HTML5 Security Pitfalls

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Agenda

- Scope of HTML5
- Browser Security
- HTML5 as Vulnerability & Exploit
- Improving Web Site Security

The Path to HTML5

3350 B.C.	Cuneiform enables stone markup languages.
July 1984	*Neuromancer*: “Cyberspace. A consensual hallucination...” (p. 51)
Dec 25, 1990	CERN httpd starts serving HTML.
Nov 1995	HTML 2.0 standardized in RFC 1866.
Dec 24, 1999	HTML 4.01 finalized.

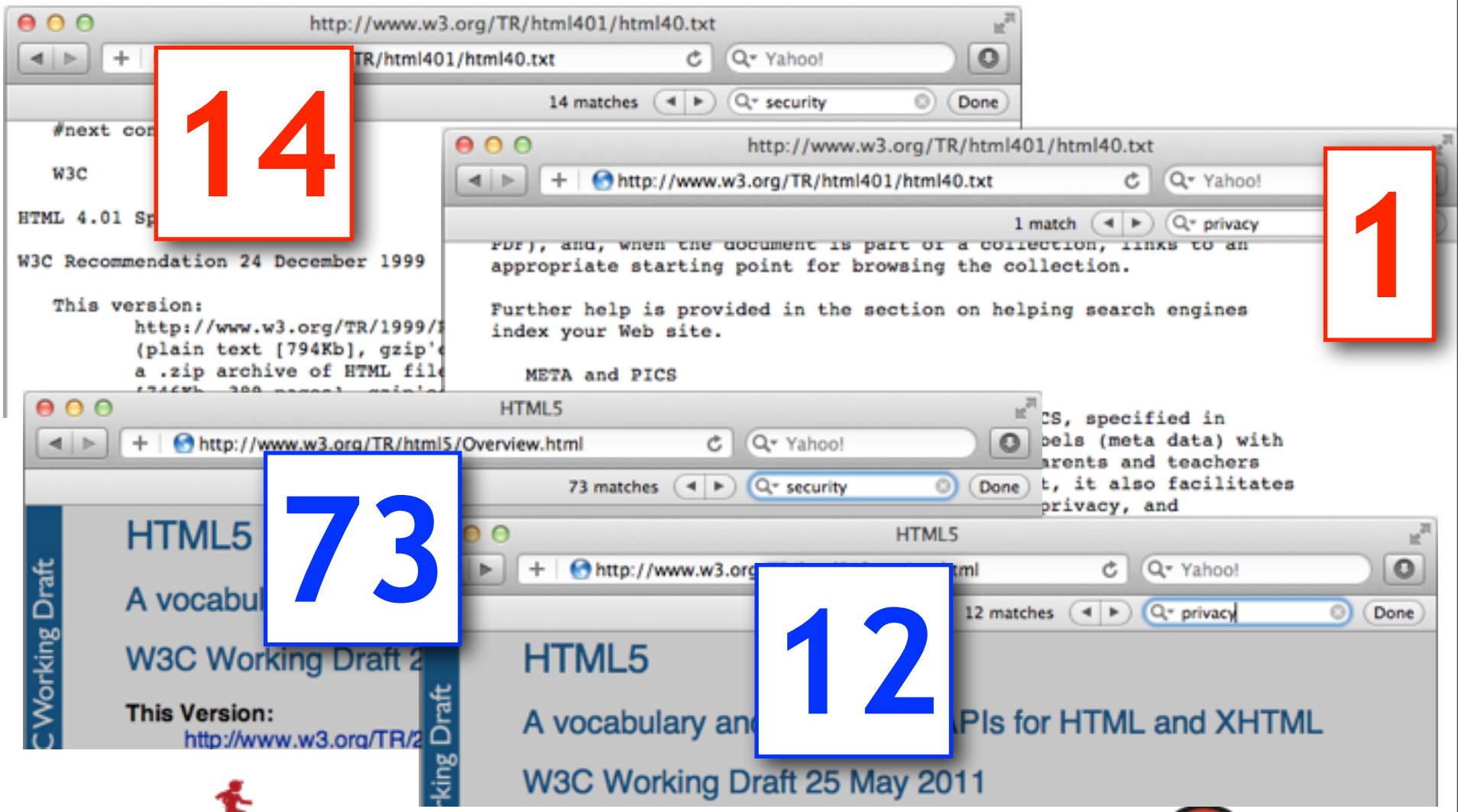
HTML5 According to Spec

- Canvas, Audio, Video
- Cross Origin Request Sharing
- Web Sockets
- Web Storage
- Web Workers

HTML5 According to Folklore

- Social [_____]
- [_____] as a Service
- Browser Games
- [_____] cloud [_____]
- W3C Web Design and Applications (CSS, DOM, HTML, JavaScript, XHR)
  - http://www.w3.org/standards/webdesign/
- Flash, Silverlight, and anything else that loads in a browser.

