


Securing Digital Democracy

Lecture 5 | *Security Procedures*



J. Alex Halderman
University of Michigan


Voter Registration

Voter Authentication  **Enfranchisement**

Almost 1/3 of eligible U.S. citizens not registered!

Voter Registration Application

Before completing this form, review the General, Application, and State specific instructions.

Are you a citizen of the United States of America? <input type="checkbox"/> Yes <input type="checkbox"/> No Will you be 18 years old on or before election day? <input type="checkbox"/> Yes <input type="checkbox"/> No <b style="color: red;">If you checked "No" in response to either of these questions, do not complete form. (Please see state-specific instructions for rules regarding eligibility to register prior to age 18.)		This space for office use only.			
1	(Circle one) Last Name Mr. Mrs. Miss Ms.	First Name	Middle Name(s)	(Circle one) Jr Sr II III IV	
2	Home Address	Apt. or Lot #	City/Town	State	Zip Code
3	Address Where You Get Your Mail If Different From Above		City/Town	State	Zip Code
4	Date of Birth _____ / _____ / _____ Month Day Year	5	Telephone Number (optional)	6	ID Number - (See Item 6 in the instructions for your state)
7	Choice of Party (see item 7 in the instructions for your State)	8	Race or Ethnic Group (see item 8 in the instructions for your State)		
9 I have reviewed my state's instructions and I swear/affirm that: <ul style="list-style-type: none"> ■ I am a United States citizen ■ I meet the eligibility requirements of my state and subscribe to any oath required. ■ The information I have provided is true to the best of my knowledge under penalty of perjury. If I have provided false information, I may be fined, imprisoned, or (if not a U.S. citizen). 					
Please sign full name (or put mark) ▲					
Date: _____ Month Day Year					

<https://www.sos.ca.gov/elections/register-to-vote/app-pdf/english-blank.pdf>

5.1 Voter Registration

Please fill out the sections below if they apply to you.

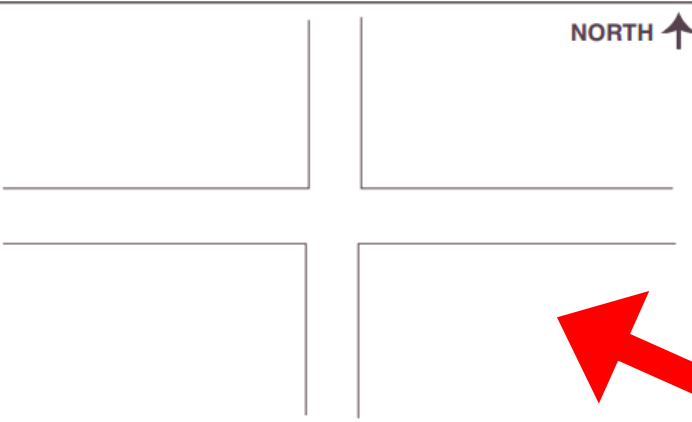
If this application is for a **change of name**, what was your name before you changed it?

A	Mr. Mrs. Miss Ms.	Last Name	First Name	Middle Name(s)	(Circle one) Jr Sr II III IV

If you were **registered before but this is the first time you are registering from the address in Box 2**, what was your address where you were registered before?

B	Street (or route and box number)	Apt. or Lot #	City/Town/County	State	Zip Code

If you live in a rural area but do not have a street number, or if you have no address, please show on the map where you live.

C	<input type="checkbox"/> Write in the names of the crossroads (or streets) nearest to where you live.									
	<input type="checkbox"/> Draw an X to show where you live.									
	<input type="checkbox"/> Use a dot to show any schools, churches, stores, or other landmarks near where you live, and write the name of the landmark.									
	<table border="1"><tr><td>Example</td><td rowspan="2">Route #2</td><td>● Grocery Store</td></tr><tr><td></td><td>Woodchuck Road</td></tr><tr><td>Public School ●</td><td></td><td>X</td></tr></table>	Example	Route #2	● Grocery Store		Woodchuck Road	Public School ●		X	
Example	Route #2	● Grocery Store								
		Woodchuck Road								
Public School ●		X								

If the applicant is unable to sign, who helped the applicant fill out this application? Give name, address and phone number (phone number optional).

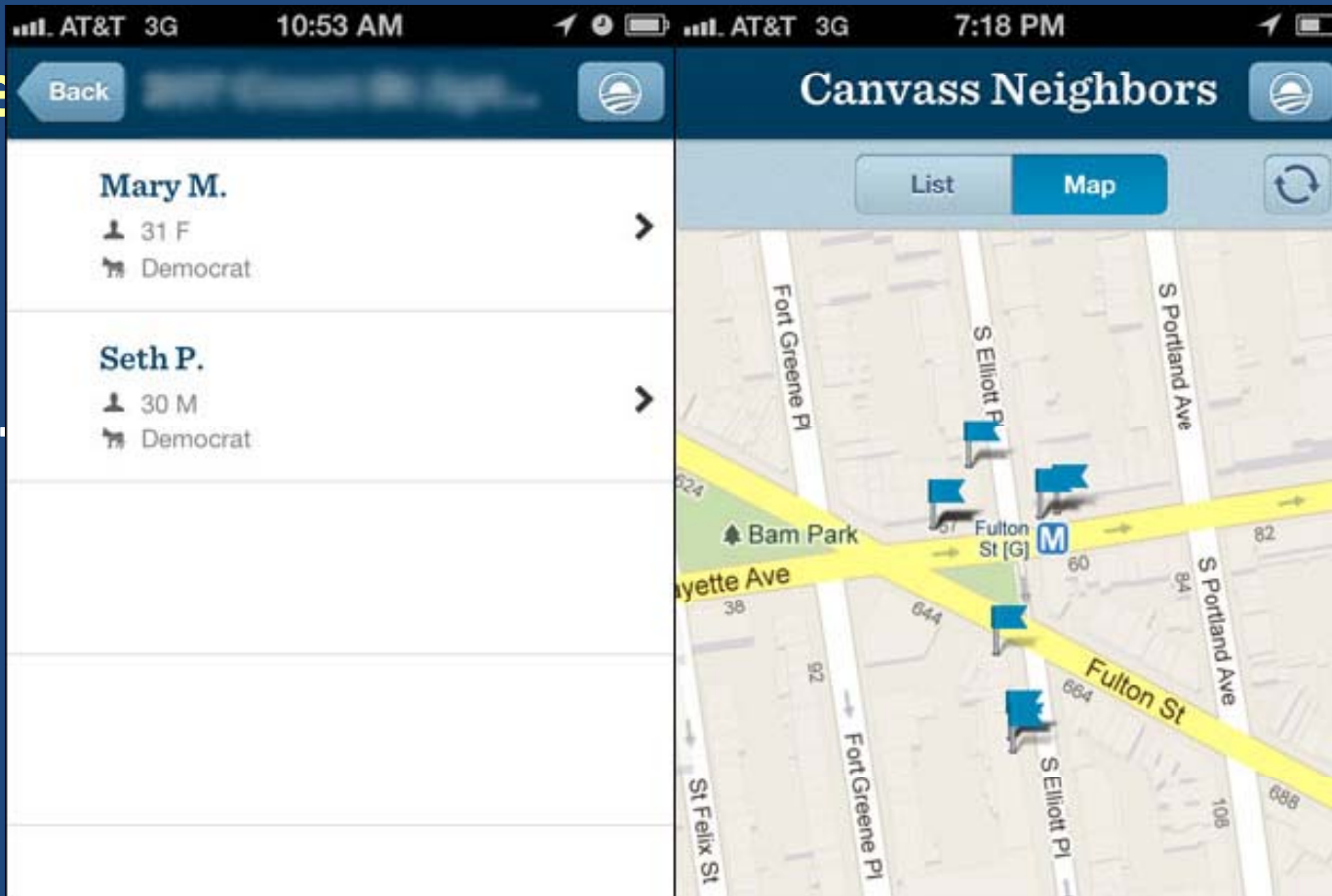
D	
----------	--

Mail this application to the address provided for your State.

