Access Control and Privacy Policies (4)

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Slides:	KEATS (also homework is there)

Unix-Style Access Control

- Q: “I am using Windows. Why should I care?”
  A: In Windows you have similar groups:
  - administrators group
    (has complete control over the machine)
  - authenticated users
  - server operators
  - power users
  - network configuration operators
- Modern versions of Windows have more fine-grained AC than Unix; they do not have a setuid bit, but have `runas` (asks for a password).

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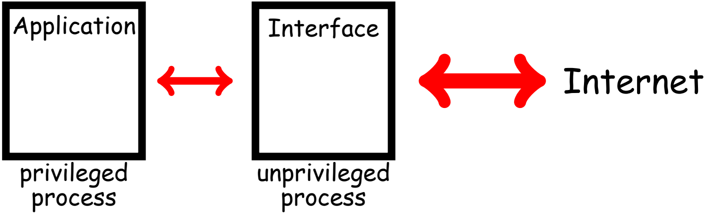
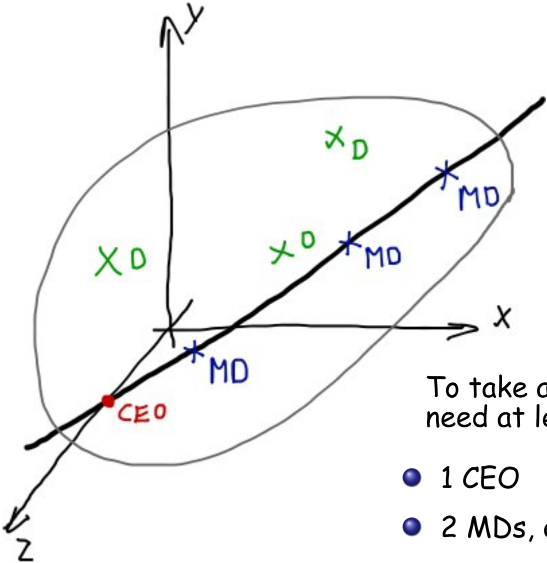
- Modern versions of Windows have more fine-grained AC than Unix; they do not have a setuid bit, but have `runas` (asks for a password).
- OS provided access control can add to your security.

Network Applications: Privilege Separation



- the idea is make the attack surface smaller and mitigate the consequences of an attack

Shared Access Control



To take an action you need at least either:

- 1 CEO
- 2 MDs, or
- 3 Ds

Lessons from Access Control

Not just restricted to Unix:

- if you have too many roles (i.e. too finegrained AC), then hierarchy is too complex
  you invite situations like. . . let's be root

- you can still abuse the system. . .

A “Cron”-Attack

The idea is to trick a privileged person to do something on your behalf:

- root:

  ```
  rm /tmp/*/*
  ```

A "Cron"-Attack

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  ```
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  ```

  the shell behind the scenes:

  rm /tmp/dir$_1$/file$_1$ /tmp/dir$_1$/file$_2$ /tmp/dir$_2$/file$_1$ ...

  this takes time

A “Cron”-Attack

1. attacker (creates a fake passwd file)
   ```
   mkdir /tmp/a; cat > /tmp/a/passwd
   ```
2. root (does the daily cleaning)
   ```
   rm /tmp/*/*
   ```
   records that /tmp/a/passwd
   should be deleted, but does not do it yet
3. attacker (meanwhile deletes the fake passwd file, and establishes a link to the real passwd file)
   ```
   rm /tmp/a/passwd; rmdir /tmp/a;
   ln -s /etc /tmp/a
   ```
4. root now deletes the real passwd file

A “Cron”-Attack

1. **attacker** (creates a fake passwd file)

   ```
   mkdir /tmp/a; cat > /tmp/a/passwd
   ```

2. ro

   ```
   rr
   ```

   To prevent this kind of attack, you need additional policies (don’t do such operations as root).

   should be deleted, but does not do it yet

3. **attacker** (meanwhile deletes the fake passwd file, and establishes a link to the real passwd file)

   ```
   rm /tmp/a/passwd; rmdir /tmp/a;
   ln -s /etc /tmp/a
   ```

4. root now deletes the real passwd file

Schneier Analysis

There is no absolutely secure system and security almost never comes for free.

