



# Online Voting in Ontario's Municipal Elections

A Conflict of Legal Principles and Technology?

Aleksander Essex

Anthony Cardillo  
Nicholas Akinyokun



Ontario in 2018 saw 2-4 times more online ballots cast than Estonia in 2019

# Online voting security research

Online voting has no device you can buy and reverse engineer

What can we do?



# Municipal Elections Act

- Strict procedures for paper ballots
- Strict procedures for ranked-choice voting
- “Alternative voting methods”
  - Basically whatever you want
- No standards, guidance, best practices
- Cities make their own decisions about online voting, often *only* in consulting vendors

# Legal Principles\*

- **Ballot secrecy.** The secrecy and confidentiality of the voting process is paramount,
- **Fairness.** The election shall be fair and non-biased. Voters and candidates shall be treated fairly and consistently,
- **Accessibility.** The election shall be accessible to the voters,
- **Integrity.** The integrity of the voting process shall be maintained through out the election,
- **Certainty.** There is to be certainty that the results of the election reflect the votes cast,
- **Eligibility.** Valid votes are counted and invalid votes are rejected

\*Not actually in the Act

Who's using online voting?

# Ontario Municipalities

Canada

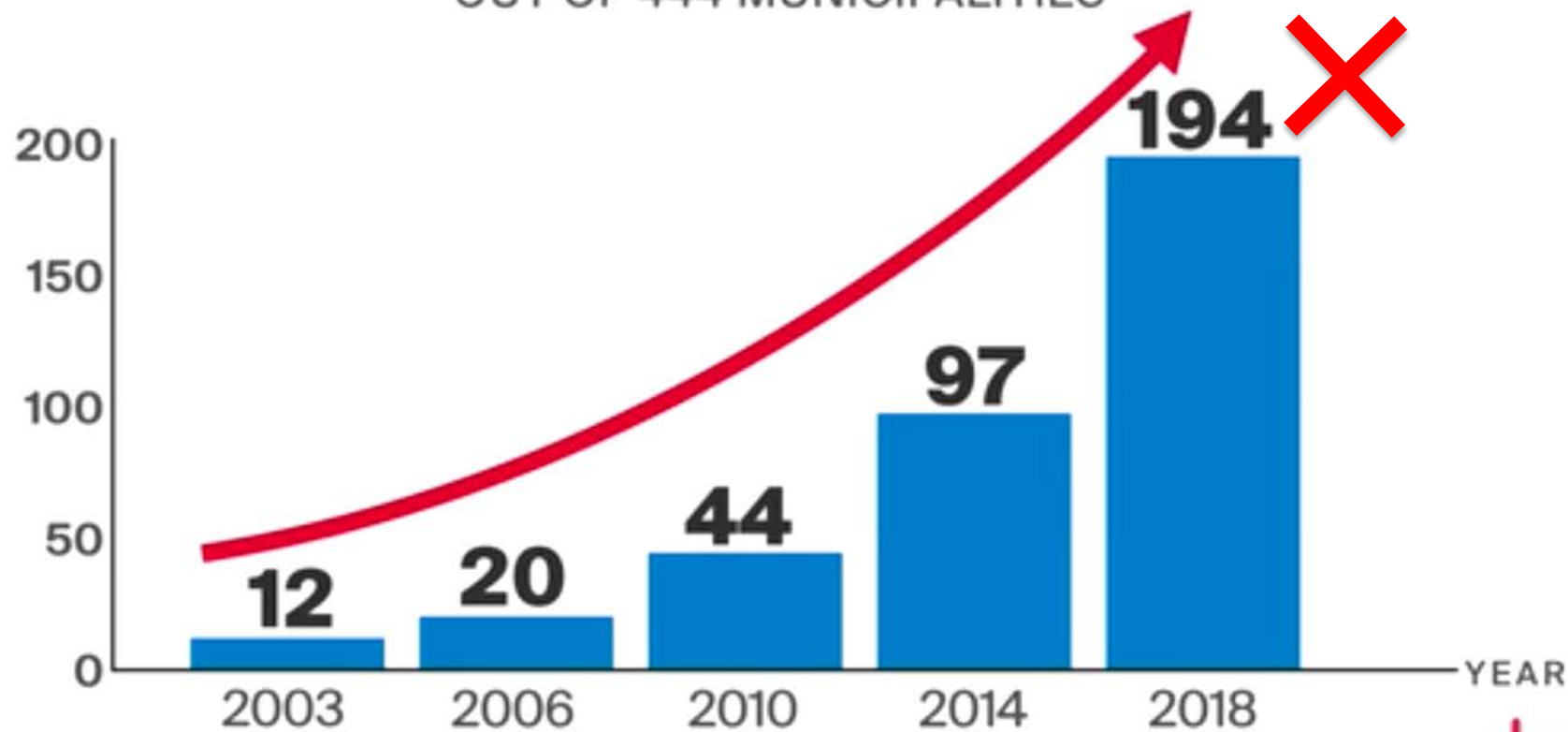
