CYBR 435: Cyber Risk
Spring 2022

Lab Assignment #3: Penetration Testing: Scanning and Reconnaissance

- Name only: ______________________________________
- Release date: Feb 17, 2022 (Thursday), 2:00 pm
- Due date: Feb 24, 2022 (Thursday), 2:00 pm
- Assignment should be **SUBMITTED on Blackboard before Due Date**. Other submission methods will NOT be accepted.
- **LATE Submission will NOT Be Accepted** on Blackboard since the submission link will be closed automatically after due date;
    - Additional submission for missing answer **will NOT Be Accepted**.
- It should be done INDIVIDUALLY; **Show ALL your work and evidence to support your answers**.
    - Answer only without evidence receives half credits.
- Total: 10 pts

Introduction

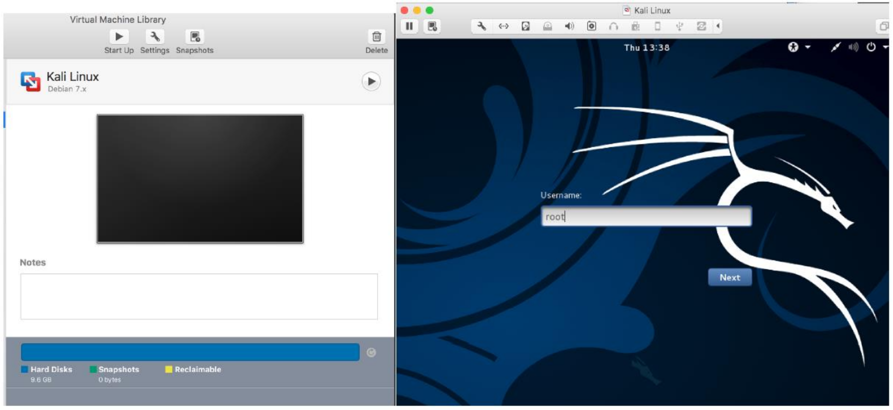
The key to successfully exploit or intrude a remote system is about the information you have. The first step for penetration testing is the scanning and reconnaissance. In this lab, you will learn how to use tools to scan and retrieve information from a targeting system. You will be using nmap and OpenVAS to scan a vulnerable machine and identify exploits that can be used to attack it. We will use two Linux virtual machines: one is a Kali Linux with nmap and OpenVAS installed; and the other one is intentionally vulnerable Linux. We will use the nmap and OpenVAS on Kali Linux to scan the vulnerable Linux machine.

Software Requirements

- The VMWare Software
  • https://www.vmware.com/
- The VirtualBox Software
  • https://www.virtualbox.org/wiki/Downloads
  • https://www.vmware.com/support/developer/ovf/
  • https://www.mylearning.be/2017/12/convert-a-vmware-fusion-virtual-machine-to-virtualbox-on-mac/
- The Kali Linux, Penetration Testing Distribution
  https://www.kali.org/downloads/
- Metasploitable2: Vulnerable Linux Platform
  http://sourceforge.net/projects/metasploitable/files/Metasploitable2/
- nmap: the Network Mapper - Free Security Scanner
  https://nmap.org/
- OpenVAS: Open Vulnerability Assessment System
  http://www.openvas.org/index.html

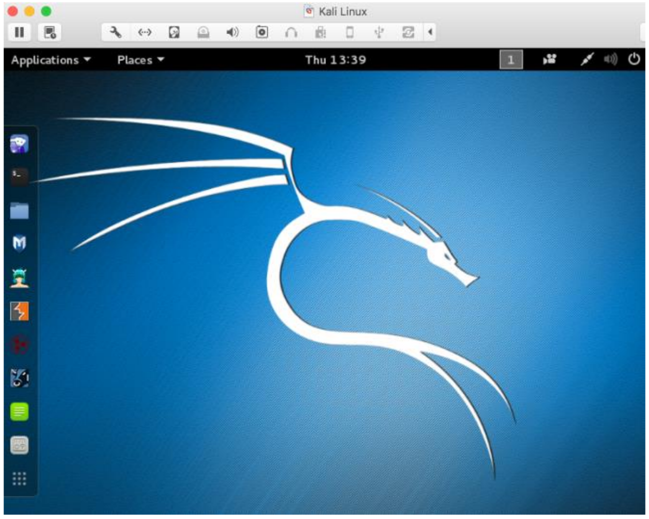
Starting the Lab 3 Virtual Machines

We need to use two VMs for this lab: the Kali Linux and the Metasploitable2-Linux.
First, select the Kali Linux and press Start up

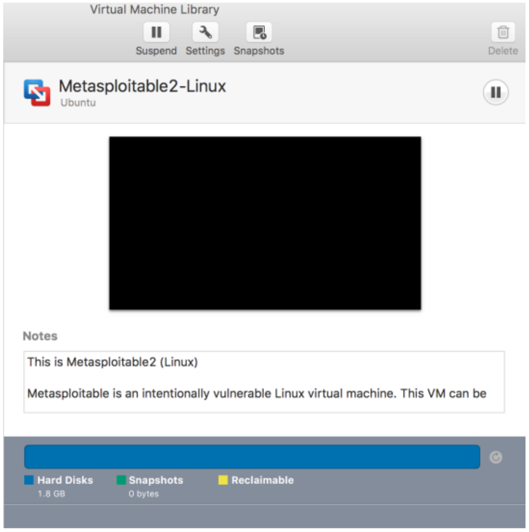


Username: root

Login the Kali Linux with username root and password [default credential: kali/kali]. Below is the screen snapshot after login