- What assets are you trying to protect?
- What are the risks to these assets?
- How well does the security solution mitigate those risks?
- What other risks does the security solution cause?
- What costs and trade-offs does the security solution impose?

Example: Credit Cards

You might have the policy of not typing in your credit card online. Worthwhile or not?

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- What assets are you trying to protect?

  your credit card number

Example: Credit Cards

You might have the policy of not typing in your credit card online. Worthwhile or not?

- What assets are you trying to protect?
- What are the risks to these assets?

  With credit cards you loose a fixed amount £50. Amazon £50.

Example: Credit Cards

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- What assets are you trying to protect?
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- How well does the security solution mitigate those risks?

  Well, hackers steal credit cards from databases. They usually do not attack you individually.

Example: Credit Cards

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- What assets are you trying to protect?
- What are the risks to these assets?
- How well does the security solution mitigate those risks?
- What other risks does the security solution cause?

    None (?)

Example: Credit Cards

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Internet shopping is convenient and sometimes cheaper.

Example: Credit Cards

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- What assets are you trying to protect?
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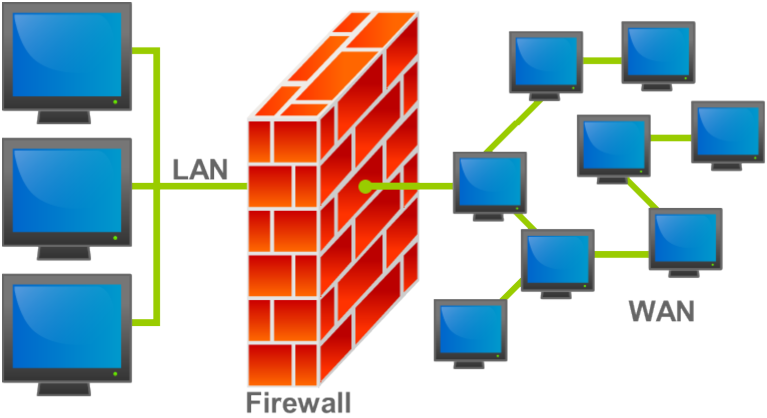
  No!

Example: Firewall



A firewall is a piece of software that controls incoming and outgoing traffic according to some rules.

Example: Firewall

- What assets are you trying to protect?
  Whatever is behind the firewall (credit cards, passwords, blueprints, ...)

Example: Firewall

- What assets are you trying to protect?
- What are the risks to these assets?

  With a small online shop you are already at risk. Pentagon, definitely.

Example: Firewall

- What assets are you trying to protect?
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- How well does the security solution mitigate those risks?

  Well, at home so not much. Everywhere else, if properly configurated then it does.

Example: Firewall

- What assets are you trying to protect?
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  There might be backdoors or bugs in the firewall, but generally they are secure. You choose to prevent certain traffic.

Example: Firewall

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  Minimal to modest. Firewalls are part of free software. You need a knowledgeable person to set them up.

Example: Firewall

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  Yes!

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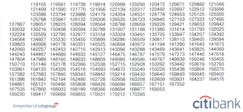
Google uses nowadays two-factor authentication. But it is an old(er) idea. It is used for example in Germany and Netherlands for online transactions.



