy

2. Anonymity

3. Scalability

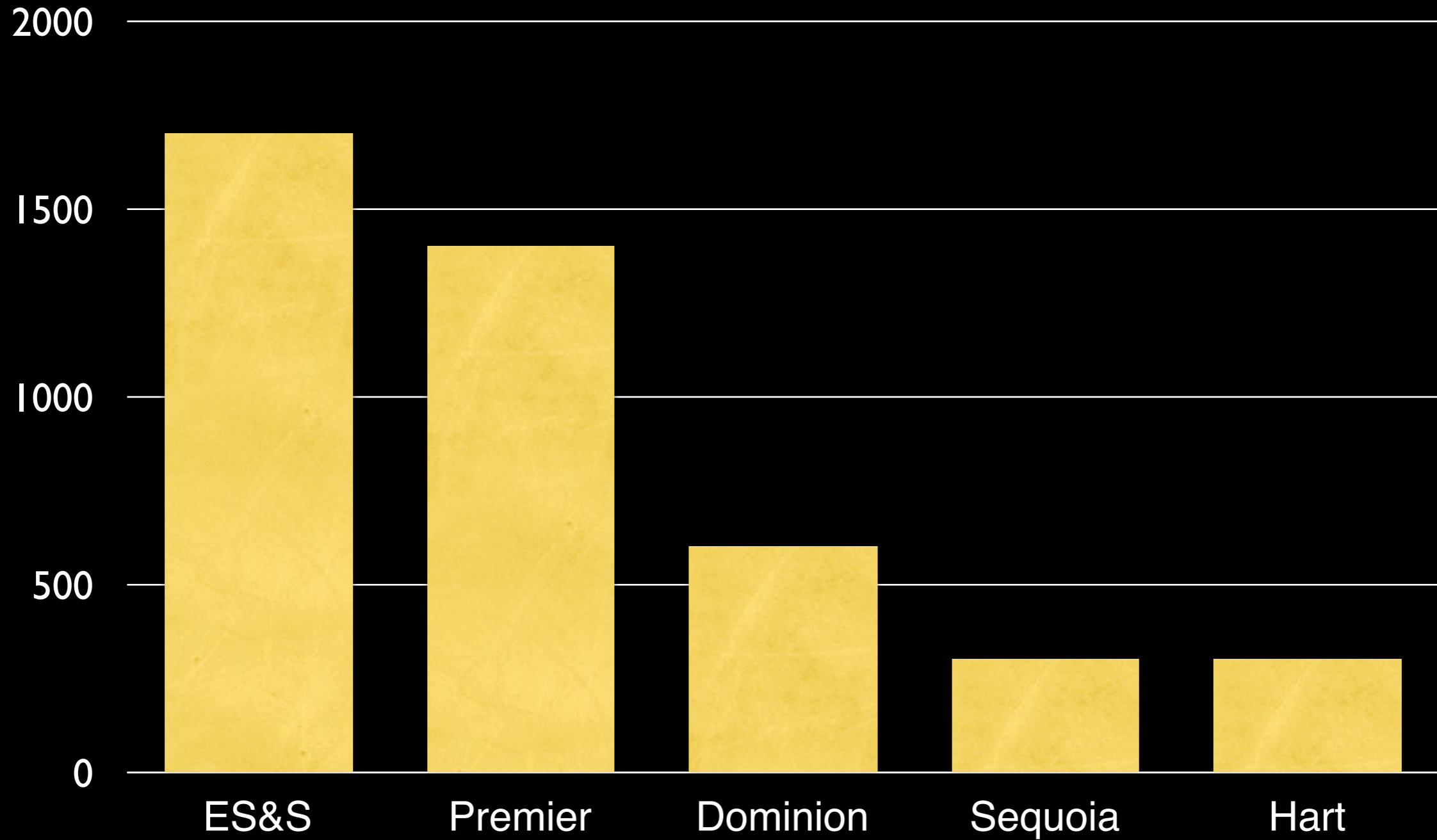
4. Speed

Ariel J. Feldman, J. Alex Halderman,
& Edward W. Felten,
Princeton University:

“Simply put,
many computer scientists
doubt that paperless DREs
[Direct Recording Electronics]
can be made reliable and secure,
and they expect
that any failures of such systems
would likely go undetected.”

