Penetration testing

Planning

Scope : Team project5 jackson nano
Goal : Penetration test with project artifacts to find vulnerabilities.

Information gathering

Environments

- IP addresses : 192.168.0.166
- Network protections : Nothing

OS Version

uname -a

Linux LgFaceRecProject 4.9.201-tegra #1 SMP PREEMPT Fri Feb 19 08:40:32 PST 2021 aarch64 aarch64 aarch64 GNU/Linux

lsb_release -a
No LSB modules are available.
Distributor ID: Ubuntu
Description: Ubuntu 18.04.5 LTS
Release: 18.04
Codename: bionic

cat /proc/version
Linux version 4.9.201-tegra (buildbrain@mobile-u64-5294-d8000) (gcc version 7.3.1 20180425 [linaro-7.3-2018.05 revision d29120a424ecfbc167ef90065c0eeb7f91977701] (Linaro GCC 7.3-2018.05)) #1 SMP PREEMPT Fri Feb 19 08:40:32 PST 2021

Software Package Version

cryptmount-5.2.4 openssl - 1.1.1-1ubuntu2.1~18 arm64

nmap scanning result

```
Host is up (0.00031s latency).
Not shown: 992 closed ports
PORT     STATE SERVICE       VERSION
22/tcp   open  ssh           OpenSSH 7.6p1 Ubuntu 4ubuntu0.3 (Ubuntu Linux; protocol 2.0)
53/tcp   open  domain        dnsmasq 2.79
111/tcp  open  rpcbind       2-4 (RPC #100000)
3389/tcp open  ms-wbt-server xrdp
5000/tcp open  upnp?
5001/tcp open  tcpwrapped
6000/tcp open  X11?
6001/tcp open  X11:1?
Service Info: OS: Linux; CPE: cpe:/o:linux:linux_kernel
```

- 5000 & 5001 tcp port for non-secure mode
- 6000 & 6001 tcp port for secure mode

Threat Modeling

It checks whether there is a way to penetrate Team5's end product through vulnerabilities contained by the Software or OS.

1. Exploits the TCP port used by the implemented SW, causing system malfunction.
2. Exploits the TCP port used by the implemented SW to obtain root through privilege escalation.
3. Exploits the TCP port used by implemented SW to cause crash/hang of services and reduce availability.
4. Find vulnerabilities in other ports running on the OS and penetrate to cause system malfunctions or acquire root.

Vulnerability analysis & exploitation

To analyze the vulnerabilities, we analyzed some of the tools mentioned in the class and confirmed that they are available in this phase2.

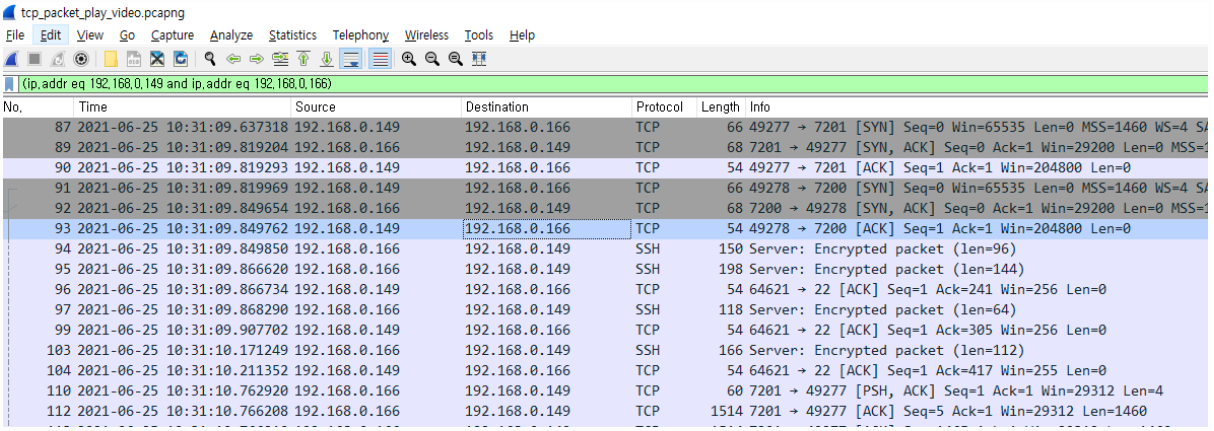
Test Domain	How to test	Tools
Network System	Check communication data between server and client	wireshark, Burp Suite, netcat
Server/Client System	Check the vulnerabilities in a program or OS system.	netcat, nmap, metasploit
Library used in Server/Client	Check the version of the library used and find there is a public CVE that has not	Searching internet

	been improved.	

