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 Justic Earl Warren
Reynolds v. Sims (1964)

Image from http://media.redandblack.com/vimages/shared/vnews/stories/4134015b6da62-57-1.jpg

"I'd like the paper ballot, please."

Voting

A voting system
has 4 required characteristics

1. Accuracy

2. Anonymity

3. Scalability

4. Speed

Accuracy is how well the voter's intent is properly counted

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

Slide 1

of jurisdictions as of August 2010
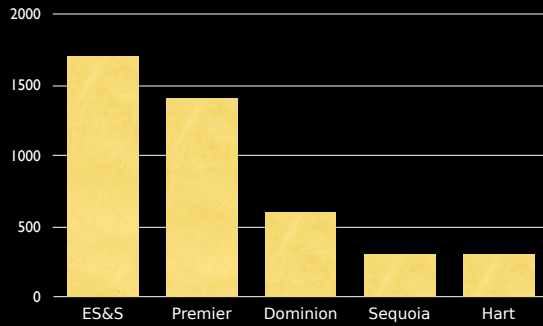
2000				
1500				
1000				
500				
0				
ES&S	Premier	Dominion	Sequoia	Hart

Slide 2

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 • $?)

Source: http://en.wikipedia.org/wiki/Premier_Election_Solutions
Source: http://techdirt.com/articles/20090903/1538136098.shtml

Slide 3

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

http://blog.wired.com/27bstroke6/2008/10/ess-voting-mach.html

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…"

http://www.cnn.com/2008/POLITICS/10/24/voting.problems/index.html

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. …"

http://www.cnn.com/2008/POLITICS/10/24/voting.problems/index.html

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

Jackson County, West Virginia
2008
ES&S

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

VIDEO THE VOTE
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."

http://blog.wired.com/27bstroke6/2008/10/ess-voting-mach.html

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
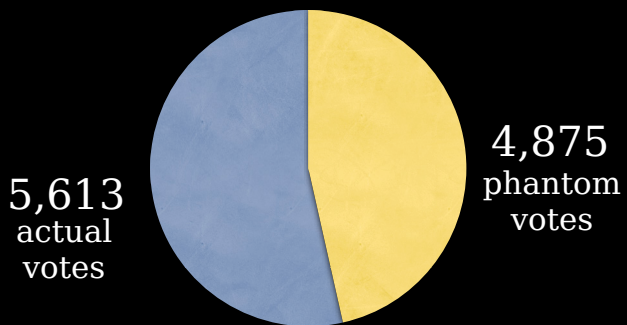http://machinist.salon.com/blog/2008/10/27/early_voting/index.html

Rapid City, South Dakota
June 2009
ES&S

10,488
votes counted

http://techdirt.com/articles/20090608/2201455173.shtml
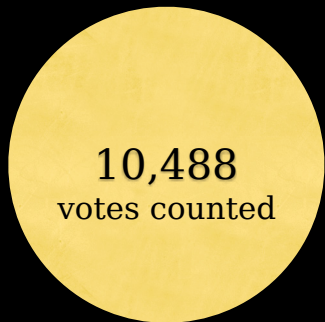
Ballots recounted, which led to ...

Rapid City, South Dakota
June 2009
ES&S

4,875
phantom
votes

5,613
actual
votes

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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(May 2010 • $?)

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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

1

"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. Progam 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

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:

Source: Trachtenberg, Mitch. "Diebold Admits Audit Logs in ALL Versions of Their Software Fail to Record Ballot Deletions". The Brad Blog (17 March 2009). http://www.bradblog.com/?p=6995. Accessed 19 May 2012.

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

Flaws have been present
over a decade
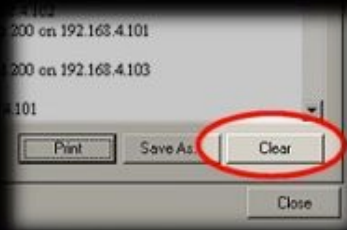
Source: Trachtenberg, Mitch. "Diebold Admits Audit Logs in ALL Versions of Their Software Fail to Record Ballot Deletions". The Brad Blog (17 March 2009). http://www.bradblog.com/?p=6995. Accessed 19 May 2012.

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

Source: Trachtenberg, Mitch. "Diebold Admits Audit Logs in ALL Versions of Their Software Fail to Record Ballot Deletions". The Brad Blog (17 March 2009). http://www.bradblog.com/?p=6995. Accessed 19 May 2012.

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"

Source: Trachtenberg, Mitch. "Diebold Admits Audit Logs in ALL Versions of Their Software Fail to Record Ballot Deletions". The Brad Blog (17 March 2009). http://www.bradblog.com/?p=6995. Accessed 19 May 2012.

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

Jackson County, WV
Clerk Jeff Waybright
2008
ES&S

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

VIDEO VOTE
www.videothevote.org

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 `fboot.nb0`
is on removable memory card

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

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 problems 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

Google "vote" & any of these:
Bruce Schneier
Edward Felten
Avi Rubin

APRIL 7
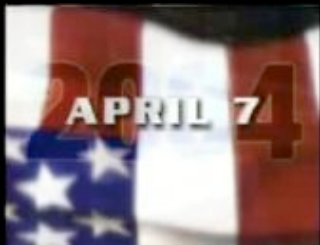
Thank you!

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