Reflecting Reality



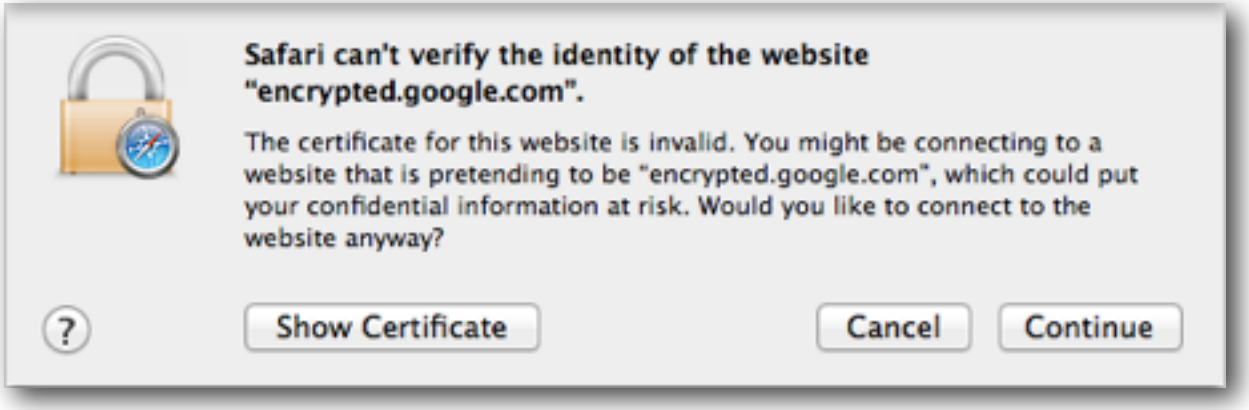
Privacy & Security

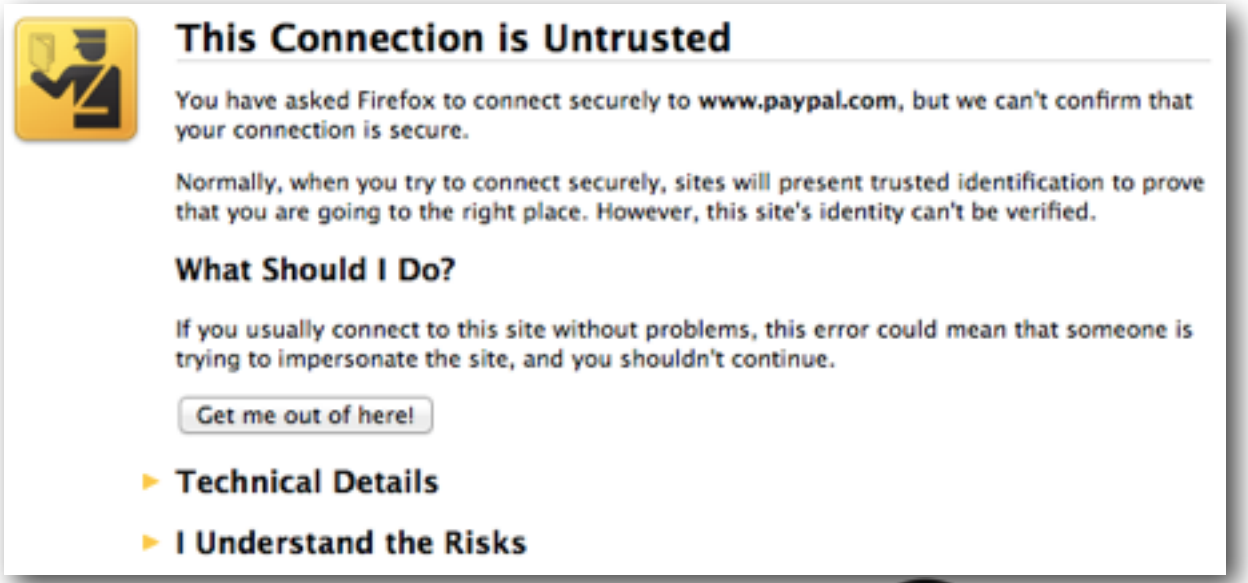
- Issues with design vs. implementation
  - Ambiguities, Errors, Deficiencies
- Security barriers stronger outside of browser than within.
- The rise of “privacy exploits”
- Pre-HTML5 issues don’t go away post-HTML5

Security from Design

- Prepared statements, parameterized queries. (SQL injection)
- Cryptography (HMAC vs. MAC)
- X-Frame-Options header (clickjacking)
- Origin header (cross-site request forgery)

IRRelevant Security



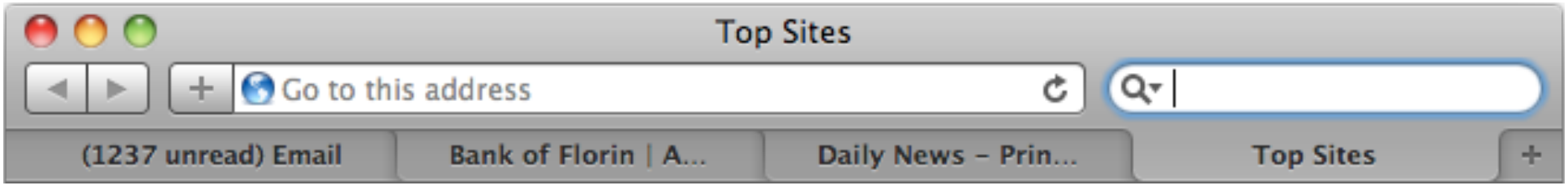


IRRelevant Security

Good Cert

Bad Cert

The "Dirty Harry" Postulate



With three tabs already open in your browser of choice, do you feel lucky?

