Cross-site Scripting

(Also known as XSS)

Andrew Kerr | Sept 8, 2015
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whoami

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- Fifth year Software Engineering @ UF

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- Secretary of UFSIT for > 2yrs

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MMA CTF Recap

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- Lots of people there on Friday!
- Left Friday night in top 15%

We want your writeups!

Cross-site Scripting

(Also known as XSS)

XSS

Cross-Site Scripting (XSS) attacks are a type of injection, in which malicious scripts are injected into otherwise benign and trusted web sites. XSS attacks occur when an attacker uses a web application to send malicious code, generally in the form of a browser side script, to a different end user.

– OWASP

Ok... what does that mean?

andrewcore

Title

HTML Preview

#tags

Close Post

andrewcore

Title

HTML Preview

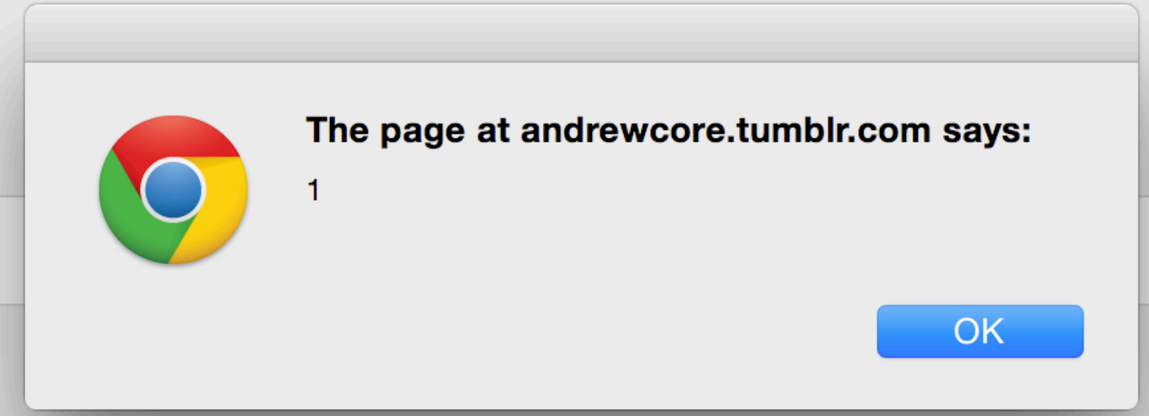
```
<script>alert(1)</script>
```

#tags

Close

Post

Nerd. Currently skipping class at the University of Florida. Formally engineering at Tumblr and BlockScore (YC S14).



Why does this work?

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- Backend server does not sanitize input correctly
- Poor client-side JavaScript executes given parameters

Why do it?

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- Steal session cookies

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- Steal logins by defacing

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- Exploit the browser/plugins

Why do it?

- Steal session cookies
- Steal logins by defacing
- Exploit the browser/plugins
- For the lulz