## Scytl Online Voting



During the 2018 Ontario Municipal Elections, 103 municipalities including the City of Markham and the Town of Newmarket, leveraged Scytl's online & phone voting technology, enabling over 1 million eligible voters to securely cast their votes electronically, ensuring the efficient, timely and transparent publication of the final results within less than 10 minutes (on average) after the closing of the polling stations. Scytl's technology was used by over 50% of the municipalities opting for electronic voting in this election. Scytl also provided its technology in the previous 2014 Municipal Elections, experiencing from 2014 to 2018 an increase of online voting adoption over 100% among municipalities in Ontario.

# ONTARIO MUNICIPALITIES OFFERING ONLINE VOTING

OUT OF 444 MUNICIPALITIES



Source: Intellivote Systems Inc.

tvo





For Immediate Release  
October 22, 2018

## Dominion Voting Statement Regarding Internet Voting Service Slowdown Affecting Ontario Municipalities

**(TORONTO, ON)** - Dominion Voting Systems has issued the following statement regarding today's Internet Voting Service slowdown affecting Ontario Municipal election customers:

Just after 6:00 PM ET this evening, voters in approximately 51 Ontario Municipalities using Dominion's Internet Voting (IV) portal experienced slow traffic into the system. This load issue was documented, reviewed and determined to be the result of a Toronto-based Internet Colocation provider placing an unauthorized limit on incoming voting traffic that was roughly 1/10th of the system's designated bandwidth. Our company was unaware of this issue until our municipal customers and their voters reached out to us for assistance, or to share complaints.

“The Ministry does not have a list of who will be using internet voting in the 2018 election.

