CySA+ Lab Series

Lab 01: Network Enumeration

Document Version: 2022-10-10

Material in this Lab Aligns to the Following	
CompTIA CySA+ (CS0-002) Exam Objectives	1.2 - Given a scenario, utilize threat intelligence to support organizational security 1.3 - Given a scenario, perform vulnerability managemenactivitieses 1.4 - Given a scenario, analyze the output from commvulnerabilitylty tools 1.7 - Given a scenario, implement controls to mitigate attacks and software vulnerabilities
All-In-One CompTIA CySA+ Second Edition ISBN-13: 978-1260464306 Chapters	2: Threat Intelligence in Support of Organizational Security 3: Vulnerability Management Activities 4: Vulnerability Assessment Tools 7: Mitigating Controls for Attacks and Software Vulnerabilities

Contents

Introduction

This lab will explore various network enumeration and reconnaissance scanning methods. This lab will introduce several common tools, *netstat* (monitor connections on a network), *nmap* (perform port scanning), and *legion* (a GUI network host and port scanner).

In addition, you will see how a firewall can protect resources on the network by blocking scans.

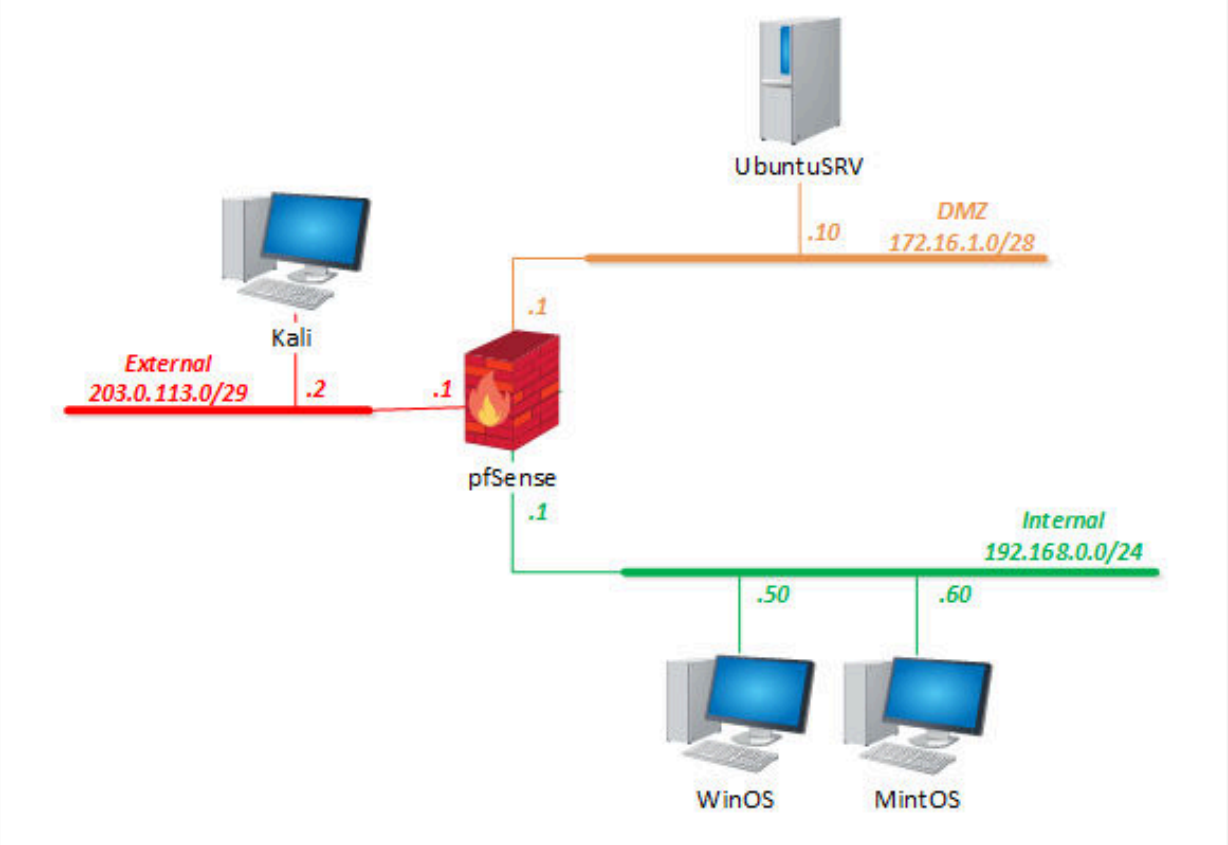
Objective

In this lab, you will be conducting network and port scans using various tools. You will be performing the following tasks:

- Perform Host Ports Scans with *NETSTAT*
- Perform Network Scans with *NMAP*
- Perform OS Fingerprinting with *NMAP*
- Perform Host Scans with *LEGION*

You will also be looking at how firewalls can protect resources on the network by conducting scans with and without firewalls.