5.1 Voter Registration

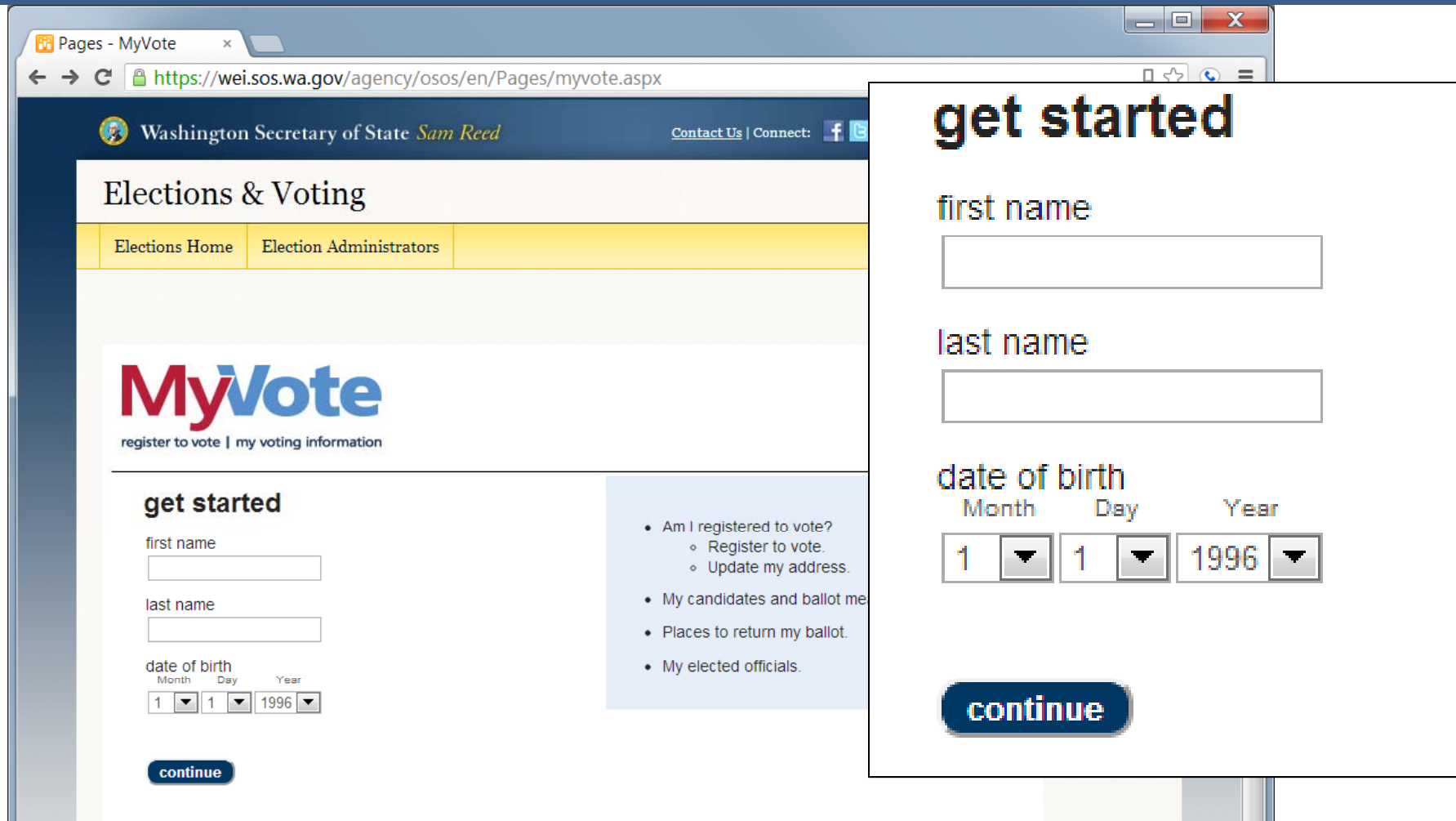
Vote

Aut



ment

5.1 Voter Registration



The image shows a screenshot of a web browser displaying the MyVote website. The browser's address bar shows the URL <https://wei.sos.wa.gov/agency/osos/en/Pages/myvote.aspx>. The page header includes the Washington Secretary of State *Sam Reed* and social media links for Facebook and Twitter. The main navigation bar is titled "Elections & Voting" and contains links for "Elections Home" and "Election Administrators". The MyVote logo is prominently displayed with the tagline "register to vote | my voting information".

The "get started" section of the form includes the following fields and options:

- first name:
- last name:
- date of birth: Month (1), Day (1), Year (1996)

A "continue" button is located at the bottom of the form. To the right of the form, a list of links is provided:

- Am I registered to vote?
 - Register to vote.
 - Update my address.
- My candidates and ballot me
- Places to return my ballot.
- My elected officials.

A magnified view of the "get started" form is overlaid on the right side of the screenshot, showing the input fields and the "continue" button in more detail.

5.1 Voter Registration

SP Sound Politics Washi x

← → ↻ www.soundpolitics.com/voterlookup.html

Sound Politics Washington State Voter Database

This service provides online access to a public release of the [Washington State Voter Registration Database](#) (February 29, 2012)

You may search for voters by county and street address or by name. Scroll down below the data entry form for instructions.

County: (select one county if searching by address)

Search by Address

House Number: (Show entire block?)

Prefix	Street Name	Type	Postfix
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

or

Search by Name

Last Name:

First part of first name:

Sort by : First Name Address

Search by Name

Last Name:

First part of first name:

Sort by : First Name Address

Sound Politics Washi x

usefulwork.com/cgi-bin/wavoterdb.cgi

Sound Politics Washington State Voter Database

County	Last Name	First / Middle Name	M/F	Number	Street	City	Last Voted	Birthdate	Registered	PAV	Status	Cong.	Leg.	Prec.
KI	PUBLIC	JOHN Q	M	100	MAPLE DR	REDMOND	2011-NOV-08	1950-JAN-01	1995-FEB-01	P	A	1	48	2790

Data is from [Secretary of State's Voter Registration Database](#) public release of Feb. 29, 2012

If this database is useful to you, [please make a contribution to help us cover our costs:](#)

[Donate](#)

Sound Politics Washington State Voter Database

County	Last Name	First / Middle Name	M/F	Number	Street	City	Last Voted	Birthdate	Registered	PA
KI	PUBLIC	JOHN Q	M	100	MAPLE DR	REDMOND	2011-NOV-08	1950-JAN-01	1995-FEB-01	P

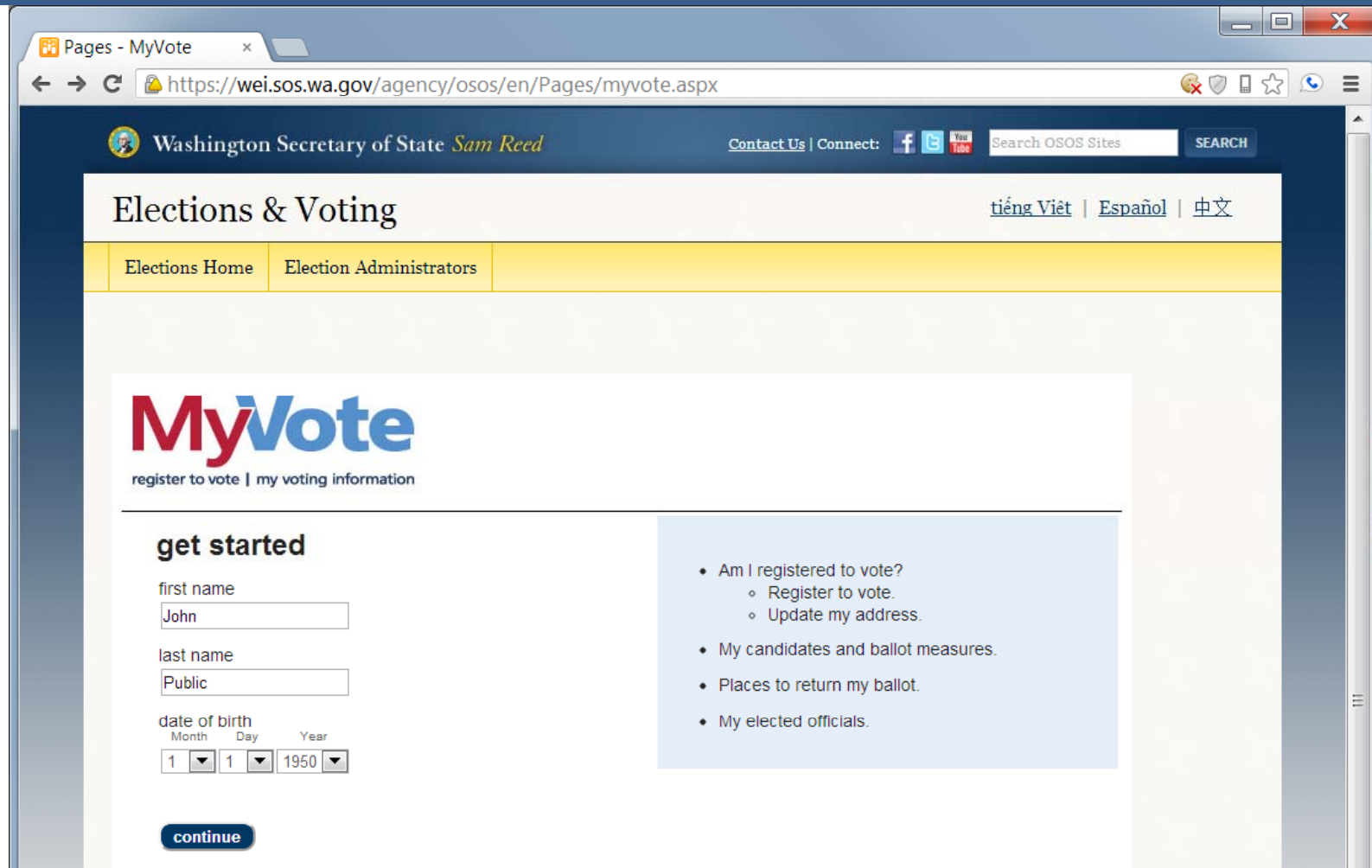
Data is from [Secretary of State's Voter Registration Database](#) public release of Feb. 29, 2012