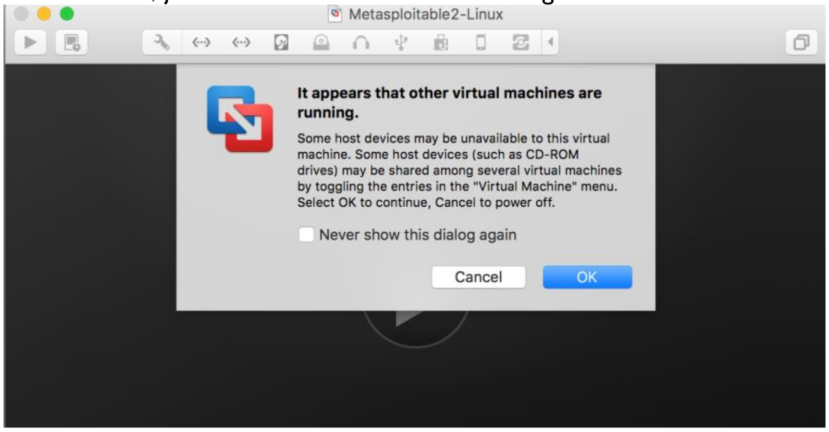
Then, you select Metasploitble2-Linux, and press Start up. This is an intentionally vulnerable Linux VM that you will attack against.



This is Metasploitable2 (Linux)

Metasploitable is an intentionally vulnerable Linux virtual machine. This VM can be

If you see the window below, just click OK. This is due to running two VM at the same time.



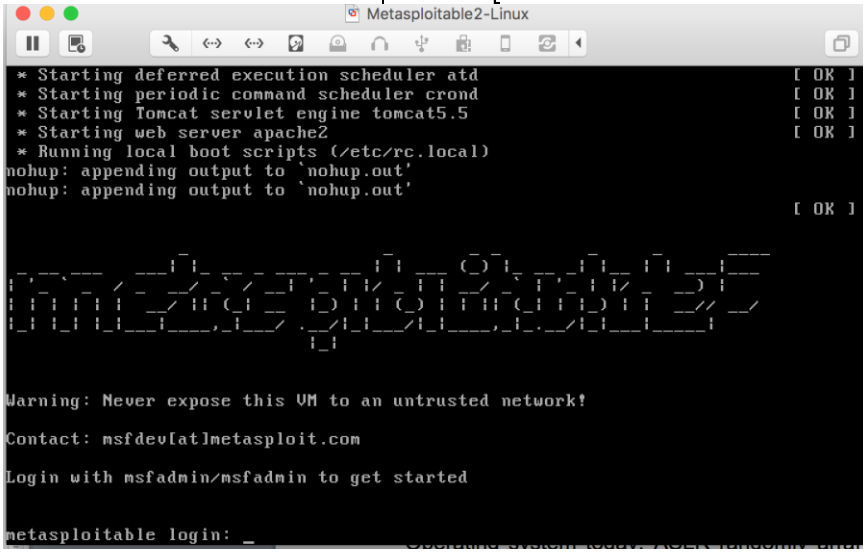
It appears that other virtual machines are running.

Some host devices may be unavailable to this virtual machine. Some host devices (such as CD-ROM drives) may be shared among several virtual machines by toggling the entries in the "Virtual Machine" menu. Select OK to continue, Cancel to power off.

