Scanning & Enumeration

Installing Kioptrix

Kioptrix is a vulnerable VM that will be used for some practice. It's downloadable from the internet. This is the link https://www.vulnhub.com/entry/kioptrix-level-1-1,22/. Another useful resource can be found here: https://www.abatchy.com/2017/02/oscp-like-vulnhub-vms.

When importing the Kioptrix Level 1 VM for the first time, I encountered an issue where I got a `Kernel Panic` error while booting. I solved this problem by changing the Storage interface from SCSI to IDE. The VM only works with IDE storage interface. This resource helped: https://www.hypn.za.net/blog/2017/07/15/running-kioptrix-level-1-and-others-in-virtualbox/.

I also encountered another issue where I could not ping IP addresses (e.g `1.1.1.1`). I fixed this issue by searching for the term `Bridge` in the `.vmx` config file and changing it to `nat` (lowercase). Then, I right-clicked on the config file and selected `Open with...` -> selected `VMware Fusion...`.

TIP: The login uname is `john` and passwd is `TwoCows2`.

When using the Kioptrix VM, we cannot easily know our IP address using a command like `ifconfig`. A little trick to know our password is using the `ping` command. Here's an example:

```
[john@kioptrix john]$ ping 1.1.1.1
PING 1.1.1.1 (1.1.1.1) from 192.168.229.133 : 56(84) bytes of data.
64 bytes from 1.1.1.1: icmp_seq=0 ttl=128 time=6.776 msec
64 bytes from 1.1.1.1: icmp_seq=1 ttl=128 time=9.043 msec
64 bytes from 1.1.1.1: icmp_seq=2 ttl=128 time=8.701 msec
64 bytes from 1.1.1.1: icmp_seq=3 ttl=128 time=8.694 msec

--- 1.1.1.1 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
round-trip min/avg/max/mdev = 6.776/8.303/9.043/0.897 ms
[john@kioptrix john]$
```

The highlighted IP address is the IP address of the Kioptrix machine.

Scanning with Nmap

First of all let's find out the IP address of our Kali Linux machine using the `ifconfig` command shown below:

```
root@kali:~# ifconfig -a
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.229.132  netmask 255.255.255.0  broadcast 192.168.229.255
        inet6 fe80::20c:29ff:fef6:c5b3  prefixlen 64  scopeid 0x20<link>
        ether 00:0c:29:f6:c5:b3  txqueuelen 1000  (Ethernet)
        RX packets 987104  bytes 476404069 (454.3 MiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 990264  bytes 213579673 (203.6 MiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 1022  bytes 351103 (342.8 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 1022  bytes 351103 (342.8 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

root@kali:~#
```

Next, let's use a tool called `arp-scan` to identify the devices on our network as shown below:

```
root@kali:~# arp-scan -l
Interface: eth0, type: EN10MB, MAC: 00:0c:29:f6:c5:b3, IPv4: 192.168.229.132
Starting arp-scan 1.9.7 with 256 hosts (https://github.com/royhills/arp-scan)
192.168.229.1   00:50:56:c0:00:08       VMware, Inc.
192.168.229.2   00:50:56:eb:29:6e       VMware, Inc.
192.168.229.133 00:0c:29:b7:cd:07       VMware, Inc.
192.168.229.254 00:50:56:e9:d2:b6       VMware, Inc.

4 packets received by filter, 0 packets dropped by kernel
Ending arp-scan 1.9.7: 256 hosts scanned in 1.877 seconds (136.39 hosts/sec). 4 responded
root@kali:~#
```


Let's use a tool called `netdiscover` to find out more information about our network using ARP as shown below:

```
root@kali:~# netdiscover -r 192.168.229.0/24
```

In the picture above, the `-r` flag is used to specify the range and the `192.168.229.0/24` means that we are looking for machines with these three octects on the `/24` subnet. The results of the scan are shown below:

```
 Currently scanning: Finished!   |   Screen View: Unique Hosts

 4 Captured ARP Req/Rep packets, from 4 hosts.   Total size: 240
 _____________________________________________________________________________
   IP            At MAC Address     Count     Len  MAC Vendor / Hostname
 -----------------------------------------------------------------------------
 192.168.229.1   00:50:56:c0:00:08      1      60  VMware, Inc.
 192.168.229.2   00:50:56:eb:29:6e      1      60  VMware, Inc.
 192.168.229.133 00:0c:29:b7:cd:07      1      60  VMware, Inc.
 192.168.229.254 00:50:56:e9:d2:b6      1      60  VMware, Inc.

root@kali:~#
```

Nmap stands for Network Mapper. In our practice, we'll be using Nmap is stealth mode most of the time.

NOTE: In a secure network, stealth mode is very detectable. It's not that "stealth".

Nmap uses a modified three-way handshake when scanning in stealth mode:

`Non-Stealth Mode (Three-way handshake): SYN -> SYN ACK -> ACK`

`Stealth Mode: SYN -> SYN ACK -> RST`

Basically, the three-way handshake establishes a connection. On the other hand the stealth mode doesn't and that's because of the `RST` flag that resets the connection just as the connection is about to be established. Nmap stealth mode is default in some cases. Stealth mode can be used using the `-sS` switch (flag) as shown below:

```
root@kali:~# nmap -T4 -p- -A 192.168.229.133
Starting Nmap 7.80 ( https://nmap.org ) at 2020-07-10 00:04 EDT
```

As we can see in the above picture, the `-T4` flag means that on a scale of 1 to 5, with 1 being the slowest and 5 the fastest, we are scanning at a speed of 4 out of 5. With slower scans, detection is harder and we hardly miss vital information, but with faster scans, detection is easier and we can miss out on a lot of valuable information. The `-p-` flag means that we are scanning all ports on the target machine. In some cases where we are targeting a specific port such as port 80 (HTTP) we use the `-p` flag such that `-p 80` will scan just port 80. When we don't use the `-p-` or `-p` flags, our attack machine will scan the top 1000 most common ports. It is recommended to use the `-p-` because our target system might be running services on "uncommon" ports. `-A` gives us all possible information on a port.