M/F: gender

Number: May include a suffix such as APT to indicate whether the registration record indicates an apartment. Click on the link to see all voters registered at that street address.

LastVoted: The date of the last election in which the voter is credited with voting (or blank if never credited).


5.1 Voter Registration



The screenshot shows a web browser window displaying the MyVote website. The browser's address bar shows the URL <https://wei.sos.wa.gov/agency/osos/en/Pages/myvote.aspx>. The website header includes the Washington Secretary of State *Sam Reed* logo, social media links for Facebook, Twitter, and YouTube, and a search bar for OSOS Sites. The main navigation bar features "Elections & Voting" with language options for [tiếng Việt](#), [Español](#), and [中文](#). Below this is a yellow navigation bar with "Elections Home" and "Election Administrators". The main content area features the "MyVote" logo with the tagline "register to vote | my voting information". A "get started" section contains a registration form with fields for "first name" (John), "last name" (Public), and "date of birth" (Month: 1, Day: 1, Year: 1950). A "continue" button is located below the form. To the right of the form is a light blue box containing a list of links: "Am I registered to vote?" (with sub-links "Register to vote." and "Update my address."), "My candidates and ballot measures.", "Places to return my ballot.", and "My elected officials."

Pages - MyVote x

← → ↻ <https://wei.sos.wa.gov/agency/osos/en/Pages/myvote.aspx> 🔒 📱 ☆ 🌐 ☰

 Washington Secretary of State *Sam Reed* [Contact Us](#) | Connect: [f](#) [t](#) [You Tube](#) [SEARCH](#)

Elections & Voting [tiếng Việt](#) | [Español](#) | [中文](#)

[Elections Home](#) [Election Administrators](#)

MyVote
register to vote | my voting information

get started

first name

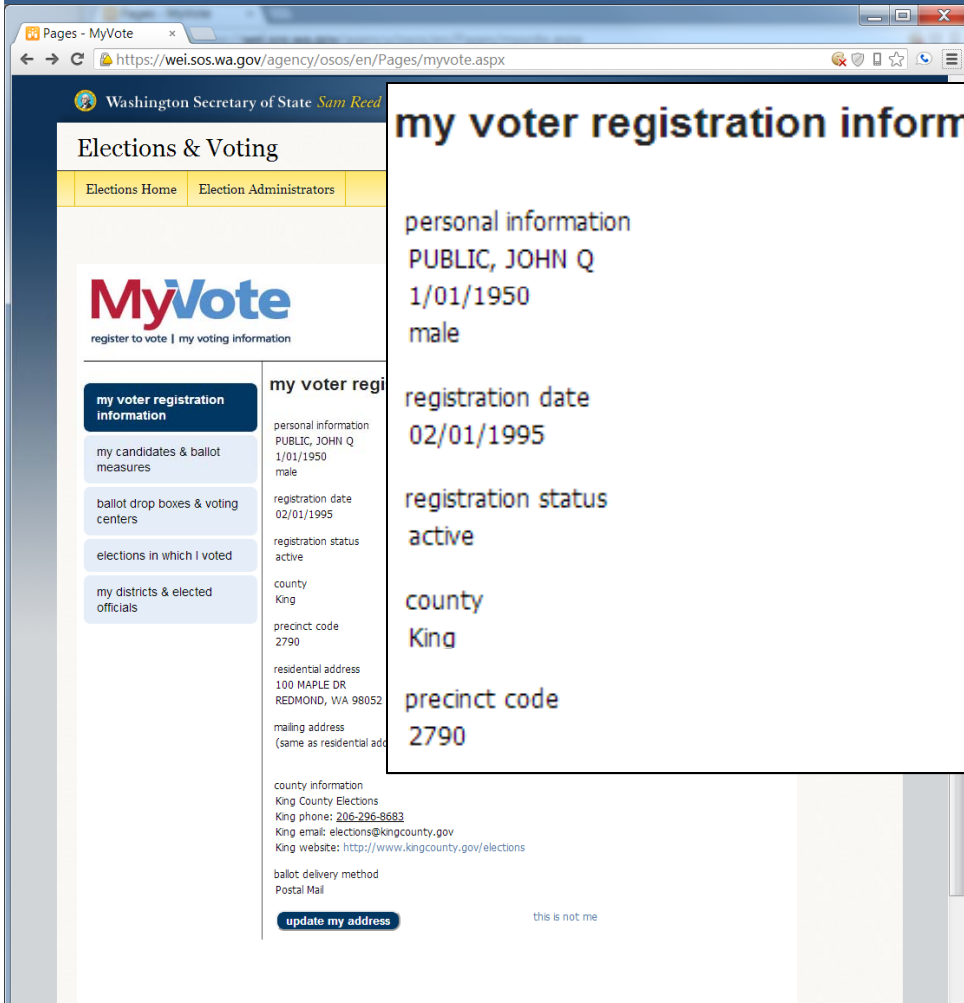
last name

date of birth
Month Day Year

[continue](#)

- Am I registered to vote?
 - Register to vote.
 - Update my address.
- My candidates and ballot measures.
- Places to return my ballot.
- My elected officials.

5.1 Voter Registration



my voter registration information

personal information
PUBLIC, JOHN Q
1/01/1950
male

registration date
02/01/1995

registration status
active

county
King

precinct code
2790

residential address
100 MAPLE DR
REDMOND, WA 98052

mailing address
(same as residential address)

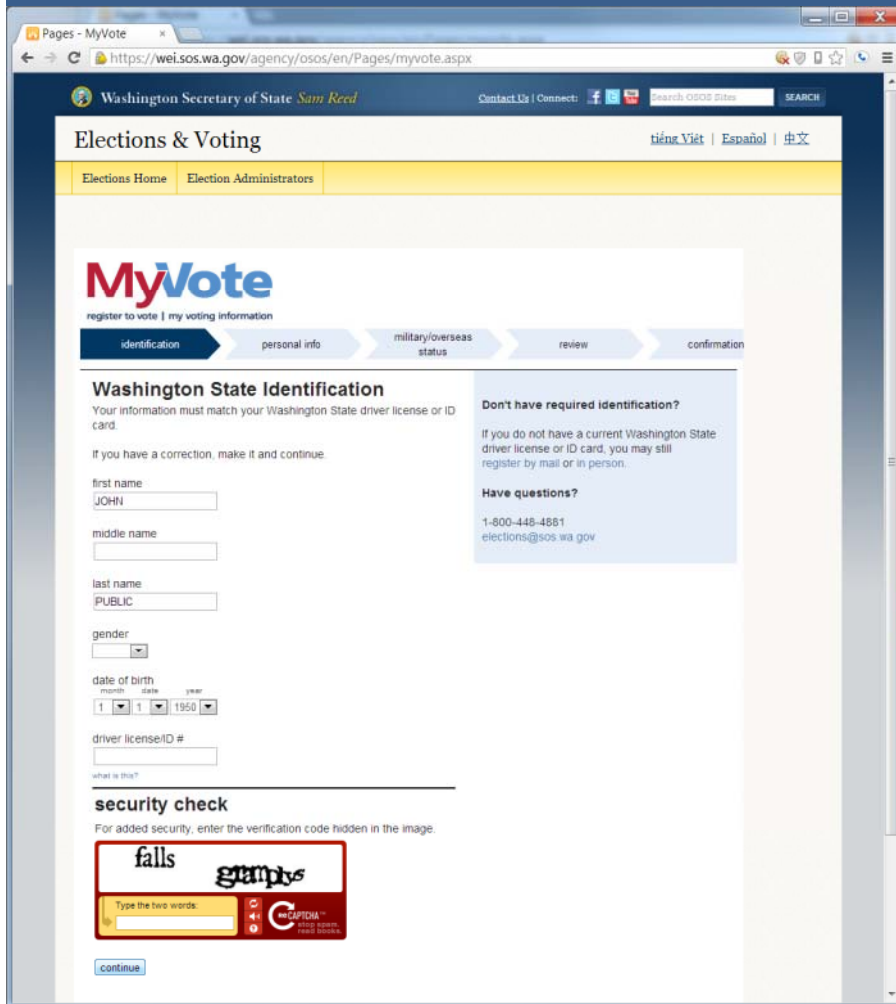
county information
King County Elections
King phone: 206-296-8683
King email: elections@kingcounty.gov
King website: <http://www.kingcounty.gov/elections>

ballot delivery method
Postal Mail

[update my address](#)