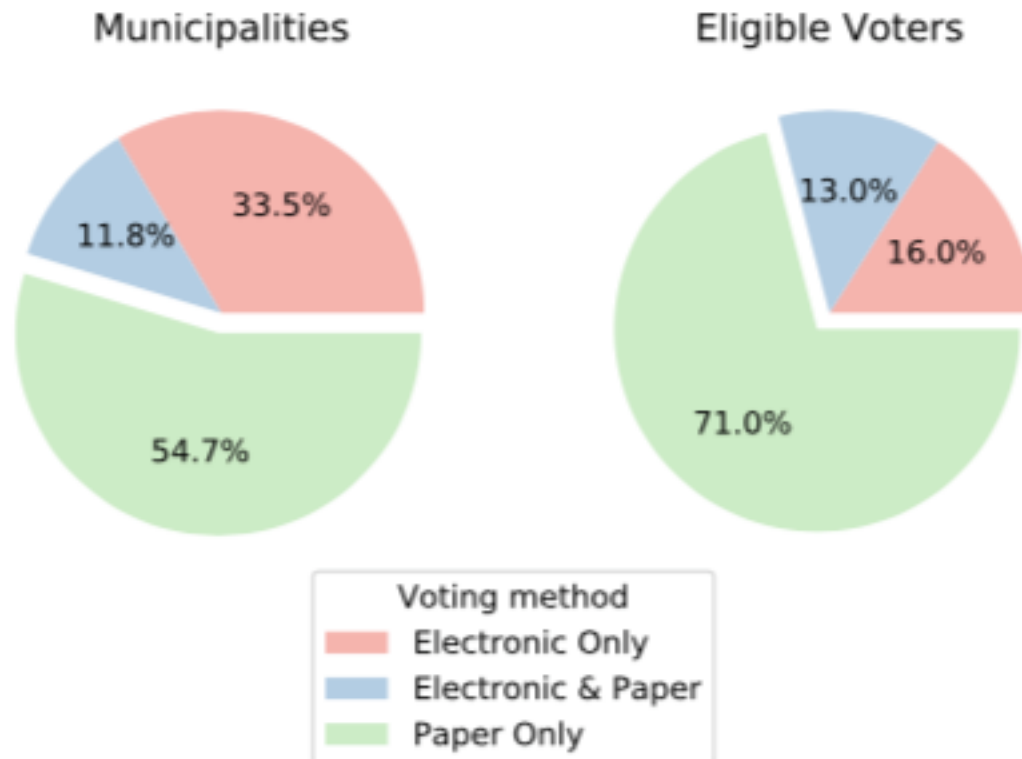
Municipal Affairs and Housing





So we did it the hard way

- Create list of Ontario municipalities
  - Found and reported errors in Municipal Affairs' list
- Figure out which cities worked with which vendor
  - RegEx, DNS lookups, banners, certificate transparency logs
  - Manual web search of municipal docs
- Verify
  - Acclaimed contests: website but no election
  - Anticipatory election websites: city went with different vendor
- Combined with AMO's population data
  - Found and reported errors in AMO's list



Voting method	Municipalities		Eligible Voters	
Electronic ballot only	131	(33.5%)	1,512,076	(16.0%)
Electronic and paper	46	(11.8%)	1,230,019	(13.0%)
Paper ballot only	214	(54.7%)	6,702,533	(71.0%)
<b>Total</b>	<b>391</b>		<b>9,444,628</b>	

Table 1: Voting methods offered in the 2018 Ontario municipal election.

Disaster preparedness

## Why communities need an online voting disaster plan



Why online voting should come with a disaster plan 0:46

Essex said while most cities have plans in place for tornadoes or floods, none of the communities he's spoken to have a plan in case an election is derailed because of electronic abnormalities.

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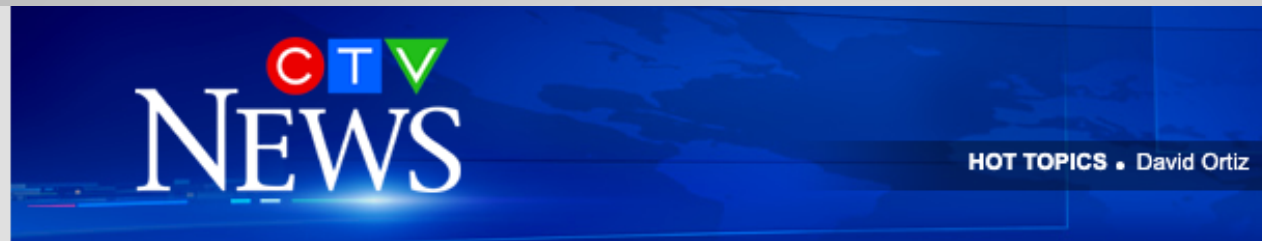


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“I don’t have a disaster plan right now”

“We’re hoping nothing does happen”



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## Online election snafus in dozens of Ontario communities raise systemic questions

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LIVE EVENT June 9, 2019 WATCH LIVE: The Golden State Warriors take the court for practice ahead of