□ Never show this dialog again

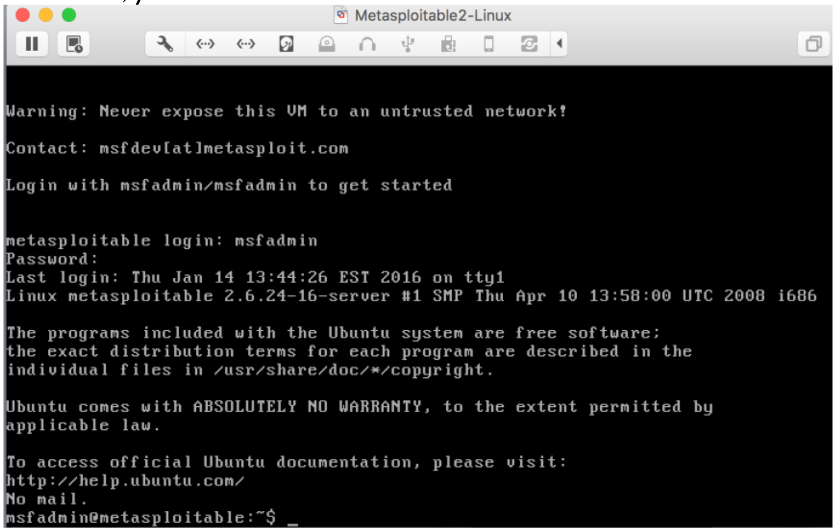
Cancel OK

Log into the virtual machine with username and password [default credential: msfadmin/msfadmin].



```
 * Starting deferred execution scheduler atd                             [ OK ]
 * Starting periodic command scheduler crond                             [ OK ]
 * Starting Tomcat servlet engine tomcat5.5                              [ OK ]
 * Starting web server apache2                                           [ OK ]
 * Running local boot scripts (/etc/rc.local)
nohup: appending output to `nohup.out'
nohup: appending output to `nohup.out'
                                                                         [ OK ]

                _                  _       _ _        _     _      ____
 _ __ ___   ___| |_ __ _ ___ _ __ | | ___ (_) |_ __ _| |__ | | ___|___
| '_ ` _   / _   __/ _` / __| '_  | |/ _  | | __/ _` | '_  | |/ _   __) |
| | | | | |  __/ || (_| __  |_) | | (_) | | || (_| | |_) | |  __// __/
|_| |_| |_|___|____,_|___/ .__/|_|___/|_|____,_|_.__/|_|___|_____|
                            |_|


Warning: Never expose this VM to an untrusted network!

Contact: msfdev[at]metasploit.com

Login with msfadmin/msfadmin to get started


metasploitable login: _
```

After you log into the VM, you will see the screen below.



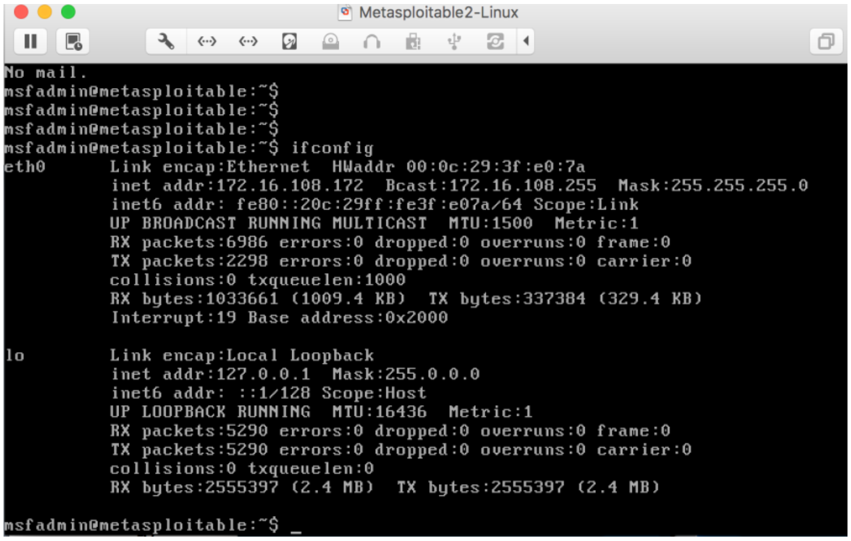
```

Warning: Never expose this VM to an untrusted network!

Contact: msfdev[at]metasploit.com

Login with msfadmin/msfadmin to get started


metasploitable login: msfadmin
Password:
Last login: Thu Jan 14 13:44:26 EST 2016 on tty1
Linux metasploitable 2.6.24-16-server #1 SMP Thu Apr 10 13:58:00 UTC 2008 i686

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

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To access official Ubuntu documentation, please visit:
http://help.ubuntu.com/
No mail.
msfadmin@metasploitable:~$ _
```

Finding the IP Address of the Attacking Target

For the purpose of this lab, it uses Metasploitable2-Linux as the attacking target. First, we need to find the host IP address of the target to launch a scanning. You can use the command "ifconfig" (ipconfig is the windows equivalent). This command allows you to find all the connected interfaces and network cards.

Go to the Metasploitable2-Linux VM, and execute the following command

$ ifconfig



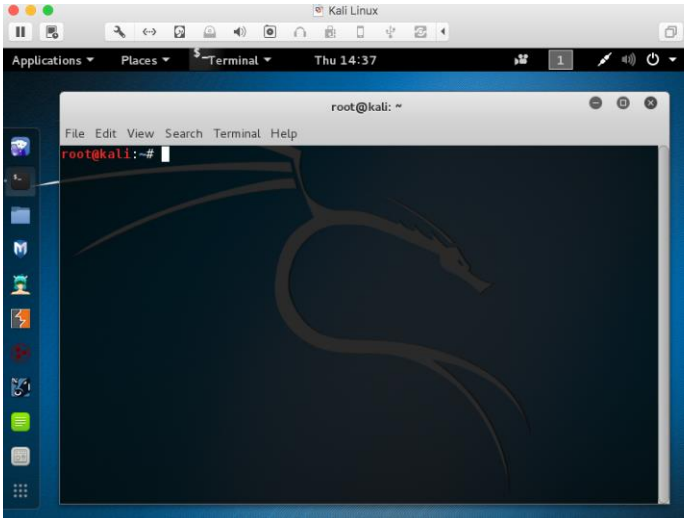
```
No mail.
msfadmin@metasploitable:~$
msfadmin@metasploitable:~$
msfadmin@metasploitable:~$
msfadmin@metasploitable:~$ ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0c:29:3f:e0:7a
          inet addr:172.16.108.172  Bcast:172.16.108.255  Mask:255.255.255.0
          inet6 addr: fe80::20c:29ff:fe3f:e07a/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:6986 errors:0 dropped:0 overruns:0 frame:0
          TX packets:2298 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1033661 (1009.4 KB)  TX bytes:337384 (329.4 KB)
          Interrupt:19 Base address:0x2000

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:5290 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5290 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:2555397 (2.4 MB)  TX bytes:2555397 (2.4 MB)

msfadmin@metasploitable:~$ _
```

From the screenshot above, we can see that the IP address of the network interface, eth0, is 172.16.108.172. This is the IP address for the target that you will use later in this lab. When you work on the lab in the classroom, you will get a different IP address for your Metaploitable2-Linux VM. Note that this is not a public IP but we can access it within the subset.