Lab Topology



Lab Settings

The information in the table below will be needed in order to complete the lab. The task sections below provide details on the use of this information.

Virtual Machine	IP Address	Account	Password
WinOS (Server 2019)	192.168.0.50	Administrator	NDGlabpass123!
MintOS (Linux Mint)	192.168.0.60	sysadmin	NDGlabpass123!
OSSIM (Alien Vault)	172.16.1.2	root	NDGlabpass123!
UbuntuSRV (Ubuntu Server)	172.16.1.10	sysadmin	NDGlabpass123!
Kali	203.0.113.2	sysadmin	NDGlabpass123!
pfSense	203.0.113.1 172.16.1.1 192.168.0.1	admin	NDGlabpass123!

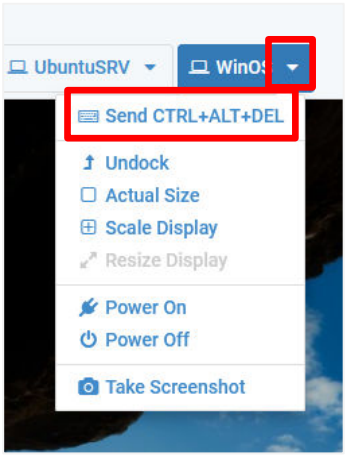
1 Utilizing Netstat to Perform System Scans

The *netstat* (network statistics) command-line utility is used for displaying network connections in TCP/IP networks. It can display network connections for routing tables, network interfaces, transport layer protocols, and multicast memberships. In addition, security analysts can use *netstat* to discover masquerade connections, sockets, and listening states. The tool was originally a Unix command, but has been ported to Linux, Windows, and macOS. *netstat* will only display the information on the local computer where you run the program.

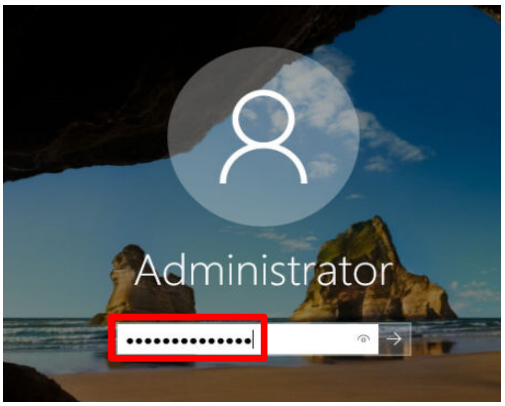
In this task, you will use *netstat* to scan your machine to discover which ports are open, and which processes with their respective Process Identifiers (PIDs) are listening on those ports.

Process Identifiers or PIDs are numbers that are used in Unix/Linux, Windows, and MacOS (also Android and iOS, but not as easy to show) to identify an active process. In this way, multiple instances of a program can run concurrently, each one running with its own PID.

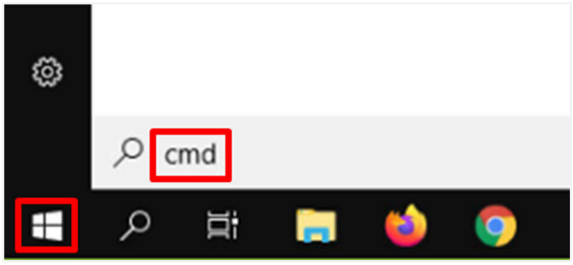
1. Change the focus to the **WinOS** host.
2. Bring up the login window by sending a Ctrl + Alt + Delete. To do this, click the **WinOS** dropdown menu and click **Send CTRL+ALT+DEL**.