Companies

■ # of jurisdictions as of August 2010



Global Election Systems, Inc. (GES)



Bought by Diebold
(2002 • \$24.7 million)



Changes name to Premier Election Solutions
(2007)



Bought by ES&S
(September 2009 • \$5 million)



Bought by Dominion Voting Systems
(May 2010 • \$?)

Examples

Volusia County, FL
2000
Diebold

Al Gore gets –16,022 votes

San Bernardino County, CA 2001

Programming error
causes computers
to look for votes in the wrong place
on a ballot in 33 local elections
No votes registered for those ballots

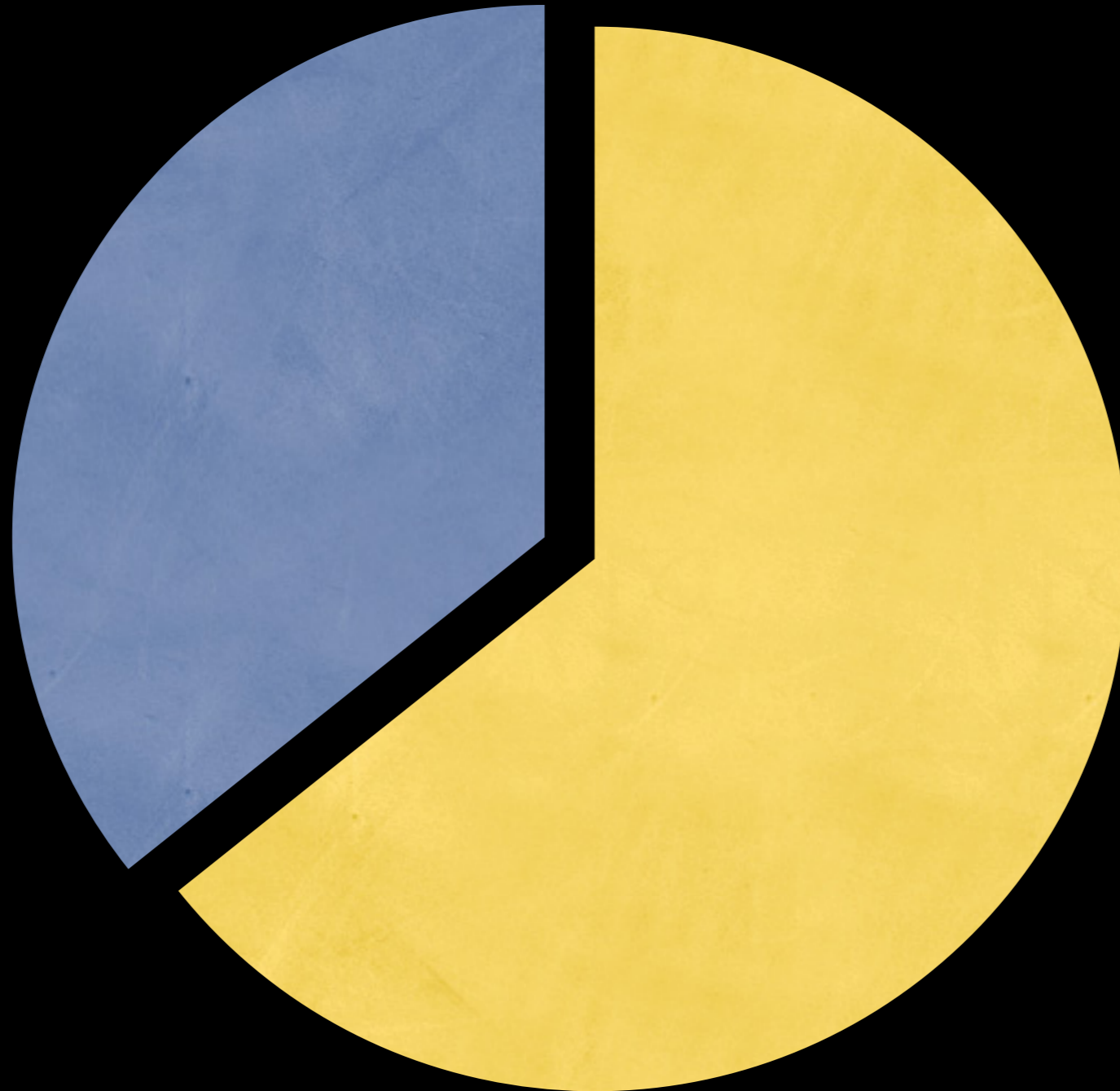
Boone County, IA 2003

140,000 votes counted on machines



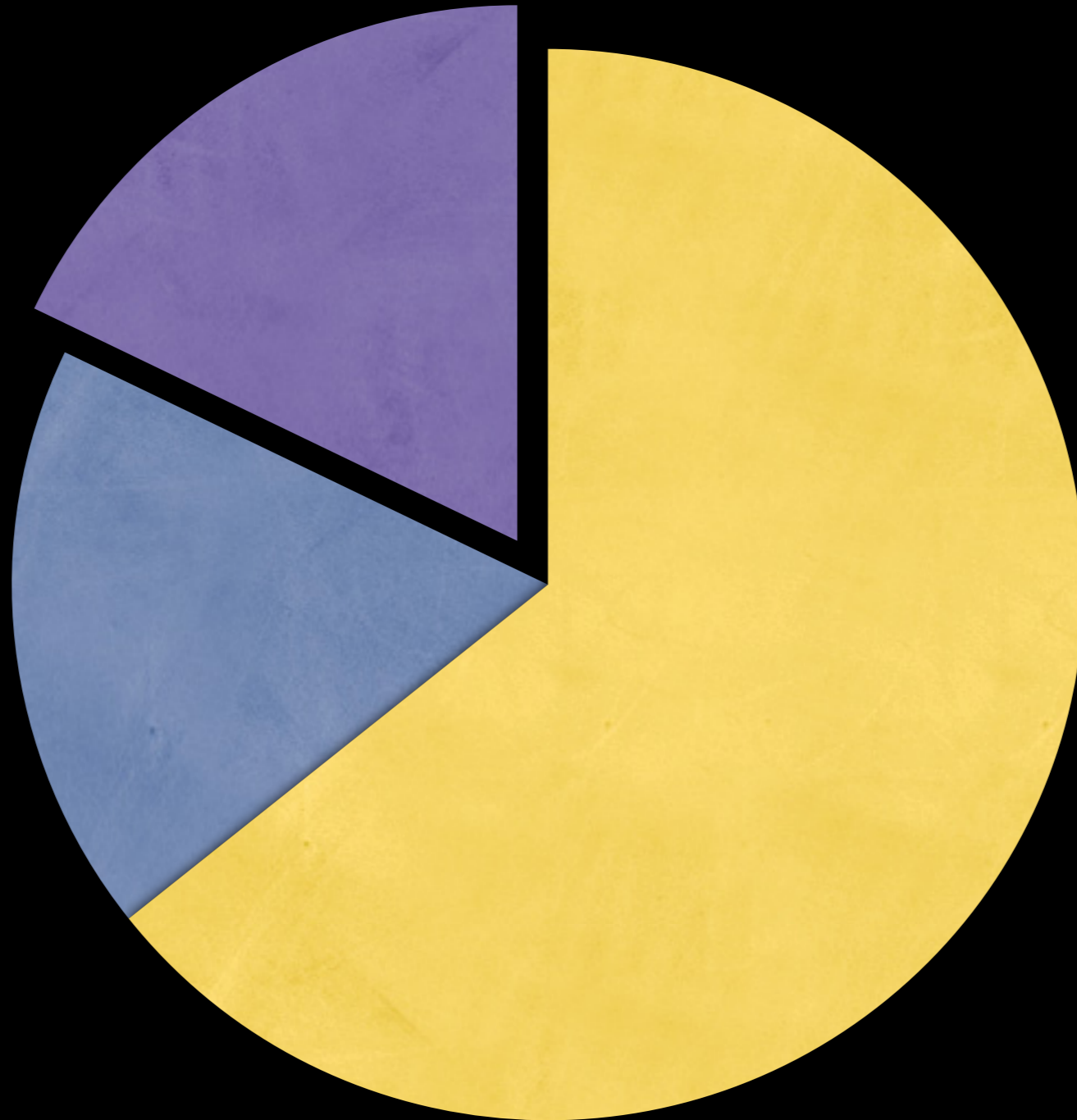
Boone County, IA 2003

50,000 people live there



Boone County, IA 2003

25,000 eligible to vote



Palm Beach County, FL 2004

Audits of voting machine logs
reveal more than 100,000 errors

- ✓ Timestamps of 2010
- ✓ Cards stuck or misread
- ✓ Powering down (128 times!)
- ✓ “Unknown event” messages
 - ✓ & many others