Scanning the Target Using nmap

nmap ("Network Mapper") is an open source tool for network exploration and security auditing. Though it was designed to rapidly scan large networks, we use it for scanning the target host in this lab.

Go to the Kali Linux, and open up a terminal by clicking the icon



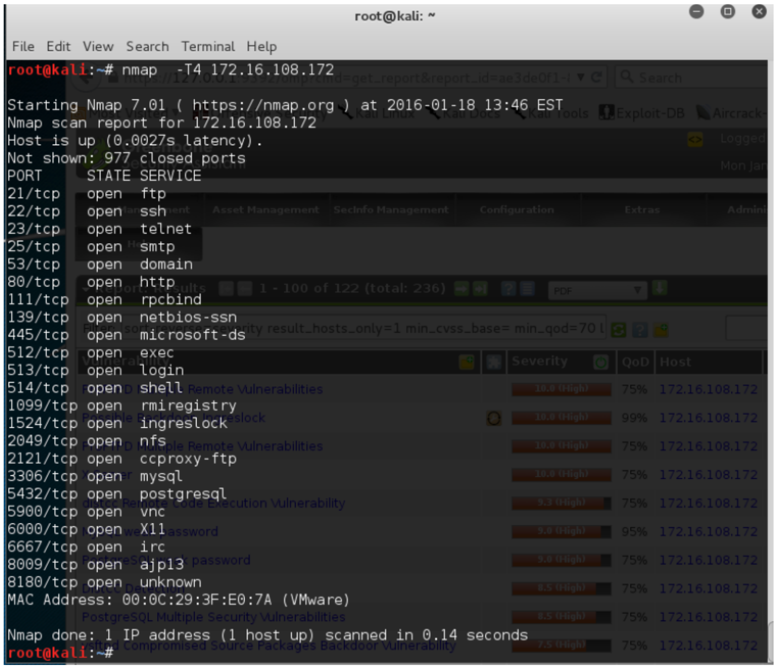
```
root@kali:~#
```

Since nmap has been installed on the Kali Linux, we can just launch the scanning in the terminal by typing the following command:

$ nmap –T4 172.16.108.172

nmap is the execution command; option -T4 means faster execution; and 172.16.108.172 is the IP address of the target. As mentioned, you will have a different

IP address when working on this with the VMs in the classroom.



```
root@kali:~# nmap  -T4 172.16.108.172

Starting Nmap 7.01 ( https://nmap.org ) at 2016-01-18 13:46 EST
Nmap scan report for 172.16.108.172
Host is up (0.0027s latency).
Not shown: 977 closed ports
PORT     STATE SERVICE
21/tcp   open  ftp
22/tcp   open  ssh
23/tcp   open  telnet
25/tcp   open  smtp
53/tcp   open  domain
80/tcp   open  http
111/tcp  open  rpcbind
139/tcp  open  netbios-ssn
445/tcp  open  microsoft-ds
512/tcp  open  exec
513/tcp  open  login
514/tcp  open  shell
1099/tcp open  rmiregistry
1524/tcp open  ingreslock
2049/tcp open  nfs
2121/tcp open  ccproxy-ftp
3306/tcp open  mysql
5432/tcp open  postgresql
5900/tcp open  vnc
6000/tcp open  X11
6667/tcp open  irc
8009/tcp open  ajp13
8180/tcp open  unknown
MAC Address: 00:0C:29:3F:E0:7A (VMware)

Nmap done: 1 IP address (1 host up) scanned in 0.14 seconds
root@kali:~#
```

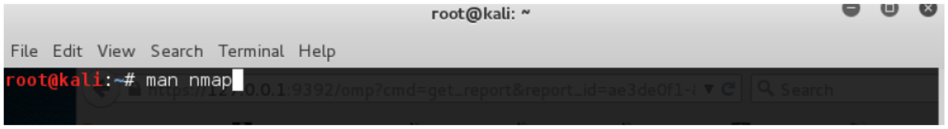
The screenshot above shows a quick scan of the target machine using nmap. We can see that there are many open ports and services on the target system including FTP, SSH, HTTP, and MySQL. These services may contain vulnerabilities that you can exploit.

nmap provides many useful functions that we can use. You can find more information from the man page of nmap

