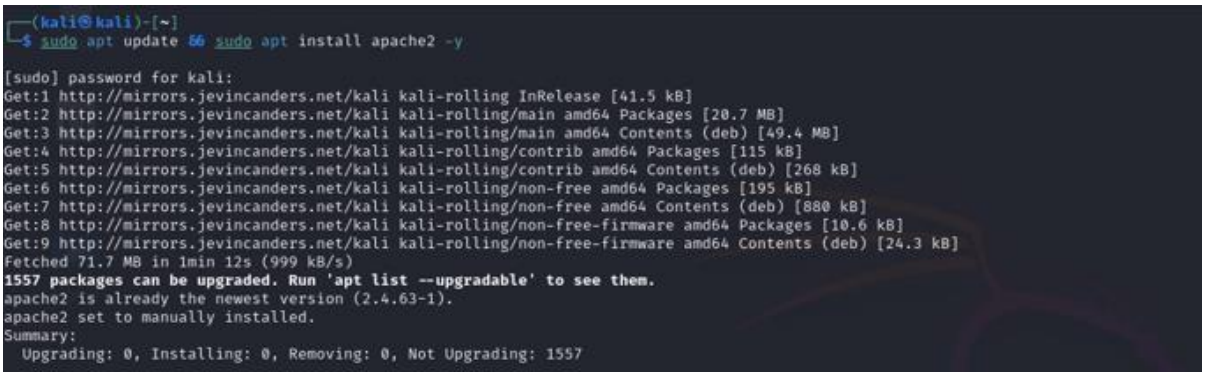
# Task 3 :

## Firewall & Network Security

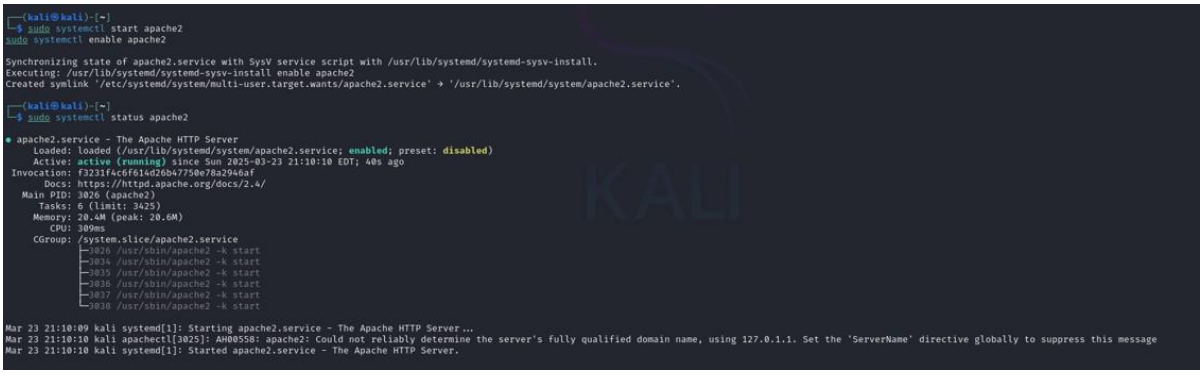
### Setup

1. Install and configure a basic web server (apache2) and disable the firewall (ufw disable).
2. Install Apache using **sudo apt update && sudo apt install -y apache2**.




**3. Setting up apache web server :**

Start and enable the Apache2 server to make it active and ready to use.




**4. Disable Firewall (UFW)**

Install UFW and check its status. If it shows "inactive," the firewall is installed but not enabled.