http://bit.ly/wszWO
http://bit.ly/lSxst
http://bit.ly/OApJX
http://bit.ly/SAFEST

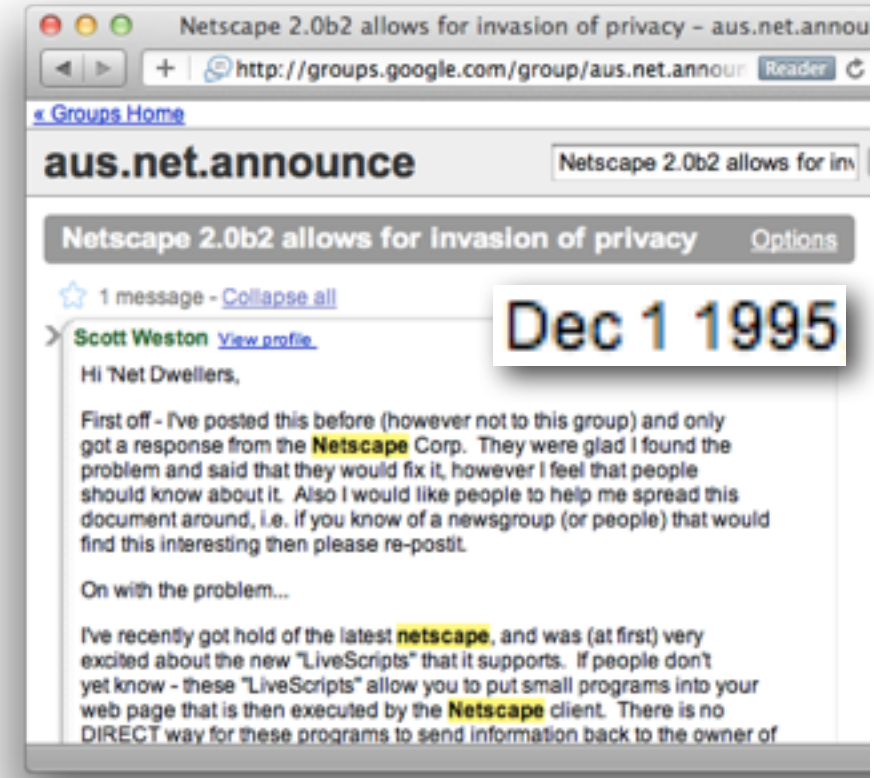
Never Mind the IDN, Here's the QR Codes

Exploits vs. Enablers

- Review and demonstrate how vulnerabilities might **arise** from HTML5
- Review and demonstrate how well-known vulnerabilities can be **further exploited** by HTML5 features

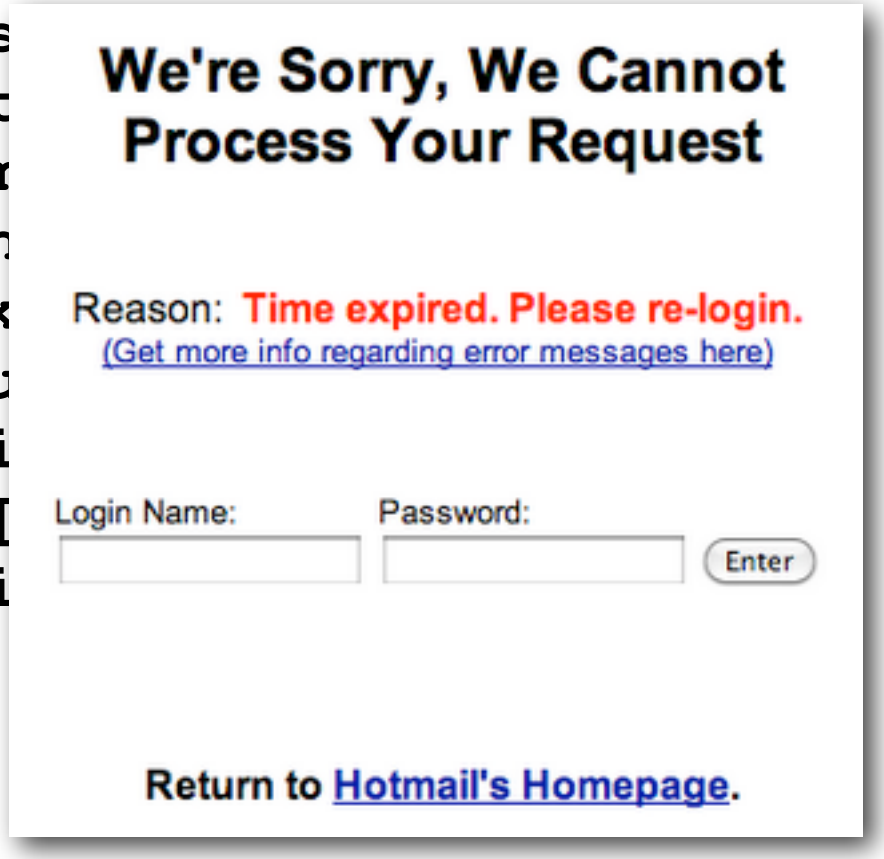
The Path to XSS

- The perpetual web vulnerability.
- Browser quirks, deficient parsers, incorrect implementations
- http://ha.ckers.org/xss.html
- http://html5sec.org/
- http://xssed.com/



Oldest Trick in the HTML

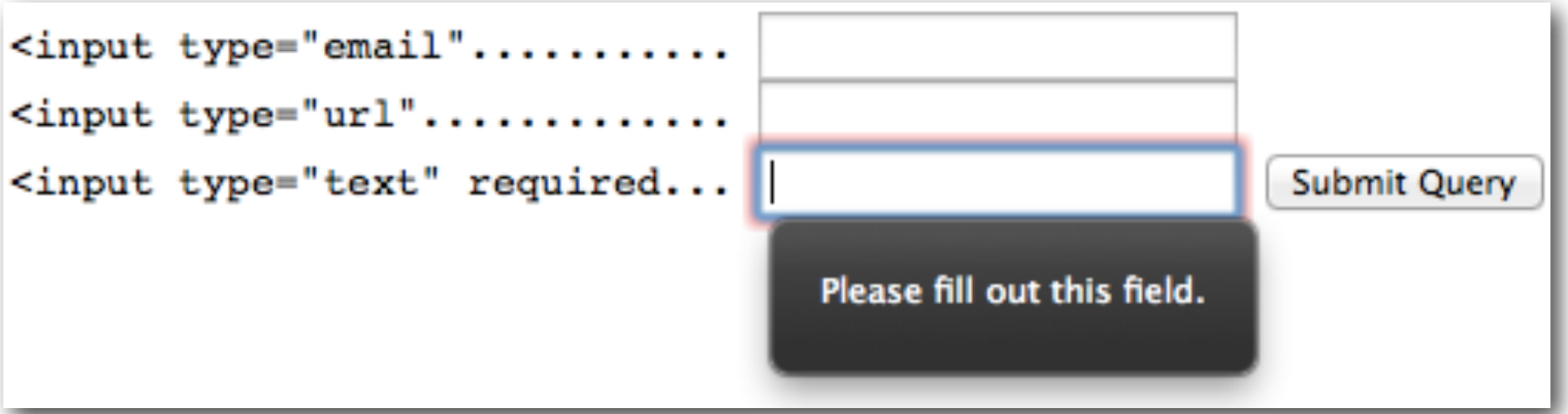
```
<img src="javascript:errurl='http://
www.because-we-can.com/us
getmsg.htm';nomenulinks=t
inks.length;for(i=0;i<nom
{top.submenu.document.lin
top.submenu.document.link
noworklinks=top.work.docu
for(i=0;i<noworklinks-1;i
{top.work.document.links[
top.work.document.links[i
```



http://www.deadliestwebattacks.com/2010/01/earliest-ish-hack-against-web-based-e.html