These are the results of the scan below:

```
root@kali:~# nmap -T4 -p- -A 192.168.229.133
Starting Nmap 7.80 ( https://nmap.org ) at 2020-07-10 00:04 EDT
Nmap scan report for 192.168.229.133
Host is up (0.00048s latency).
Not shown: 65529 closed ports
PORT     STATE SERVICE     VERSION
22/tcp   open  ssh         OpenSSH 2.9p2 (protocol 1.99)
| ssh-hostkey:
|   1024 b8:74:6c:db:fd:8b:e6:66:e9:2a:2b:df:5e:6f:64:86 (RSA1)
|   1024 8f:8e:5b:81:ed:21:ab:c1:80:e1:57:a3:3c:85:c4:71 (DSA)
|_  1024 ed:4e:a9:4a:06:14:ff:15:14:ce:da:3a:80:db:e2:81 (RSA)
|_sshv1: Server supports SSHv1
80/tcp   open  http        Apache httpd 1.3.20 ((Unix)  (Red-Hat/Linux) mod_ssl/2.8.4 OpenSSL/0.9.6b)
| http-methods:
|_  Potentially risky methods: TRACE
|_http-server-header: Apache/1.3.20 (Unix)  (Red-Hat/Linux) mod_ssl/2.8.4 OpenSSL/0.9.6b
|_http-title: Test Page for the Apache Web Server on Red Hat Linux
111/tcp  open  rpcbind     2 (RPC #100000)
139/tcp  open  netbios-ssn Samba smbd (workgroup: Cf2MYGROUP)
443/tcp  open  ssl/https   Apache/1.3.20 (Unix)  (Red-Hat/Linux) mod_ssl/2.8.4 OpenSSL/0.9.6b
|_http-server-header: Apache/1.3.20 (Unix)  (Red-Hat/Linux) mod_ssl/2.8.4 OpenSSL/0.9.6b
|_http-title: 400 Bad Request
|_ssl-date: 2020-07-10T04:07:39+00:00; +1m59s from scanner time.
| sslv2:
|   SSLv2 supported
|   ciphers:
|     SSL2_RC2_128_CBC_WITH_MD5
|     SSL2_RC4_64_WITH_MD5
|     SSL2_DES_192_EDE3_CBC_WITH_MD5
|     SSL2_RC2_128_CBC_EXPORT40_WITH_MD5
|     SSL2_DES_64_CBC_WITH_MD5
|     SSL2_RC4_128_WITH_MD5
|_    SSL2_RC4_128_EXPORT40_WITH_MD5
1024/tcp open  status      1 (RPC #100024)
MAC Address: 00:0C:29:B7:CD:07 (VMware)
Device type: general purpose
Running: Linux 2.4.X
OS CPE: cpe:/o:linux:linux_kernel:2.4
OS details: Linux 2.4.9 - 2.4.18 (likely embedded)
Network Distance: 1 hop

Host script results:
|_clock-skew: 1m58s
|_nbstat: NetBIOS name: KIOPTRIX, NetBIOS user: <unknown>, NetBIOS MAC: <unknown> (unknown)
|_smb2-time: Protocol negotiation failed (SMB2)

TRACEROUTE
HOP RTT     ADDRESS
1   0.48 ms 192.168.229.133

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 131.74 seconds
root@kali:~#
```

When examining the results, we want to look at the open ports and the services running on those ports.

Enumerating HTTP/HTTPS Part 1

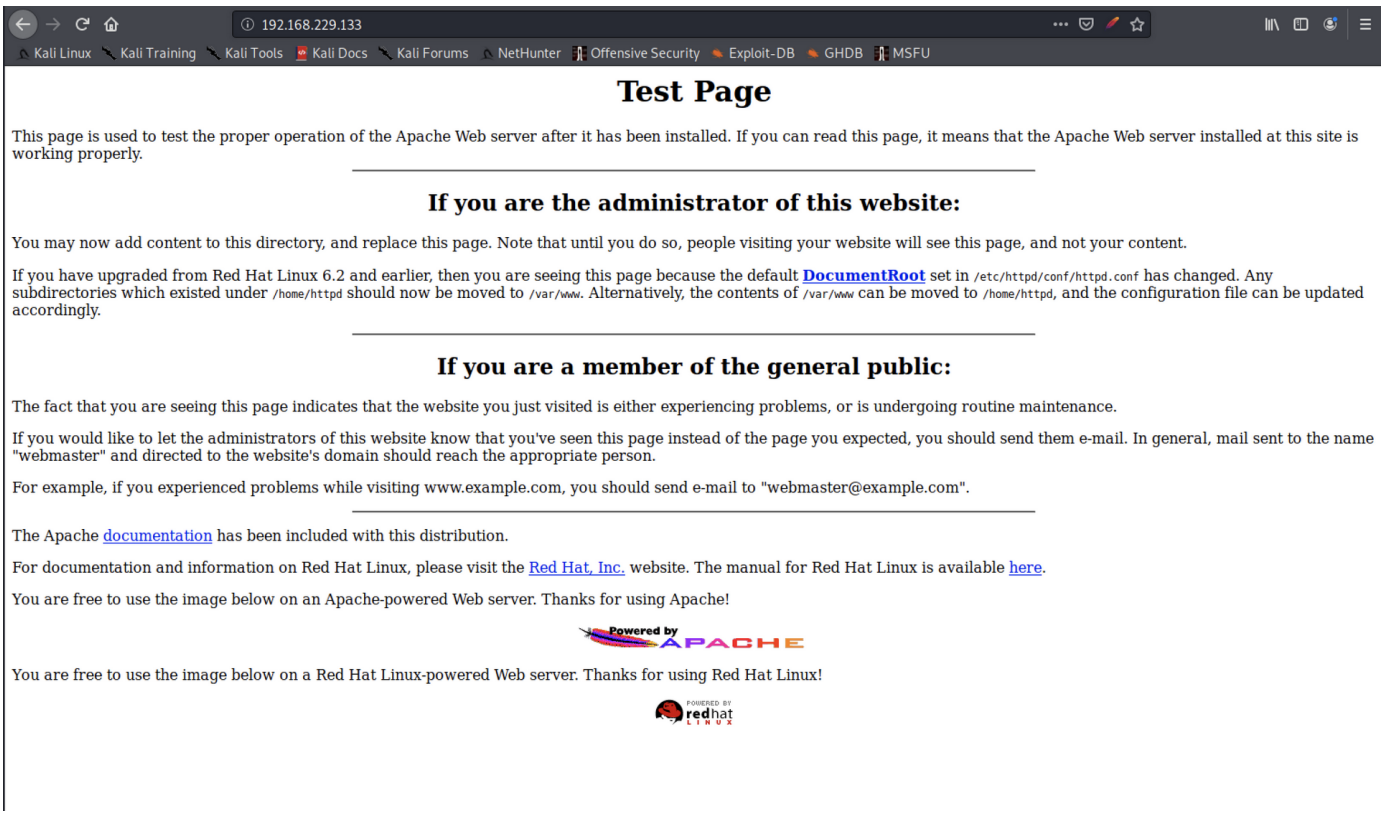
Before we start enumeration, we should notice some important ports such at:

1. 22 - SSH
2. 80 - HTTP (probably a Web Server)
3. 111 - RPC
4. 139 - Samba
5. 443 - HTTPS

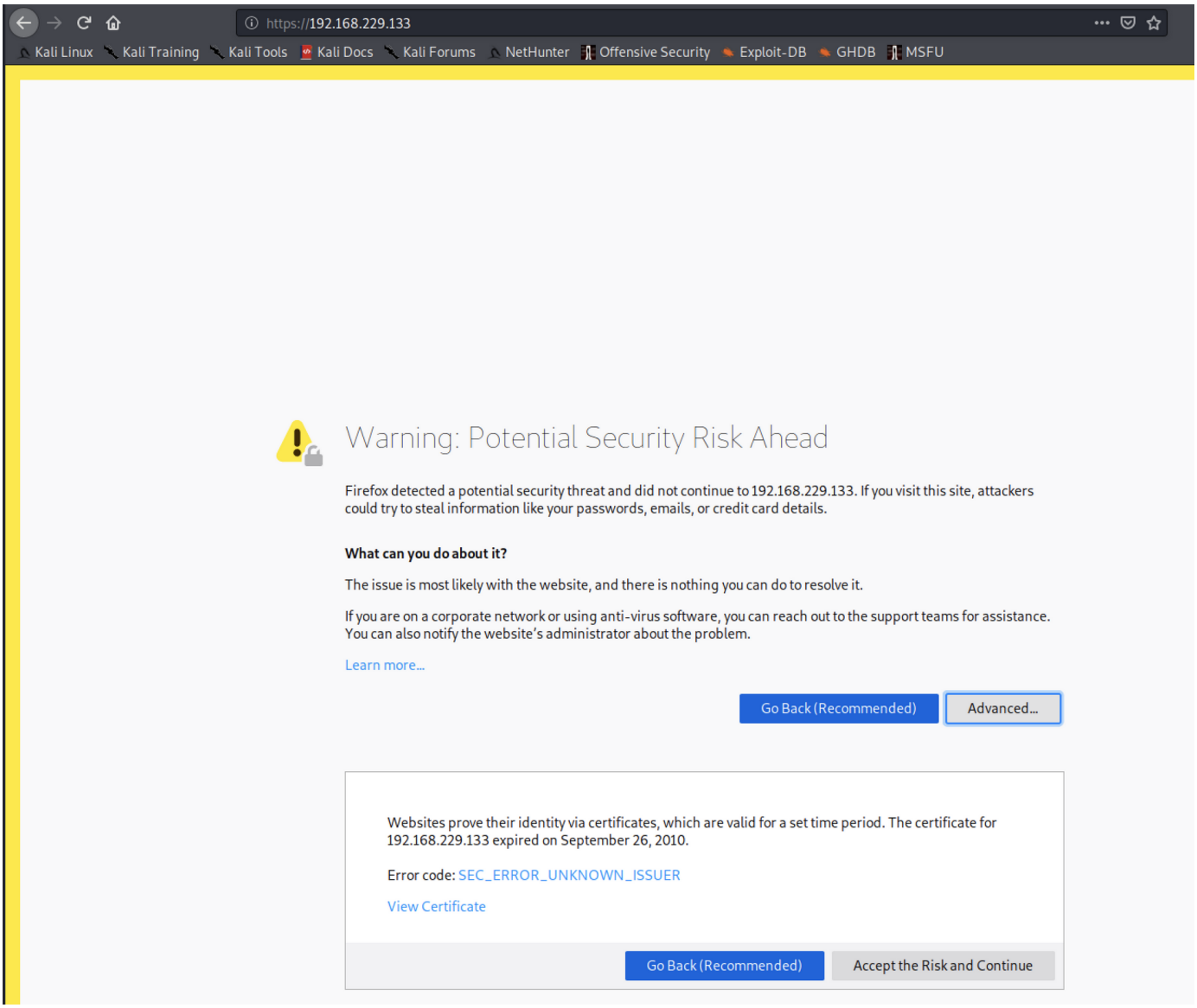
We also need to think of our "Point/Port of Attack". Usually we want to look at port 80, 111, 139, and 443. Port 22 attacks are uncommon and are not the easiest to attack.