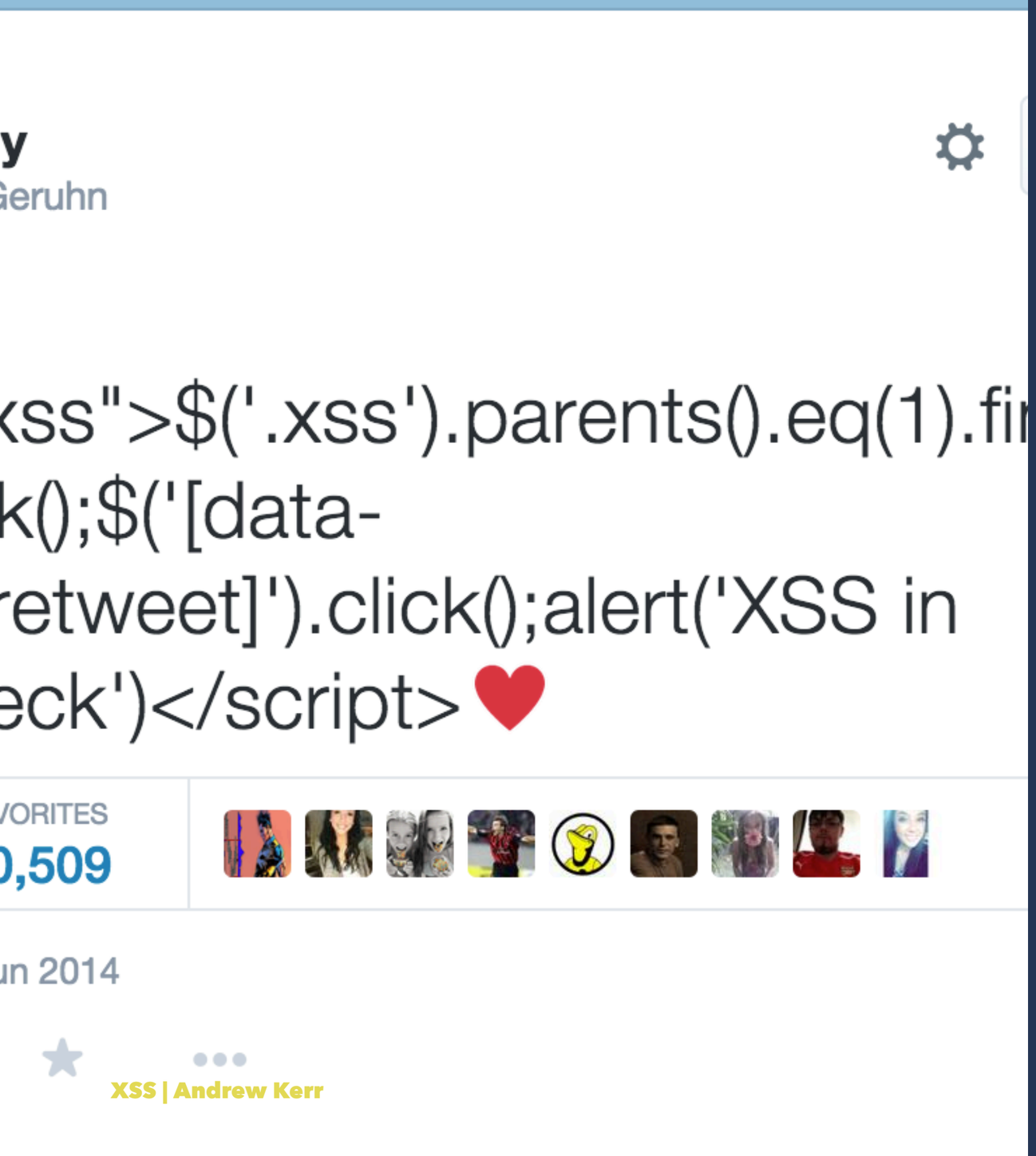
***andy**
@derGeruhn

Follow

<script class="xss">$('.xss').parents().eq(1).find('a').eq(1).click();$('[data-action=retweet]').click();alert('XSS in Tweetdeck')</script> ❤