[this is](#)

5.1 Voter Registration



The screenshot shows the Washington State MyVote registration page. The browser address bar displays <https://wsl.sos.wa.gov/agency/osos/en/Pages/myvote.aspx>. The page header includes the Washington Secretary of State *Sam Reed* and navigation links for [Contact Us](#), [Connect](#), and social media icons. The main navigation bar features [Elections Home](#) and [Election Administrators](#). The MyVote logo is prominently displayed, with the tagline "register to vote | my voting information". A progress bar indicates the current step: **identification**, followed by personal info, military/overseas status, review, and confirmation. The "Washington State Identification" section contains a form with the following fields: first name (JOHN), middle name (empty), last name (PUBLIC), gender (dropdown), date of birth (month: 1, date: 1, year: 1950), and driver license/ID # (empty). A "security check" section is also present, featuring a CAPTCHA with the words "falls" and "gramps" and a "continue" button. A sidebar on the right provides information for users who do not have a current Washington State driver license or ID card, including contact details for questions.

first name
JOHN

middle name

last name
PUBLIC

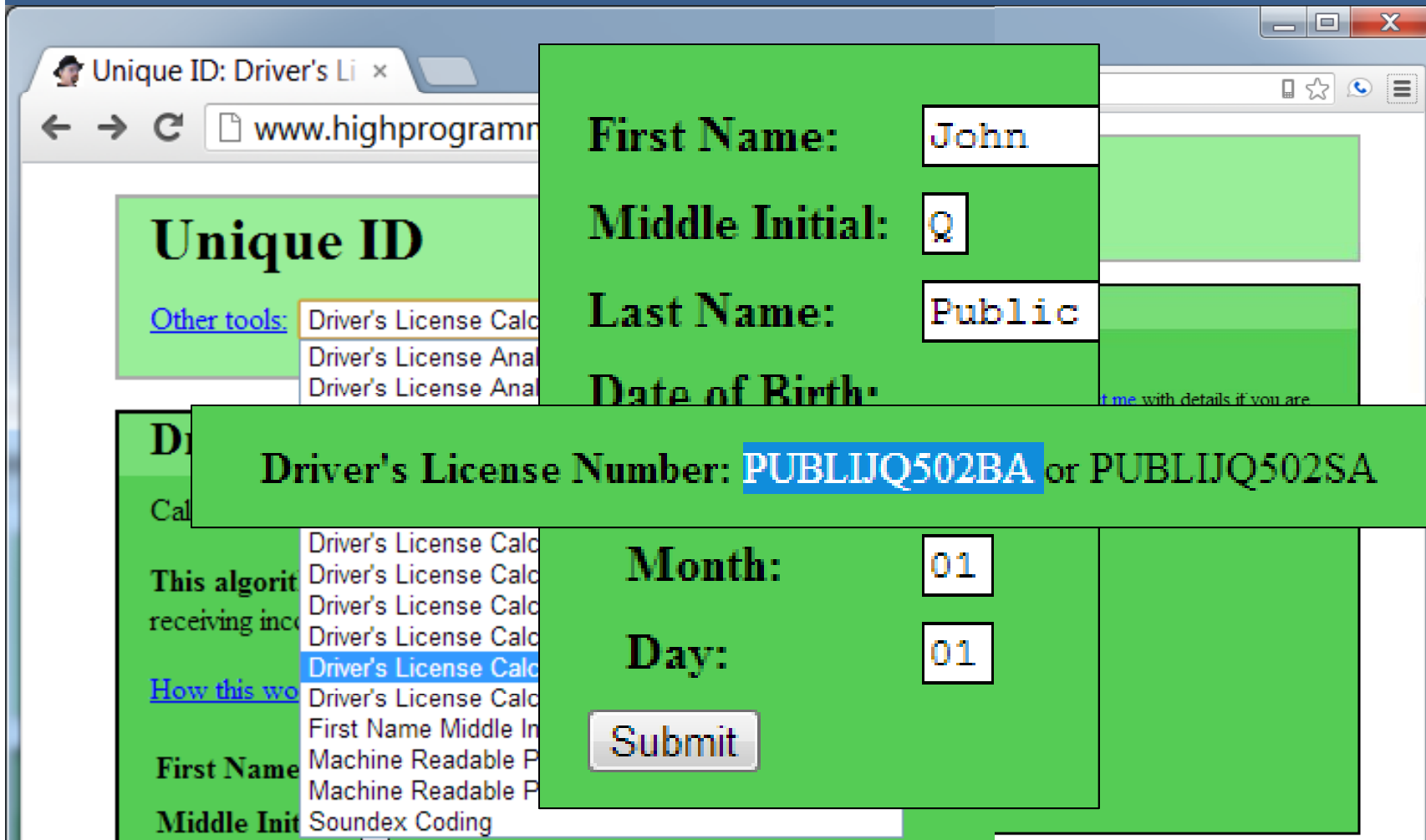
gender

date of birth
month: 1, date: 1, year: 1950

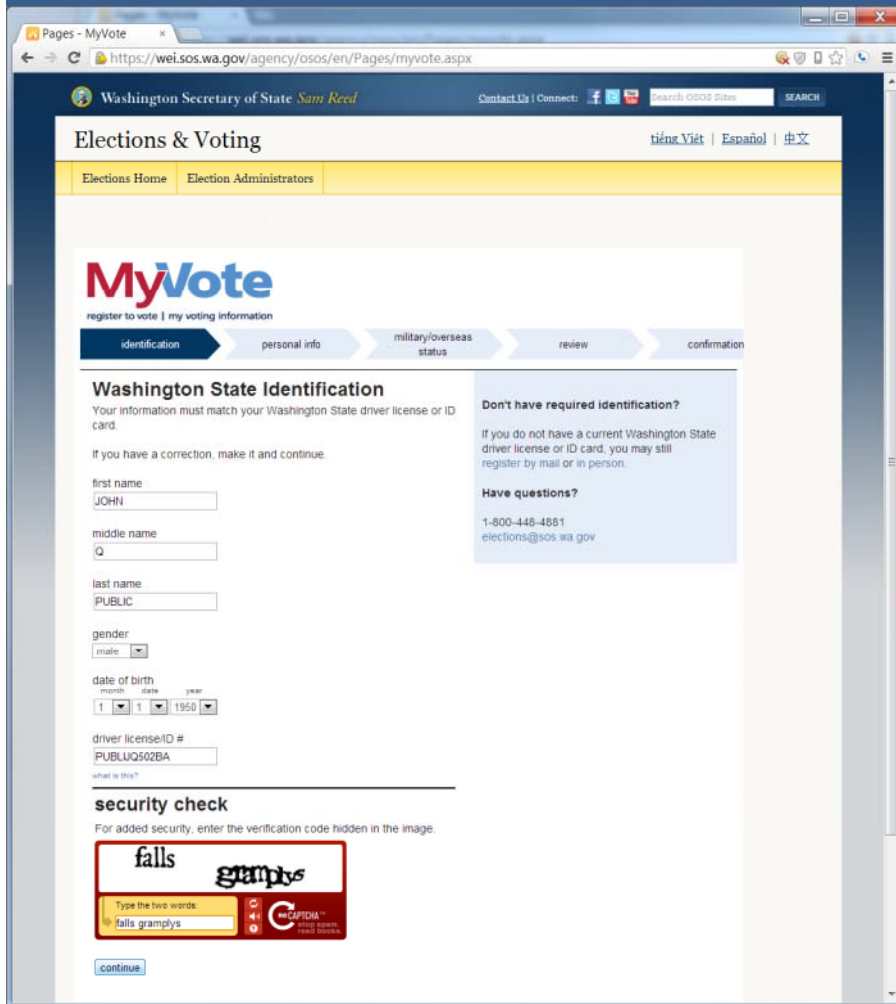
driver license/ID #

what is this?