Run **sudo apt update && sudo apt install -y ufw** to update the package list and install UFW.

```
┌──(kali㉿kali)-[~]
└─$ sudo apt update && sudo apt install ufw -y

Hit:1 http://http.kali.org/kali kali-rolling InRelease
1557 packages can be upgraded. Run 'apt list --upgradable' to see them.
Installing:
  ufw

Suggested packages:
  rsyslog

Summary:
  Upgrading: 0, Installing: 1, Removing: 0, Not Upgrading: 1557
  Download size: 169 kB
  Space needed: 880 kB / 62.9 GB available

Get:1 http://kali.download/kali kali-rolling/main amd64 ufw all 0.36.2-9 [169 kB]
Fetched 169 kB in 6s (28.8 kB/s)
Preconfiguring packages ...
Selecting previously unselected package ufw.
(Reading database ... 401537 files and directories currently installed.)
Preparing to unpack .../archives/ufw_0.36.2-9_all.deb ...
Unpacking ufw (0.36.2-9) ...
Setting up ufw (0.36.2-9) ...

Creating config file /etc/ufw/before.rules with new version

Creating config file /etc/ufw/before6.rules with new version

Creating config file /etc/ufw/after.rules with new version

Creating config file /etc/ufw/after6.rules with new version
update-rc.d: We have no instructions for the ufw init script.
update-rc.d: It looks like a non-network service, we enable it.
Created symlink '/etc/systemd/system/multi-user.target.wants/ufw.service' → '/usr/lib/systemd/system/ufw.service'.
Processing triggers for kali-menu (2024.4.0) ...
Processing triggers for man-db (2.13.0-1) ...
```

```
┌──(kali㉿kali)-[~]
└─$ sudo ufw status

Status: inactive
```

**Disable ufw**
**Disable UFW using sudo ufw disable.**

```
┌──(kali㉿kali)-[~]
└─$ sudo ufw disable
```

# Exploit : port scanning with Nmap and Netcat

1. Perform a basic Nmap scan to check for open ports

Run **nmap -sV -A 10.0.2.15** to perform a basic scan and check for open ports.

```
┌──(kali㉿kali)-[~]
└─$ nmap -sV -A 10.0.2.15

Starting Nmap 7.94SVN ( https://nmap.org ) at 2025-03-23 21:18 EDT
Nmap scan report for 10.0.2.15
Host is up (0.0060s latency).
Not shown: 998 closed tcp ports (reset)
PORT   STATE SERVICE VERSION
22/tcp open  ssh     OpenSSH 9.9p1 Debian 3 (protocol 2.0)
| ssh-hostkey:
|   256 e3:ac:ba:bc:c2:a6:84:ff:03:44:30:62:c2:03:a0:69 (ECDSA)
|_  256 9e:a4:ef:87:96:24:49:7d:b2:84:2e:e7:34:0a:06:b1 (ED25519)
80/tcp open  http    Apache httpd 2.4.63 ((Debian))
|_http-server-header: Apache/2.4.63 (Debian)
|_http-title: Apache2 Debian Default Page: It works
Device type: general purpose
Running: Linux 2.6.X
OS CPE: cpe:/o:linux:linux_kernel:2.6.32
OS details: Linux 2.6.32
Network Distance: 0 hops
Service Info: OS: Linux; CPE: cpe:/o:linux:linux_kernel

OS and Service detection performed. Please report any incorrect results at https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 10.16 seconds
```

2. Then we use Netcat to check if a specific port is open. Scans all possible ports on the server.

This helps an attacker find which ports are open and potentially vulnerable.

```
┌──(kali㉿kali)-[~]
└─$ nc -zv 10.0.2.15 1-65535

10.0.2.15: inverse host lookup failed: Unknown host
(UNKNOWN) [10.0.2.15] 60558 (?) open
(UNKNOWN) [10.0.2.15] 45212 (?) open
(UNKNOWN) [10.0.2.15] 80 (http) open
(UNKNOWN) [10.0.2.15] 22 (ssh) open
```

# Mitigation: Firewall & Network Hardening

- Allow **SSH connections** for remote login.
- Allow **HTTP traffic** for websites.
- All other unnecessary services will be blocked, allowing only SSH and HTTP access.

```
┌──(kali㉿kali)-[~]
└─$ sudo ufw allow 22/tcp
sudo ufw allow 80/tcp

Rules updated
Rules updated (v6)
Rules updated
Rules updated (v6)
```

1. Turns on the firewall with the rules we just set.  Any service that is **not explicitly allowed** will now be blocked.