Sarasota County, Florida
2006
ES&S

18,000 ballots showed no vote cast
in the 13th Congressional District

Undervote rate was 5 times normal

100s of voters complained that day

Race lost by 400 votes

Jacksonville, FL 2008

“We’re having problems with the poll machines,” a voter in Jacksonville, Florida, told the CNN Voter Hotline. “They’re not aligned correctly, so you’re not sure about which candidate you’re voting for...”

Jackson County, West Virginia
2008
ES&S

“I went in there
and pushed the Democrat ticket,
and it jumped
to the Republican ticket
for president of the United States,’
said Calvin Thomas,
an 81-year-old West Virginian. ...”

Jackson County, West Virginia
2008
ES&S

“... The same thing happened to his daughter, Micki Clendenin, when she cast her ballot.”

Jackson County, West Virginia
2008
ES&S

TOUCH SCREEN VOTE FLIPPING
Jackson County, West Virginia
October 23rd, 2008



www.videothevote.org

Decatur County, TN
2008
ES&S

3 voters complain
they voted for McCain
& a vote for Obama was registered

“Voters who are too tall
don’t have a good view of the ballot
and might think
they’re touching the center of the box
when they’re not.”

Mineral Wells, TX
2008
ES&S

Voters report machines switch
straight-party vote
from Democratic to Republican

http://www.mineralwellsindex.com/local/local_story_298161535.html
http://machinist.salon.com/blog/2008/10/27/early_voting/index.html