**WHAT
COULD GO
WRONG?**



5.1 Voter Registration



The screenshot shows the Washington State MyVote website. The page title is "Washington State Identification". The user is currently in the "identification" step of a five-step process: identification, personal info, military/overseas status, review, and confirmation. The form fields are as follows:

- first name: JOHN
- middle name: Q
- last name: PUBLIC
- gender: male
- date of birth: 1/1/1950
- driver license/ID #: PUBLIQ502BA

There is a "security check" section with a CAPTCHA image showing the words "falls" and "grampys". A "continue" button is located at the bottom of the form.

Washington State Identification

Your information must match your Washington State driver license or ID card.

If you have a correction, make it and continue.

first name

middle name

last name

gender

date of birth

month: 1, date: 1, year: 1950

driver license/ID #

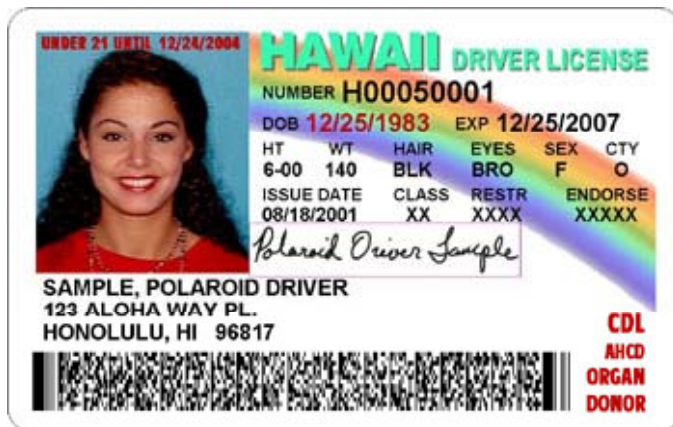
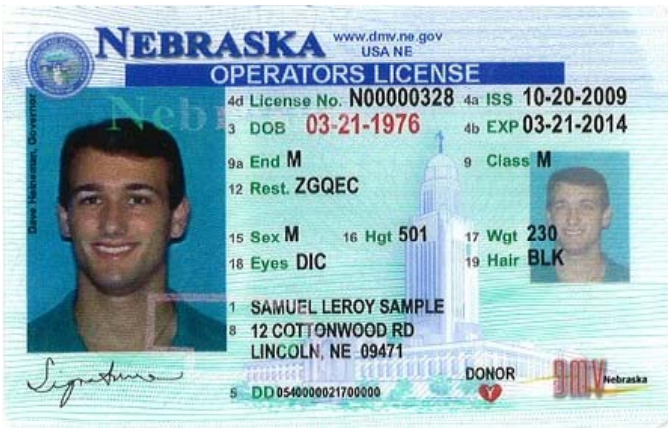
what is this?

Voter Authentication














(left) Public domain image from Wikimedia Commons, http://en.wikipedia.org/wiki/File:Mustermann_nPA.jpg
 (right) Image by DNI Electronico via Wikimedia Commons, <http://en.wikipedia.org/wiki/File:Dnielectronico.jpg>
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5.2 Voter Authentication



5.2 Voter Authentication

ROSTER OF ACTIVE VOTERS
AFTER COUNTING SIGNATURES, PLACE INSIDE FRONT COVER OF ROSTER-INDEX

RESIDENCE	VOTER ID	AFF #	PARTY	REG. DATE	SIGNATURE	VOTER NAME
3751 HARRISON ST 201		01S340862	DEM	10/21/03	*** ABSENTEE VOTER ***	VAL LEE BLAKELY
ADDRESS :						
3798 HARRISON ST 1		7GE158290	GRN	10/13/06	*** ABSENTEE VOTER ***	LAUREN CATHERINE BOOTH
ADDRESS :						
567 OAKLAND AVE 111		59D021682	NP	3/30/92	*** ABSENTEE VOTER ***	JACK H BOWMAN
ADDRESS :						
645 EL DORADO AVE 104		01M741300	NP	10/2/06	*** ABSENTEE VOTER ***	FRANCINE BROADNAX
ADDRESS :						
142 MOSS AVE 8		01L657067	NP	5/22/06	*** ABSENTEE VOTER ***	TESSA DIAHANN CHRISTENSON
ADDRESS :						
555 OAKLAND AVE 2E		65A808348	DEM	10/23/06	*** ABSENTEE VOTER ***	MICHELLE CHANTAL CHUN LEROY
ADDRESS :						
567 OAKLAND AVE 302		FAP062097	REP	10/17/06	X	LORA C CROSSLIN
ADDRESS :						
3798 HARRISON ST 3		60O500451	DEM	10/23/06	X	MITZI DEARING
ADDRESS :						
645 EL DORADO AVE 206		01S507170	DEM	10/23/06	X	SUSAN MARY DUFFY
ADDRESS :						
3768 HARRISON ST 307		01K609739	NP	9/14/99	*** ABSENTEE VOTER ***	RAYMOND KENNETH FARRIN
ADDRESS :						
561 EL DORADO AVE		67F450650	DEM	10/13/06	*** ABSENTEE VOTER ***	LAWRENCE WILLIAM FASANO
ADDRESS :						
Total : 11						

GENERAL ELECTION
TUESDAY, NOVEMBER 7, 2006

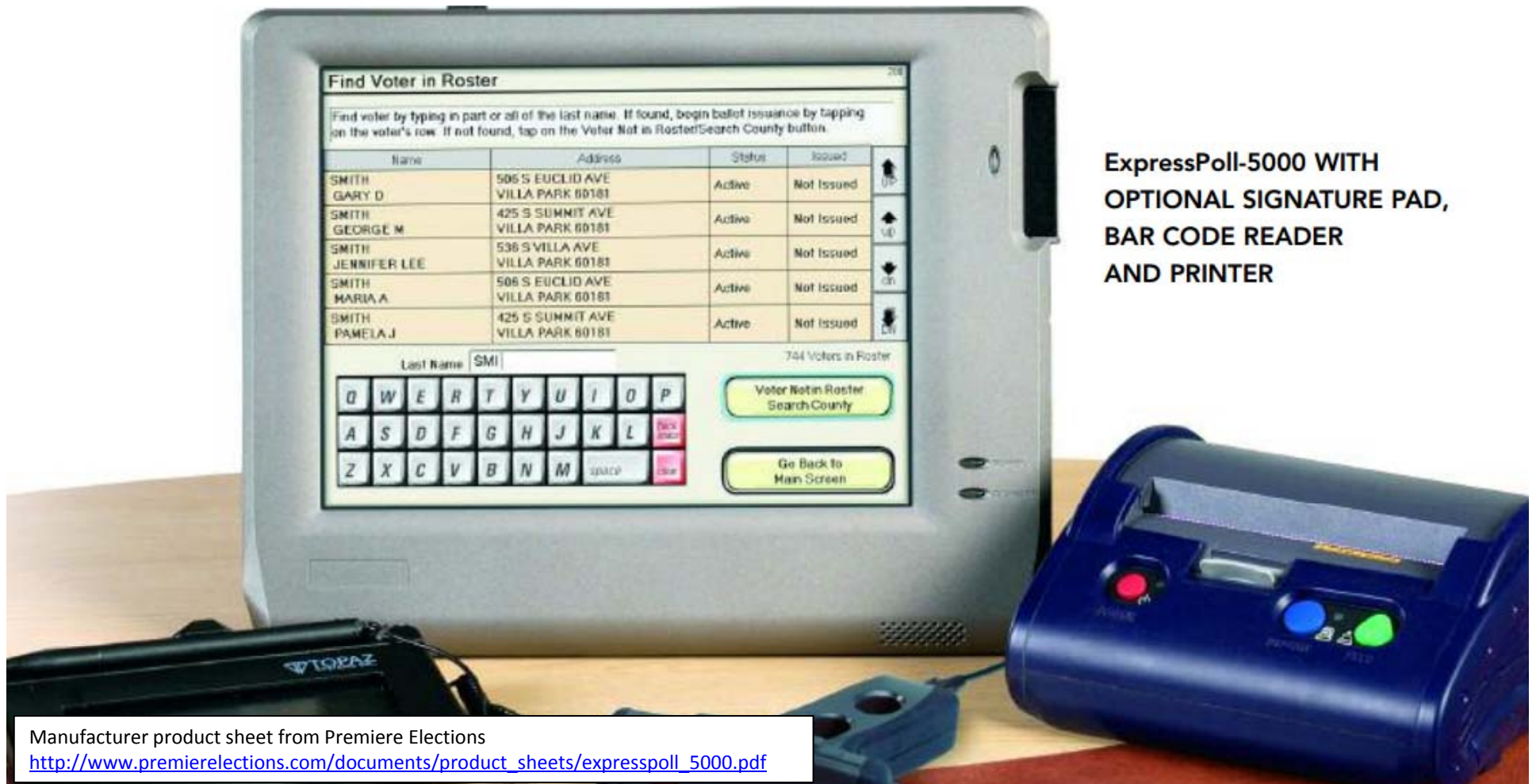
225400
THE HARRISON LOBBY
3933 HARRISON ST OAK
R711.05 Page 1 of 5