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	121409	121590	121770	121956	122139	122317	122492	122697	122912	123096
	123596	123794	123988	124179	124354	124531	124778	124953	125125	125300
	125768	125947	126132	126306	126535	126723	126945	127153	127323	127495
127867	128051	128225	128394	128564	128766	128959	129226	129421	129653	129842
130032	130216	130408	130594	130789	131007	131198	131380	131614	131793	132025
132224	132529	132795	132977	133154	133324	133491	133705	133947	134207	134392
134564	134927	135230	135450	135899	136286	136509	136817	138113	139405	139594
139823	140006	140178	140351	140525	140694	140972	141194	141380	141643	141873
142060	142257	142453	142715	142913	143096	143288	143469	143641	143825	144069
144243	144497	144689	144933	145127	146475	146787	147079	147273	147446	147618
147804	147989	148160	148633	148809	149085	149586	149767	149939	150246	150455
150710	151146	152178	152366	152538	152715	152908	153262	153442	153619	153793
153961	154133	154329	154519	154693	154872	155049	155226	155438	155804	156370
157382	157583	157840	158343	158842	159214	159430	159640	159843	160045	160402
161386	161843	162194	162480	162728	162958	163208	163609	163931	164237	164576
164861	165121	165466	165808	166426	166699	166957	167151	167352		
167535	167800	168003	168189	168366	168694	168877	169053			
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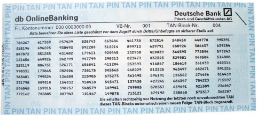

PIN TAN PIN TAN PIN TAN PIN TAN PIN TAN PIN TAN PIN TAN PIN TAN PIN

db OnlineBanking

Deutsche Bank
Privat- und Geschäftskunden AG

Fil. Kontonummer 000 0000000 00 VB-Nr. 001 TAN-Block-Nr. 004

Bitte bewahren Sie diese Liste geschützt vor dem Zugriff durch Dritte/Unbefugte an sicherer Stelle auf.

784267	617359	257429	838743	063486	461730	572014	548450	440778	995391
058196	696225	938493	892280	312214	899713	639791	088926	386637	639254
047872	551255	431482	179611	920445	132938	420039	360593	772804	570243
121656	649926	242799	947799	298313	823473	032303	529081	049584	514888
353119	886751	526171	656041	411204	253593	416867	186610	361039	002316
998331	173865	282006	738175	805565	468229	813325	963497	682671	591326
385401	799524	136580	225985	875273	561495	596191	106562	274606	014439
331798	009010	154033	950418	545471	137438	427245	686347	784223	715597
506545	159915	398757	548579	169961	709005	878557	659691	021589	236047
772162	705885	007943	101067	149878	713121	079192	238868	575317	365207

Sie erhalten rechtzeitig vor Nutzung der letzten noch unverbrauchten TAN dieses TAN-Blocks automatisch einen neuen Folge- TAN-Block zugesandt.

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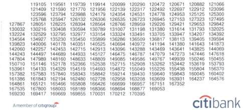

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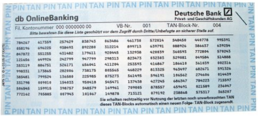

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Or nowadays by SMS (restricts the validity of the numbers) or with a secure generator

Ex: Two-Factor Authentication

- What assets are you trying to protect?

  Your bank account.

Ex: Two-Factor Authentication

- What assets are you trying to protect?
- What are the risks to these assets?

  Nowadays pretty high risk.

Ex: Two-Factor Authentication

- What assets are you trying to protect?
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  It prevents problems when passwords are stolen. Man-in-the-middle attacks still possible.

Ex: Two-Factor Authentication

- What assets are you trying to protect?
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- How well does the security solution mitigate those risks?
- What other risks does the security solution cause?

    Your mobile phone or credit card/pin might be stolen. SIM card become valuable.

Ex: Two-Factor Authentication

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- What costs and trade-offs does the security solution impose?

  Banks need to establish an infrastructure.
  For you it might be inconvenient.

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  Yes!

Security Seals

According to Ross Anderson: "...is a tamper-indicating device designed to leave non-erasable, unambiguous evidence of unauthorized entry or tampering."