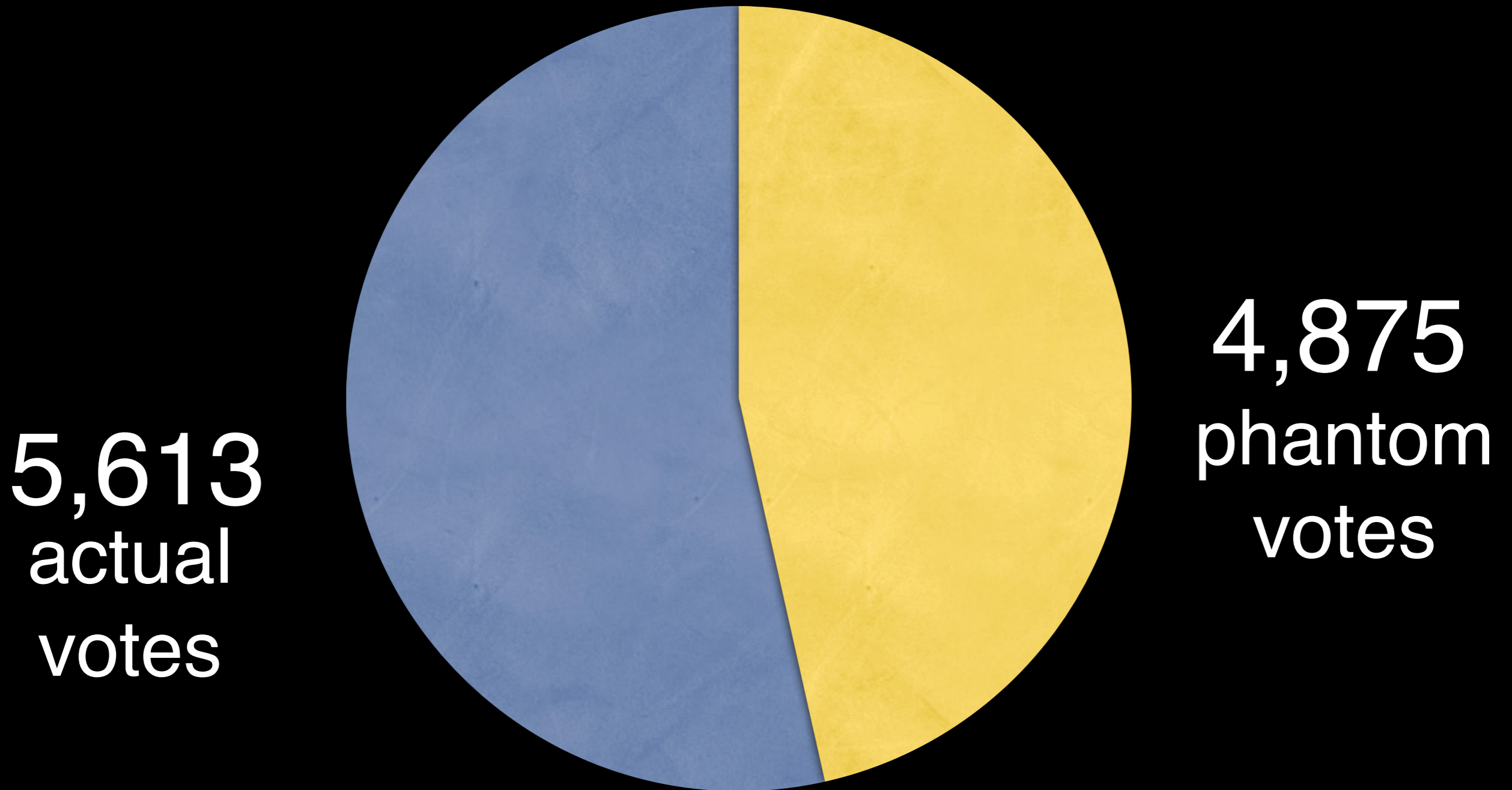
Rapid City, South Dakota
June 2009
ES&S

10,488
votes counted

Rapid City, South Dakota

June 2009

ES&S



New York, NY
2012

1% of all votes
in 13th Congressional District
were never counted

Charles Rangel won by 2% margin

New York Daily News:

“It defies logic that 514 people
went to the polls
in this hotly-contested race
and voted for no one.”

Diebold

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(2002 • \$24.7 million)



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(2007)



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(September 2009 • \$5 million)



Bought by Dominion Voting Systems
(May 2010 • \$?)

Alterations Without Notifications

Georgia, 2002

Diebold changes machines' software

8 times

without the state examining it

6 electoral upsets,

including the incumbent senator,

ahead in the polls,

who loses by 11 points

After the election,

Diebold overwrites the flash memory

on all machines' cards

Alameda County, CA
November 2003

Diebold alters software on machines
prior to the elections
without submitting software
for testing
or notifying the state
about the updates

From
the Horse's Mouth

March 2003

Someone breaks into
a Diebold website
& copies 1000s of messages
from an internal discussion board

The messages & source code
are provided to journalists
& posted on college websites

“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.... I would appreciate an explanation on why the memory cards start giving check sum messages. We had this happen in several precincts...”

(18 January 2001)

2

“Over [the past three years] I have become increasingly concerned about the apparent lack of concern over the practice of writing contracts to provide products and services which do not exist and then attempting to build these items on an unreasonable timetable with no written plan, little to no time for testing, and minimal resources. ...



“... It also seems to be an accepted practice to exaggerate our progress and functionality to our customers and ourselves”
(5 October 2001)

3

“For a demonstration [for El Paso County, Colorado] I suggest you fake it. Program them both so they look the same, and then just do the upload fro [sic] the AV. That is what we did in the last AT/AV [AccuTouch/AccuVote] demo.”
(19 March 1999)

4

“Right now you can open GEMS’ .mdb file with MS-Access, and alter its contents.

That includes the audit log. This isn’t anything new. ... Now, where the perception comes in is that its right now very **easy** to change the contents.

Double click the .mdb file. ...



“... It is possible to put a secret password on the .mdb file to prevent Metamor [a consulting company] from opening it with Access. Being able to end-run the database has admittedly got people out of a bind though. ...



