Usability & Security

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Computer Security Lecture 20
Today’s Lecture

• Usability & Security
  – Often the most over looked factor.
  – Social Engineering

• Cost benefit analysis for security advice
Cranor et al.'s Crying Wolf: “An Empirical Study of SSL Warning Effectiveness.”

A scientific test of how users react to certificate warnings.

Their first idea: make them think their online bank account is being attacked:

Use a web proxy to do a man in the middle attack.

Problem: This would be illegal.
Second Idea

• Remove the root certificate from browser so that web site certificates can’t be verified.

• Therefore the browser gives the same warning as a faked certificate.

• See how users react.
There is a problem with this website's security certificate.

The security certificate presented by this website was issued for a different website's address.

Security certificate problems may indicate an attempt to fool you or intercept any data you send to the server.

We recommend that you close this webpage and do not continue to this website.

- Click here to close this webpage.
- Continue to this website (not recommended).
- More information
Security Error: Domain Name Mismatch

You have attempted to establish a connection with "www.whitehouse.gov". However, the security certificate presented belongs to "a248.e.akamai.net". It is possible, though unlikely, that someone may be trying to intercept your communication with this web site.

If you suspect the certificate shown does not belong to "www.whitehouse.gov", please cancel the connection and notify the site administrator.

View Certificate  Cancel  OK
This Connection is Untrusted

You have asked Firefox to connect securely to webmin.nicola.textdrive.com, but we can't confirm that your connection is secure.

Normally, when you try to connect securely, sites will present trusted identification to prove that you are going to the right place. However, this site's identity can't be verified.

What Should I Do?

If you usually connect to this site without problems, this error could mean that someone is trying to impersonate the site, and you shouldn't continue.

Get me out of here!

Technical Details

webmin.nicola.textdrive.com uses an invalid security certificate.

The certificate is only valid for *.textdrive.com

(Error code: ssl_error_bad_cert_domain)

I Understand the Risks

If you understand what's going on, you can tell Firefox to start trusting this site's identification. Even if you trust the site, this error could mean that someone is tampering with your connection.

Don't add an exception unless you know there's a good reason why this site doesn't use trusted identification.

Add Exception...
Laboratory Study

- 100 participants
- 5 Randomly-assigned conditions
  - FF2
  - FF3
  - IE7
  - Single-page custom warning
  - Multi-page custom warning
- 4 tasks, warning triggered twice
  - Bank
  - Library catalog
In risky situation, significantly fewer people heeded IE7 and FF2 than other warnings.
In low risk situation, almost all users overrode warnings except in FF3 condition.

FF3 has 4-step process to override warnings.
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If you suspect the certificate shown does not belong to "www.whitehouse.gov", please cancel the connection and notify the site administrator.

View Certificate  Cancel  OK
Something happened and you need to click OK to get on with doing things.

Certificate mismatch security identification administrator communication intercept liliputian snotweasel foxtrot omegaforce.
Other “Social” Attacks

• There are many ways information can leak out of a system.

• Computer security experts often overlook the non-technical attacks.
Other Ways to Get Information

• “Shoulder surfing”
  – reading data from someone's laptop screen,
  – and from paper documents

• Dumpster driving:
  – Picking documents out of the trash
For example

• A Defcon talk by Johnny Long at
  – http://www.youtube.com/watch?v=5CWrzVJYLWw

• Particularly 34:00 - 39:00.

• Imagine you are in charge of security for a company, how could you stop these kinds of data leaks?
Social Engineering

In general people want to be helpful.

• Why not just phone them up and ask for: Passwords, Credit card numbers, etc. etc.

• Attackers might say they are from the phone company and walk into your server room.
For example

- Kevin Mitnick at “HOPE” on stealing source code by just asking for it:

http://www.youtube.com/watch?v=puNkT5h6ams
http://www.youtube.com/watch?v=Xm4qjtrmGjM&NR
5:26 to 1:00

Kevin spent 5 years in jail for this and other crimes. I’m showing you this so you can think about how to stop this kind of attack.
Danger:

This often leads to people thinking:

“Users are stupid: they are the problem”

NO! Users are doing what they need to do to get the job done. Bad security design is often the problem.
When is a New Security Measure Good?

When it saves more than it costs:

\[
\text{Sum of change in Costs} < \text{Sum of change in Benefits}
\]

Benefits can be very hard to calculate, however we know a security measure is bad when:

\[
\text{Sum of change in Costs} > \text{Total possible losses}
\]
Example: Checking the URLs

Phishing sites often use fake URLs to trick people into giving away their password.

Which of these URLs belongs to PayPal?

- www.paypal.com
- www.paypa1.com
- www.paypal.com
- www.paypal.org
- 66.211.169.2
- active-www.paypal.com
- www.paypal.org.host.com
- www.paypalobjects.com
- www.palpay.com
Losses Due To Phishing

Using US figures from 2008:

Total losses due to phishing attacks: $60 million

Number of Internet users: 180 million

Phishing cost per person: 33 cents / a year
Cost Benefit Analysis

Valuing people’s time at twice US minimum wage: $7.25.

It doesn’t make sense for the average user to spend more than 2.6 mins per year, looking at URLs.

Maybe the users aren’t so stupid after all.
What is the point of certificates in TLS/SSL?

- There is no evidence of large scale, active MITM of TLS/SSL.
- Phishing sites don’t use fake certificates
Fake Certificates

There is no record of major financial lost due to fake certificates.

– Almost all certificate alerts are false positives.

Cost of checking a certificates: 10mins, once every 2 years, for 180 million people, at twice min. wage = $108.7 mil
Certificate Warnings

These were some real and “fake”.

Which don’t give you a certificate warning?

No correlation between warnings and fake URLs

| www.paypal.com                  |
| www.paypal1.com                |
| www.paypal.com                 |
| www.paypal.org                 |
| 66.211.169.2                   |
| active-www.paypal.com          |
| www.paypal.org.host.com        |
| www.paypalobjects.com          |
| www.paypal.com                 |
Some Warnings:

• I’m not saying don’t look for a correct certificates. I’m saying this is a design mistake in SSL.

• Does 10 minutes really cost $1.21?

• Costs calculated like this are very rough, and may totally change over night.
Some Warnings:

• Some groups of people are much more likely to be targeted e.g.
  – people with financial or government information
  – Syria used fake certificates to access dissidents Facebook accounts.
Recommended Paper:

“So Long, And No Thanks for the Externalities: The Rational Rejection of Security Advice by Users”

By Cormac Herley
Conclusions

• The easiest way into any system is usually to exploit human factors.

• A good security policy can help, but a bad policy can make things worse.
  – Users want to get their work done, and will find a way around a policy if it stops them.
  – Users are sometimes “right” to ignore security advice.