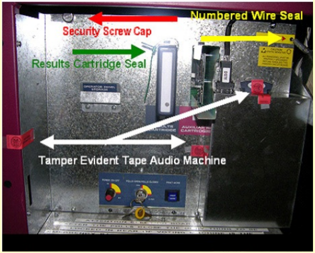
They also need some quite sophisticated policies (seal regiment).

Security Seals (2)

- at the Argonne National Laboratory they tested 244 different security seals
  - meantime to break the seals for a trained person: 100 s
  - including 19% that were used for safeguard of nuclear material

- Andrew Appel defeated all security seals which were supposed to keep voting machines safe

Security Seals (2)



- The tamper-indicating tape can be lifted using a heat gun.
- The security screw cap can be removed using a screwdriver, then the serial-numbered top can be replaced (undamaged) onto a fresh (unnumbered) base.
- The wire seal can be defeated using a #4 wood screw.
- The plastic strap seal can be picked using a jeweler's screwdriver.

Example: Security Seals

- What assets are you trying to protect?
  Voting machines, doors.

Example: Security Seals

- What assets are you trying to protect?
- What are the risks to these assets?

  Casual thieves, insider attacks.

Example: Security Seals

- What assets are you trying to protect?
- What are the risks to these assets?
- How well does the security solution mitigate those risks?

  Needs a quite complicated security regiment.

Example: Security Seals

- What assets are you trying to protect?
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  You might not notice tampering.

Example: Security Seals

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  The “hardware” is cheap, but indirect costs can be quite high.

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  No! Though in some areas they work: airport, swimming pool

Ex: Security by Obscurity

You might think it is a good idea to keep a security relevant algorithm or software secret.

- What assets are you trying to protect?

  source code, an algorithm

Ex: Security by Obscurity

You might think it is a good idea to keep a security relevant algorithm or software secret.

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  Can be pretty high (Oystercards).

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  Not really. The source code can be reverse engineered, stolen. . .

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You prevent scrutiny and independent advice. You also more likely than not get it wrong.

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  No!

Voting as Security Problem

What are the security requirements of a voting system?

Voting as Security Problem

What are the security requirements of a voting system?

- Integrity

- The outcome matches with the voter intend.
- There might be gigantic sums at stake.

Voting as Security Problem

What are the security requirements of a voting system?

- Integrity
- Ballot Secrecy

Voting as Security Problem

What are the security requirements of a voting system?

- Integrity
- Ballot Secrecy

- Nobody can find out how you voted.
- (Stronger) Even if you try, you cannot prove how you voted.

Voting as Security Problem

What are the security requirements of a voting system?

- Integrity
- Ballot Secrecy
- Voter Authentication

- Only authorised voters can vote up to the permitted number of votes.

Voting as Security Problem

What are the security requirements of a voting system?

- Integrity
- Ballot Secrecy
- Voter Authentication
- Enfranchisement

- Only authorised voters should be able to vote up to the permitted number of votes.

Voting as Security Problem

What are the security requirements of a voting system?

- Integrity
- Ballot Secrecy
- Voter Authentication
- Enfranchisement
- Availability

- The voting system should accept all authorised votes and produce results in a timely manner.

Ballot Boxes

Problems with Voting

Integrity vs. Ballot Secrecy

Authentication vs. Enfranchisement

Problems with Voting

Integrity vs. Ballot Secrecy

Authentication vs. Enfranchisement

Further constraints:

- costs
- accessibility
- convenience
- intelligibility

E-Voting

- The Netherlands between 1997 - 2006 had electronic voting machines
  (hacktivists had found that they could be hacked and emitted radio signals revealing how you voted)
- Germany had used them in pilot studies
  (in 2007 a law suit has reached the highest court and it rejected electronic voting on the grounds of not being understandable by the general public)
- UK used optical scan voting systems in a few polls

