Bypassing CSRF protections with ClickJacking and HTTP Parameter Pollution

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Content

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This idea occurred to me a few weeks back when discussing the potential impact of ClickJacking attacks with Luca. Submitting forms using ClickJacking is hard work and is only successful in very rare scenarios. The Twitter ClickJacking attack was one famous instance where form submission was involved, but it was a form that was submitted over 'GET' request.

In this post I will discuss a technique that can be used to bypassing any CSRF counter measures and submit POST method -based forms with attacker controlled data using ClickJacking. This works on JSP applications and partially on ASP.NET applications.

Let us take the case of a simple primary Email ID update form. Such forms are common in many web applications. They are simple but extremely important, if an attacker manages to force a victim to update his primary Email ID with that of the attacker's ID then the attacker can perform a password reset and compromise the victim's account.

A sample Email ID update form is given below, this contains a 'csrf-token' parameter for CSRF protection:

> <form method="POST">

<input type="text" name="email" value=""></input> <input type="hidden" name="csrf-token" value="a0a0a0a0a0a"/> </form>

Let's say this form is available at 'www.example.com/updateEmail.jsp' Since this form does not contain an 'action' attribute, on submission the form will be submitted to the current URL in the address bar, which will be 'www.example.com/updateEmail.jsp'.

The source code of 'updateEmail.jsp' would typically look like this:

```
if ( request.parameter("email").isSet() && request.parameter("csrf-token").isValid() )
```

{ //process the form and update the email ID } else { //display an empty form to the user (CSRF token included) }

The application checks if the request contains a valid CSRF token, if not it displays the form to the user.

Now to submit our sample form using ClickJacking the attacker can include an iframe like this '<iframe src="http://www.example.com/updateEmail.jsp?email=evil@attackermail.com">'

When this request goes to the server the application would display the update form. When this form is submitted by the victim using ClickJacking the request that is sent to the server is like this:

```
POST /updateEmail.jsp?email=evil@attackermail.com HTTP/1.1
```

Host: www.example.com

email=&csrf-token=a0a0a0a0a0

Since the form was not filled by the victim, the email parameter in the POST body is blank. However since the action attribute of the form was empty the form is submitted to www.example.com/updateEmail.jsp?email=evil@attackermail.com. Now the QueryString contains the attacker entered value for the 'email' parameter.

This request contains two values for the 'email' parameter, one in POST body and one in QueryString. Enter HTTP Parameter Pollution, when the server side JSP code calls request.parameter("email"), the value that is returned is the one in the QueryString and not the POST body. Since this value can be controlled by the attacker he can trick the victim in to updating his account with the attacker's mail ID.

This attack can also work in cases when the form is submitted with JavaScript like this:

```
<form onSubmit=process()>
```

<input type="text" name="email" value=""></input> <input type="hidden" name="csrf-token" value="a0a0a0a0a0a"> </form>

<script> function process() { //check if email is set form.action = document.location; //document.location will give out the entire URL with parameters form.method = "post"; form.submit(); } </script>

Apart from JSP applications, this attack can be extended to ASP.NET applications as well. However since ASP.NET appends a ','(comma) between duplicate parameters, it not as clean. But there are plenty of areas where having a trailing ',' won't hurt. In ASP.NET applications the form action is always set by the framework because of the 'runat="server"' attribute. The only requirement now is that the application should make use of Request.Params. Even if the application does not use Request.Params, forms submitted over 'GET' are still vulnerable. So all ASP.NET application using Request.Params or submitting forms over 'GET' are vulnerable to this attack!

Similar attack is also possible on ASP applications where the form element is of the form described earlier and if it is submitted over 'GET'. Like ASP.NET application a trailing comma is introduced here as well. A more detailed description of HTTP Parameter Pollution on ASP and ASP.NET

applications and the significance of Request.Params is explained here. This whitepaper discusses how HPP can be used to bypass WAF.

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