

Access Control and Privacy Policies (1)

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Slides: KEATS

Security Engineers

According to Bruce Schneier, **security engineers** require a particular **mindset**:

"Security engineers — at least the good ones — see the world differently. They can't walk into a store without noticing how they might shoplift. They can't use a computer without wondering about the security vulnerabilities. They can't vote without trying to figure out how to vote twice. They just can't help it."

Chip-and-PIN

- Chip-and-PIN was introduced in the UK in 2004
- before that customers had to sign a receipt
- Is Chip-and-PIN a more secure system?

(Some other countries still use the old method.)

Yes ...

"Chip-and-PIN is so effective in this country [UK] that fraudsters are starting to move their activities overseas," said Emile Abu-Shakra, spokesman for Lloyds TSB (in the *Guardian*, 2006).

- mag-stripe cards cannot be cloned anymore
- stolen or cloned cards need to be used abroad
- fraud on lost, stolen and counterfeit credit cards was down £60m (24%) on 2004's figure

But let's see ...

Bank

customer / you

But let's see ...

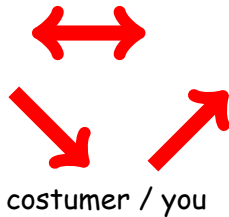
Bank



costumer / you

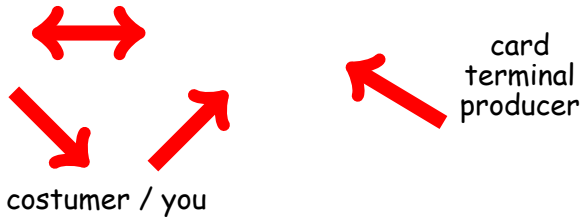
But let's see ...

Bank



But let's see ...

Bank



Chip-and-PIN

- A "tamperesitant" terminal playing Tetris on [youtube](#).

(<http://www.youtube.com/watch?v=wWTzkD9M0sU>)

Chip-and-PIN

- in 2006, Shell petrol stations stopped accepting Chip-and-PIN after £1m had been stolen from customer accounts
- in 2008, hundreds of card readers for use in Britain, Ireland, the Netherlands, Denmark, and Belgium had been expertly tampered with shortly after manufacture so that details and PINs of credit cards were sent during the 9 months before over mobile phone networks to criminals in Lahore, Pakistan

Chip-and-PIN is Broken

- man-in-the-middle attacks by the group around Ross Anderson

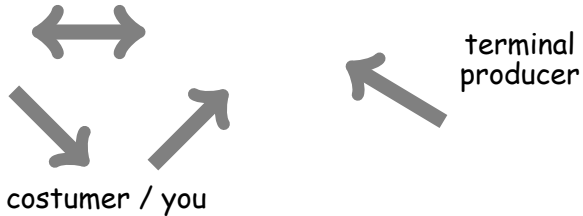
on BBC Newsnight
in 2010 or [youtube](#)

Chip-and-PIN is Really Broken

- same group successfully attacked this year card readers and ATM machines
- the problem: several types of ATMs generate poor random numbers, which are used as nonces

The Problem ...

Bank



- the burden of proof for fraud and financial liability was shifted to the costumer

Being Screwed Again

- **Responsibility**

"You understand that you are financially responsible for all uses of RBS Secure."

https://www.rbssecure.co.uk/rbs/tdsecure/terms_of_use.jsp

Web Applications

Servers from
Dot.com Inc.

Client(s)

- What are pitfalls and best practices?

Web Applications

Servers from
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Client(s)
GET request



- What are pitfalls and best practices?

Web Applications

Servers from
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webpage

Client(s)



- What are pitfalls and best practices?

Web Applications

Servers from
Dot.com Inc.

POST data

Client(s)



- What are pitfalls and best practices?

Scala + Play

a simple response from the server:

alternative response:

```
Ok("<H1>Hello world!</H1>").as(HTML)
```


Cookies

Servers from
Dot.com Inc.