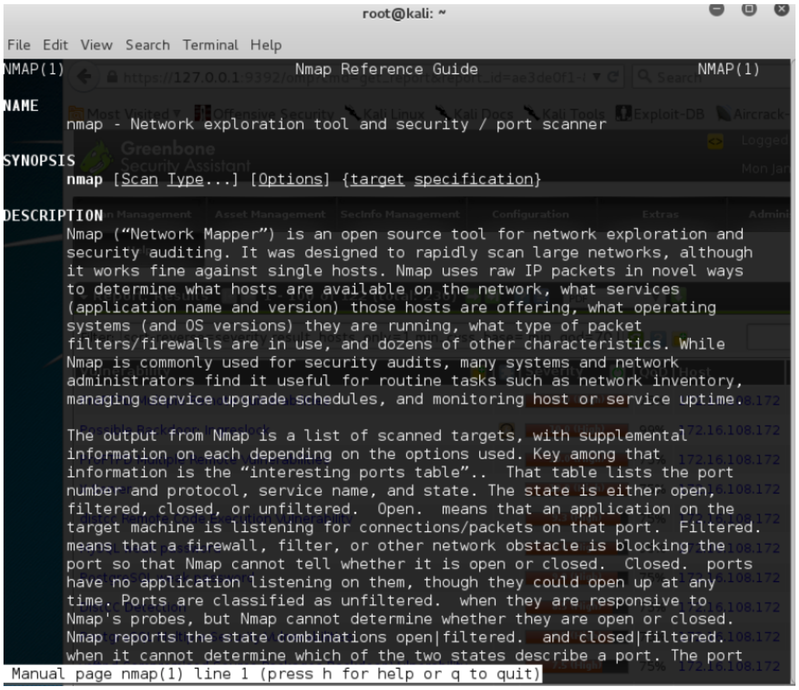
from this link: http://linux.die.net/man/1/nmap

Or execute the following command in a terminal:

$ man nmap



```
root@kali:~# man nmap
```



```
NMAP(1)                    Nmap Reference Guide                    NMAP(1)

NAME
       nmap - Network exploration tool and security / port scanner

SYNOPSIS
       nmap [Scan Type...] [Options] {target specification}

DESCRIPTION
       Nmap ("Network Mapper") is an open source tool for network exploration and
       security auditing. It was designed to rapidly scan large networks, although
       it works fine against single hosts. Nmap uses raw IP packets in novel ways
       to determine what hosts are available on the network, what services
       (application name and version) those hosts are offering, what operating
       systems (and OS versions) they are running, what type of packet
       filters/firewalls are in use, and dozens of other characteristics. While
       Nmap is commonly used for security audits, many systems and network
       administrators find it useful for routine tasks such as network inventory,
       managing service upgrade schedules, and monitoring host or service uptime.

       The output from Nmap is a list of scanned targets, with supplemental
       information on each depending on the options used. Key among that
       information is the "interesting ports table".. That table lists the port
       number and protocol, service name, and state. The state is either open,
       filtered, closed, or unfiltered. Open. means that an application on the
       target machine is listening for connections/packets on that port. Filtered.
       means that a firewall, filter, or other network obstacle is blocking the
       port so that Nmap cannot tell whether it is open or closed. Closed. ports
       have no application listening on them, though they could open up at any
       time. Ports are classified as unfiltered. when they are responsive to
       Nmap's probes, but Nmap cannot determine whether they are open or closed.
       Nmap reports the state combinations open|filtered. and closed|filtered.
       when it cannot determine which of the two states describe a port. The port
 Manual page nmap(1) line 1 (press h for help or q to quit)
```

The screenshot above shows the man page of nmap.

Vulnerability Scanning Using OpenVAS

OpenVAS is an open-source framework of several services and tools offering a comprehensive and powerful vulnerability scanning and vulnerability management solution. In our Kali Linux image, OpenVAS has been installed and setup for you.

If you want to setup OpenVAS in your own machine, you can follow the steps below.

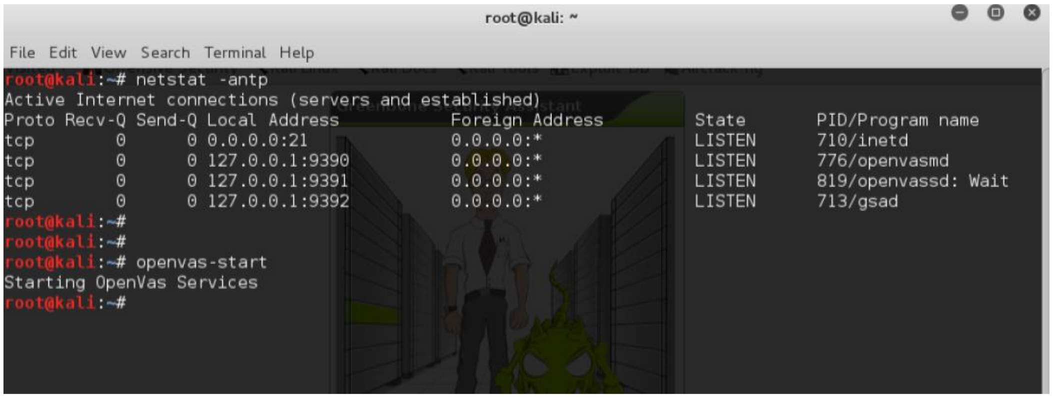
```
root@kali:~# apt-get update
root@kali:~# apt-get dist-upgrade
root@kali:~# apt-get install openvas
root@kali:~# openvas-setup
```

Since the Kali Linux image has everything setup for you, you don't need to run the setup commands. You can run the following command to check if the OpenVAS manager, scanner, and GSAD services are listening:

```
root@kali:~# netstat –antp
```