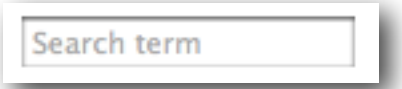
HTML5 Form Validation

- New form and input types and attributes
- Usability does not confer security
- Remember server-side validation



Client Validation

```
<input type="text" name="a" value=""
placeholder="search term">
```



- Not to contain HTML
- Still an XSS vector if placeholder value is dynamically changed from user input

Variations on a Theme

```
<input type="image"
   src="-42" onerror=alert(9)//">
<input type="image"
  src=""formaction=javascript:alert(9);a="
">
<input type="text" name="a"
  value="" autofocus onfocus=alert(9);a="
">
<input type="text" name="a"
  value="" autofocus onblur=alert(9);a="
">
```

It's Only HTML5, But We Like It

```
<body onscroll=alert(9)>

<body oninput=alert(9)>


<video>
<source src=a onerror=alert(9)>
</video>
```

XSS

- Regular expressions excel at pattern matching -- not parsing.

```
<a id=">"href=javascript:alert(9)>

<meta name=""<img src=a
onerror="alert(9)">

<!--<img src="http://valid.site/?--><img
src=a onerror=alert(9)//"
```

Speaking of Parsing Surprises

```
<input type="text" name="a" value='___'>
<input type="text" name="b" value="___">
```

```
<input type="text" name="a" value='\'id='>
<input type="text" name="b" value="'><img
src=a onerror=javascript:alert(9)//">
```

Render Unto XSS

Source of: http://localhost/7dwa/HWA/ch2/quotes.html

```
<html>
<body>
<input type="text" name="a" value='1'>
<input type="text" name="b" value="2">
</form>
<script>
</script>
</body>
</html>
```

Source of: http://localhost/7dwa/HWA/ch2/quotes.html

```
<html>
<body>
<input type="text" name="a" value='\'id='>
<input type="text" name="b" value="'><img
src=a onerror=javascript:alert(9)//">
</form>
<script>
</script>
</body>
</html>
```

Line 9, Col 8

Render Unto XSS + HTML5

```
<input type="text" name="a" value='___'>
<input type="text" name="b" value="___">
```

```
<input type="text" name="a" value='\'id='>
<input type="text" name="b"
value="'onfocus=javascript:alert(9)//">
```

"DOM Stealing"

- Taking advantage of JavaScript variables' global scope.
- DOM-based XSS
- Accessing elements by id
  - .getElementById(x)
  - id's make for easy DOM programming and therefore easy XSS programming

- ...and keyloggers, etc.
  - http://labs.portcullis.co.uk/application/xssshell/

Web Workers

- Worker() and SharedWorker() enable threading within JavaScript.
- Designed with security in mind, e.g. restricted from accessing the DOM.
- Still able to access XHR.

Web Workers Pitfalls

- Bringing concurrency attacks to the browser?
  - Predicated on misuse or poor use of Workers by the web application.
  - Client-side validation without sever-side confirmation, e.g. race conditions in authorization.
- DoS: Battery draining attacks on the device
- DoS: Bandwidth attacks against other sites
- Password cracking (interesting, but poorly suited), distributed click fraud (more interesting, potentially lucrative)

Relaxing Same Origin Policy

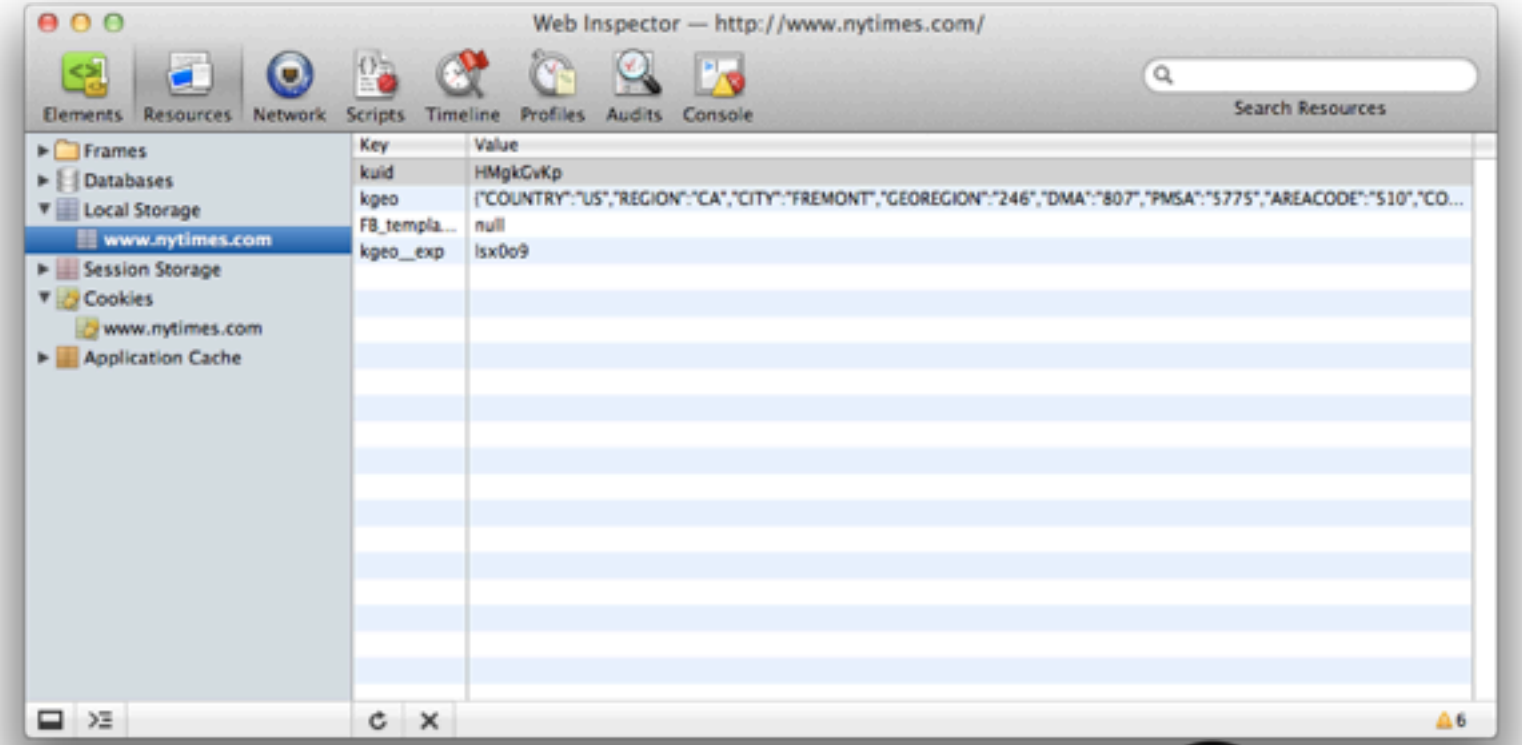
- Cross-page/domain messaging
- Web developers already using clumsy work-arounds for Same Origin, why not accept and standardize to help secure?
- There will always be ugly, insecure web development, e.g. JSONP.