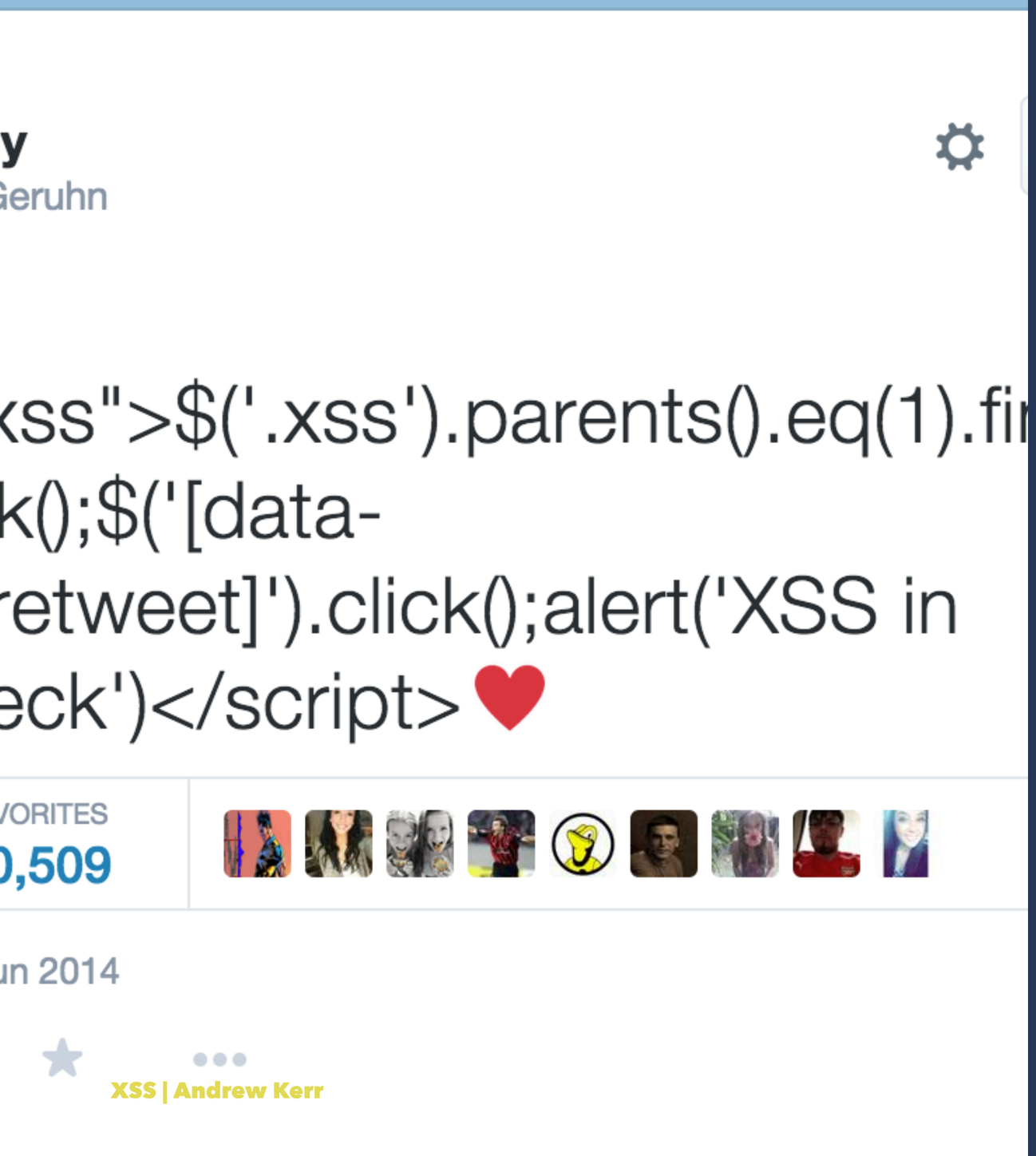
RETWEETS	FAVORITES
71,317	10,509

12:36 PM - 11 Jun 2014



Remember this?