E-Voting

- US used mechanical machines since the 50s, later punch cards, now DREs and optical scan voting machines (fantastic "ecosystem" for study)
- Estonia used in 2007 the world's first Internet vote in national elections (there are earlier pilot studies)
- India uses e-voting devices since at least 2003 ("keep-it-simple" machines produced by a government owned company)
- South Africa used software for its tallying in the 1993 elections (when Nelson Mandela was elected) (they found the tallying software was rigged, but they were able to tally manually)

A Brief History of Voting

- Athenians
  - show of hands
  - ballots on pieces of pottery
  - different colours of stones
  - “facebook”-like authorisation

problems with vote buying / no ballot privacy

- French Revolution and the US Constitution got things “started” with paper ballots (you first had to bring your own, or later were pre-printed by the parties)

Ballot Boxes

Security policies involved with paper ballots:

1. you need to check that the ballot box is empty at the start of the poll / no false bottom (ballot stuffing)
2. you need guard the ballot box during the poll
3. tallied by a team at the end of the poll (you can have observers)

Paper Ballots

What can go wrong with paper ballots?

Paper Ballots

What can go wrong with paper ballots?

THE BALLOT
IN COUNTING THERE IS STRENGTH
"THAT'S WHAT'S THE MATTER."
Boss Tweed. "As long as I count the Votes, what are you going to do about it? say?"

William M. Tweed, US Politician in 1860's
"As long as I count the votes, what are you going to do about it?"

Paper Ballots

What can go wrong with paper ballots?

Chain Voting Attack

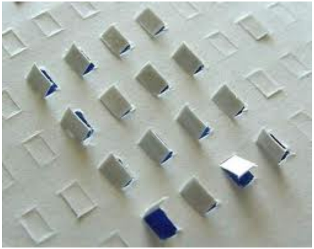
1. you obtain a blank ballot and fill it out as you want
2. you give it to a voter outside the polling station
3. voter receives a new blank ballot
4. voter submits prefilled ballot
5. voter gives blank ballot to you, you give money
6. goto 1

Mechanical Voting Machines

- Lever Voting Machines (ca. 1930 - 1990)

Mechanical Voting Machines

- Lever Voting Machines (ca. 1930 - 1990)
- Punch Cards (ca. 1950 - 2000)



Electronic Voting Machines

DREs

Optical Scan

Electronic Voting Machines

DREs

Optical Scan

all are computers

DREs

Direct-recording electronic voting machines
(votes are recorded for example memory cards)
typically touchscreen machines
usually no papertrail (hard to add: ballot secrecy)

Diebold Machines

The work by J. Alex Halderman:

- acquired a machine from an anonymous source
- the source code running the machine was tried to keep secret

Diebold Machines

The work by J. Alex Halderman:

- acquired a machine from an anonymous source
- the source code running the machine was tried to keep secret
- first reversed-engineered the machine (extremely tedious)
- could completely reboot the machine and even install a virus that infects other Diebold machines
- obtained also the source code for other machines

Diebold Machines

What could go wrong?

Diebold Machines

What could go wrong? Failure-in-depth.

Diebold Machines

What could go wrong? Failure-in-depth.

A non-obvious problem:

- you can nowadays get old machines, which still store old polls
- the paper ballot box needed to be secured during the voting until counting; e-voting machines need to be secured during the entire life-time

Paper Trail

Conclusion:
Any electronic solution should have a paper trail.

Paper Trail

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Any electronic solution should have a paper trail.