Cross Origin Request Sharing Pitfalls

- Trust -- The number one issue with permitting communication with another domain.
- Mixing code and data (sound familiar?)
- Header injection attacks to spoof Access-Control headers
- ...and mistakes happen: crossdomain.xml

Web Storage

- Unencrypted store for user data.
- Not opaque to the user
- Local and Session



Web Storage Pitfalls

- Bad place to put context info that should be server-side.
- Use Local vs. Session Storage appropriately.
- Will be targeted by trojans, bots, etc. already looking for financial data, key stores on the file system.
- Nice target for privacy exploits if not security exploits.
- XSS document.cookie attack on steroids -- local storage doesn't have an httponly attribute

Web Sockets

- More XmlHttpRequest object on steroids
- Primarily a way to leverage vulnerabilities and make XSS more interesting.
- Host detection and port scanning
- Denial of Service
- Information stealing

Plugin Plague

- Plugins still learning from ActiveX (Adobe Flash, Microsoft Silverlight, Google Native Client, ...)
- Impedance mismatch between sandboxes.
- Inconsistent enforcement of Same Origin Policy.

Plugin Plague

- Remember privacy?
- Tracking tokens and browser controls.

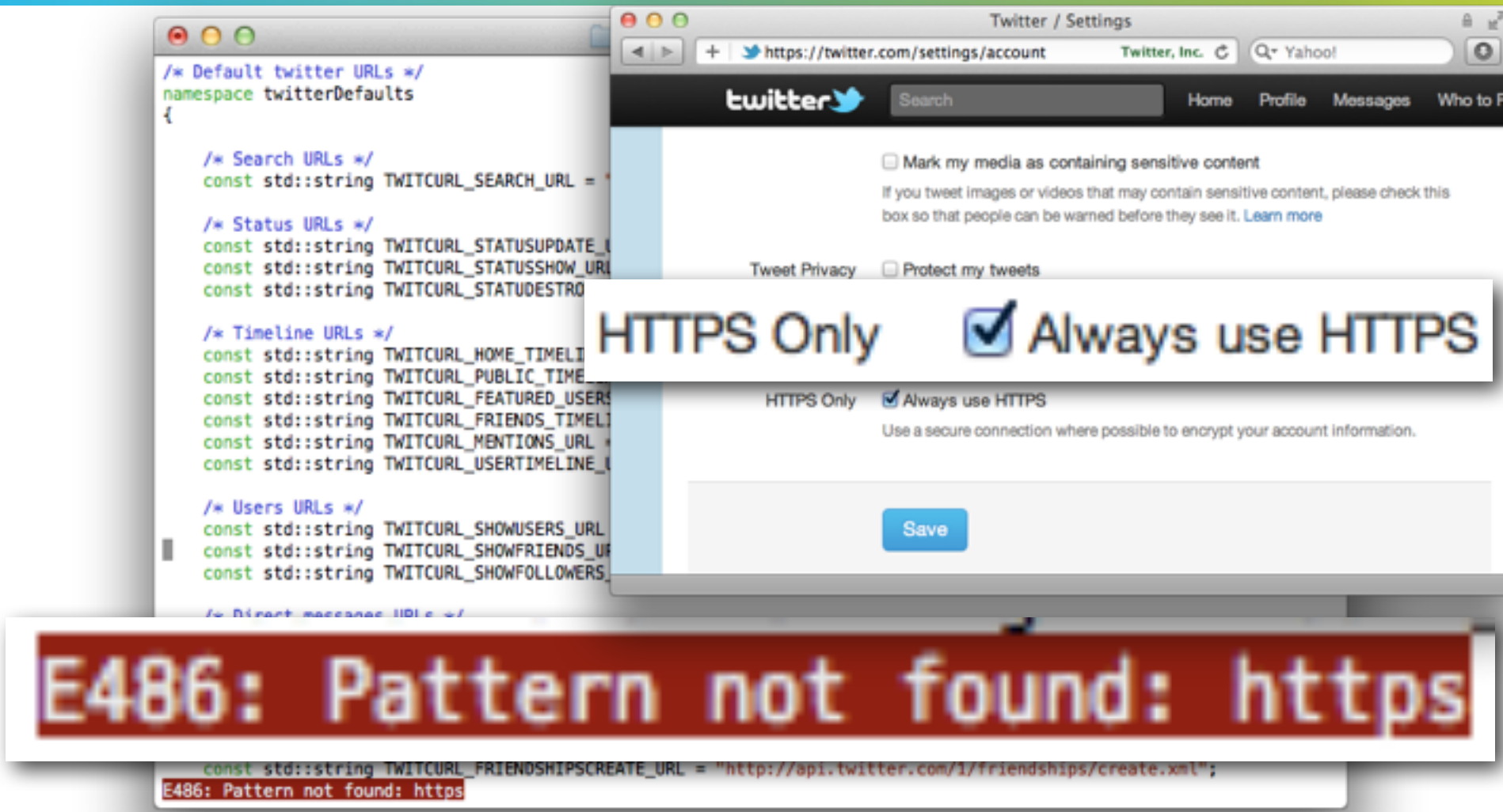
Overextending the Browser

- WebGL crossing the boundary from user-space browser to kernel-space drivers
- Geolocation's privacy implications yet another boon to XSS attacks

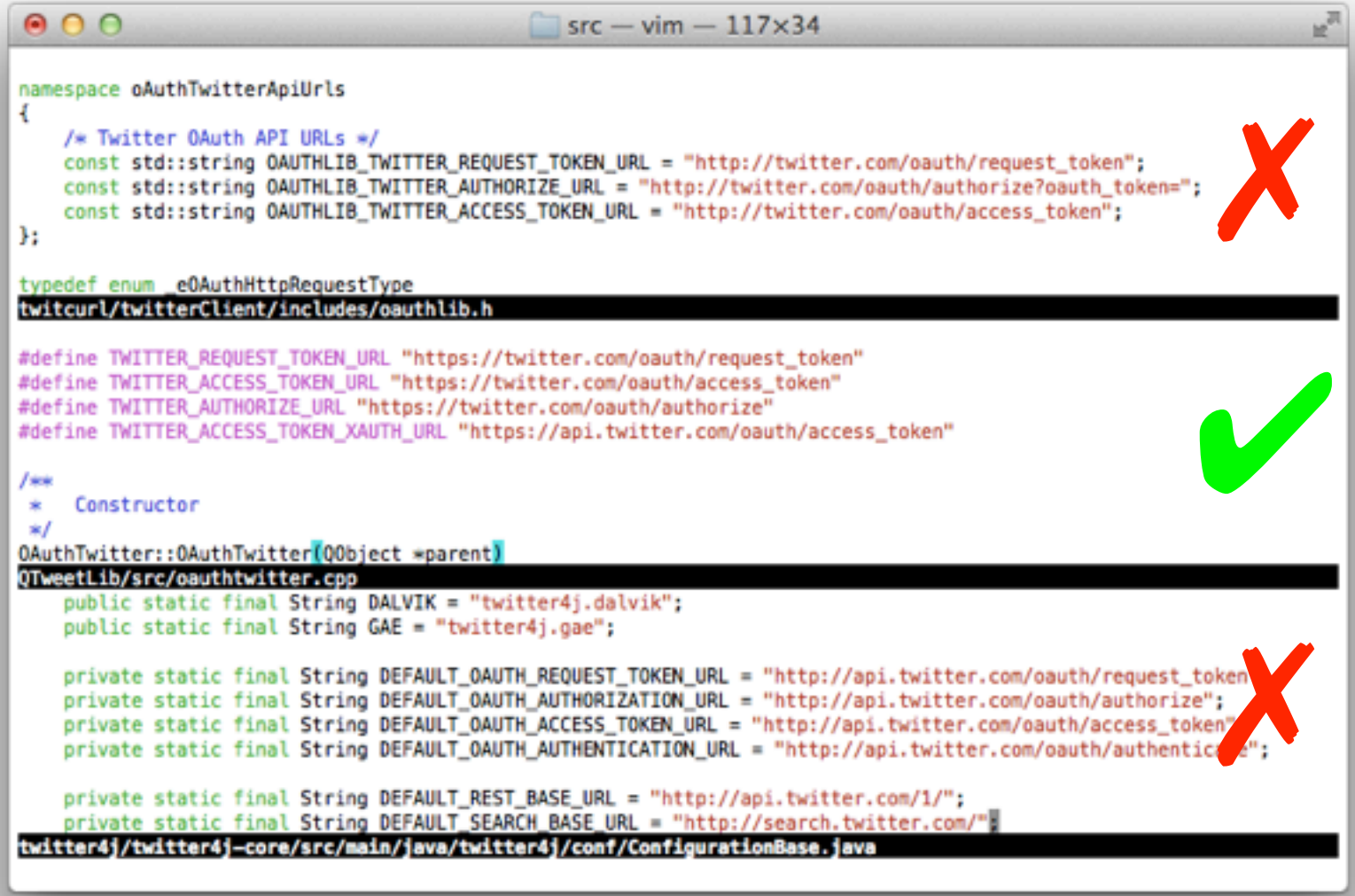
Considering Code

- The impact of mobile has driven more growth in web sites and HTML5 -- at the expense of security.
- HTTPS in the browser too often becomes HTTP in the mobile.
- Back to the web hacking days of quickly written PHP vs. secure PHP?