- ❤ emoji broke XSS sanitization on TweetDeck



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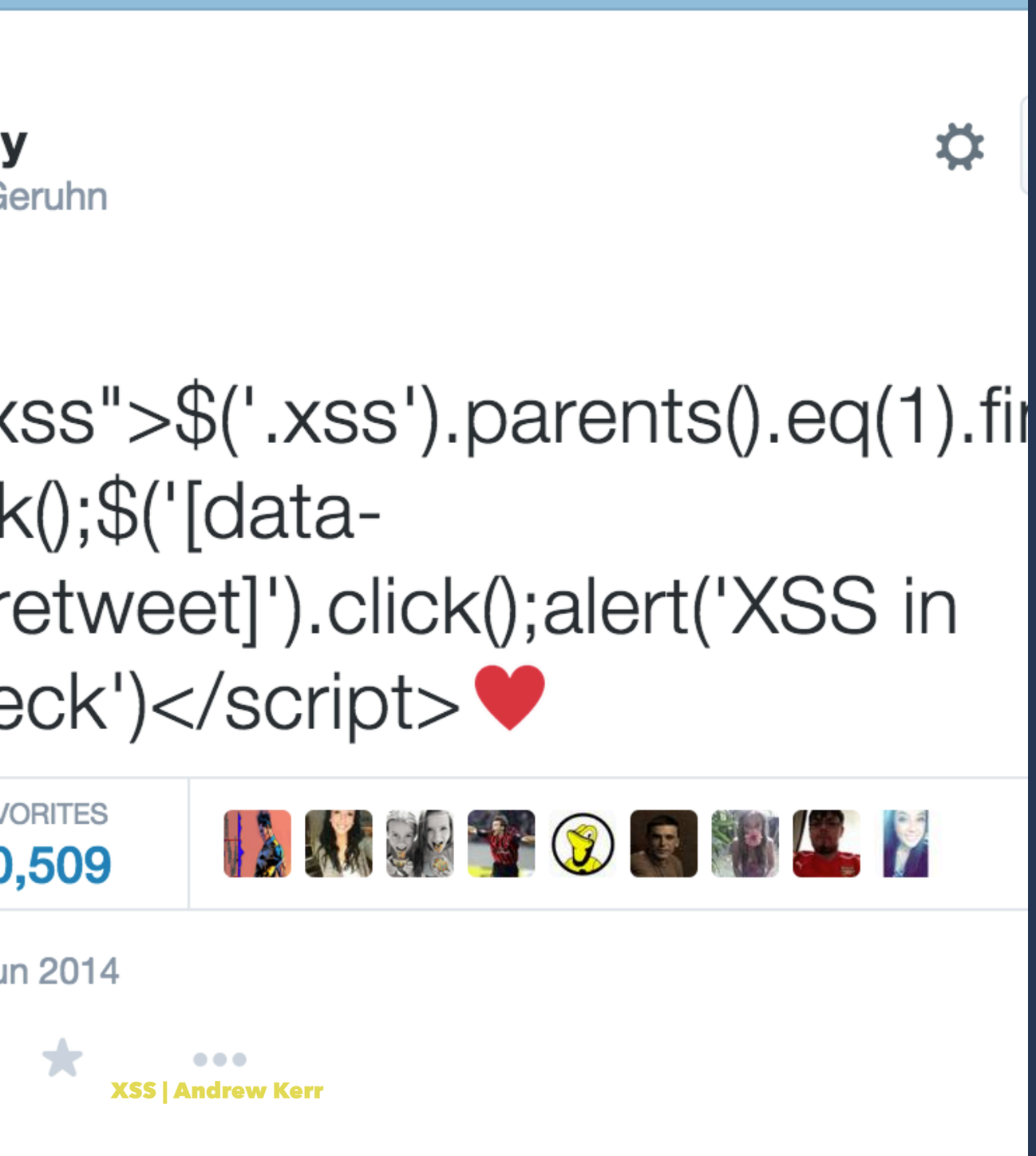


Remember this?

- ❤ emoji broke XSS sanitization on TweetDeck
- Auto-magically retweeted itself 70,000+ times
- Good thing it wasn't malicious!