**POLITICS** October 23, 2018 2:07 pm Updated: October 24, 2018 12:02 pm

## Online voting in 51 Ontario municipalities marred by election-day 'system load issue'

 **CityNews** LOCAL VIDEO CONTACT US 🔍

## Online voting systems delay election results across Ontario



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## Online voting causes headaches in 51 Ontario cities and towns

DOMINION  
VOTING



For Immediate Release  
October 22, 2018

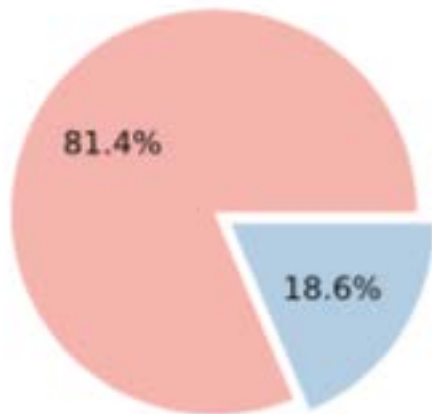
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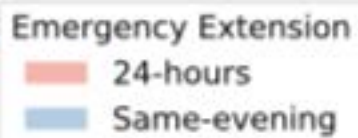
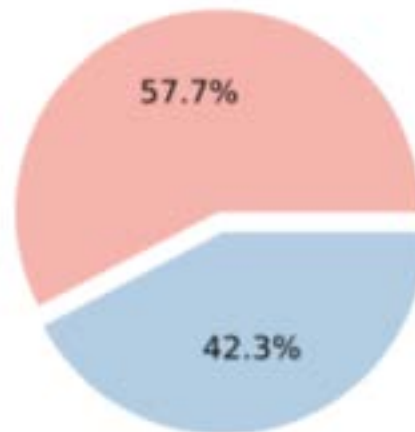
Just after 6:00 PM ET this evening, voters in approximately 51 Ontario Municipalities using Dominion's Internet Voting (IV) portal experienced slow traffic into the system. This load issue was documented, reviewed and determined to be the result of a Toronto-based Internet Colocation provider placing an unauthorized limit on incoming voting traffic that was roughly 1/10th of the system's designated bandwidth. Our company was unaware of this issue until our municipal customers and their voters reached out to us for assistance, or to share complaints.

Dominion eventually identified the problem to be a restrictive bandwidth limit placed on incoming traffic for Dominion's data centre by an external internet service provider. It was later determined that the slowdown and timeout issues were caused by a miscommunication between Dominion and the service provider regarding the port bandwidth and the limits placed upon it. The bandwidth requested by Dominion was 1Gbs; however, it was revealed that this was mistakenly taken by the service provider to be the upper potential bandwidth limit not the continuous bandwidth standard. During the slowdown of the system the bandwidth limit was set to only 100 Mbs, which Dominion indicated was approximately only half of the expected peak requirement.

Municipalities



Eligible Voters



Emergency Extension	Municipalities	Eligible Voters
24-hour extension	35	575,022
Same-evening extension	8	422,085
Total	43	997,107

Table 3: Emergency extensions due to Dominion’s election night slowdown

Voter authentication

# Voter Authentication

Vendor	Primary factor (mailed)	Second factor
Dominion	13-digit ID & 8-digit PIN	Date of birth
Intelivote	16-digit PIN	Date of birth
Scytl	16-digit PIN	Date of birth
Simply Voting	9-digit PIN	Date of birth



## Voter Information Package (VIP)

John Sample  
123 Main Street  
Markham, ON  
A1B 2C3

Ward: 1  
School Support: EP

### VOTING DAYS

**Start:** Oct. 12, 2018 | 10 AM EDT  
**End:** Oct. 22, 2018 | 8 PM EDT

### ONLINE VOTING PIN

**1111 2222 3333 4444**



## HOW DO I VOTE ONLINE?

- Vote anywhere, anytime from a computer or mobile device during Voting Days
- Make sure you have the most current internet browser for your operating system
- Log on to **anytown.election.ca** using your Online Voting PIN and date of birth
- Cast your ballot