225400

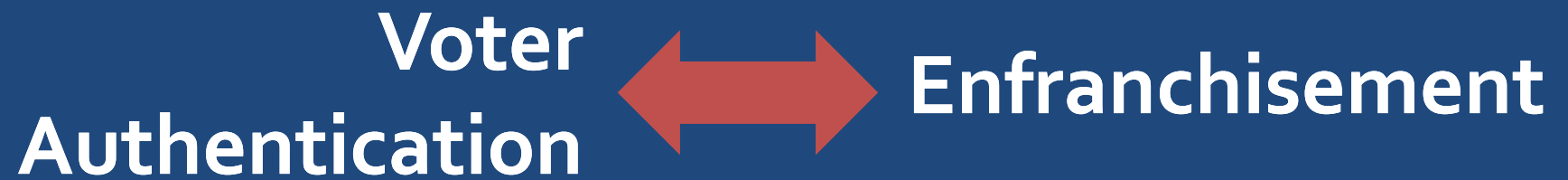
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O

Image by Joe Hall (Flickr user joebeone), licensed under a Creative Commons Attribution license, <http://www.flickr.com/photos/joebeone/292549434/>

5.2 Voter Authentication



VoterID?





I-D-UP.COM
www.i-d-up.com


=


REAL

**Scans+UV Ink+Identical Holo Overlay =
Best Fake ID Online You Can Buy!**

Home
Products
FAQs
Prices
Order
Contact Us

Best Fake ID Online
Templates and Finished Licenses



Close up look

You supply this:



We make you this:



See more close up work of our templates and printed licenses

Close up proof we produce the best fake id online.



CLICK IMAGES TO ENLARGE

We start with a real license and make the best cloned template with zero difference to a real license. We then make a clone of the hologram overlay for our supplier source to produce. We also laser-engage and perforate images for those states that have these features.



Image by Flickr user isafmedia, licensed under a Creative Commons Attribution 2.0 Generic license.
<http://www.flickr.com/photos/isafmedia/5007269322/in/photostream/>

Looking Ahead...

Guarding against Tampering



Between polling and counting



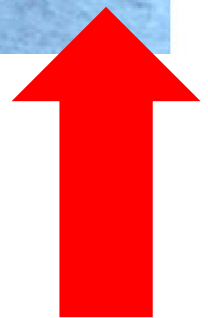
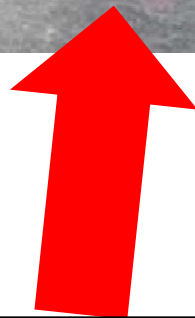
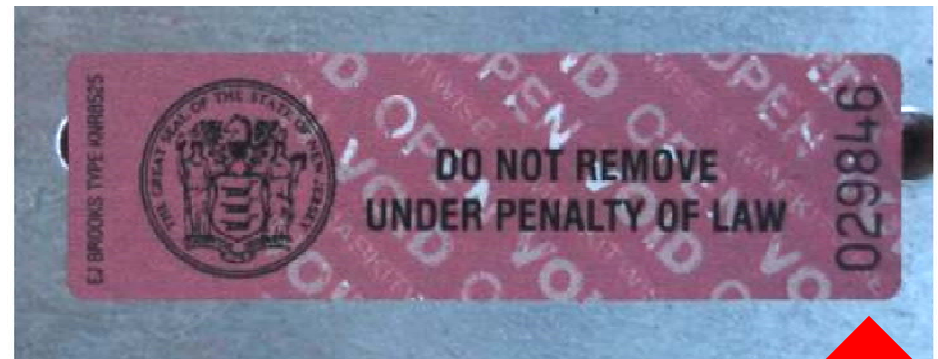
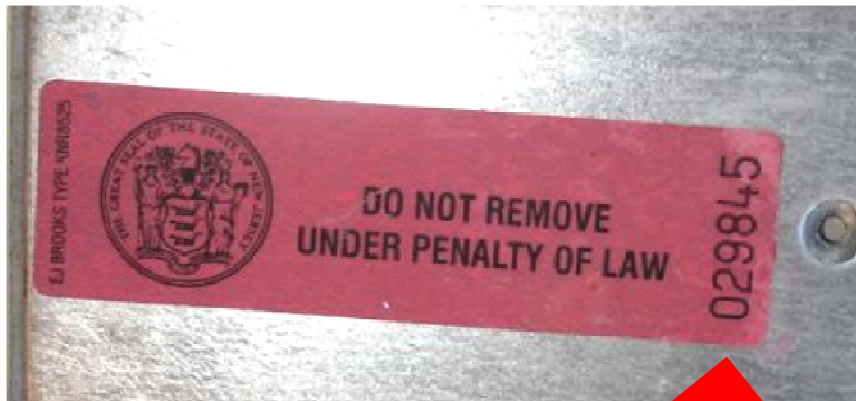
At all times!