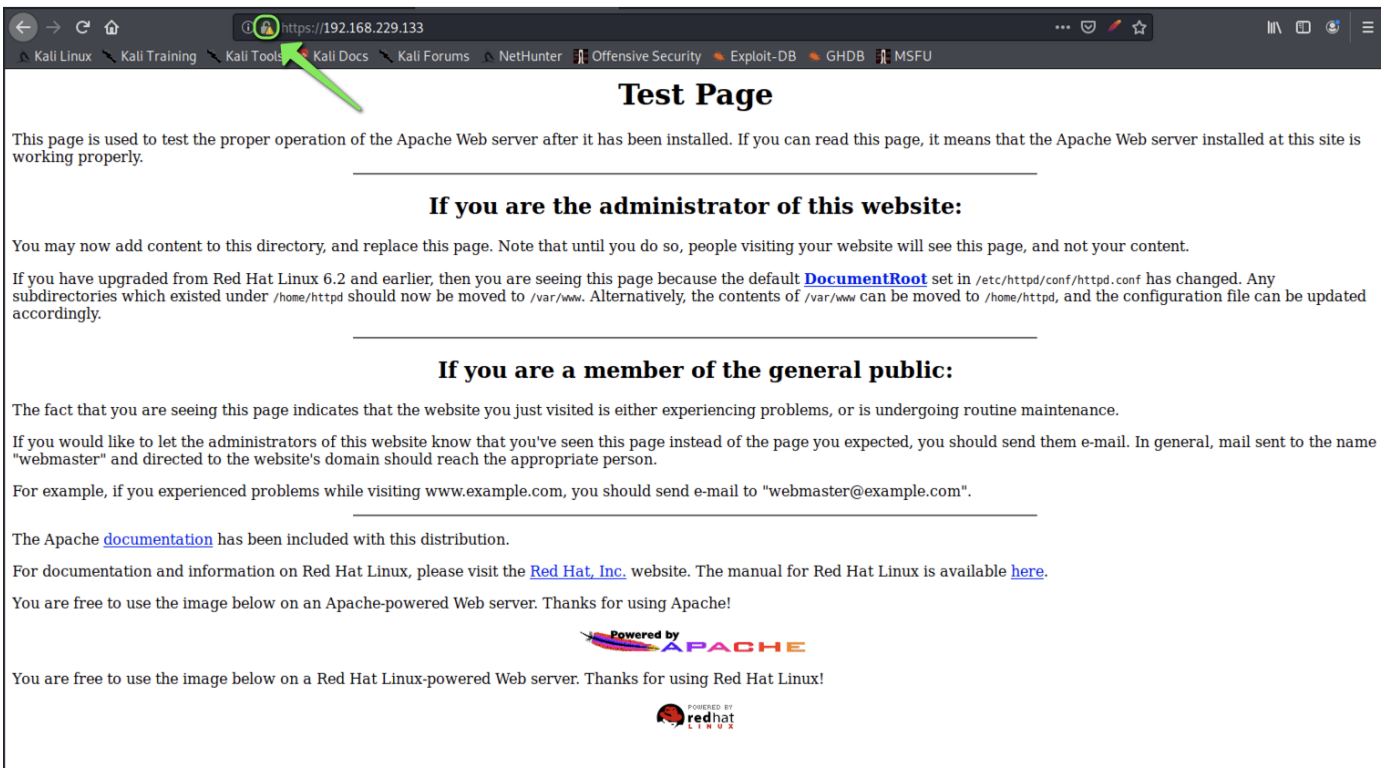
Let's investigate ports 80 and 443. Usually, when we have those ports, we have a web server and a website. So the first step would be to go to the website on our browser to see what it's like as shown below:

Port 80 (HTTP): Simply type the IP address in the search bar as shown below:



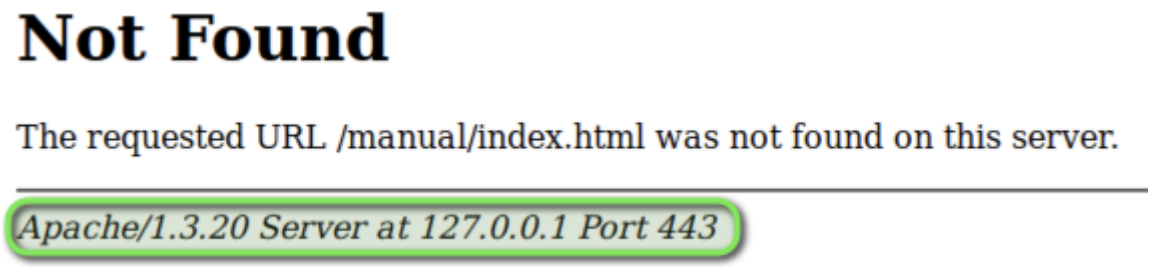
Port 443 (HTTPS): Simply prefix the IP address with `https://` as shown below and you'll recieve a warning page (accept it and you'll get the same page on the port 80 with a minor difference):





The webpage is not really exploitable. However, it gives us some information. For example the owner is running a version of Apache on a Red Hat Linux computer. Furthermore this webpage