### WHAT OFFICES AM I VOTING FOR?

- Mayor
- Regional Councillor
- Ward Councillor
- York Region District School Board Trustee
- York Catholic District School Board Trustee
- Conseil scolaire Viamonde Trustee
- Conseil scolaire catholique MonAvenir Trustee

See other side for  
more information





## Login

Personal Identification Number (PIN)

Date of Birth

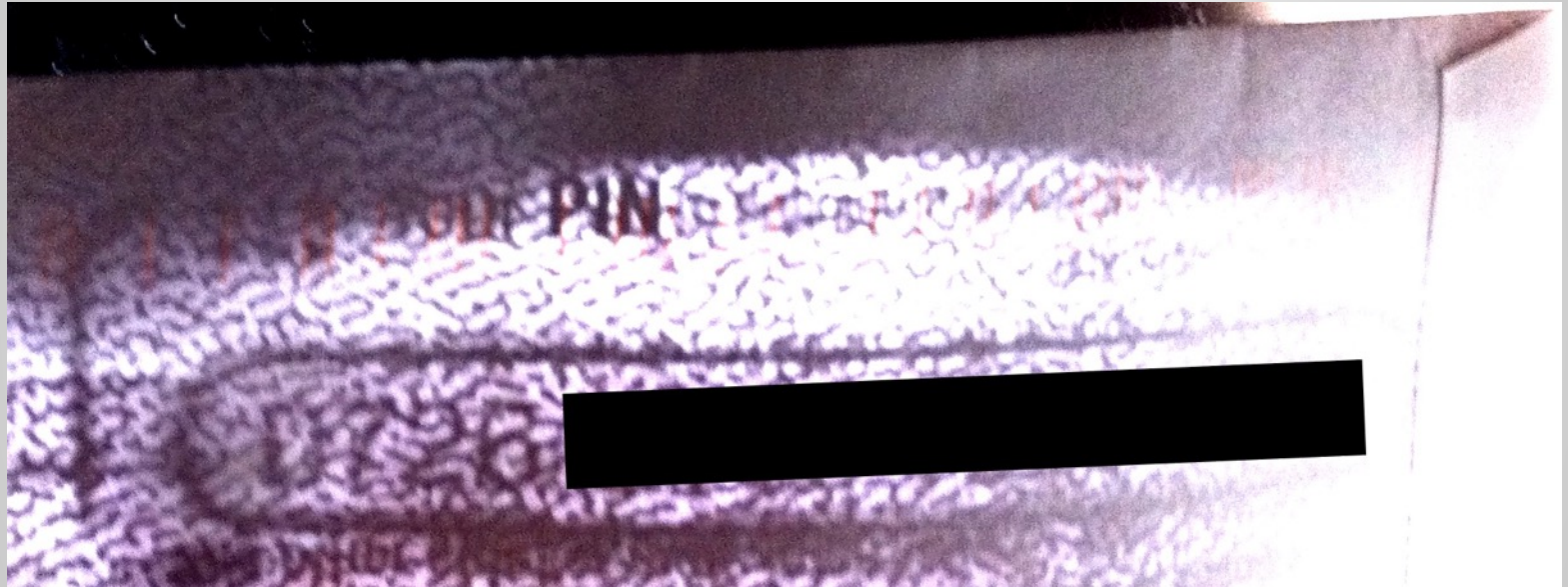
  

For example 01 31 1978

I'm not a robot  [Privacy](#) - [Terms](#)

Login





Toronto

## Dead dog registered to cast vote in upcoming Mono, Ont. election



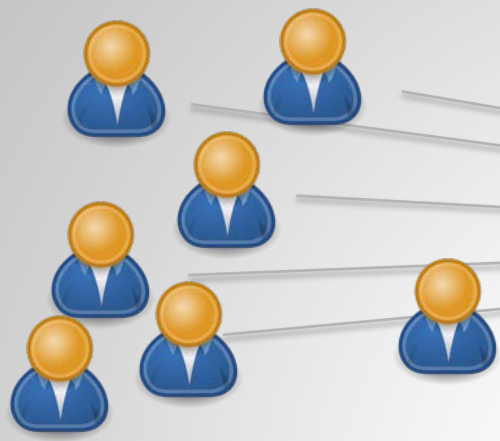
Cookie had been gone four years when she was given the chance to participate in local democracy

