Exploiting CSRF Protected XSS

Exploiting CSRF Protected XSS - kuza55, kuza55.blogspot.com.

- Published: date not stated
- Original: <https://kuza55.blogspot.com/2008/02/exploiting-csrf-protected-xss.html>
- Preserved from: https://kuza55.blogspot.com/2008/02/exploiting-csrf-protected-xss.html (live) on 2026-08-10
- Licence: unknown

Content

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XSS vulnerabilities which are protected by CSRF protections, are usually considered unexploitable due to the fact that we have no way of predicting the CSRF token.

However, these protections do nothing more than check that the user is first "logged in" and that the CSRF token they sent is tied to their session; nowhere in this chain of events is there a condition which states that an attacker must be forcing the victim to use their own session identifier (cookie).

If we are able to force the victim to send a request which contains the attacker's cookie, CSRF token and XSS payload, then we will pass the CSRF protection checks and have script execution.

A General Case

So how would we go about this? As I mentioned in my "Exploiting Logged Out XSS Vulnerabilities" post, Flash (until 9,0,115,0 and not in IE) allows us to spoof the Cookie header for a single request, however this suffers from the same problem that we cannot completely over-write cookies; only add an additional Cookie header.

This is indeed a possible attack vector though; if we first make sure the user is "logged out" (and also has no value for the login cookie) either by simply waiting, using a CSRF attack to log the user out (and hoping the website also clears it's cookies), or exhausting the browser's cookie limit, we can then add our own Cookie, CSRF token and XSS payload to the request using similar Flash code e.g.

```
class Attack { static function main(mc) { var req:LoadVars = new LoadVars(); req.addRequestHeader("Cookie", "PHPSESSID=our_valid_session_id"); req.x = "y"; req.send("http://site.com/page.php?csrf_token=our_csrf_token&variable=", "_self", "POST"); // Note: The method must be POST, and must contain // POST data, otherwise headers don't get attached } }
```

Then the application will receive a request with our (the attacker's) session id, a valid CSRF token and our XSS payload from the victim's browser.

Of course, the problem with this is that if the user is actually logged out (which we forced, due to our inability to simply over-write the cookie or stop it being sent) and the browser no longer has the victim's cookies, the only attacks we have from this point are the other attacks mentioned in my "Exploiting Logged Out XSS Vulnerabilities" post. And while this is not ideal, it does at least give us something other than an unexploitable XSS.

Cookie tricks

Again, with this technique we can also set a cookie for the specific path, either by having an XSS on a related subdomain or by abusing a cros-site cooking bug, and then the user will still have their original cookie intact and we can simply remove our own cookie from the user's browser once our XSS has fired.

Abusing RequestRodeo

Another case where the user would be logged out is the case where we can somehow get the cookies stripped from the user's request.

The technique I presented at 24c3 talked about abusing one such piece of software which stripped cookies; the RequestRodeo Firefox extension which was created by Martin Johns and Justus Winter which does a good job of protecting against a lot of CSRF attacks by stripping cookies from requests originating from 3rd party sites (i.e. a request going to site.com which was induced by evil.com will not have any cookies attached to it). Which is just what we need.

Of course, this is a nice place to note that this is of course a niche piece of software that doesn't really provide a valid avenue for exploitation in almost any scenario, but as I explained in my post "Understanding Cookie Security" we can also delete all a users' cookies by exhausting the browser's global limit on on the amount of cookies it will store.

Anyway, given that RequestRodeo all cookies (including the ones we are attempting to send via Flash), we still face the problem that we need to be sending a valid session identifier for which we need to be sending a valid CSRF token. We do not face this problem when we remove the user's cookies, and can use the Flash approach outlined above, but we can also use this approach, which has the added benifit of still working on everyone (not just those who are unpatched).

Anyway, one interesting feature of PHP and other frameworks is that they accept session identifiers through the URL. This has of course led to easily exploitable Session Fixation attacks; however in PHP at least, if a cookie is being sent, then the value in the URL is completely ignored.

In our case, no cookie is being sent, since it is either being stripped by RequestRodeo, or has been deleted by us, so we can simply supply our session identifier through the URL, attach our CSRF token and XSS payload and we're done, except in this case the browser still has the user's cookies, and our XSS functions like normal.

The result of this attack is the same as the above if we have deleted the cookies from the user's browser, however if we have stripped the cookies with RequestRodeo or some similar

tool/technique/etc, then we have the further benifit of the user still being logged in when our XSS fires.

Other Cookie Tricks

As I wrote in my post "Understanding Cookie Security", if we have an XSS which is largely unexploitable (except via pure Session Fixation) since it is on a subdomain with no accounts, we can use it to set almost arbitrary cookies for other subdomains.

This gives us a perfect avenue, since we can set the path to only over-write cookies for our single CSRF Protected XSS page, and send the appropriate CSRF token and XSS payload for.

Self-Only CSRF Protected Persistent XSS

One case which is much simpler to exploit than the general case though, is where there are CSRF protections on the form where you submit the actual XSS, but the XSS is a persistent XSS for the user, in that it is rendered on another page (which is itself not CSRF protected, since it is used to display rather than edit data)

CAPTCHAs As CSRF Protections

CAPTCHAs are not designed to be CSRF protections, and in certain cases are bypassable.

There are essentially two (not completely broken) types of CAPTCHA systems I have seen in widespread use, one where the plaintext is simply stored in the server-side session and the captcha is included in a form like this: `<img src="captcha.php" />` The other is when a form has a hidden input tag which contains a value which is also inside the image URL, like so: `<input type="hidden" name="captcha_id" value="1234567890" /> <img src="captcha.php?id=1234567890" />`

The first system is trivially bypassed for CSRF & CSRF Protected XSS attacks by simply inserting the CAPTCHA onto a page, or inside an iframe (to strip/spoof referers), and asking the user to solve it.

The second can often be trivially bypassed for CSRF & CSRF Protected XSS attacks since the id is usually not user-dependant and the CAPTCHA does not keep track of what id it sent the user. Therefore the attacker can simply retrieve the appropriate CAPTCHA, solve it, and put the answer along with the corresponding captcha id in the csrf or csrf protected xss attack.

Conclusion

So essentially if we can somehow trick the application into using an attacker's session identifier, either by altering the cookie (e.g. via subdomain tricks, Flash, injecting into Set-Cookie headers, or whatever other trick we can come up with), or by suppressing or deleting the cookie and passing the identifier through another means such as the URL, then all CSRF protected XSSs are exploitable.

However if we cannot, then we can still exploit some scenarios such as self-only CSRF protected persistent XSS if the logout/login functionality is not CSRF-protected (which very few are). And we

can also bypass the semi-CSRF protection of CAPTCHAs in several cases.