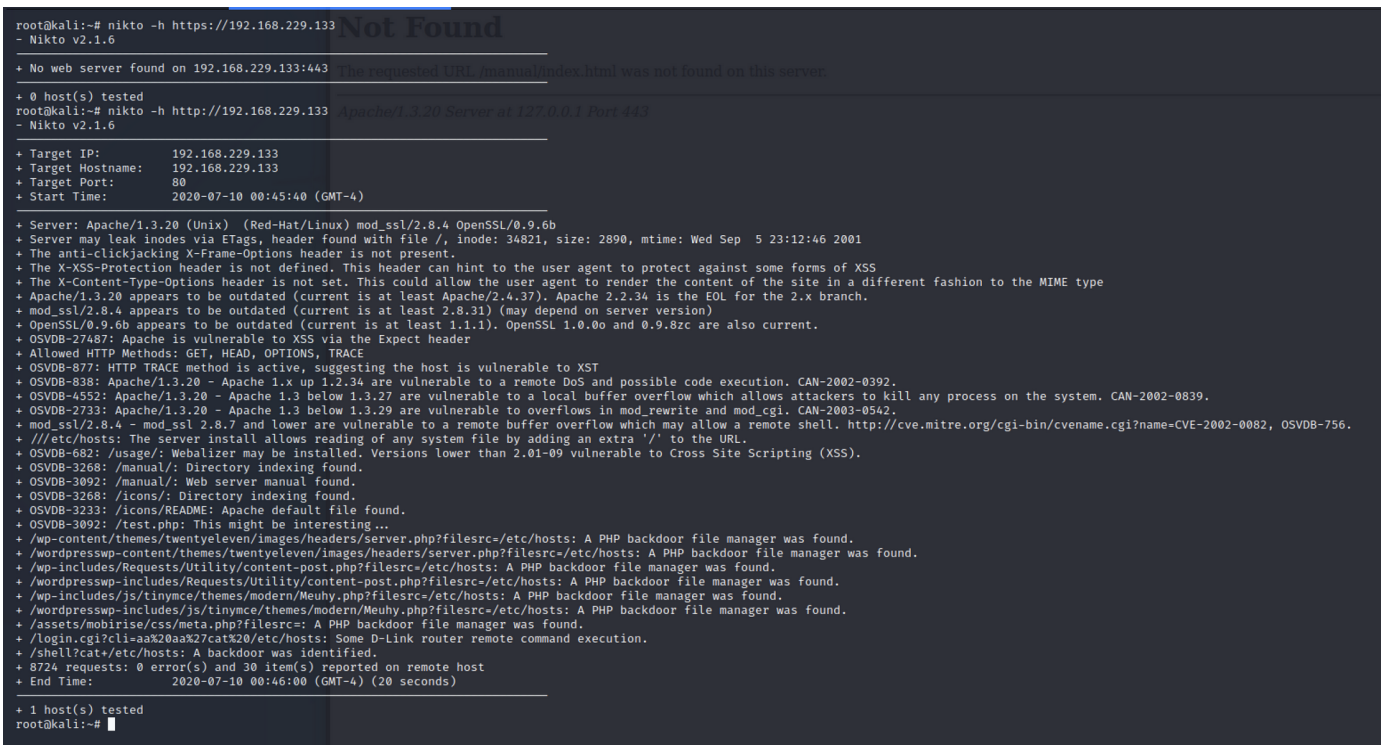
is a default webpage for Aoache. When a website owner runs a default webpage, it usually implies that they have directories behind that website. We could then use a directory busting tool such as `dirbuster` to find those directories. On the other hand, it could also imply that the website owners just left ports 80 & 443 open which means that the website owner has poor security hygiene. If we click on a link such as `documentation` it takes us to a `Not Found...` page which is an error 404. This page, however, gives us some information too as shown below:



We can see that it is running Apache version 1.3.20. In some cases, we could find the hostname of the server on this page too.

Now, we will use a tool called `nikto` to run a vulnerability scan on the target box as shown below:

NOTE: a secure network/website will auto-block `nikto` scans.