CBC News · Posted: Oct 11, 2018 5:50 PM ET | Last Updated: October 11, 2018



Results transparency

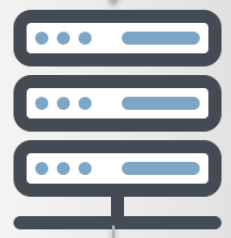
Voters



Cast ballots



Network/cloud infrastructure



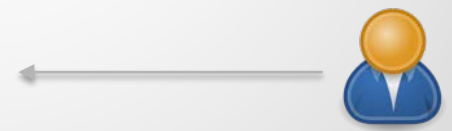
Election server

Vote totals



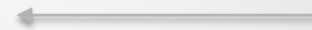
Official results

Election official





Official results



Election official

# What the voter sees



### Internal Threat Sources:

- **Legitimate Voters**: Legitimate voters have a limited level of access to voting system equipment. That is, each voter is allowed to submit registration information, obtain the proper ballot given their registration status, and cast a single ballot. Voters may, for example, attempt to use or expand their authorized level of access to damage the election system, change the results of the election, or harm the credibility of the election results.
- **Election Officials**: Election officials have a significant level of access to data on voting system equipment. They are users of the election system with access to voter and ballot information, but may not be authorized system administrators. However, while election officials may be restricted from certain administrative functions, such as software installation, they often have relatively unrestricted physical access to voting system equipment. Malicious election officials could use their privileged access to voting systems to exploit the system.
- **System Operators**: While election officials are users of an election system, system operators serve as administrators, ensuring that the systems function properly or seeing that vital operations are fulfilled. System operators may administer the election system directly, or they may administer the supporting infrastructure for the election. For example, postal mail employees, including mail carriers and sorters, would be system operators in elections which use the postal mail as a communications medium. Network technicians at major telephone companies or Internet Service Providers (ISPs) would be examples of system operators when the telephone network or the Internet is used. In all cases system operators have a privileged level of access to equipment that is vital to conducting the election.
- **Other insiders**: Other individuals or organizations may have privileged access to voting system equipment, either before, during or after an election is conducted. For example:
  - Voting System Manufacturers
  - Voting System Integrators
  - Support staff

# Judge reserves decision in Lambton Shores election case

A lawyer for six Lambton Shores voters and unsuccessful candidates argued in a Sarnia court Friday that October's council election in the municipality should be annulled and a new vote held.



Paul Morden

[More from Paul Morden](#)

Published on: May 31, 2019 | Last Updated: May 31, 2019 5:27 PM EDT

E HONDA

## Lambton Shores' election challenged in court

A group of voters and unsuccessful candidates have gone to court seeking to annul October's municipal council election results in Lambton Shores.



*(From left to right) Dianne Russell, Jordy Speake, John Russell, Gayle MacGregor, Doug Bonesteel, and Scott MacGregor outside the Sarnia courthouse. February 28, 2019. (Photo by Colin Gowdy, BlackburnNews)*

## Date set for legal challenge of Lambton Shores election

BY COLIN GOWDY

FEBRUARY 28, 2019 1:44PM

@CGowdyCHOK



# Where is the...?

- Public demonstration system
- Public intrusion test
- Source code
- Minimum cybersecurity standards
- Privacy impact assessment
- Disaster / cyber-incident response plans
- ISO 27001 certification
- Security protocol specification and security proofs
- Penetration testing report
- System auditor report
- Justification that scrutineering is non-trivial
- Evidence the vote totals are free from modification or error

Ballot secrecy



## Security Overview

Simply Voting Inc. will be providing the Internet and Telephone Voting System for the 2018 Ontario Municipal Elections. The Simply Voting system is secure and protects the secrecy of your vote.