Otherwise, just start the services by executing the following command

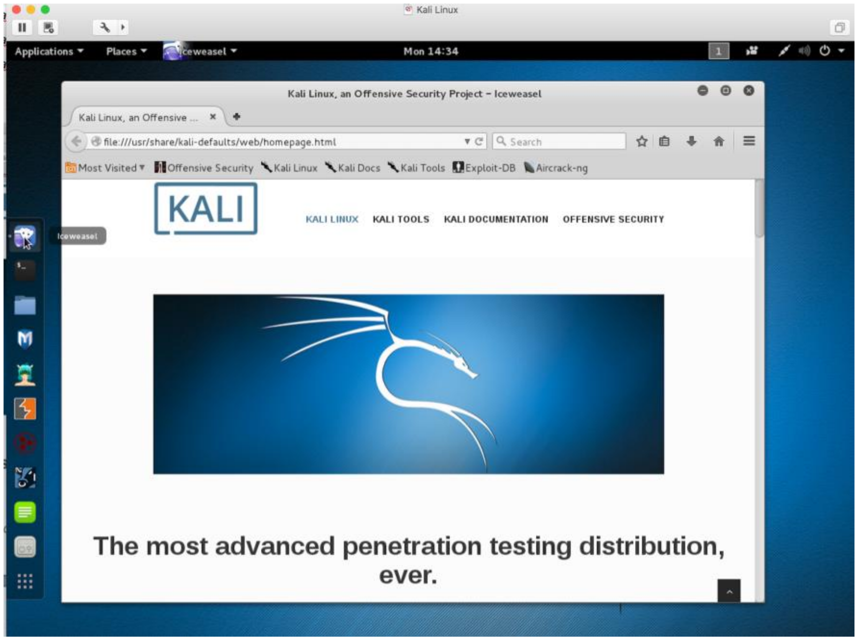
```
root@kali:~# openvas-start
```



```
root@kali:~# netstat -antp
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State       PID/Program name
tcp        0      0 0.0.0.0:21              0.0.0.0:*               LISTEN      710/inetd
tcp        0      0 127.0.0.1:9390          0.0.0.0:*               LISTEN      776/openvasmd
tcp        0      0 127.0.0.1:9391          0.0.0.0:*               LISTEN      819/openvassd: Wait
tcp        0      0 127.0.0.1:9392          0.0.0.0:*               LISTEN      713/gsad
root@kali:~#
root@kali:~#
root@kali:~# openvas-start
Starting OpenVas Services
root@kali:~#
```

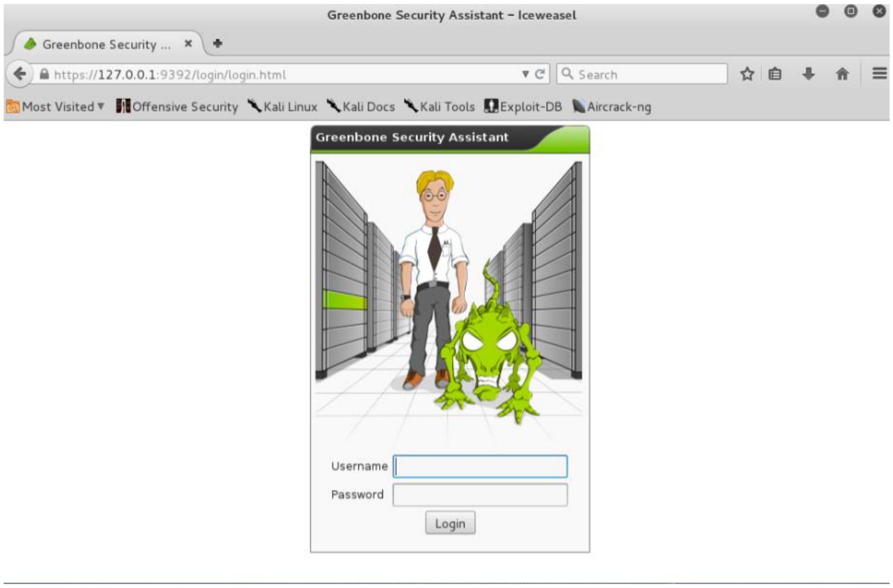
Connecting to the OpenVAS Web Interface

Go to the Kali Linux, and open the browser, Iceweasel, by clicking the icon



The most advanced penetration testing distribution, ever.

Then, go to https://127.0.0.1:9392 and accept the self-signed SSL certificate.