“Jane (I think it was Jane) did some fancy footwork on the .mdb file in Gaston recently. I know our dealers do it. King County is famous for it. That’s why we’ve never put a password on the file before.”

(18 October 2001)

Expert Analysis

Avi Rubin
of Johns Hopkins University
analyzes the stolen Diebold source code
His findings?

It would be easy
for a Diebold insider
to alter the system
to affect votes

Since the code is “closed”,
it could be changed
without detection

All voting machines
use the same hard-coded password

1111

Without a paper trail,
there is no way to audit the system,
& no way to reconstruct
a disputed election

“Our analysis shows that this voting system is far below even the most minimal security standards applicable in other contexts. We highlight several issues including unauthorized privilege escalation, incorrect use of cryptography, vulnerabilities to network threats, and poor software development processes.”

Audit Logs

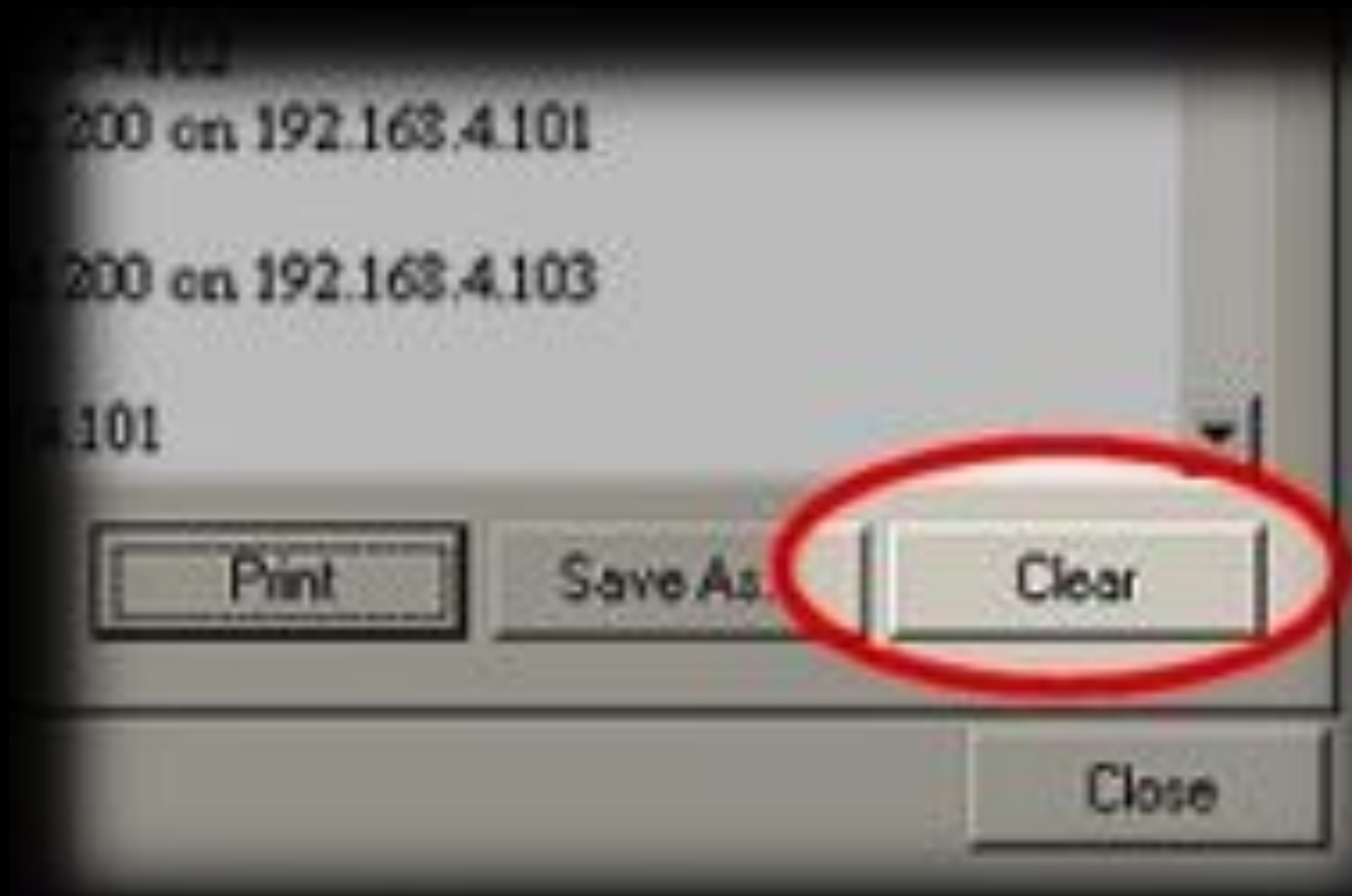
March 17, 2009

Justin Bales,

Premier's Western Region manager, at a
California state public hearing,
admits the following
about machines used in 34 states:

Audit log system
does not record ballot deletions,
even on election days

Flaws have been present
over a decade



Clear button
deletes the audit log
without asking for confirmation
from the user

Bales of Premier:

“It was just not
in the initial program,
but now
we’re taking a serious look at that.”

California Secretary of State
on Diebold’s audit logs:

“Useless”

Keys

Ed Felten, Princeton:

“The access panel door
on a Diebold
AccuVote-TS voting machine
— the door that protects
the memory card
that stores the votes,
and is the main barrier
to the injection of a virus —
can be opened with a standard key
that is widely available on the Internet.”

Problems

Expensive

Why won't
Missouri Secretary of State
Robin Carnahan
decertify voting machines?

Calibration

Jackson County, WV
Clerk Jeff Waybright
2008
ES&S

EXAMINING TOUCHSCREEN
VOTE FLIPPING
Jackson County, West Virginia
Oct. 23, 2008



Hackability