5.3 Guarding Against Tampering



<http://www.cs.princeton.edu/~appel/voting/SealsOnVotingMachines.pdf>

Tamper-Evident Seals



<http://www.cs.princeton.edu/~appel/voting/SealsOnVotingMachines.pdf>

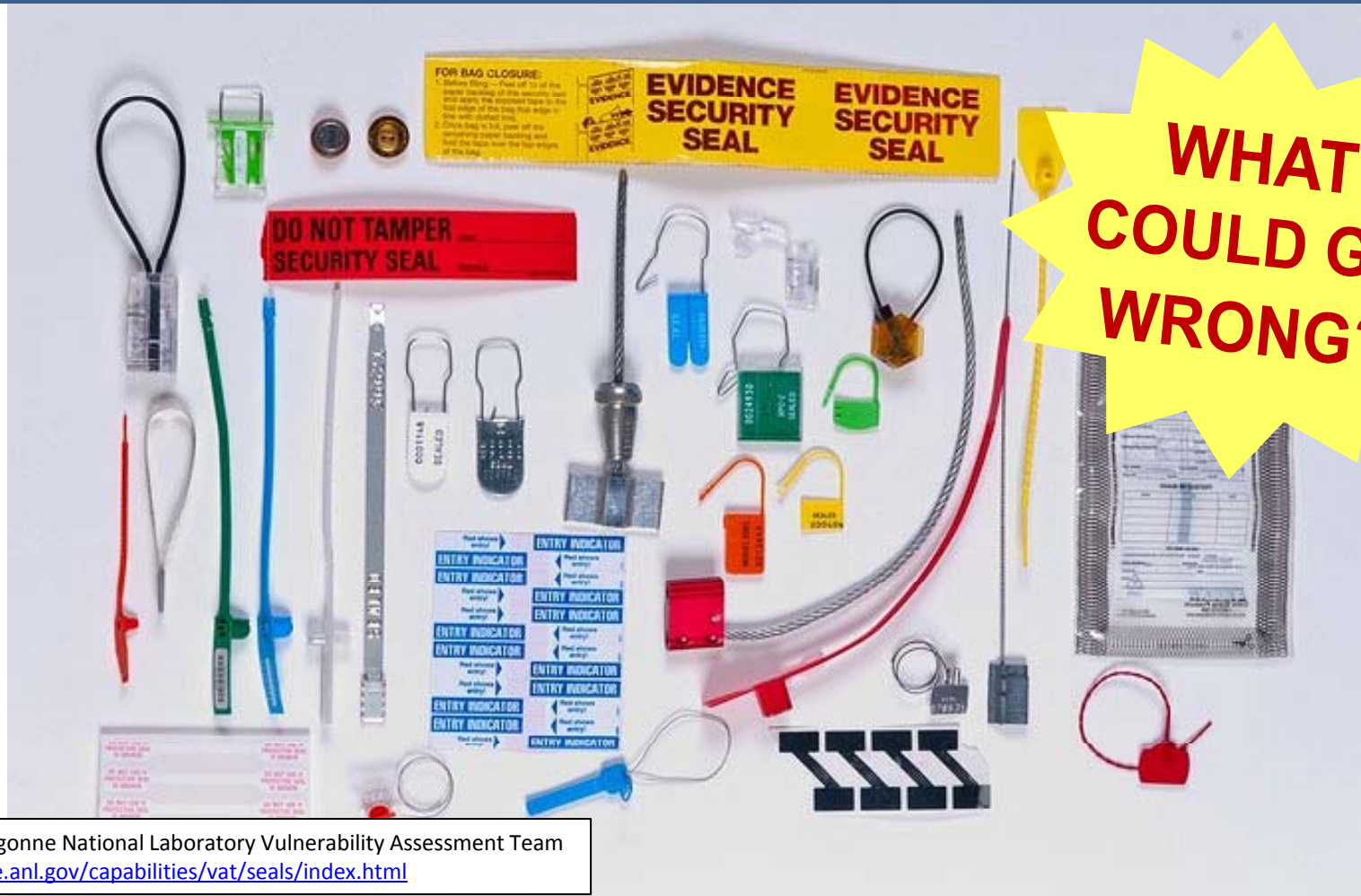


Image from Argonne National Laboratory Vulnerability Assessment Team
<http://www.ne.anl.gov/capabilities/vat/seals/index.html>



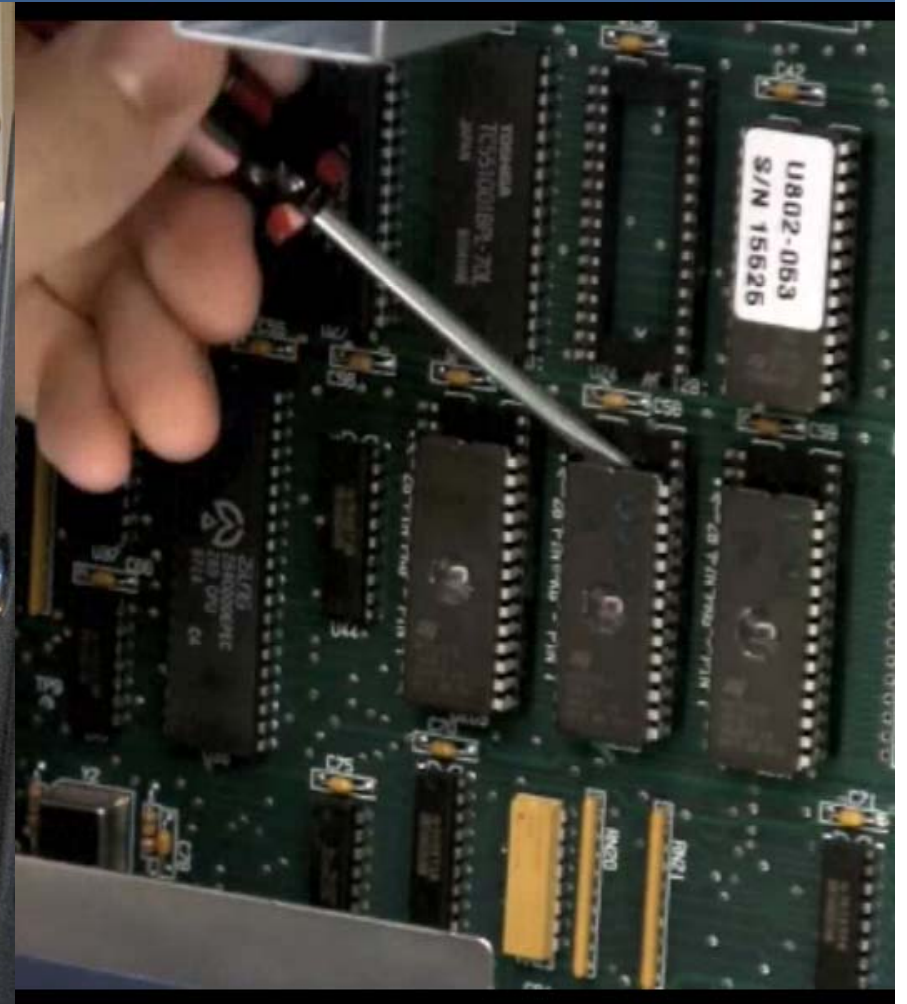
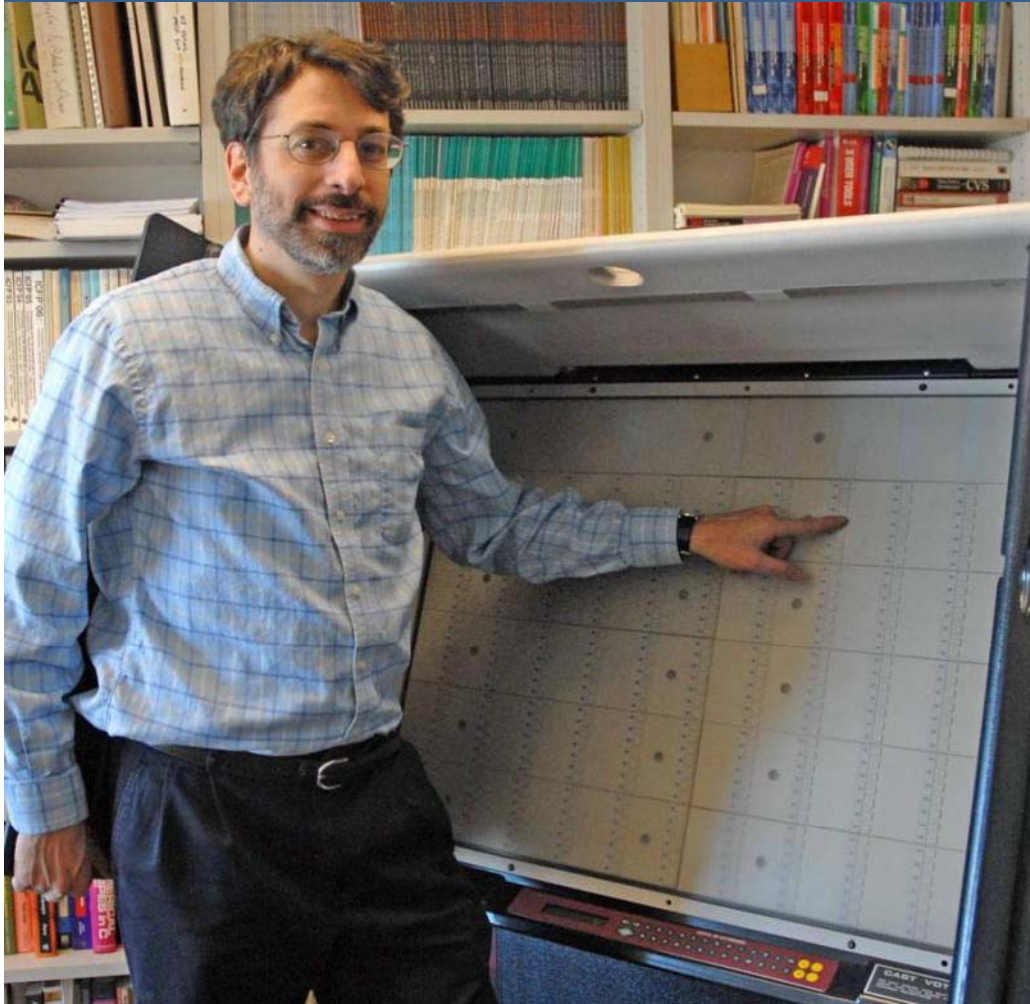
Results for 244 Seals