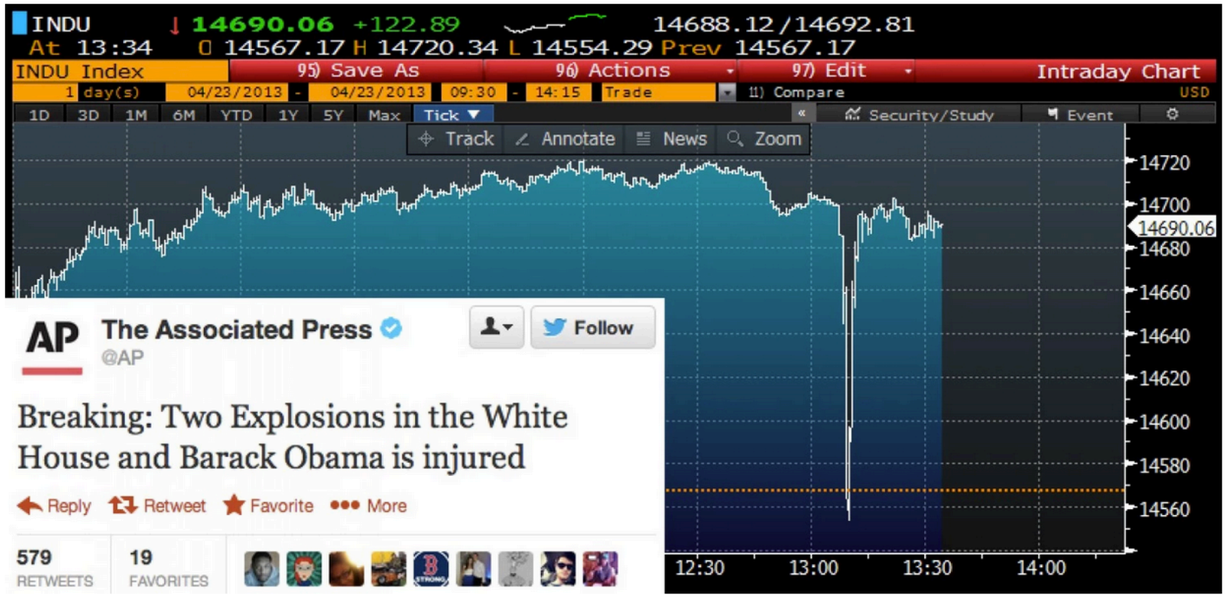
Ok, but it's Twitter... why does it matter?

WorldViews

Syrian hackers claim AP hack that tipped stock market by $136 billion. Is it terrorism?

A | 0

By Max Fisher April 23, 2013 Follow @Max_Fisher



This chart shows the Dow Jones Industrial Average during Tuesday afternoon's drop, caused by a fake A.P. tweet, inset at left.

Most Read World

1 Pope calls on Europe's Catholics to take in refugees

2 The Arab world's wealthiest nations are doing next to nothing for Syria's refugees

3 An American family saved their son from joining the Islamic State. Now he might go to prison.

4 The push and pull of China's orbit

5 Germans are obsessed with the U.S. But they'll deny it

XSS Payloads

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- A **TON** of possible XSS payloads

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- A **TON** of possible XSS payloads
- `<script>alert(1)</script>`
- `<img src="x" onerror="alert(1)" />`
- `<a href="javascript: alert(1)">Click me!</a>`
- and more!

Types of XSS

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1. Reflected

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2. Stored

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2. Stored
3. DOM-based

Reflected XSS

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- Ability to inject code and have the server return it back, unsanitized
  - Not stored on the server/in a database!

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Reflected XSS

- Ability to inject code and have the server return it back, unsanitized
  - Not stored on the server/in a database!
- Normally hidden in the URL
  - Don't click on random links!
- Example: search forms showing input on results page after submission

Reflected XSS Vulnerable Code Example

```
// www.site.com/search.php?q=search+query
$search_query = $_GET['q'];
echo '<h1>Search results for: ' . $search_query . '</h1>;
```

www.site.com/search.php?
q=<script>alert(1)</script>

Search results for:

Reflected XSS Vulnerable Code Example

```
// www.site.com/search.php?q=search+query
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Q: What's wrong with this code?

Reflected XSS Vulnerable Code Example

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A: UNSANITIZED USER INPUT

Stored XSS

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- Ability to inject code and have the server store it and return it without sanitizing it in either case

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- Ability to inject code and have the server store it and return it without sanitizing it in either case
- HOLY CRAP THIS IS HORRIBLE
  - Only way for end user to protect themselves is to disable JS
- Example: form post storing XSS

Stored XSS Example

***andy**
@derGeruhn

Follow

<script class="xss">$('.xss').parents().eq(1).find('a').eq(1).click();$('[data-action=retweet]').click();alert('XSS in Tweetdeck')</script> ❤

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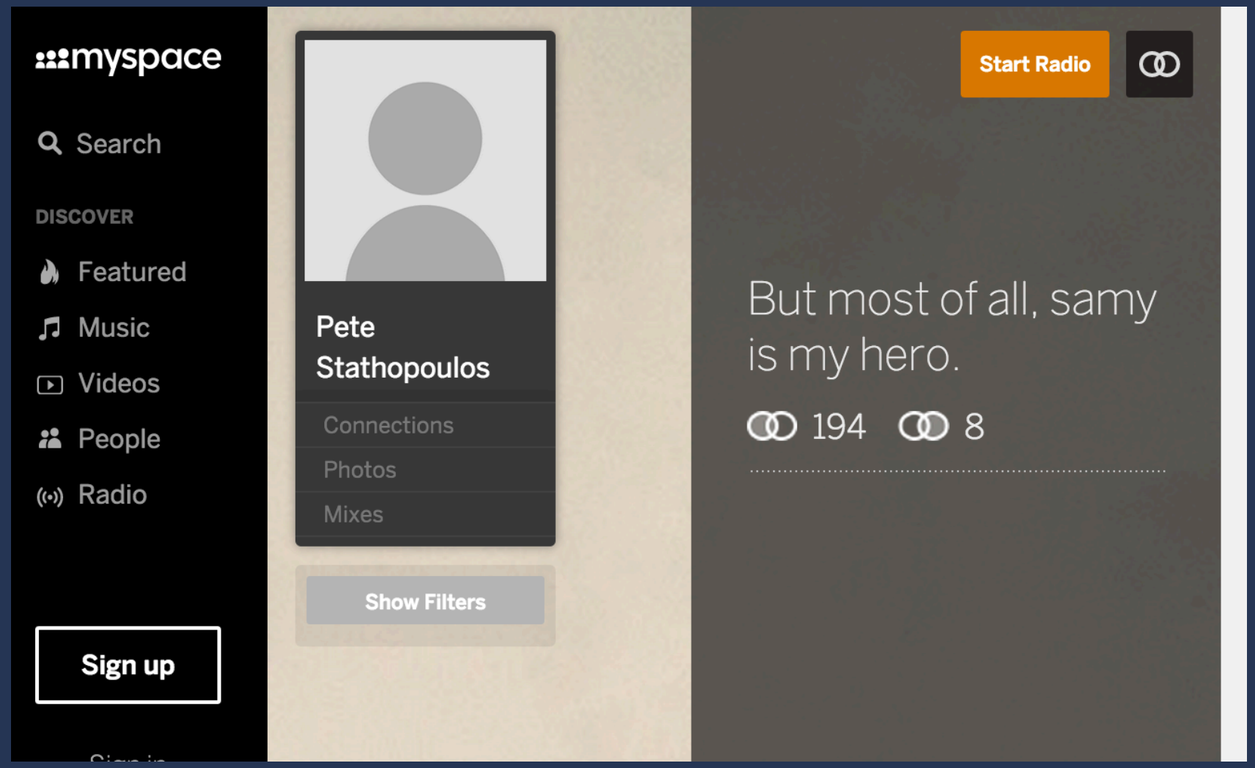
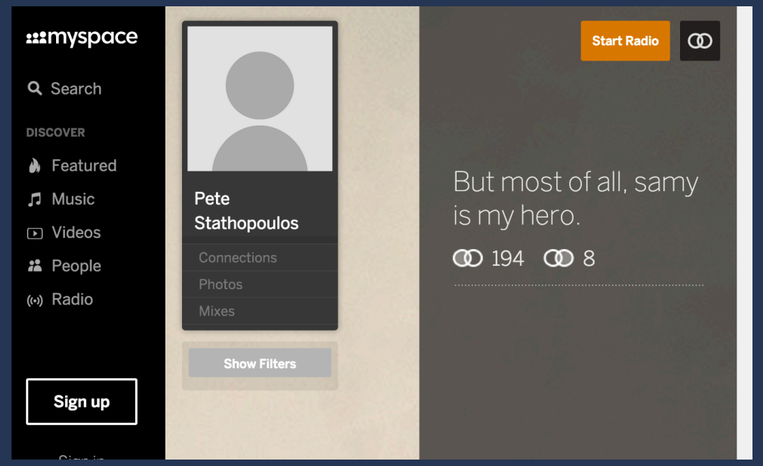
- Posted 'but most of all, samy is my hero' to victims



Samy MySpace worm

- Posted 'but most of all, samy is my hero' to victims
- Fastest spreading virus of all time
  - 1+ million runs in ~20hrs



Stored XSS Vulnerable Code Example