3. Log in as *Administrator* using the password: `NDGlabpass123!`

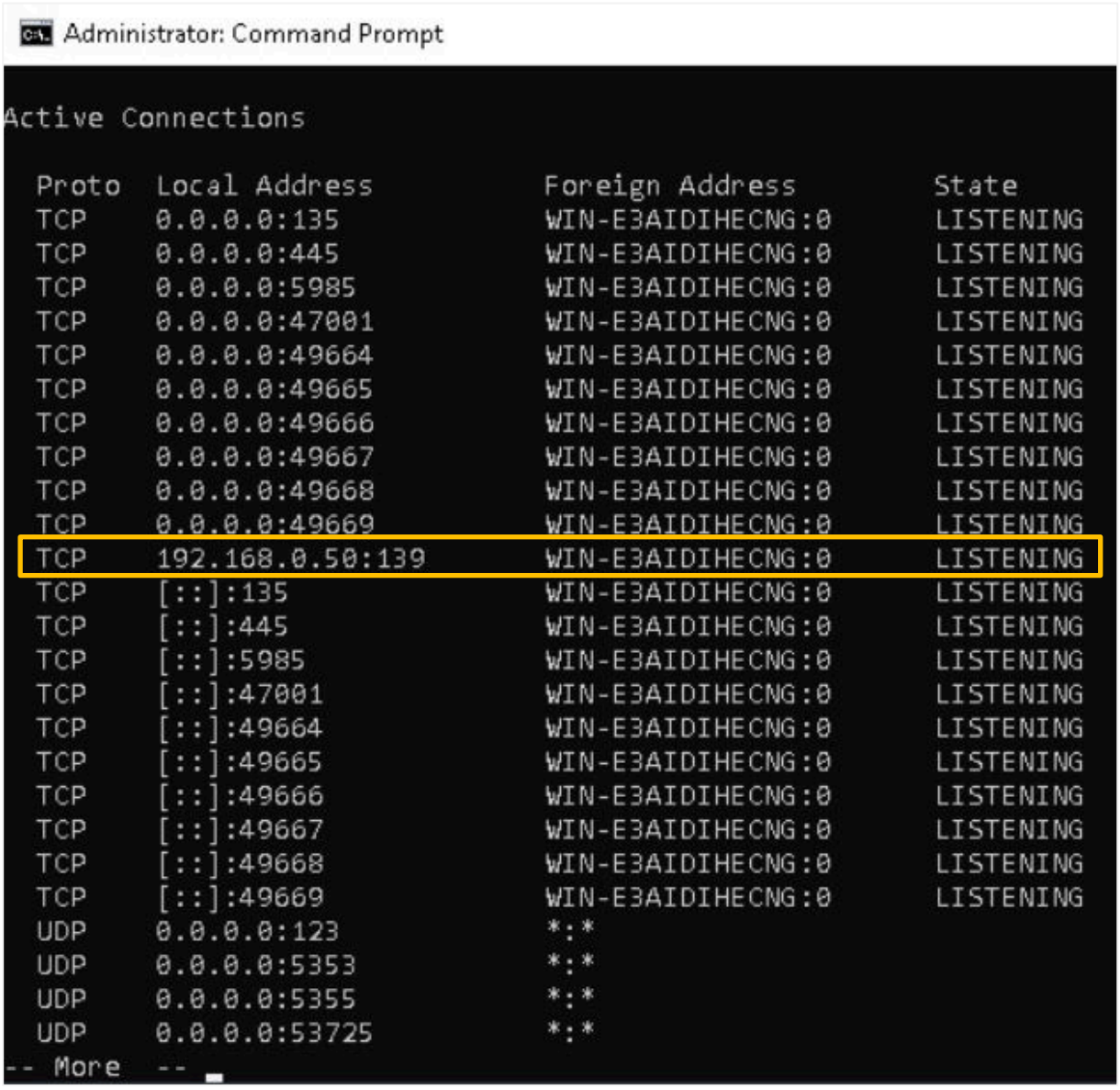


4. Click on the **Windows Start** button in the bottom-left corner, type `cmd` and then press **Enter** to bring up the command prompt window.