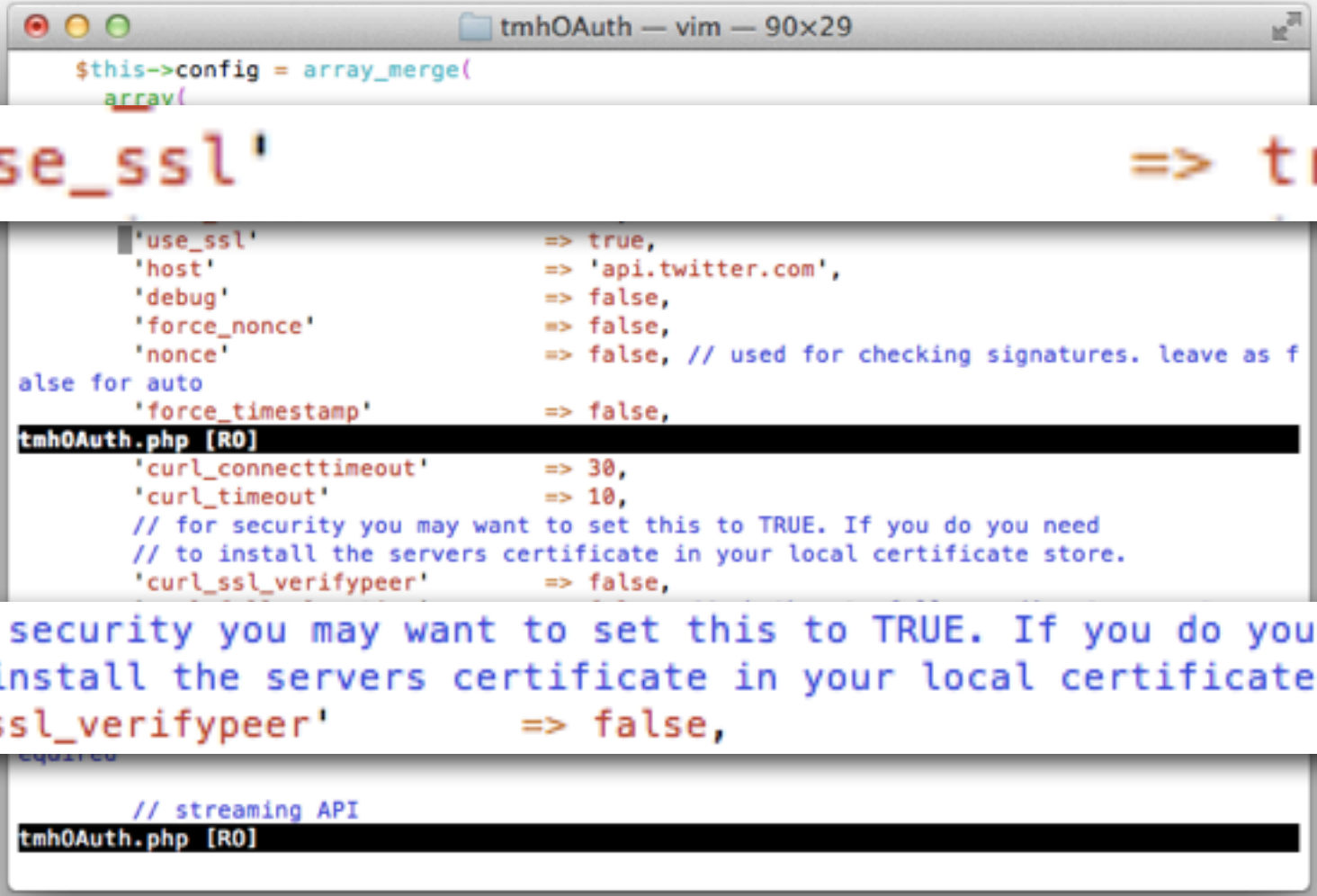
There's an "S" for that...



Inconsistent Design

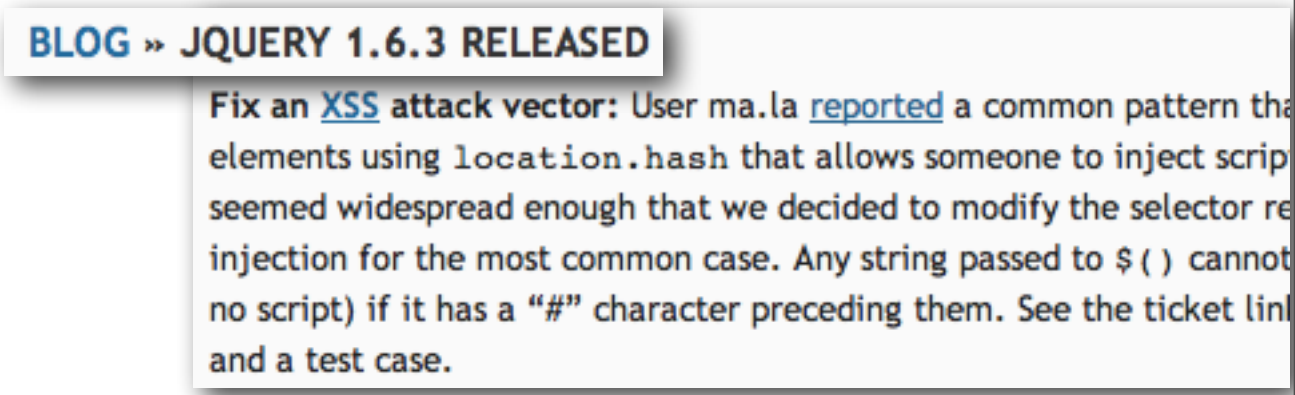


Small Steps


tmhOAuth — vim — 90×29
$this->config = array_merge(
array(
'use_ssl' => true,
'host' => 'api.twitter.com',
'debug' => false,
'force_nonce' => false,
'nonce' => false, // used for checking signatures. leave as f
alse for auto
'force_timestamp' => false,
tmhOAuth.php [RO]
'curl_connecttimeout' => 30,
'curl_timeout' => 10,
// for security you may want to set this to TRUE. If you do you need
// to install the servers certificate in your local certificate store.
'curl_ssl_verifypeer' => false,
// streaming API
tmhOAuth.php [RO]

Frameworks

- Provide a means to improve design and implementation
- Encourage consistency
- Shift from addressing security issues with code fixes to upgrading versions -- patch management vs. code review



Frameworks

- Establish clearer boundaries between the client and server.
- Reviewing an API is easier than crawling a site.
- Makes for easier unit tests, but harder automated tests (i.e. crawling).
- Remember rate limiting.