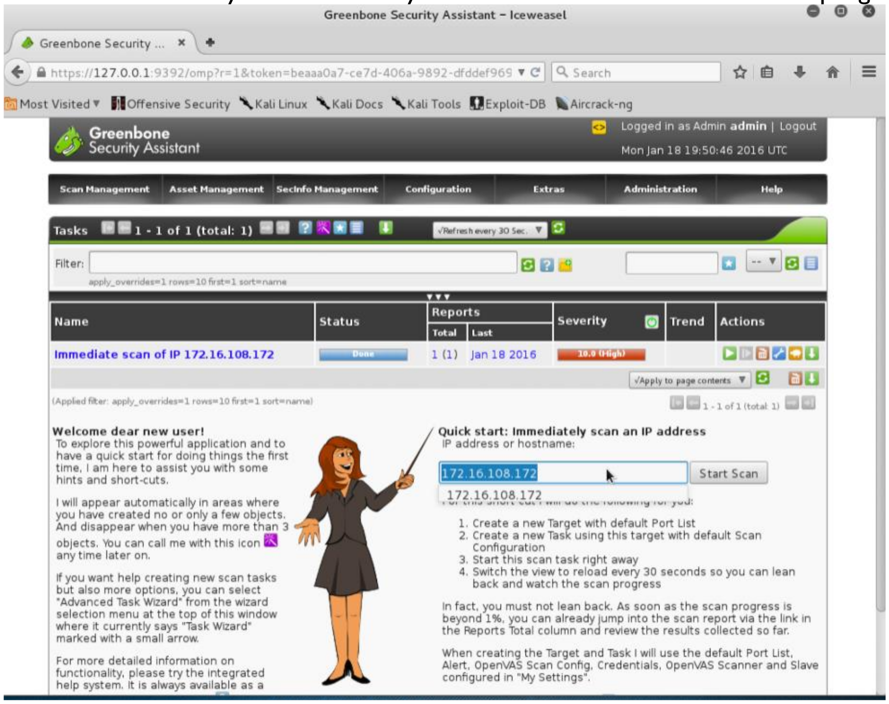


Input the username as admin and the password [the admin password was generated during the setup phase (look at the output above if you missed it) https://www.kali.org/blog/openvas-vulnerability-scanning/].

The screenshot on next page is the homepage of OpenVAS. Type the IP address of the target in the "Quick start" box, and press "Start Scan". It will do the following for you:

1. Create a new Target with default Port List
2. Create a new Task using this target with default Scan Configuration

3. Start this scan task right away
4. Switch the view to reload every 30 seconds so you can lean back and watch the scan progress


Greenbone Security Assistant – Iceweasel
Greenbone Security ...
https://127.0.0.1:9392/omp?r=1&token=beaaa0a7-ce7d-406a-9892-dfddef969
Search
Most Visited
Offensive Security
Kali Linux
Kali Docs
Kali Tools
Exploit-DB
Aircrack-ng
Greenbone Security Assistant
Logged in as Admin admin | Logout
Mon Jan 18 19:50:46 2016 UTC
Scan Management
Asset Management
SecInfo Management
Configuration
Extras
Administration
Help
Tasks
1 - 1 of 1 (total: 1)
√Refresh every 30 Sec.
Filter:
apply_overrides=1 rows=10 first=1 sort=name
√Apply to page contents
(Applied filter: apply_overrides=1 rows=10 first=1 sort=name)
1 - 1 of 1 (total: 1)

Name	Status	Reports		Severity	Trend	Actions
		Total	Last			
Immediate scan of IP 172.16.108.172	Done	1 (1)	Jan 18 2016	10.0 (High)		

Welcome dear new user!
To explore this powerful application and to have a quick start for doing things the first time, I am here to assist you with some hints and short-cuts.

I will appear automatically in areas where you have created no or only a few objects. And disappear when you have more than 3 objects. You can call me with this icon any time later on.

If you want help creating new scan tasks but also more options, you can select "Advanced Task Wizard" from the wizard selection menu at the top of this window where it currently says "Task Wizard" marked with a small arrow.

For more detailed information on functionality, please try the integrated help system. It is always available as a

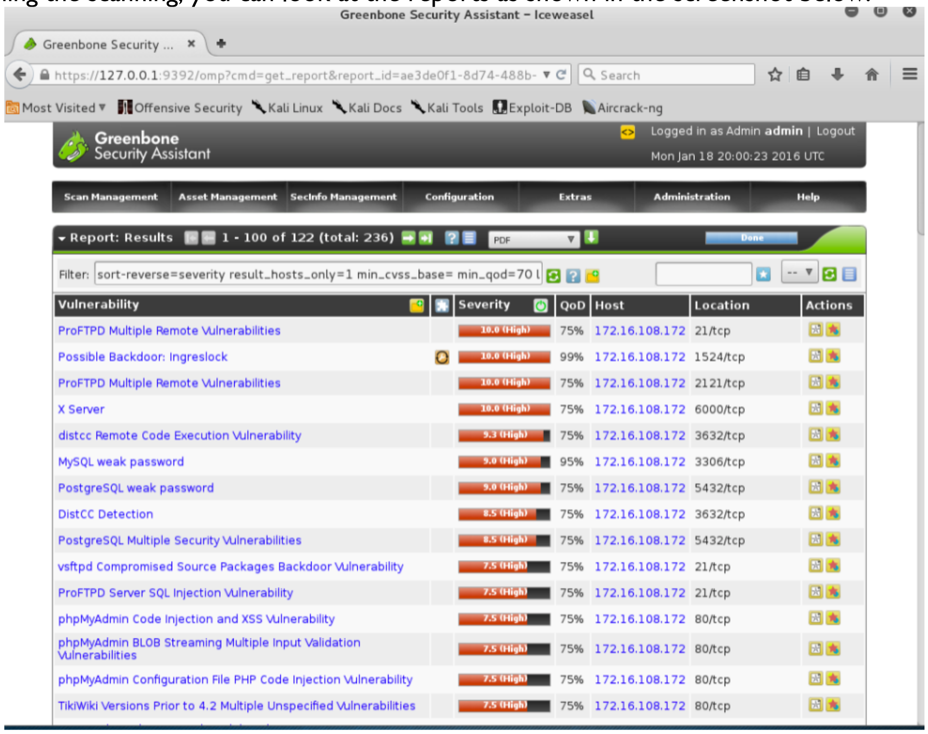
Quick start: Immediately scan an IP address
IP address or hostname:
172.16.108.172 Start Scan
172.16.108.172
For this short-cut I will do the following for you:

1. Create a new Target with default Port List
2. Create a new Task using this target with default Scan Configuration
3. Start this scan task right away
4. Switch the view to reload every 30 seconds so you can lean back and watch the scan progress

In fact, you must not lean back. As soon as the scan progress is beyond 1%, you can already jump into the scan report via the link in the Reports Total column and review the results collected so far.