From *Security Analysis of the Diebold AccuVote-TS Voting Machine*:

“Anyone who has physical access to a voting machine, or to a memory card that will later be inserted into a machine, can install ... malicious software using a simple method that takes as little as one minute. In practice, poll workers and others often have unsupervised access to the machines.”

Dan S. Wallach,
Associate Prof. of Computer Science,
Rice University

“What we learned from
the California Top-to-Bottom Review
and the Ohio EVEREST study
was that, indeed, these systems are
unquestionably and unconscionably
insecure.”

When machine boots,
it checks to see if `fbboot.nb0`
is on removable memory card

If it is, the machine
replaces bootloader code
on its on-board flash memory
with new `fbboot.nb0`

When machine boots,
it checks to see if `explorer.glb`
is on removable memory card

If it is,
the machine runs `explorer.glb`
without any authentication

Operating system
used by Diebold voting machines:

Windows CE 3.0

Uniformity

Millions of copies
of the same machines
are in use across the USA

One problem means that
elections across the country
would be affected

Infrastructure

What if the electricity fails?

The Biggest Problem



Solutions

Better Security Procedures

In the Netherlands,
after a voting foundation
demonstrated security holes,
the Dutch government
ordered all software to be replaced,
all hardware to be checked,
unflashable firmware to be installed,
& iron seal to be placed on machines

Machines were checked randomly
on election day

Paper ballots must always
be available,
enough for everyone to use
if necessary

Open Source

What's *open source*?

Secrecy does not mean security

Dan S. Wallach,
Associate Prof. of Computer Science,
Rice University

“Disclosing the source code only results in
a complete forfeiture of the software’s
security if there was never any security
there in the first place. ...



“If the product is well-engineered, then disclosing the software will cause no additional security problems. If the product is poorly-engineered, then the lack of disclosure only serves the purpose of delaying the inevitable.”