Frameworks

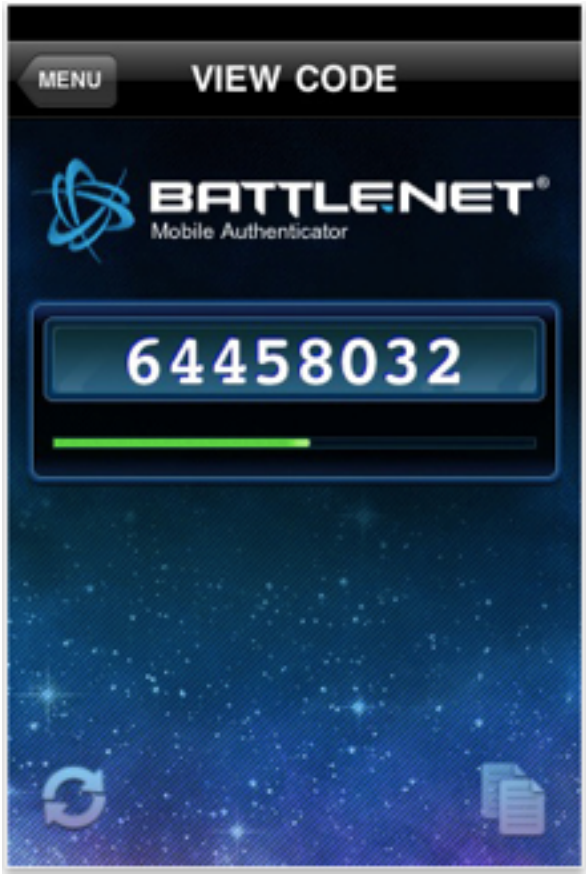
- Avoid quirks, standards are more standard now.
- Prefer feature detection over User Agent sniffing
- Agree where encoding takes place, how text is received from an API.
  - What's the destination?
  - What's the expectation?
- Stop building HTML on the server -- avoid the easy XSS mistakes. (And worry about DOM XSS.)

Browser Pitfalls

- When is data an element, attribute, id, class, text, or script?
- Insufficient Same Origin Policy restriction
- Uncontrollable tracking data (user can't clear, manage, etc. a tracking atom)
- Trust is based on DNS -- and fragile.

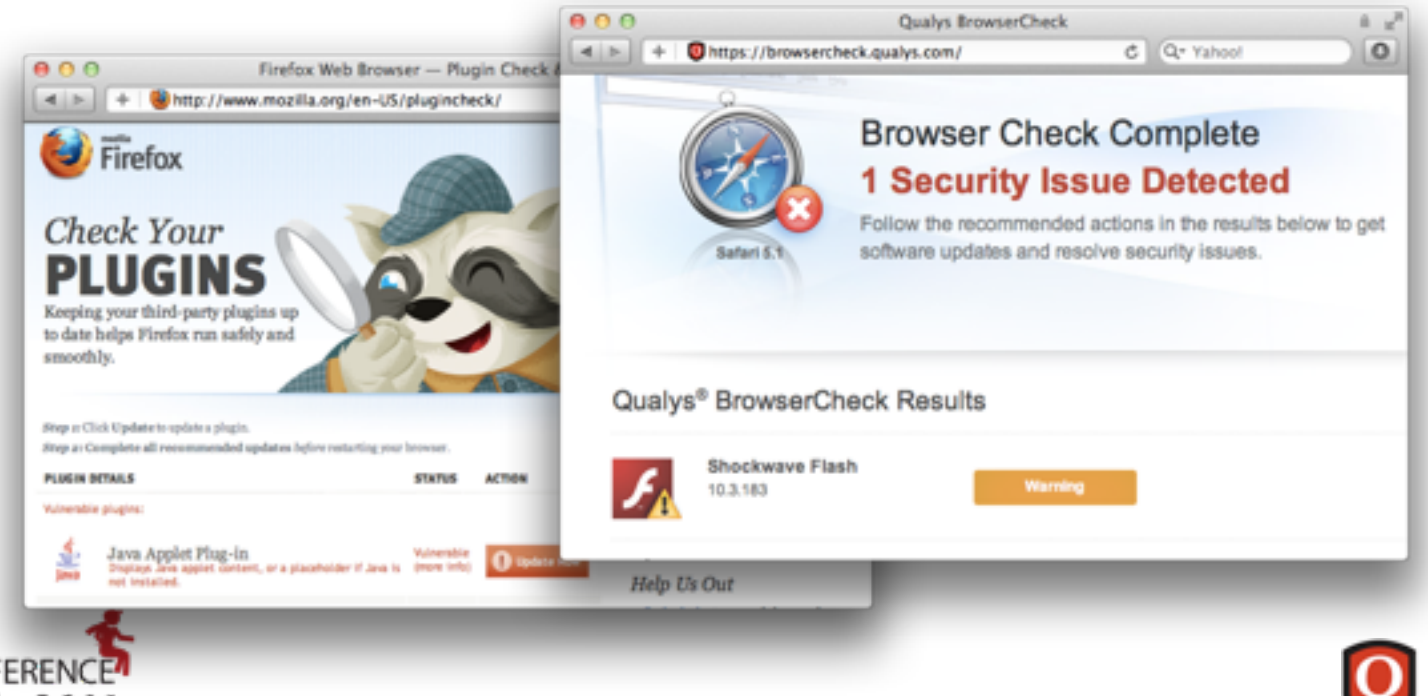
Final Note for Users

- Use a unique password for your prime email account -- this is your *de facto* identity.
- Does a video game provide more security than your bank?



Final Note for Users

- Keep the browser up to date
  - Notice how compromised SSL certificates are fixed with patches, not protocols.
- Keep the plugins up to date.



Apply

- Address decade-old issues first.
- HTML5's new features extend the attack surface for browsers -- keep the browser up to date.
- HTML5 can be leveraged to enhance an exploit against "old" HTML4.
- Move towards frameworks and distinct boundaries between API and the client.
- Understand the privacy implications of HTML5 features.

Thank you!

- Questions mshema@qualys.com
- Slides http://www.deadliestwebattacks.com/