2. First we enable firewall for active defense.

3. By checking status it will show that **only SSH (22) and HTTP (80) are allowed**, while everything else is blocked.

```
┌──(kali㉿kali)-[~]
└─$ sudo ufw enable

Firewall is active and enabled on system startup

┌──(kali㉿kali)-[~]
└─$ sudo ufw status verbose

Status: active
Logging: on (low)
Default: deny (incoming), allow (outgoing), disabled (routed)
New profiles: skip

To                         Action      From
--                         ------      ----
22/tcp                     ALLOW IN    Anywhere
80/tcp                     ALLOW IN    Anywhere
22/tcp (v6)                ALLOW IN    Anywhere (v6)
80/tcp (v6)                ALLOW IN    Anywhere (v6)
```

4. To provide an extra layer of security, we can use iptables to block specific services.

```
┌──(kali㉿kali)-[~]
└─$ sudo iptables -A INPUT -p tcp --dport 23 -j DROP
sudo iptables -A INPUT -p tcp --dport 21 -j DROP
```

```
┌──(kali㉿kali)-[~]
└─$ sudo netstat -tulnp

Active Internet connections (only servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State       PID/Program name
tcp        0      0 0.0.0.0:22              0.0.0.0:*               LISTEN      709/sshd: /usr/sbin
tcp6       0      0 :::80                   :::*                    LISTEN      3026/apache2
tcp6       0      0 :::22                   :::*                    LISTEN      709/sshd: /usr/sbin
```

**This shows a list of all open ports and the services running on them.**

After enabling the firewall and iptables rules, run the same command again and compare the results to see how many ports were blocked.

```
┌──(kali㉿kali)-[~]
└─$ nmap -sV -A 10.0.2.15

Starting Nmap 7.94SVN ( https://nmap.org ) at 2025-03-23 21:32 EDT
Nmap scan report for 10.0.2.15
Host is up (0.000098s latency).
Not shown: 998 closed tcp ports (reset)
PORT   STATE SERVICE VERSION
22/tcp open  ssh     OpenSSH 9.9p1 Debian 3 (protocol 2.0)
| ssh-hostkey:
|   256 e3:ac:ba:bc:c2:a6:84:ff:03:44:30:62:c2:03:a0:69 (ECDSA)
|_  256 9e:a4:ef:87:96:24:49:7d:b2:84:2e:e7:34:0a:06:b1 (ED25519)
80/tcp open  http    Apache httpd 2.4.63 ((Debian))
|_http-title: Apache2 Debian Default Page: It works
|_http-server-header: Apache/2.4.63 (Debian)
Device type: general purpose
Running: Linux 2.6.X
OS CPE: cpe:/o:linux:linux_kernel:2.6.32
OS details: Linux 2.6.32
Network Distance: 0 hops
Service Info: OS: Linux; CPE: cpe:/o:linux:linux_kernel

OS and Service detection performed. Please report any incorrect results at https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 8.38 seconds
```

Updated **nmap & netstat** results (showing only **ports 22 & 80** open). Screenshot of **sudo ufw status** confirming restricted access.

```
┌──(kali㉿kali)-[~]
└─$ sudo ufw status verbose

Status: active
Logging: on (low)
Default: deny (incoming), allow (outgoing), disabled (routed)
New profiles: skip

To                         Action      From
--                         ------      ----
22/tcp                     ALLOW IN    Anywhere
80/tcp                     ALLOW IN    Anywhere
22/tcp (v6)                ALLOW IN    Anywhere (v6)
80/tcp (v6)                ALLOW IN    Anywhere (v6)
```