5. In the command prompt window, enter the following *netstat* command to check which *TCP* and *UDP* ports are *LISTENING* for a connection and which have an *ESTABLISHED* connection. A port that is LISTENING is a potential "open door" that can be exploited.

```
netstat -a | more
```

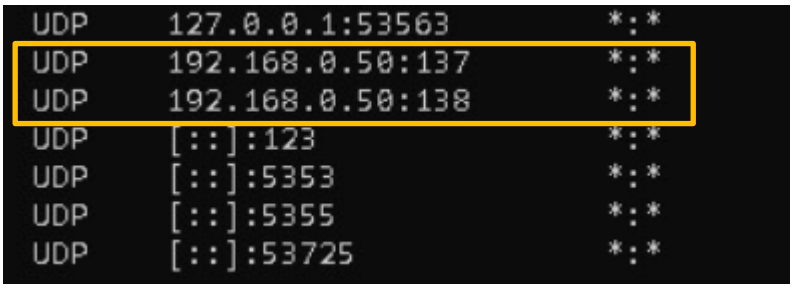


The **-a** option displays all connections and listening ports.

The **| more** (reads as "pipe to more") is a good way of displaying output one screen at a time. If the output is more than one screen's worth, the output will pause. Pressing the Spacebar will continue the output to the next screen.

The first page of the output displayed above shows that *TCP Port 139* is *LISTENING*. This port is used for the *NetBIOS Session Service*. This protocol is used for *Windows File and Print Sharing*. Since there are a number of vulnerabilities associated with the implementation of the protocol, a security analyst needs to be aware of the risks of leaving this port open.

