

## 46 Rack parses encoded cookie names allowing an attacker to send malicious `\_\_Host-` and `\_\_Secure-` prefixed cookies

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### TIMELINE



fetchto99 submitted a report to [Ruby on Rails](#).

Jun 10th (3 ye

The [rack cookie parser](#) parses the cookie string using `unescape`. This allows a malicious attacker to set a second cookie with the name being percent encoded. Typically it would be expected that we cannot trust cookies and in *most* cases that's true. However in a couple of cases certain expectations are set. Cookies allow [cookie prefixes](#) on the cookie name to indicate to the browser certain attributes. In this case there are 2 special attributes we care about: `__Secure-` and `__Host-`. When the browser sends these cookies to the server certain [assumptions](#) are made around these cookies:

1. `__Secure-` prefix: Cookies names starting with `__Secure-` (dash is part of the prefix) must be set with the secure flag from a secure page (HTTPS).
2. `__Host-` prefix: Cookies with names starting with `__Host-` must be set with the secure flag, must be from a secure page (HTTPS), must not have a domain specified (and therefore aren't sent to subdomains) and the path must be `/`

The flaw in Rack allows for a `__%48ost-` or `__%53ecure-` cookie to be set **without** the required attributes (i.e. set without HTTPS, from root domain, or from a sec page). This means a malicious cookie set by an attacker could set a `__%48ost-` cookie from a subdomain knowing that Rack would parse it as `__Host-`. Furthermore since the browser won't enforce the `HostOnly` attribute to `__%48ost-` cookies an attacker could control the `__Host-` prefixed cookie from a subdomain by setting wildcard domain on the `__%48ost-` cookie.

It should be noted that while the [cookie spec](#) recommends encoding for the value of a cookie it doesn't make any suggestions around the encoding of the name of cookie.

Here's a simple PoC test case which fails:

Code 1.34 KiB

[Wrap lines](#) [Copy](#) [Dow](#)

```
1 # frozen_string_literal: true
2
3 require_relative 'helper'
4
5 describe Rack::Utils, "malicious cookie" do
6   # Fails and __Host-evil reads the malicious value and sets it as the cookie
7   # rather than reading the actual __Host cookie
8   #
9   # Furthermore, browsers enforce HostOnly for `__Host-` cookies but they would
10  # not enforce it for "__%48ost" cookies so a malicious script could potentially
11  # set this cookie knowing it would be parsed as the `__Host-` cookie
12  #
13  # Lastly, when the cookie is made it could be set with the `example.com` domain
14  # wildcard, thus a malicious script on a subdomain could set the cookie and it
15  # would be parsed by the root domain
16  #
17  # This is due to the cookie being unescaped, thus:
18  # URI.unescape("__%48ost-evil") => "__Host-evil"
19  #
20  # Currently fails, should be passing
21  it "doesn't parse malicious __Host cookie" do
22    env = Rack::MockRequest.env_for("", "HTTP_COOKIE" => "__%48ost-evil=evil;__Host-evil=abc")
23    cookies = Rack::Utils.parse_cookies(env)
24    cookies.must_equal({ "__%48ost-evil" => "evil", "__Host-evil" => "abc" })
25  end
26
27  # Less of a security issue and more of a bug
28  it "generic foo=bar example" do
29    env = Rack::MockRequest.env_for("", "HTTP_COOKIE" => "%66oo=baz;foo=bar")
30    cookies = Rack::Utils.parse_cookies(env)
31    cookies.must_equal({ "%66oo" => "baz", "foo" => "bar" })
32  end
33 end
```

An attacker could potentially set the cookie from a malicious script on a subdomain like so, bypassing any expectations around the attributes of the cookie:

Code 60 Bytes

[Wrap lines](#) [Copy](#) [Dow](#)

```
1 document.cookie = "__%48ost-evil=evil; domain=.example.com";
```

I should note I work for GitHub, I'm not sure if there's any conflict with payouts in this case (and I certainly don't want/need a payout), however should you chose to payout for this I'd like the money to be donated to charity. If possible could it please be donated to [NAACP Legal Defense and Education Fund](#) their donaiton page be found [here](#).

### Impact


An attacker can control cookies by encoding creating a second cookie with the name url encoded. This means that the `__Host-` and `__Secure-` prefixed cookies be controlled. Furthermore, a malicious attacker could set this cookie from a subdomain and have it apply to the root domain, in which case the Rack would parse t attackers cookie.




fetchto99 posted a comment.

Jun 10th (3 ye


A cookie name/ value can be any UTF-8 character, except control characters, spaces, or tabs. It also must not contain a separator character like the following: `()@,;:\\" / [ ] ? = { }`.

 **fletchto99** posted a comment. Jun 11th (3 ye  
I had a go at attempting to patch the issue today. I'm not sure if it's the most performant solution but I figured I'd help out where possible. I'm not too sure what's required in terms of backports but hopefully this can help kickstart a fix.


1 attachment:  
**F864477:** [fix.patch](#)

 **tenderlove** Ruby on Rails staff posted a comment. Jun 12th (3 ye  
**@fletchto99** what do you think about this as a patch? It's based off of your patch, but passes the test suite and should allocate fewer objects. If you think it will work can you send me a patch using `git format-patch` so I can retain your contribution information?


1 attachment:  
**F866010:** [out.diff](#)

 **fletchto99** posted a comment. Jun 12th (3 ye  
Hey **@tenderlove**, here's a patch file created via `format-patch`. Feel free to touch up the commit message if rack follows any guidelines around commit messages  
Cheers!

1 attachment:  
**F866020:** [0001-When-parsing-cookies-only-decode-the-values.patch](#)

 **jack\_mccracken** posted a comment. Jun 12th (3 ye  
Hey **@fletchto99**,  
I've prepared the following advisory and final patchset. Let me know if you spot any errors.


3 attachments:  
**F866114:** [0001-2.1.3-When-parsing-cookies-only-decode-the-values.patch](#)  
**F866115:** [0001-2.2.2-When-parsing-cookies-only-decode-the-values.patch](#)  
**F866122:** [895727\\_advisory.txt](#)

 **fletchto99** posted a comment. Jun 12th (3 ye  
Hey Jack. The advisory looks good. I just noticed I used my GitHub email for the patches. I've updated them to use my personal email. Besides that everything looks good, thanks!


2 attachments:  
**F866148:** [0001-2.1.3-When-parsing-cookies-only-decode-the-values.patch](#)  
**F866149:** [0001-2.2.2-When-parsing-cookies-only-decode-the-values.patch](#)


 **tenderlove** Ruby on Rails staff updated the severity to Low. Jun 15th (3 ye

 **tenderlove** Ruby on Rails staff closed the report and changed the status to **Resolved**. Jun 15th (3 ye  
This is shipped, thanks!

 **fletchto99** requested to disclose this report. Jun 15th (3 ye  
Thanks **@tenderlove** and **@jack\_mccracken**, unless there's any reservations any issues with disclosing?

 **jack\_mccracken** agreed to disclose this report. Jun 16th (3 ye

 This report has been disclosed. Jun 16th (3 ye

 **The Internet Bug Bounty** has decided that this report is not eligible for a bounty. Feb 9th (2 ye  
Hi **@fletchto99**. No problems disclosing this, I just have completely forgotten to do that. Also since this is a low severity bug I'm not awarding a bounty (as that is within our bounty rules say).