Network System Analysis with wireshark

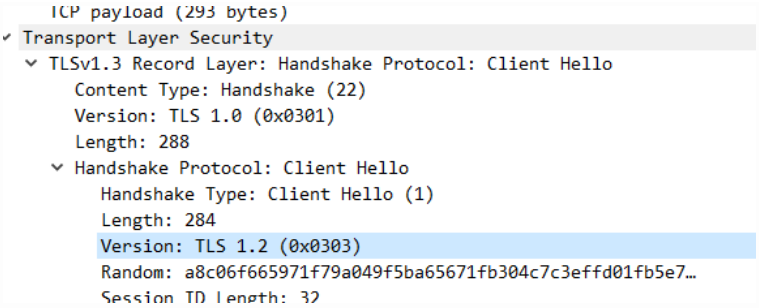
1. non-secure mode

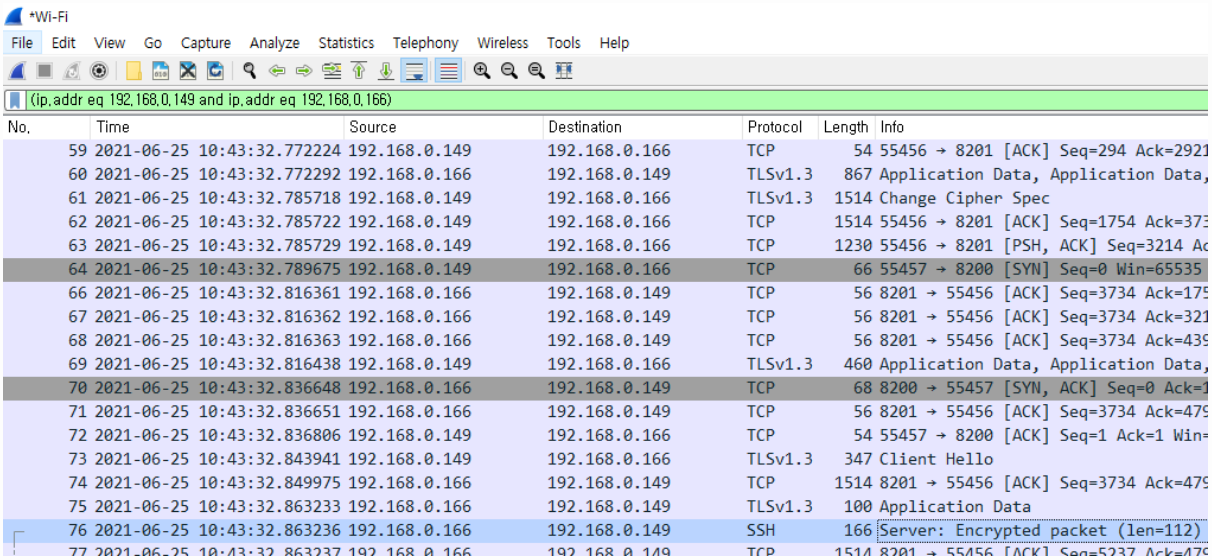
Checked : There is no encryption and handshake. It is a normal operation.



2. secure mode

Checked : handshake for tls communication and verified crypto communication.





Burp Suite : Supports the ability to run from browser in client, configure proxy in local, and check and forward packets one by one. In this project, it was difficult to do something using that tool, and we found another tool that could configure proxy on the local, but there was no significant difference from wireshark.

netcat : This tool can network scan and other things. Especially, we can acquire a shell if netcat is run on the server side by reserving port.

System Analysis with metasploit

1. We can't find exploit methods for port 500/5001/6000/6001 which are reserved for server(camera) service.

2. rpcbind using port 111 has below CVEs.
   check rpcbind version : 0.2.3-0.6ubuntu0.18.04.1 arm64

```
hedaesik@LgFaceRecProject:~$ dpkg -l rpcbind
Desired=Unknown/Install/Remove/Purge/Hold
| Status=Not/Inst/Conf-files/Unpacked/half-conf/Half-inst/trig-aWait/Trig-pend
|/ Err?=(none)/Reinst-required (Status,Err: uppercase=bad)
||/ Name                                  Version                 Architecture            Description
+++-==================================-======================-======================-==================================================
ii  rpcbind                               0.2.3-0.6ubuntu0.18.04.1 arm64                  converts RPC program numbers into universal addresses
```

   - CVE-2010-2061(gain privilege to local users only)
   - CVE-2010-2064 (gain privilege to local users only)
   - CVE-2017-8779 (script : auxiliary/dos/rpc/rpcbomb)
     The DOS attack was successful through the script corresponding to this CVE item, and the camera image was stopped in the Client due to the DOS attack.