6. If the **- - More - -**is shown on the last line of the page, press the **Spacebar** to show the next page.

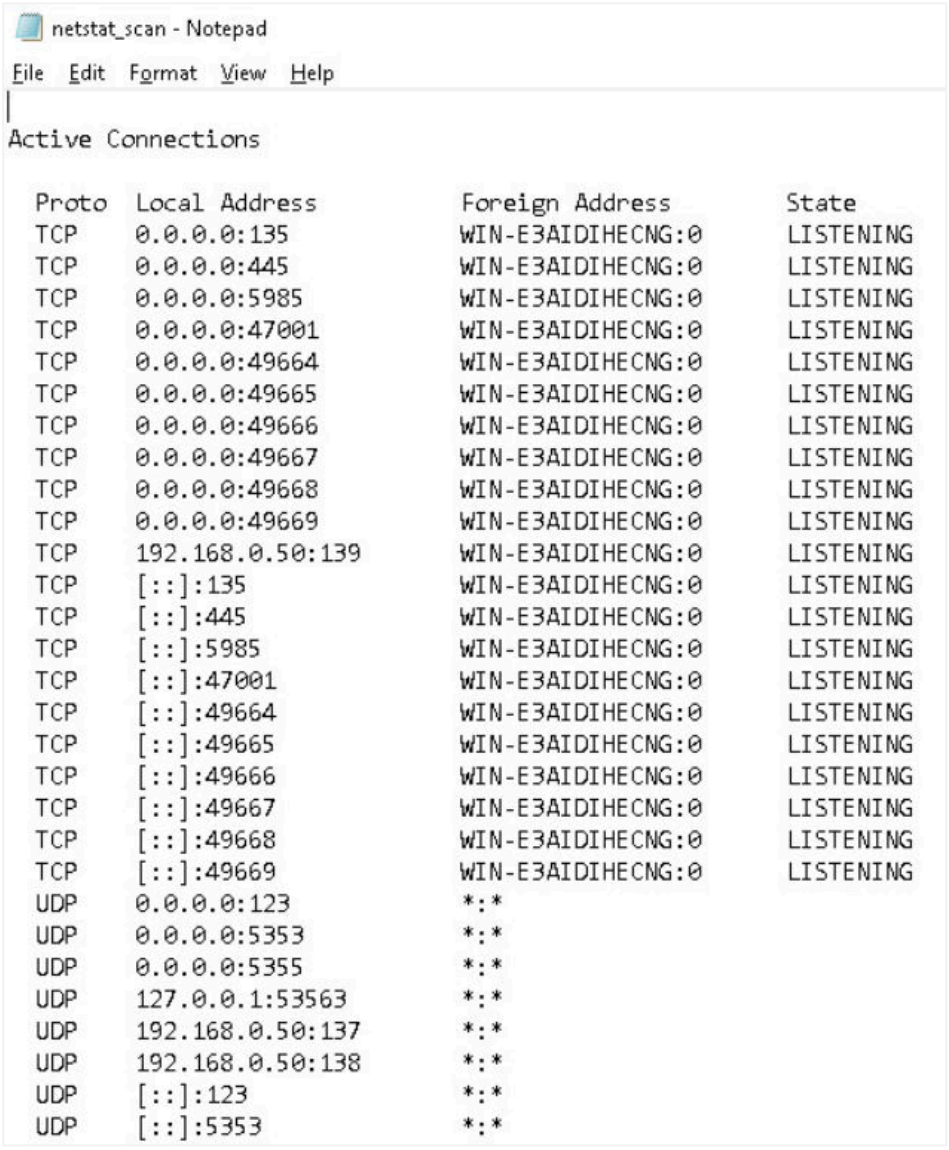


Notice that for *UDP, Port 137*, *NetBIOS Name Service* and *Port 138, NetBIOS Datagram Service* is shown in the list indicating that the port is open, but they do not show the *LISTENING* status. This is because *TCP* is a connection-oriented protocol that needs to establish a connection after the *Three-Way Handshake* (*SYN, SYN/ACK, ACK*), whereas *UDP* is connectionless and just opens the port and waits for datagrams to arrive. These open ports are also vulnerable and can be exploited.

7. To capture the output of the *netstat* scan, use the redirect operator (**>**) to redirect output to a text file which can be used for more detailed analysis and reporting. Type the following command, which will take the output and redirect it to a text file that will be saved on the desktop.

```
netstat –a > c:\users\administrator\desktop\netstat_scan.txt
```

8. Open the text file by double-clicking on the **netstat_scan** icon, and you will see the results in *Notepad.*



netstat_scan - Notepad

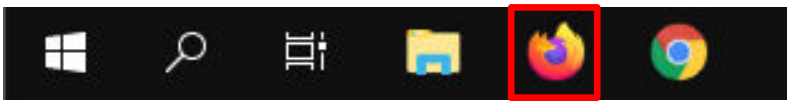
File Edit Format View Help

```
Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    0.0.0.0:135            WIN-E3AIDIHECNG:0      LISTENING
  TCP    0.0.0.0:445            WIN-E3AIDIHECNG:0      LISTENING
  TCP    0.0.0.0:5985           WIN-E3AIDIHECNG:0      LISTENING
  TCP    0.0.0.0:47001          WIN-E3AIDIHECNG:0      LISTENING
  TCP    0.0.0.0:49664          WIN-E3AIDIHECNG:0      LISTENING
  TCP    0.0.0.0:49665          WIN-E3AIDIHECNG:0      LISTENING
  TCP    0.0.0.0:49666          WIN-E3AIDIHECNG:0      LISTENING
  TCP    0.0.0.0:49667          WIN-E3AIDIHECNG:0      LISTENING
  TCP    0.0.0.0:49668          WIN-E3AIDIHECNG:0      LISTENING
  TCP    0.0.0.0:49669          WIN-E3AIDIHECNG:0      LISTENING
  TCP    192.168.0.50:139       WIN-E3AIDIHECNG:0      LISTENING
  TCP    [::]:135               WIN-E3AIDIHECNG:0      LISTENING
  TCP    [::]:445               WIN-E3AIDIHECNG:0      LISTENING
  TCP    [::]:5985              WIN-E3AIDIHECNG:0      LISTENING
  TCP    [::]:47001             WIN-E3AIDIHECNG:0      LISTENING
  TCP    [::]:49664             WIN-E3AIDIHECNG:0      LISTENING
  TCP    [::]:49665             WIN-E3AIDIHECNG:0      LISTENING
  TCP    [::]:49666             WIN-E3AIDIHECNG:0      LISTENING
  TCP    [::]:49667             WIN-E3AIDIHECNG:0      LISTENING
  TCP    [::]:49668             WIN-E3AIDIHECNG:0      LISTENING
  TCP    [::]:49669             WIN-E3AIDIHECNG:0      LISTENING
  UDP    0.0.0.0:123            *:*
  UDP    0.0.0.0:5353           *:*
  UDP    0.0.0.0:5355           *:*
  UDP    127.0.0.1:53563        *:*
  UDP    192.168.0.50:137       *:*
  UDP    192.168.0.50:138       *:*
  UDP    [::]:123               *:*
  UDP    [::]:5353              *:*
```