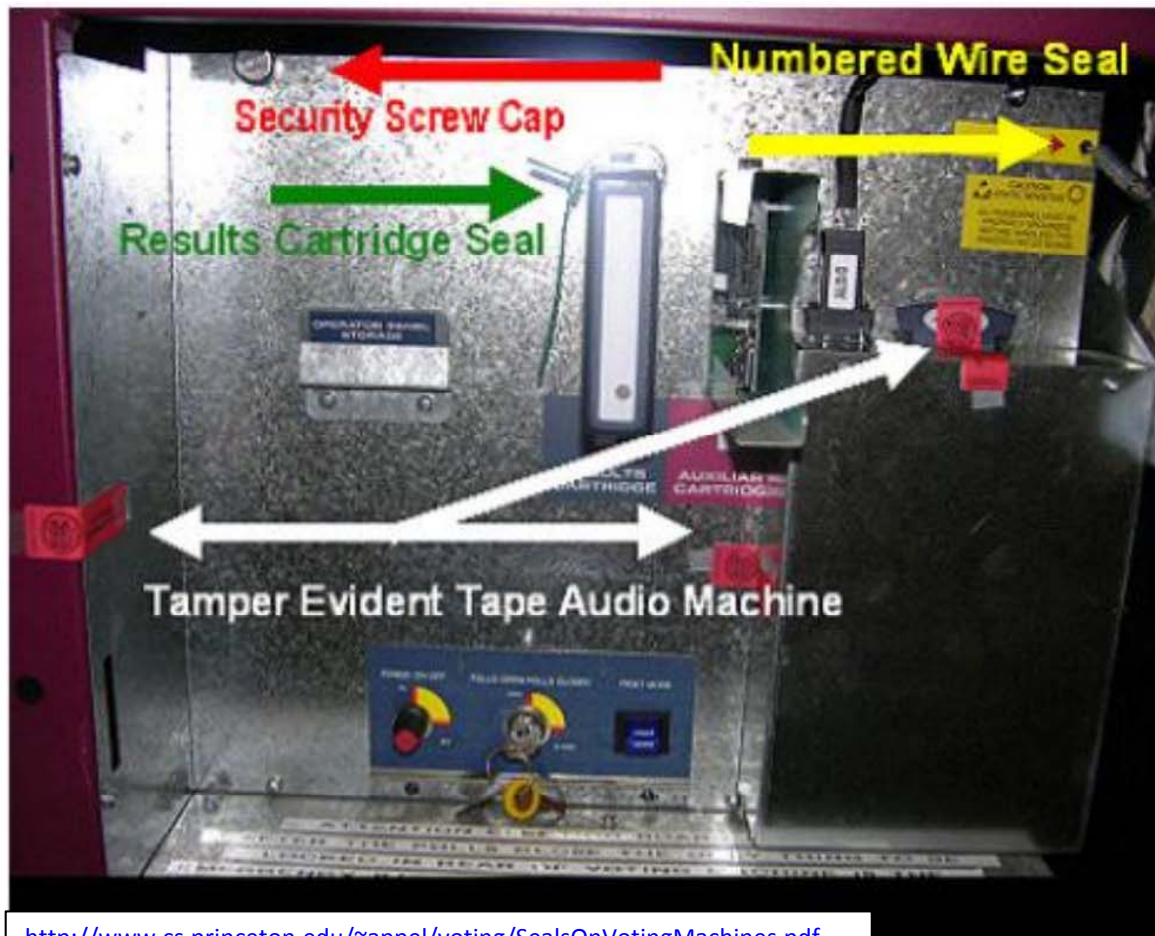
	Mean	Median
Defeat time for one person	1.4 mins	43 secs
Cost of tools/supplies	\$78	\$5
Cost per seal attacked	\$0.62	\$0.09
Time to devise successful attack	2.3 hrs	12 mins

(19% use or in consideration for nuclear safeguards!)

(left) Image from Argonne National Laboratory Vulnerability Assessment Team, <http://www.ne.anl.gov/capabilities/vat/seals/new.html>
(data) From Johnston et al., <http://www.ne.anl.gov/capabilities/vat/seals/index.html>

5.3 Guarding Against Tampering





<http://www.cs.princeton.edu/~appel/voting/SealsOnVotingMachines.pdf>

TECHNICIAN'S INSTRUCTIONS ALL MACHINES

Security Screw Cap (upper left hand corner) Insert screw into back of cap. Place numbered cap over screw. **Record number.**

Numbered wire seal (upper right hand corner) Insert numbered wire seal. Lock seal and remove excess wire. **Record number.**

Results cartridge seal – Insert plastic numbered seal. **Record number.**

AUDIO MACHINES

Tamper evident tape (3 pieces)

1. Left hand side-place a piece of tamper evident tape from the e-box to the metal shroud horizontally.

5.3 Guarding Against Tampering



Cup
Seal



<http://www.cs.princeton.edu/~appel/voting/SealsOnVotingMachines.pdf>

Padlock Seal



<http://www.cs.princeton.edu/~appel/voting/SealsOnVotingMachines.pdf>

5.3 Guarding Against Tampering



Tape
Seals



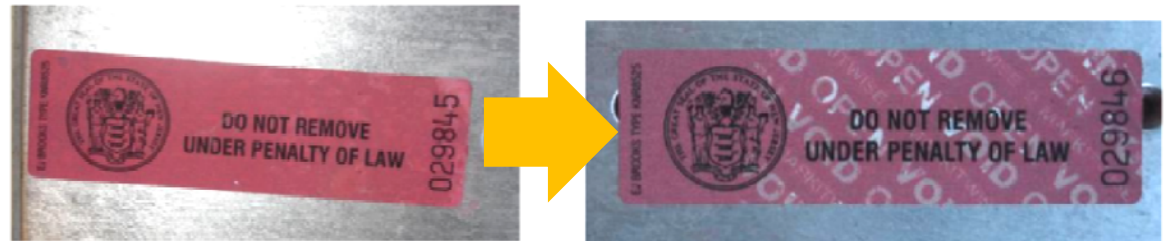
<http://www.cs.princeton.edu/~appel/voting/SealsOnVotingMachines.pdf>

Evaluating a Seal Protocol

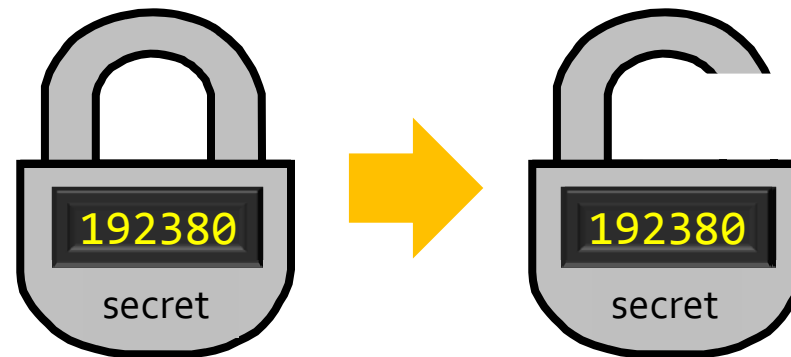
- ✓ Is the seal going to be in place when the attacker has access?
- ✓ Does the seal actually need to be removed to get in?
- ✓ Can the attack just remove it temporarily without leaving evidence?
- ✓ Can the attack replace it with a new seal without leaving evidence?
- ✓ Do election officials properly record seal numbers for each machine?
- ✓ Do election officials properly check the seal numbers later?
- ✓ Do officials inspect for evidence of tampering?
- ✓ If anomalies are detected, are they recorded and reported?
- ✓ Is appropriate action taken?



Old way: Evidence



New idea: "Anti-evidence"



Field Testing

5.4 Field Testing



Logic & Accuracy Testing

Pre-Election Testing Mode

Election

Steal This Election

Vote Center

Princeton Vote Center

Unit Version Copy Count

Test Count	Reporting	Clear Totals
View Ballot Results	Transfer Results	Set For Election
Create Voter Cards	Accumulator	Supervisor Functions

System Information

SN System Total



**Parallel
Testing**



What if problems are found?

Automated Analysis of Election Audit Logs

Patrick Baxter
Clemson University

Anne Edmundson
Cornell University

Keishla Ortiz
University of Puerto Rico-Arecibo

Ana Maria Quevedo
Miami Dade College

Samuel Rodríguez
University of Puerto Rico-Mayagüez

Cynthia Sturton
University of California-Berkeley

David Wagner
University of California-Berkeley

Abstract

The voting audit logs produced by electronic voting systems contain data that could be useful for uncovering procedural errors and election anomalies, but they are currently unwieldy and difficult for election officials to use in post-election audits. In this work, we develop new methods to analyze these audit logs for the detection of both procedural errors and system deficiencies. Our methods can be used to detect votes that were not included in the final tally, machines that may have ex-

In the November 2010 U.S. elections, 33% of registered voters were using Direct Recording Electronic (DRE) voting machines [22]. Federal standards require that electronic voting machines generate detailed audit logs for use during post-election audits. Unfortunately, while the logs contain large amounts of data, it is not immediately obvious what sort of useful information can be learned from the data. Furthermore, even simple tallies are cumbersome, time consuming, and prone to human error if done manually. For these reasons, election officials do not regularly perform countywide post-election audits. However, log data contain a trove of information that

<https://www.usenix.org/conference/evtvote12/automated-analysis-election-audit-logs>

Human Factors

Tracking Problems

Securing Digital Democracy

Lecture 5 | *Security Procedures*



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