When creating the Target and Task I will use the default Port List, Alert, OpenVAS Scan Config, Credentials, OpenVAS Scanner and Slave configured in "My Settings".

After finishing the scanning, you can look at the reports as shown in the screenshot below.


Greenbone Security Assistant – Iceweasel
Greenbone Security ...
https://127.0.0.1:9392/omp?cmd=get_report&report_id=ae3de0f1-8d74-488b-
Search
Most Visited
Offensive Security
Kali Linux
Kali Docs
Kali Tools
Exploit-DB
Aircrack-ng
Greenbone Security Assistant
Logged in as Admin admin | Logout
Mon Jan 18 20:00:23 2016 UTC
Scan Management
Asset Management
SecInfo Management
Configuration
Extras
Administration
Help
Report: Results
1 - 100 of 122 (total: 236)
PDF
Done
Filter: sort-reverse=severity result_hosts_only=1 min_cvss_base= min_qod=70 l

Vulnerability		Severity	QoD	Host	Location	Actions
ProFTPD Multiple Remote Vulnerabilities		10.0 (High)	75%	172.16.108.172	21/tcp	
Possible Backdoor: Ingreslock		10.0 (High)	99%	172.16.108.172	1524/tcp	
ProFTPD Multiple Remote Vulnerabilities		10.0 (High)	75%	172.16.108.172	2121/tcp	
X Server		10.0 (High)	75%	172.16.108.172	6000/tcp	
distcc Remote Code Execution Vulnerability		9.3 (High)	75%	172.16.108.172	3632/tcp	
MySQL weak password		9.0 (High)	95%	172.16.108.172	3306/tcp	
PostgreSQL weak password		9.0 (High)	75%	172.16.108.172	5432/tcp	
DistCC Detection		8.5 (High)	75%	172.16.108.172	3632/tcp	
PostgreSQL Multiple Security Vulnerabilities		8.5 (High)	75%	172.16.108.172	5432/tcp	
vsftpd Compromised Source Packages Backdoor Vulnerability		7.5 (High)	75%	172.16.108.172	21/tcp	
ProFTPD Server SQL Injection Vulnerability		7.5 (High)	75%	172.16.108.172	21/tcp	
phpMyAdmin Code Injection and XSS Vulnerability		7.5 (High)	75%	172.16.108.172	80/tcp	
phpMyAdmin BLOB Streaming Multiple Input Validation Vulnerabilities		7.5 (High)	75%	172.16.108.172	80/tcp	
phpMyAdmin Configuration File PHP Code Injection Vulnerability		7.5 (High)	75%	172.16.108.172	80/tcp	
TikiWiki Versions Prior to 4.2 Multiple Unspecified Vulnerabilities		7.5 (High)	75%	172.16.108.172	80/tcp	

Questions for the Lab

Software Requirements
All required tools are packed in the provided Lab 3 virtual machine.

- VMWare Software
  - https://www.vmware.com/
- VirtualBox Software
  - https://www.virtualbox.org/

The Lab 3 virtual machine and Metasploitable2: Vulnerable Linux Platform can be downloaded from https://www.kali.org/get-kali/ and http://sourceforge.net/projects/metasploitable/files/Metasploitable2/, respectively.

1. Read the lab instructions above and finish all the tasks. (provide a sequence of screenshots with brief screenshot descriptions to show that you have finish all the tasks.) [2 pts]

2. Go to https://owasp.org/www-project-vulnerable-web-applications-directory/, OWASP Vulnerable Web Applications Directory Project, choose one On-Line Web Application.

   a. Use nmap to scan the target and find the software version of the server OS and the running services (applications). (provide a sequence of screenshots with brief screenshot descriptions to show your scanning.) [2 pts]

   b. Go to web application vulnerability database (e.g., https://nvd.nist.gov/) and find the existing vulnerability of the discovered software version of the server OS. (provide clear screenshot with brief description.) [1 pt]

3. What are the differences if we use T1, T2, T3 flags with nmap? [1 pt] How to avoid detection from an intrusion detection system (e.g., stealthy scanning)? [1 pt]

4. Go to https://owasp.org/www-project-vulnerable-web-applications-directory/, OWASP Vulnerable Web Applications Directory Project, choose one On-Line Web Application.

   a. Use OpenVAS to find two vulnerabilities of the target. (provide a sequence of screenshots with brief screenshot descriptions to show your scanning.) [1 pt]

   b. Briefly describe the discovered two vulnerabilities of the target. [2 pts]

Happy Scanning!