```
// Storing posts
$post = $_POST['post'];
$query = $mysql_conn->prepare("INSERT INTO posts VALUES ('" . $post . "')");
$query->execute();

// Fetching and outputting posts
$query = $mysql_conn->prepare("SELECT * FROM posts");
$query->execute();
$query->bind_result($post);
while($query->fetch()) {
    echo '<p>' . $post . '</p>';
}
```

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DOM-based XSS

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- Similar to Reflected, *but* is not rendered from the server.

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- Normally due to bad JavaScript code

DOM-based XSS

- Similar to Reflected, *but* is not rendered from the server.
- Normally due to bad JavaScript code
- Also crafted by a URL
  - Don't let users pass in JS via the URL!

DOM-based XSS Vulnerable Code Example

```
// Pretend parse_get_params is imeplemented :)
var title = parse_get_params('title');
$('.page-header').html("<h1>" + title + "</h1>");
```

DOM-based XSS Vulnerable Code Example

```
// Pretend parse_get_params is imeplemented :)
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Q: And, what's the issue here?

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Q: And, what's the issue here?

A: UNSANITIZED USER INPUT

DOM-based XSS Vulnerable Code Example

```
// Pretend parse_get_params is imeplemented :)
var title = parse_get_params('title');
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```

Q: How would we exploit this?

DOM-based XSS Vulnerable Code Example

```
// Pretend parse_get_params is imeplemented :)
var title = parse_get_params('title');
$('.page-header').html("<h1>" + title + "</h1>");
```

Q: How would we exploit this?

A: Craft a URL like:

```
www.site.com/page.html?title=<img src='x'
onerror='alert(1)' />
```

Protecting Against XSS

Protecting Against XSS

```
// Pretend parse_get_params is imeplemented :)
var title = parse_get_params('title');
$('.page-header').html("<h1>" + title + "</h1>");
```

- jQuery provides a `.html` AND `.text`.

Protecting Against XSS

```
// Pretend parse_get_params is imeplemented :)
var title = parse_get_params('title');
$('.page-header').html("<h1>" + title + "</h1>");
```

- jQuery provides a `.html` AND `.text`.
- But, what's the difference?

Protecting Against XSS

Set the text contents of the matched elements.

– `.text()`

Set the HTML contents of each element in the set of matched elements.

– `.html()`

Protecting Against XSS


```
<html>
<head>
  <title>Test Page</title>
  <script type="text/javascript" src="jquery.min.js"></script>
  <script type="text/javascript">
    $(function(){
      $("#div1").html('<a href="example.html">Link</a><b>hello</b>');
      $("#div2").text('<a href="example.html">Link</a><b>hello</b>');
    });
  </script>
</head>