### ***Secret Ballot***

Whether you use the internet or telephone to vote, your vote is instantly encrypted and stored with no possibility of your vote being traced back to your identity, just like a traditional paper ballot.

It is impossible for municipal staff, Simply Voting employees or any other person to see how you have voted. Election officials will only be able to see that you cast your vote, the time you voted and the IP address or telephone number you voted from.

# How Secret is your Date of Birth?

LAST_NAME	FIRST_NAME	DATE_OF_BIRTH	RESIDENTIAL_ADDRESS1	RESIDENTIAL_CITY
JONES	AARON	1989-12-05	102 FIFTH ST E	SYCAMORE
ROTELLA	BRENDA	1961-04-14	5763 COUNTY HWY 37	UPPER SANDUSKY
PARSELL	MATTHEW	1982-11-05	15495 COUNTY HWY 47	WHARTON
BILLER	CHRISTY	1968-11-12	5210 TOWNSHIP HWY 51	UPPER SANDUSKY
WOODARD	LAURA	1960-11-02	12351 TOWNSHIP HWY 103	UPPER SANDUSKY
SNYDERCLINTON		1986-05-08	15936 TOWNSHIP HWY 10	NEVADA
OPPER	JOSHUA	1988-03-21	208 FRANKLIN ST E	WHARTON
MILLER CYNTHIA		1955-08-16	335 EIGHTH ST S	UPPER SANDUSKY
LUMAN CHRISTOPH		1975-04-15	532 WEST ST	CAREY
ROW	ROSCOE	1959-07-11	2758 TOWNSHIP HWY 88	CAREY
REINHART	RICHARD	1932-10-05	131 HIGH ST	CAREY
GOTTFRIED	RONALD	1951-02-07	12079 TOWNSHIP HWY 49	UPPER SANDUSKY
BURROUGHS	RICHARD	1969-09-19	810 FINDLAY ST E	CAREY
STONE	JAMES	1976-10-17	201 CENTER ST W	NEVADA
FRISCH BRIAN		1973-10-13	8827 COUNTY HWY 96	UPPER SANDUSKY
PAGNARD	REX	1971-05-14	14895 COUNTY HWY 113	UPPER SANDUSKY
SCHREINER	AMY	1964-08-21	3145 TOWNSHIP HWY 87	CAREY
OHLEL MICHELLE		1967-04-09	12068 COUNTY HWY 64	UPPER SANDUSKY
UNDERWOO	MARK	1967-10-23	9860 STATE HWY 103	CAREY

Less than  $2^{15}$  unique dates of birth. About 14 bits of Shannon entropy.  
Comparable to a 4 digit PIN or a 2 character password.

Overview	Contents	Summary	Chart	Notes
Name	Value			
token	60b1924a0c6c1451551513307e7f8284			
auth_2nd_year	1920			
auth_2nd_month	1			
auth_2nd_day	01			
auth_pwd	123456781234			

In a single web session the election server sees your:

- Jurisdiction (in URL)
- Date of birth (at login)
- Ballot selections (POSTed at cast time)

How unique is your  
date of birth *and*  
jurisdiction?

# Ballot Secrecy

Vendor	Eligible Voters	$k = 1$		$k = 5$	
		Max Affected	% of Eligible	Max Affected	% of Eligible
Dominion	1,323,194	531,758	(40.2%)	1,181,876	(89.3%)
Intelivote	917,733	631,098	(68.8%)	902,177	(98.3%)
Simply Voting	304,479	190,097	(62.4%)	294,912	(96.9%)
Scytl	196,689	15,781	(8.0%)	69,411	(35.3%)
Total	2,742,095	1,368,734	(49.9%)	2,448,376	(89.3%)

# Conclusion

- Date of birth is as a login credential is:
  - Weak in the best case
  - Useless in many cases
  - Cannot be changed
  - In many cases leads to voter re-identification and loss of ballot secrecy



Thank-you

@aleksessex