You still have to solve problems about Voter registration, voter authentification, guarding against tampering

E-Voting in India

Their underlying engineering principle is "keep-it-simple":

E-Voting in India

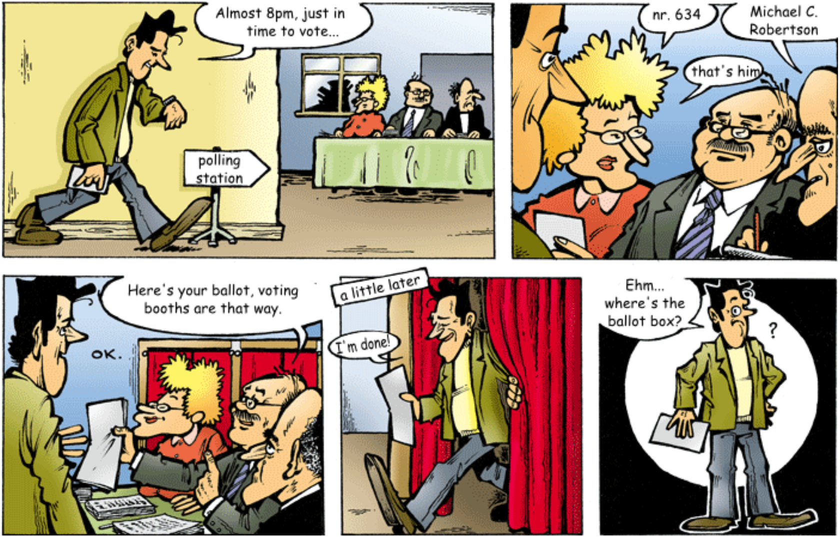
Their underlying engineering principle is "keep-it-simple":

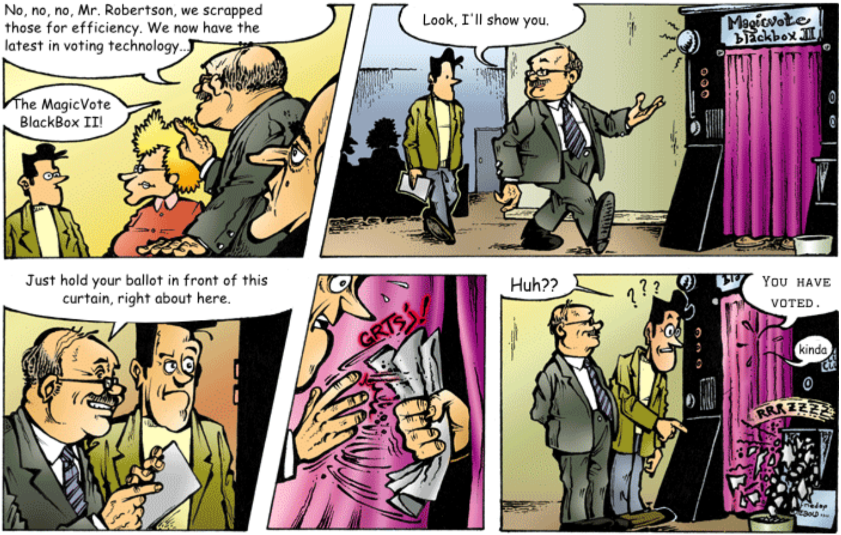
Official claims: "perfect", "tamperproof", "no need for technical improvements" , "infallible"