Voter-verified paper trails

Independent security reviews of hardware & software

Learn



Product List for the 2012
Ballot

PROCTER
Date: 10/1/11

SHIMADZU
CONDENSER FOR NEXUS 1000
Date: 10/1/11

JEKON
BRUSH FOR NEXUS 1000
DATE: 10/1/11

COMMISSIONER OF MEDICAL DEPARTMENT
Date: 10/1/11

DR. J. J. CHEN
WHITE STRAIGHT ETHIC
Date: 10/1/11

ORCA LABS
POLYURETHANE
Date: 10/1/11

ROBERT FROST
WHEEL OF 2000 HOUR
Date: 10/1/11

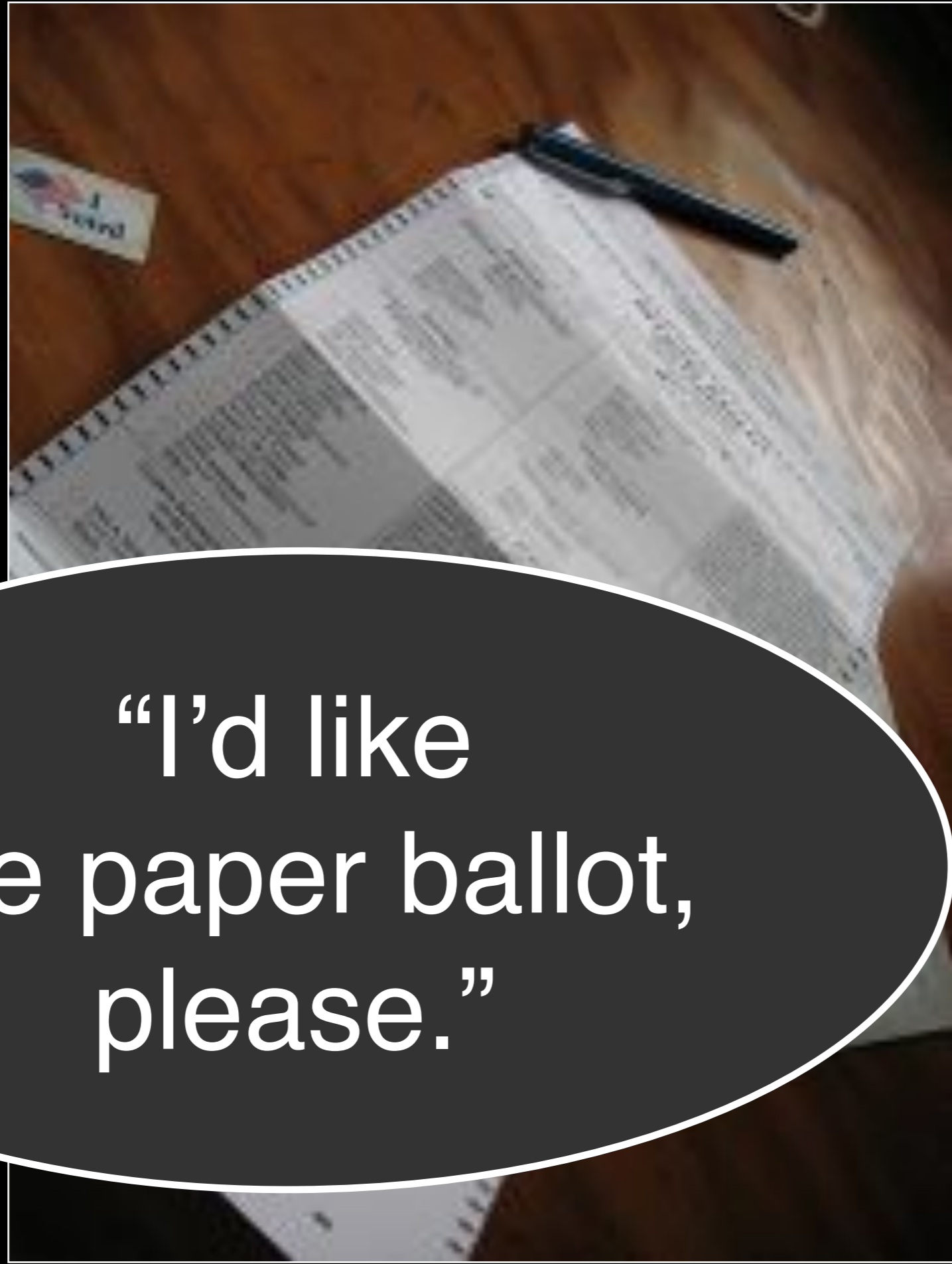
U.S. FORM
WHEEL OF 2000 HOUR
Date: 10/1/11

Print Ballot Paper

AVOID

POST-TEST
SUBJECT BATH
POST-BATH PAPER





“I’d like
the paper ballot,
please.”

Google “vote” & any of these:

Bruce Schneier

Edward Felten

Avi Rubin



Thank you!

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