3. xrdp using port 3389 has below CVEs. But xrdp's version is higher than the issued version including finded CVE.

```
xrdp -v

xrdp: A Remote Desktop Protocol server.
Copyright (C) Jay Sorg 2004-2014
See http://www.xrdp.org for more information.
Version 0.9.5
```

   - CVE-2008-5903 (xrdp <=0.4.1)
   - CVE-2008-5902 (xrdp <=0.4.1)
   - CVE-2008-5904 (xrdp <=0.4.1)

Library used in Server/Client

Team5 guide that we should install openssl by apt-get command. We install openssl to build and run a server program. Latest openssl version is 1.1.1k but openssl 1.1.1 is installed when installing the library with the "apt-get" command.

- **openssl : 1.1.1-1**

```
hedaesik@LgFaceRecProject:~/work$ openssl version
OpenSSL 1.1.1  11 Sep 2018
hedaesik@LgFaceRecProject:~/work$ dpkg -l | grep openssl
ii  openssl                    1.1.1-1ubuntu2.1~18.04.9                arm64
Secure Sockets Layer toolkit - cryptographic utility
```

openssl CVEs list : [Openssl CVE list]

We checked for vulnerabilities between 1.1.1 and 1.1.1k versions.
There are 14 vulnerabilities after version 1.1.1 and all are resolved in 1.1.1k.

Year	# of Vulnerabilities	DoS	Code Execution	Overflow	Memory Corruption	Sql Injection	XSS	Directory Traversal	Http Response Splitting	Bypass something	Gain Information	Gain Privileges	CSRF	File Inclusion	# of exploits
2018	2														
2019	6			1							1				
2020	1	1													
2021	5	2		2						1					
Total	14	3		2						1	1				

We can't find metasploit scripts but there are some vulnerabilities causing crashes and dos.

Team5 guide that we should install cryptmount and cryptsetup by apt-get command. We install cryptmount and it's dependency module. The Below package is installed to the system. To minimize vulnerabilities, investigation and improvements are also required for 3rd party libraries used in programs.

- **cryptmount : 5.2.4-1**

```
hedaesik@LgFaceRecProject:~/work$ dpkg -l | grep cryptmount
ii  cryptmount                  5.2.4-1build1                arm64
Management of encrypted file systems
```

CVE list : No CVE list.

- **cryptsetup : 2.0.2-1**

```
hedaesik@LgFaceRecProject:~/work$ dpkg -l | grep cryptsetup
ii  cryptsetup                  2:2.0.2-1ubuntu1.2                arm64
disk encryption support - startup scripts
```

CVE list : [CVE list for cryptsetup]

- **libdevmapper : 1.02.145-4.1**

```
hedaesik@LgFaceRecProject:~/work$ dpkg -l | grep libdevmapper
```

```
ii  libdevmapper1.02.1:arm64                    2:1.02.145-4.1ubuntu3.18.04.3
arm64        Linux Kernel Device Mapper userspace library
```

CVE list : No CVE list.

- **libgcrypt20 : 1.8.1**

```
hedaesik@LgFaceRecProject:~/work$ dpkg -l | grep libgcrypt20
ii  libgcrypt20:arm64                    1.8.1-4ubuntu1.2                    arm64
LGPL Crypto library - runtime library
```

CVE list : [CVE list for libgcrypt]

Post exploitation & reporting

Executive summary of results

Team potential performed a penetration test on the final artifact of Team5. Team 5 artifacts provide a streaming and face recognition service using a camera.

The aim of this assessment was to discover the vulnerabilities present in the team 5 artifacts which could pose an information security risk.

This assessment was performed from 06/22/2021 to 06/28/2021.

The vulnerabilities have been marked according to the following table:

Severity	Description
Critical	Easy exploitation / High business impact
High	Indirect exploitation / Limited target scope / Required privilege
Medium	Difficult exploitation / Low business impact
Low	Low and information level issues

Executive summary of results

We checked the following items.

1. Server/Client System
2. Network System
3. DDos
4. Library used in Server/Client

Penetration Results

	Urgent	**Critical**	**High**	**Medium**	**Low**
Server/Client System					
Network System					
DDos			**1**		
Library used in Server/Client					
Total	**0**	**0**	**1**	**0**	**0**

One issue found is as follows.

Issue	**Type**	**Impact**	**Total Score**
Dos attack to opened port used for rpcbind.	Dos(Denial Of Service)	Camera streaming is stop and	high

When dos attack is successful, the camera is not operated and also the admin can't connect to the camera. Then the admin can't restart the camera program because there is no scenario to run programs automatically. So risk of dos attack is assessed to high.

Recommendations

Set up systemd for production products so that the rpc bind does not work, and prevent dos attacks through firewall in the network environment where the actual product works.

For libraries that your application uses, we recommend that you use the latest version that addresses security issues, etc.