<body>

<div id="div1"></div>
<div id="div2"></div>

</body>
</html>
```

Protecting Against XSS

1. Know your framework/library/language!

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2. SANITIZE!

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Protecting Against XSS

1. Know your framework/library/language!
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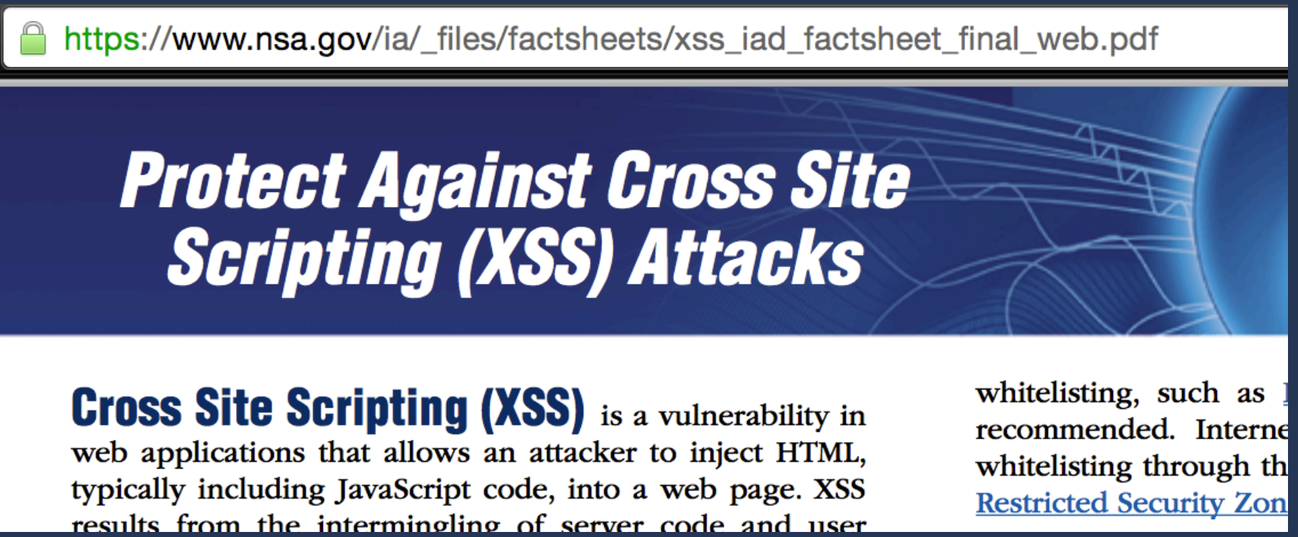
3. Whitelist, not blacklist
4. Headers

Protecting Against XSS



- Or, ya know, read the NSA's recommendations.
- https://www.nsa.gov/ia/*files/factsheets/*xssiad*factsheet*final_web.pdf

But most importantly...

TEST YOUR APPLICATION


JUST
DO IT!

Bypassing Filters

- Wonderful cheatsheet by OWASP: https://www.owasp.org/index.php/XSS*Filter*Evasion*Cheat*Sheet

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- Also, some guess work helps!

Bypassing Filters Vulnerable Code Example

```
$input = $_POST['input'];
$sanitized = str_replace('script', '', $input);
```

Bypassing Filters Vulnerable Code Example

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Q: How could we get by this?

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Q: How could we get by this?

A: Think about it :)

Resources

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- OWASP

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- OWASP
- The Web Application Hackers Handbook

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- OWASP
- The Web Application Hackers Handbook
- Mutillidae Practice Application

Ok, cool, onto challenges!

104.236.76.214

Go here

Challenges

- Server: 104.236.76.214
- Source: github.com/ufsit/xss-challenges
  - Try not to use this!
- Cheatsheet: https://www.owasp.org/index.php/XSS*Filter*Evasion*Cheat*Sheet