## Cross-Site Scripting Attacks and Possible Defenses

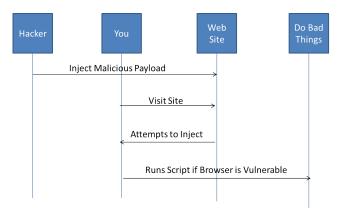
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http://www.acunetix.com/websitesecurity/xss/

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- XSS attacks have been a major issue for over a decade, and account for 84% of web security vulnerabilities in 2007 according to Symantec.
- Currently many forms of XSS attacks are not written down for study. Primarily only basic XSS attacks are listed in many cheatsheets.
- XSS attacks are continually evolving to work around existing defenses.



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2 Recent Solutions



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#### Previous Solutions

- NoScript & IE8
- noXSS & XSSAuditor
- Progression of Web Browsers

#### 2 Recent Solutions

### 3 Conclusion

- Both utilize regular expressions to identify the presence of JavaScript in HTTP request parameters and attempts to sanitize them before submission.
- This type of search can prevent some web pages from loading.
- NoScript incurs many false positives, but IE8 incurs fewer false positives than NoScript at the cost of an increase of false negatives.
- NoScript has about 40 non-trivial regular expressions in detection and sanitation.

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• Both have complex set of regular expressions for detection and sanitation. Even with this complex set of regular expressions parsing tricks can bypass the filter.

#### Example (Parsing trick)

< a < img/src/onerror = alert(1)// <

Neither NoScript nor IE8 can detect XSS scriptless attacks.

- noXSS and XSSAuditor utilize exact substring matching to match reflected content for malicious script.
- noXSS achieves a high fidelity rate but at the cost of slower performance.
- noXSS cannot handle HTML entity encoded javascript URLs. This allows a hacker to bypass the filter by inserting a full-page hyperlink.

## noXSS & XSSAuditor Cont.

- XSSAuditor is implemented on the client-side and improved upon some of the faults that were found in noXSS and IE8.
- XSSAuditor cannot handle partial-script injections which have the ability to alter the structure of script on a web page.
- XSSAuditor is unable to detect attacks that are non-script based. One such attack can be carried out using CSS.

### Example (Partial-Script Attack)

```
< script >
docuement.write(
< ahref = "../plugin.php?passed_id = <= $_GET["id"];? > " ><
/a >);
< /script >
Injected Attack
id :
```

```
); do_xss(); document.write(
```

- H1. Browsers belonging to two different families have different attack surfaces.
  - In other words, they are not sensitive to the same attack vectors.
  - Crucial to understand whether there is a shared security policy between web browser vendors against XSS attacks.



**Opera Mobile** 



- To support H1, 84 dissimilar attack vectors were chosen from a variety of cheetsheets and a few generated by the researchers.
- Tested against three types of browsers: modern/recent, mobile, and legacy versions.
- Types of attacks tested include <script> tags with various payloads, <body> tags, HTML5 tags and properties, etc.

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## Hypothesis 1 Cont.

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## Hypothesis 1 Cont.

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Travis Starkson (U of Minn, Morris)

Cross-Site Scripting Attacks and Possible Def

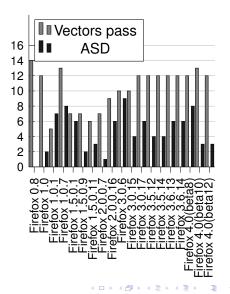
H2. Web browsers are not systematically tested with respect to their sensitivity to XSS vectors.

- Explores whether there is a clear continuity in the attack surface of a given web browser over time.
- The validation of this hypothesis would mean that web browser providers do not have a systematic regression strategy for improving the robustness of their web browser.

15/25

# Hypothesis 2 Cont.

- Figure displays Firefox regression.
- Gray shows how many attacks passed their testing, while black shows the attack surface distance (ASD) with the current version and the previous.
- This data helps support H2.



#### Previous Solutions

## 2

#### **Recent Solutions**

- XSSFilt
- Scriptless Attack Defenses

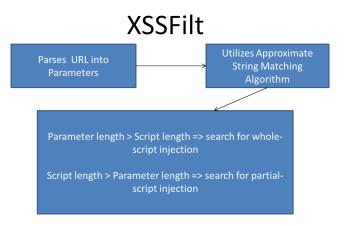
### 3 Conclusion

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**H** 16



 Utilizes an approximate string matching algorithm that can detect both whole and partial-script injections.



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- XSSFilt runs significantly slower than an exact substring matching program like XSSAuditor.
- XSSFilt has a higher false positive rate than XSSAuditor.
- XSSFilt can deal with application-specific sanitations unlike XSSAuditor.

Dataset	XSSFilt	XSSAuditor	NoScript
xssed	399/400	379/400	400/400
cheatsheet	20/20	18/20	20/20

- There is not much research done to fight against scriptless attacks.
- Content Security Policy (CSP) can be used to reduce the harm of injected malicious script. CSP can also restrict access to undesirable non-script-based files such as Cascading Style Sheet (CSS) and Scalable Vector Graphics (SVG).
- CSP is unable to cover a wide variety of scriptless attacks, but is a step in the right direction since it is able to eliminate some side channels.

- The authors of *Scriptless Attacks: Stealing the Pie Without Touching the Sill* propose a solution to a type of scriptless attack labeled double-clickjacking.
- Their solution is a patch created for Firefox that expands on the window object by adding two properties: isPopup and loadedCrossDomain.
- isPopup is true when the GUI window represented by the current DOM window object is in a detached view, while loadedCrossDomain is true if the current DOM window object was loaded in a cross-domain.
- With this ability, websites can detect if they are being loaded in a detached view, which can allow it to mitigate different scriptless attack vectors.

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### Previous Solutions

2 Recent Solutions



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- A good majority of previous defenses have trouble dealing with scriptless and/or partial-script attacks such as NoScript, IE8, noXSS, and XSSAuditor.
- Found that web browser providers do not follow a systematic regression strategy in the development of new versions of their browsers.
- Looked at a more recent defense called XSSFilt which is a client-side defense that utilizes an approximate string matching algorithm.
- Looked at the start of scriptless attack defenses
- Continous research must be done in order to combat current vulnerabilities in web security and potential future vulnerabilities since XSS is a continuously evolving problem.

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