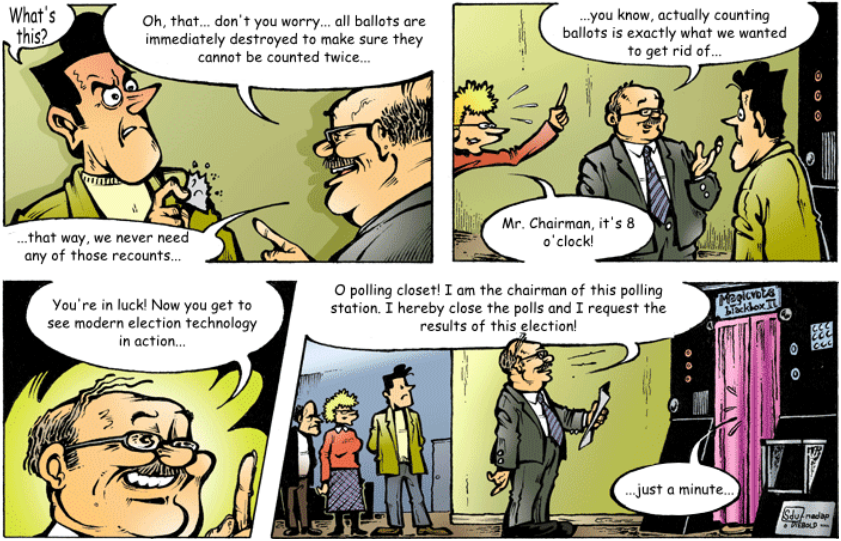
Lessons to be Learned

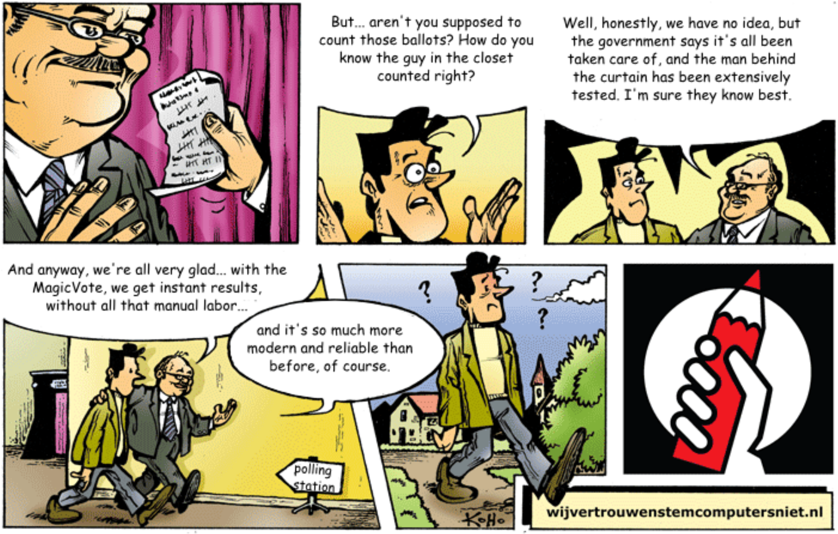
- keep a paper trail and try to keep this secure
- make the software open source
- have a simple design in order to minimise the attack surface

The adventures of citizen Michael C. Robertson


Almost 8pm, just in time to vote...
polling station
nr. 634
Michael C. Robertson
that's him
Here's your ballot, voting booths are that way.
OK.
a little later
I'm done!
Ehm... where's the ballot box?
?


No, no, no, Mr. Robertson, we scrapped those for efficiency. We now have the latest in voting technology...
The MagicVote BlackBox II!
Look, I'll show you.
Magicvote blackbox II
Just hold your ballot in front of this curtain, right about here.
GRTSJ!
Huh??
? ? ?
YOU HAVE VOTED.
kinda
RRRZZZ


What's this?
Oh, that... don't you worry... all ballots are immediately destroyed to make sure they cannot be counted twice...
...that way, we never need any of those recounts...
...you know, actually counting ballots is exactly what we wanted to get rid of...
Mr. Chairman, it's 8 o'clock!
You're in luck! Now you get to see modern election technology in action...
O polling closet! I am the chairman of this polling station. I hereby close the polls and I request the results of this election!
Magicvote blackbox II
...just a minute...
Sdu nedap
© DIEBOLD


But... aren't you supposed to count those ballots? How do you know the guy in the closet counted right?
Well, honestly, we have no idea, but the government says it's all been taken care of, and the man behind the curtain has been extensively tested. I'm sure they know best.
And anyway, we're all very glad... with the MagicVote, we get instant results, without all that manual labor...
and it's so much more modern and reliable than before, of course.
polling station
?
?
?
KoHo
wijvertrouwenstemcomputersniet.nl

Drawings: Koen Hottentot — Story: Rop Gonggrijp / Barry Wels — Color: Adam Swiecky — Translation: Jaap Weel