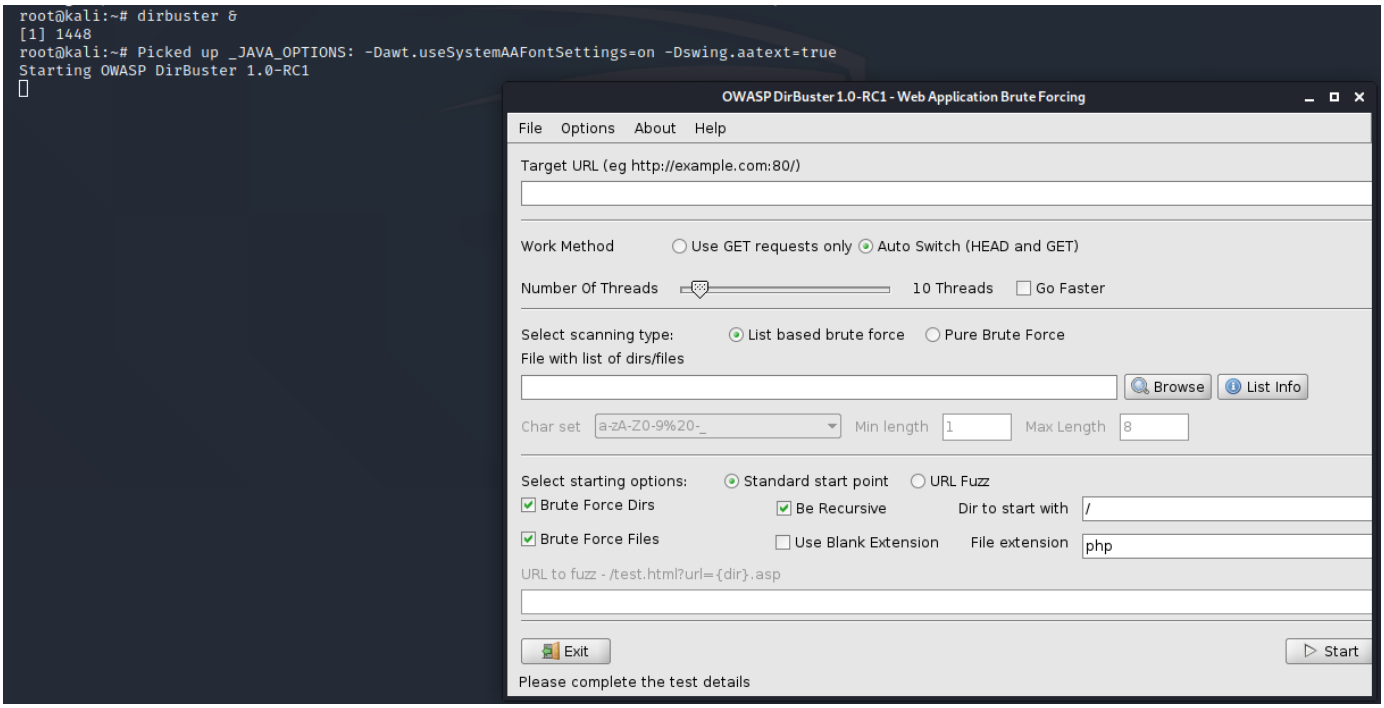


As we can see above, I used the `nikto -h` command where the `-h` flag identifies the host's (website's) address. In the first run, we targetted port 443 (HTTPS) with no results. In the second run, we targetted port 80 (HTTP) with some results. Looking through the results, we would be interested in `code execution`, `remote buffer overflow`, `HTTP TRACE`, etc.

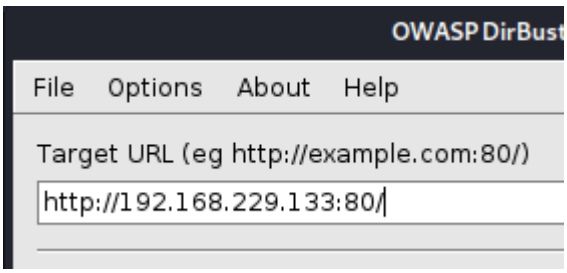
Next we'll use a tool called `dirbuster` to do some directory busting to find hidden directories behind the website.

Enumerating HTTP/HTTPS Part 2

We can use tools such as `dirb`, `dirbuster`, and `gobuster`. Let's give `dirbuster` a try. These tools go to websites and search for directories. A common way is to brute force the directory search by using wordlists of common directory names. To run `dirbuster`, we can use the `dirbuster &` command to start the program and maintain shell access as shown below:



In the `Target URL` textbox, enter the address of the web server following the syntax `http://<IP_address or hostname>:80/`. The `:80` refers to the port 80 of the web server as shown below:



NOTE: The syntax is strict and must be followed.

Next, we select the `Go Faster` and `List based brute force` options. Then, we'll click `Browse` and go to the directory where wordlists are stored.

TIP: The parent directory where wordlists are stored is `/usr/share/wordlists/`.

These tools also look for specific file extension/file types. In our case we'll stick with `php` because Apache runs on PHP. In other cases, Microsoft websites run on ASP or ASPX. That's why it's important to know the services running on the web server before doing anything else.

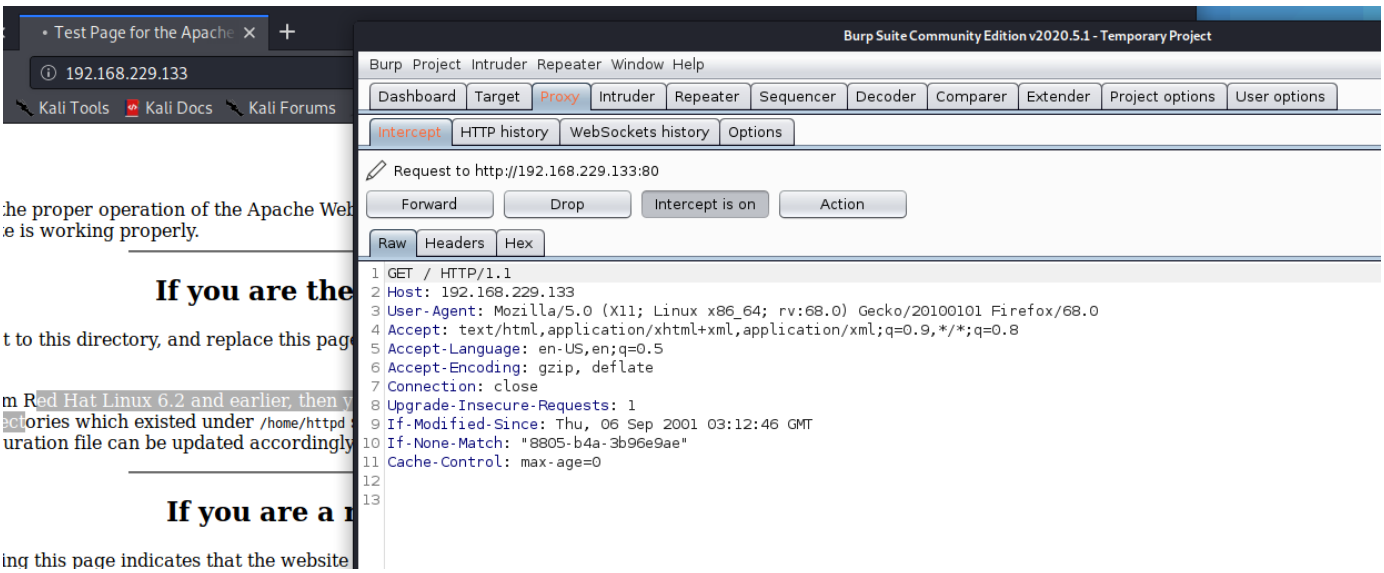
We can also search for `txt`, `zip`, `rar` file types.

