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:

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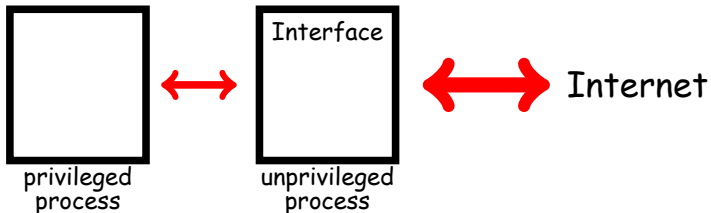
- the idea is make the attack surface smaller and mitigate the consequences of an attack

Shared Access Control
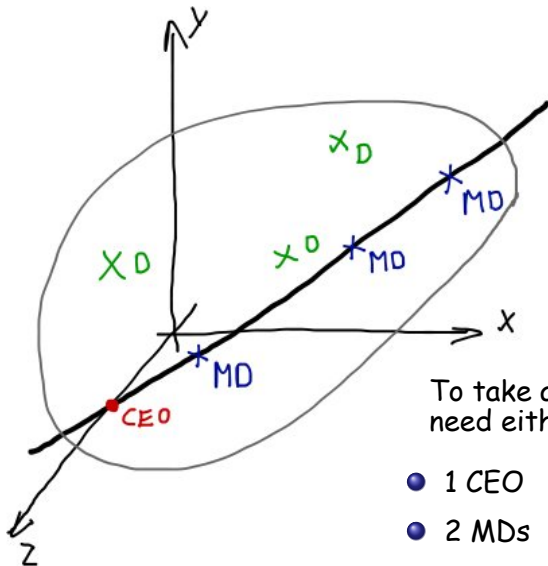
To take an action you need either:

- 1 CEO
- 2 MDs
- 3 Ds

Lessons from Access Control

- 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/*/*
  ```

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- root:
  ```
  rm /tmp/*/*
  ```

  the shell behind the scenes:
  ```
  rm /tmp/dir₁/file₁ /tmp/dir₁/file₂ /tmp/dir₂/file₁ ...
  ```

  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 [To prevent this kind of attack, you need additional policies.]
   rm

   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**

Schneier Analysis

- 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?

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

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

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

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    None (?)

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   Internet shopping is convenient and sometimes cheaper.

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  No!

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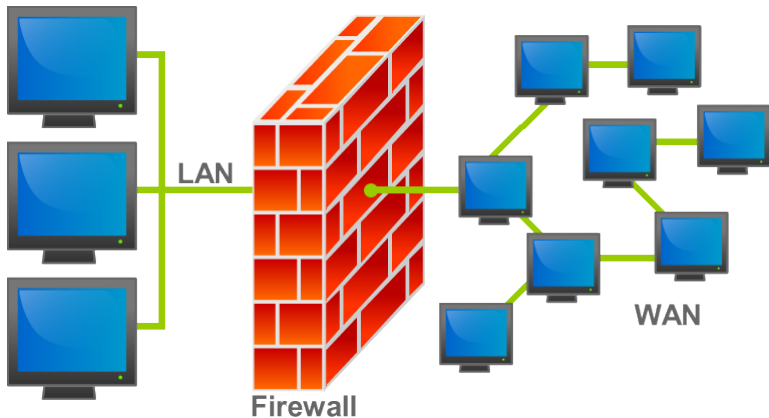
A firewall is a piece of software that controls incoming and outgoing traffic according to some rules.

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?

- What are the risks to these assets?

- How well does the security solution mitigate those risks?
  Well, at home so not much. Everywhere else, if properly configured then it does.

Example: Firewall

- 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?

  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.
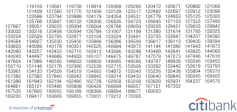
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  Yes!

Ex: Two-Factor Authentication

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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But it is an old(er) idea. It is used for example in
Germany and Netherlands for online transactions.

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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- How well does the security solution mitigate those risks?

> 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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- 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

- 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?
  - 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 (including 19% that were used for safeguard of nuclear material)
  - mean time to break the seals for a trained person: 100 s

- Andrew Appel defeated all security seals which were supposed to keep voting machines safe
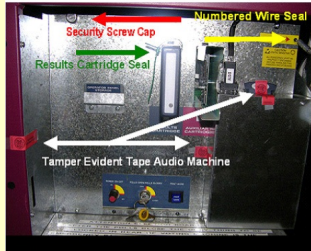
Security Seals (2)

- 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.

Ex: Security Seals

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

Ex: Security Seals

- What assets are you trying to protect?
- What are the risks to these assets?
  Casual thieves, insider attacks.

Ex: 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.

Ex: Security Seals

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- What other risks does the security solution cause?

    You might not notice tampering.

Ex: 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.

- What assets are you trying to protect?
- What are the risks to these assets?
  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
  (it has been found that they could be hacked and emitted radio signals)

- Germany, had been used 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, DREs and optical scan voting machines (fantastic "ecosystem" for research)
- Estonia used in 2007 the world's first Internet vote in national elections (there are earlier pilot studies)
- India, the biggest democracy 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 (Nelson Mandela) (they found the software was rigged, but they were able to manually tally)

A Brief History of Voting

- Athenians
  - show of hands
  - ballots on pieces of pottery
  - different colours of stones
  - "facebook"-like autorisation

- 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)

Paper Ballots

What can go wrong with paper ballots?

Paper Ballots

What can go wrong with paper ballots?

"THAT'S WHAT'S THE MATTER."

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

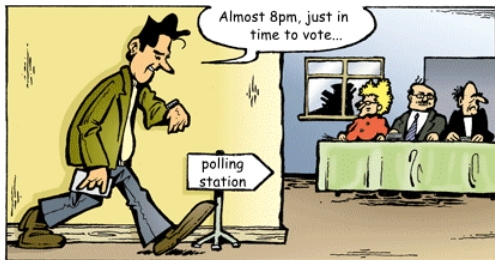- Lever Voting Machines (ca. 1930 - 1990)

Mechanical Voting Machines

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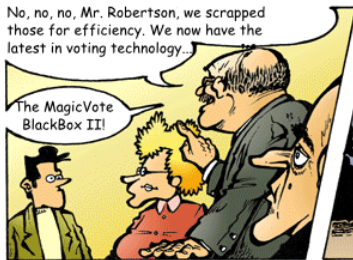- Punch Cards (ca. 1950 - 2000)
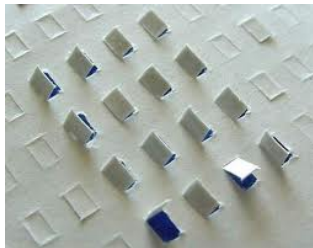
Electronic Voting Machines
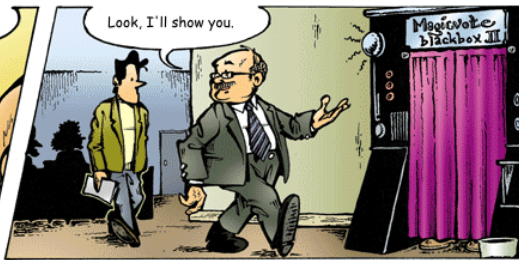
The adventures of citizen Michael C. Robertson

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