GET request Client



Cookies

Servers from
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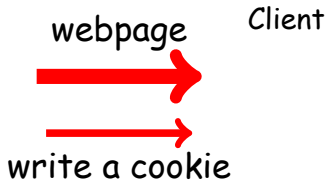
GET request Client



read a cookie

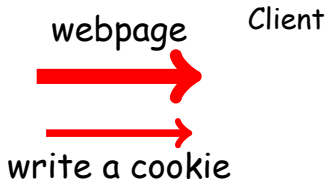
Cookies

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Cookies

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- cookies: max 4KB data
- cookie theft, cross-site scripting attacks
- session cookies, persistent cookies, HttpOnly cookies, third-party cookies, zombie cookies

Cookies

EU Privacy Directive about Cookies:

"In May 2011, a European Union law was passed stating that websites that leave non-essential cookies on visitors' devices have to alert the visitor and get acceptance from them. This law applies to both individuals and businesses based in the EU regardless of the nationality of their website's visitors or the location of their web host. It is not enough to simply update a website's terms and conditions or privacy policy. The deadline to comply with the new EU cookie law was 26th May 2012 and failure to do so could mean a fine of up to £500,000." →BBC News

- session cookies, persistent cookies, HttpOnly cookies, third-party cookies, zombie cookies

- While cookies are per web-page, this can be easily circumvented.

Pet Store
Dot.com

Dating.com

Evil-Ad-No
Privacy.com



My First Webapp

GET request:

- 1 read the cookie from client
- 2 if none is present, set `visits` to **0**
- 3 if cookie is present, extract `visits` counter
- 4 if `visits` is greater or equal **10**,
print a valued customer message
otherwise just a normal message
- 5 increase `visits` by **1** and store new cookie with client

- cookie value encoded as hash

- data integrity needs to be ensured

- the counter/hash pair is intended to prevent tampering

SHA-1

- SHA-1 is a cryptographic hash function (MD5, SHA-256, SHA-512, ...)
- message \rightarrow digest
- no known attack exists, except brute force

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- message \rightarrow digest
- no known attack exists, except brute force
- but dictionary attacks are very effective for extracting passwords (later)

should be random



Unix Passwords

- passwords are **not** stored in clear text
- instead `/etc/shadow` contains

```
name:$1$QIGCa$/ruJs8AvmrknzKTzM2TYE.:other_info
```

- `$` is separator
- `1` is MD5 (actually SHA-512 is used nowadays, `6`)
- `QIGCa` is salt
- `ruJs8AvmrknzKTzM2TYE` → password + salt

```
(openssl passwd -1 -salt QIGCa pippo)
```

Password Blunders

- in late 2009, when an SQL injection attack against online games service RockYou.com exposed 32 million **plaintext** passwords
- 1.3 million Gawker credentials exposed in December 2010 containing unsalted(?) **MD5** hashes
- June 6th, 2012, 6 million unsalted SHA-1 passwords were leaked from linkedIn

Web user maintains 25 separate accounts but uses just 6.5 passwords

Brute Forcing Passwords

- How fast can hackers crack SHA-1 passwords?

Brute Forcing Passwords

- How fast can hackers crack SHA-1 passwords?
- The answer is 2 billion attempts per second using a Radeon HD 7970

graphics card
ca. £300

password length	time
5 letters	5 secs
6 letters	500 secs
7 letters	13 hours
8 letters	57 days
9 letters	15 years

5 letters $\approx 100^5 = 10$ billion combinations
(1 letter - upper case, lower case, digits, symbols ≈ 100)

Passwords

How to recover from a breakin?

Passwords

How to recover from a breakin?

- Do not send passwords in plain text.
- Security questions are tricky to get right.
- QQ (Chinese Skype) authenticates you via contacts.

This Course

- break-ins (buffer overflows)
- access control
(role based, data security / data integrity)
- protocols
(specification)
- access control logic
- privacy

Scott McNealy:

"You have zero privacy anyway. *Get over it.*"

Books + Homework

- there is no single book I am following

Books + Homework

- there is no single book I am following
- The question “Is this relevant for the exams” is not appreciated!

Whatever is in the homework sheets (and is not marked optional) is relevant for the exam. No code needs to be written.

Take-Home Points

- Never store passwords in plain text.
- Always salt your hashes!
- Use an existing algorithm; do not write your own!

Thinking as a Defender

- What are you trying to protect?
- What properties are you trying to enforce?
- Who are the attackers? Capabilities?
Motivations?
- What kind of attack are we trying to protect?
- Who can fix any vulnerabilities?
- What are the weaknesses of the system?
- What will successful attacks cost us?
- How likely are the attacks?

Security almost always is **not** free!

The Security Mindset

- How things can go wrong.
- Think outside the box.

The difference between being criminal is to only **think** about how things can go wrong.

Maps in Scala

- `map` takes a function, say `f`, and applies it to every element of the list:

```
List(1, 2, 3, 4, 5, 6, 7, 8, 9)
```

```
List(1, 4, 9, 16, 25, 36, 49, 64, 81)
```