Now, we can click `Start` to start the process.

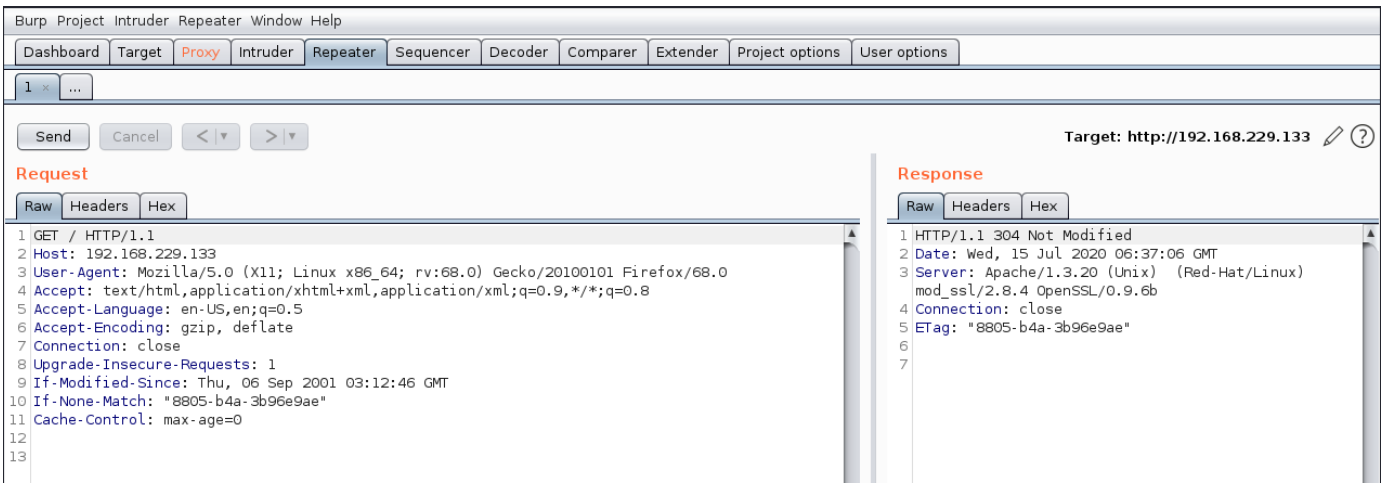
While the process is running we can start a Burpsuite session, by going to browser and starting the proxy service and starting the Burpsuite program.

TIP: If this webserver was running an actual website, a good thing to also do is to look at the page source code (primarily the comments, information disclosures, keys, passwords, usernames, etc.)

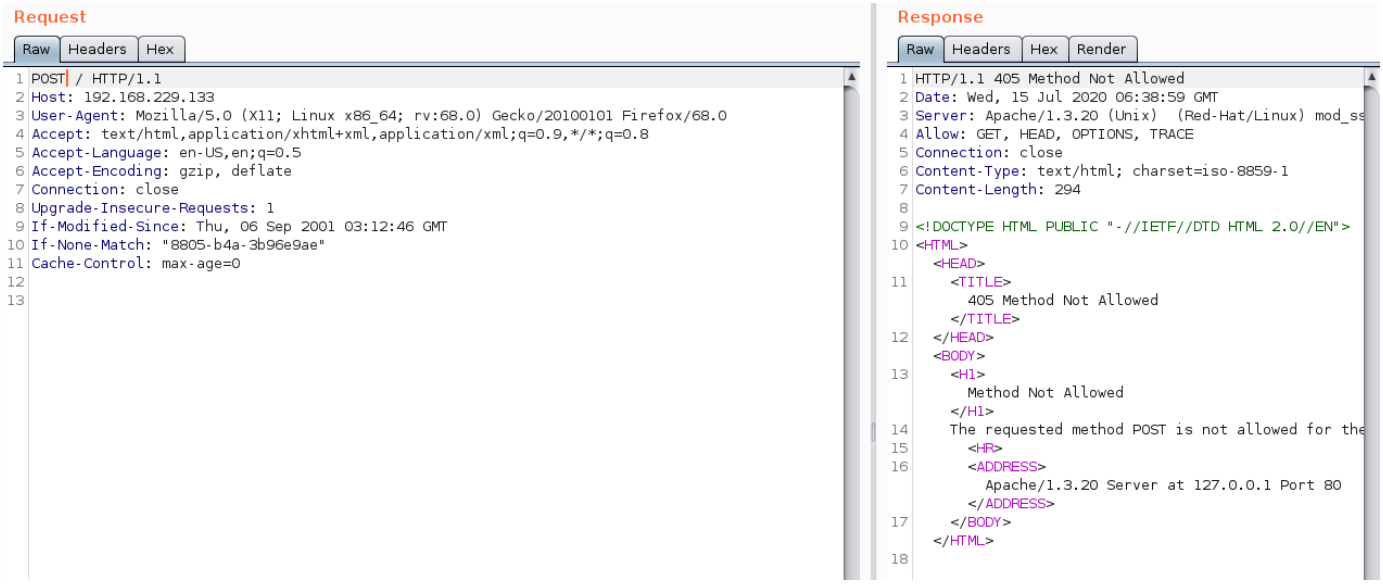
In Burpsuite, let's try intercepting the website requests. This is what we get:



Let's try sending this to the Repeater in Burpsuite. We can do this by right-clicking and selecting `Send to Repeater`. We can then go over to the `Repeater` tab and view the requests and response in real-time. So if we click `Send`, we'll see the response in real-time as shown below:

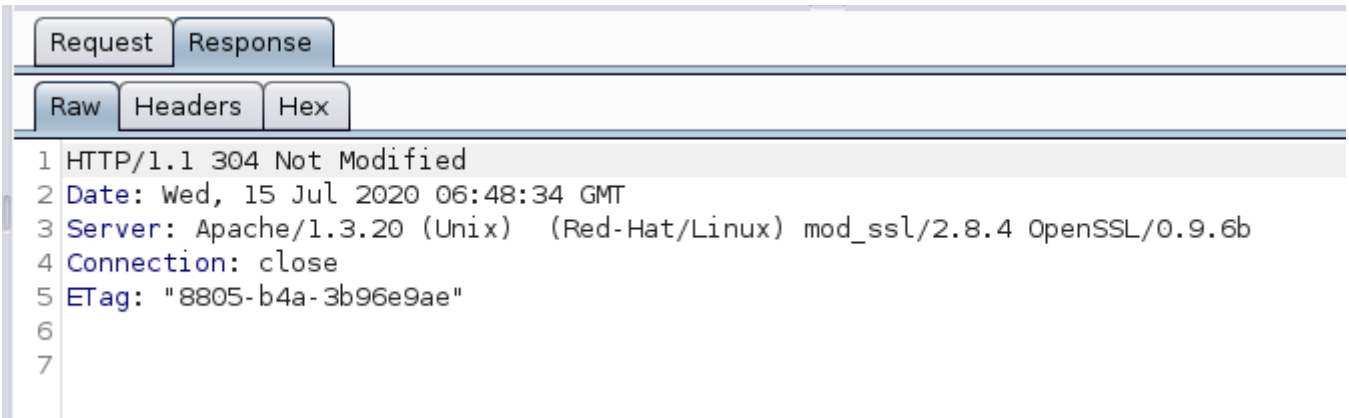


We can also edit/modify the requests. For example, we can change the `GET` request to a `POST` request and send it as shown below:



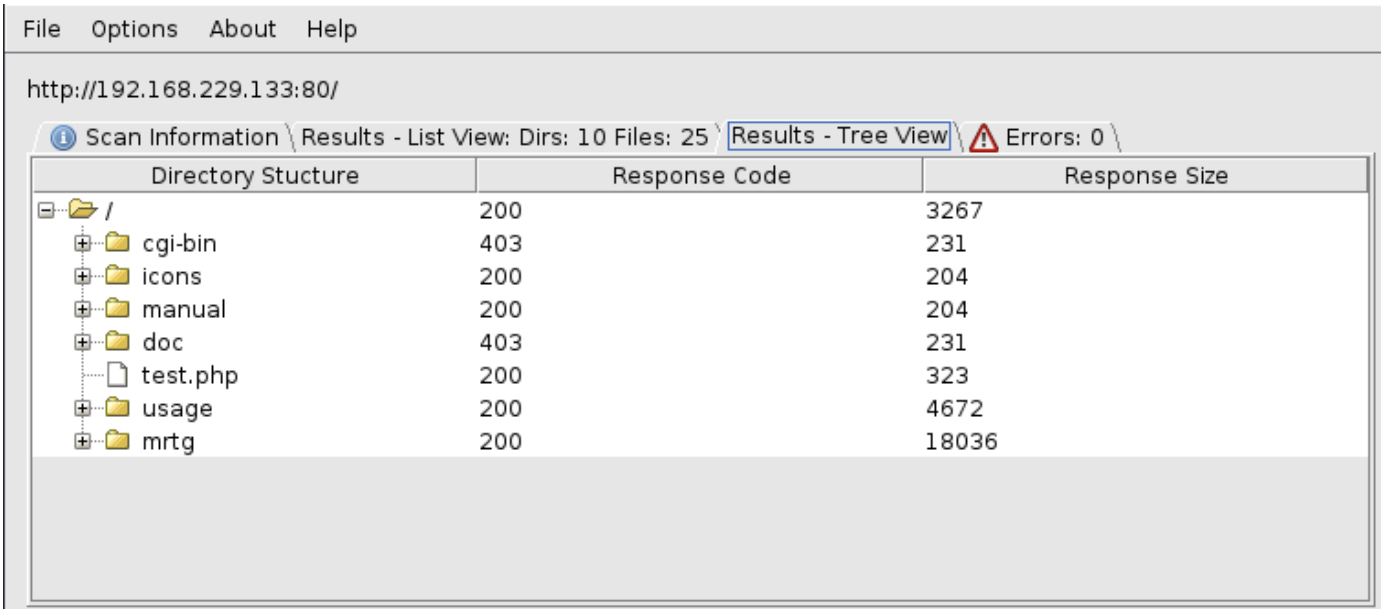
TIP: Before performing the operation below, turn off interception.

We can also set the scope of the scan by going to the `Target` tab, clicking on `Scope`, then clicking `Add` under `Include in scope` which will open the small window where we will enter the URL of the web server. A small dialogue box might ask a question regarding out-of-scope items, click `Yes`. We'll go over to `Site map` and look at the `Raw` response from the web server as shown below:



We can see that we some information on the server. We ca tell that it's running Apache on Red Hat Linux with OpenSSL. This is an issue for the owners of the server because the server is disclosing information (Server headers with version information).

Looking back at the Dirbuster session we can see that we have gathered some information as shown below:



For `Response Code`, values in the 200's show that the directory is available, values in the 300's mean that there is a redirect, values in the 400's show that there is an error somewhere, values in the 500's show that there is a server error.

We can start looking through the directories and opening them by right-clicking and selecting `Open in browser`. In the `Usage` folder, we find some interesting information that discolses information on the Website statistics. We can also see that the information was generated using a tool/service called `Webalizer` - version 2.01.