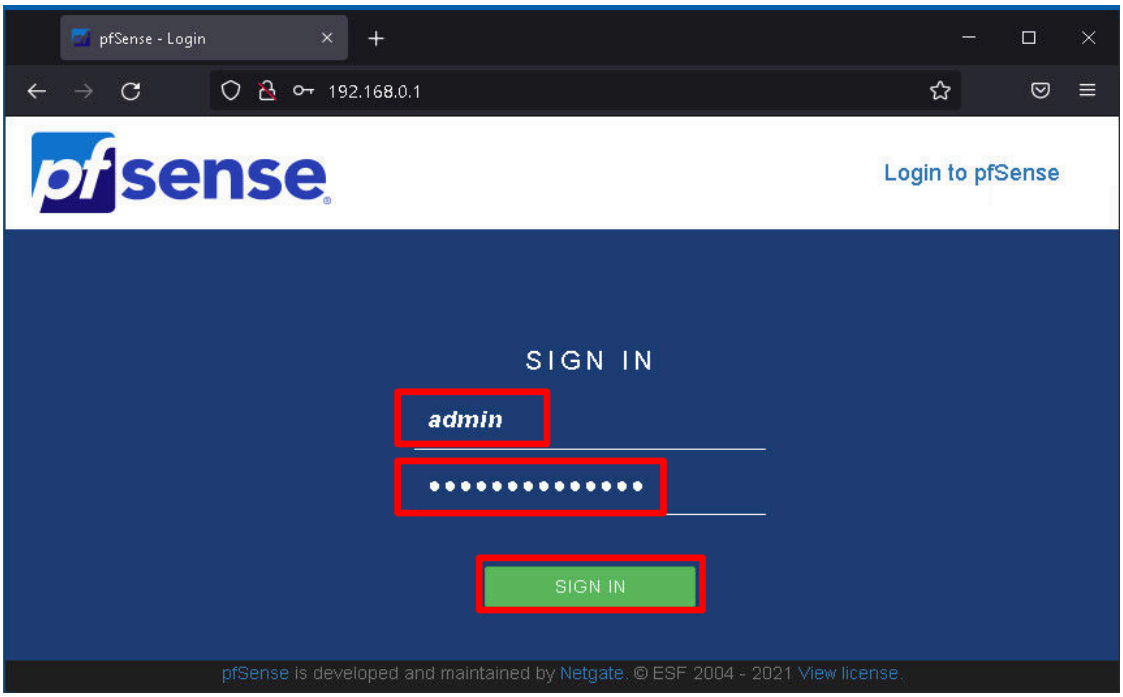
9. After looking at the report, you can close ***Notepad***.

Netstat can also show connections that have been made to TCP/UDP ports on other devices.

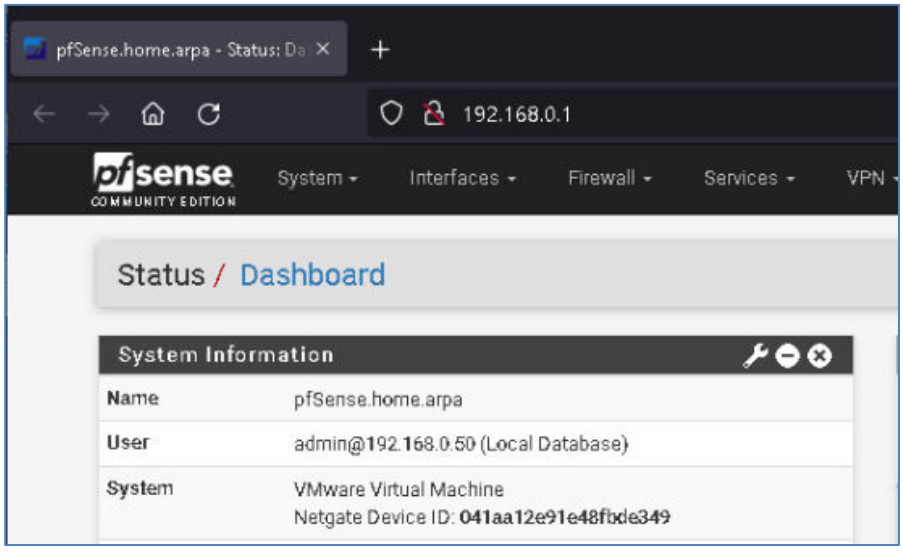
10. Click on the **Firefox** browser icon in the taskbar to open a web browser.



11. In the address bar of the browser, type `192.168.0.1`, the IP address of the *pfSense* server.
12. Log in as `admin` using the password `NDGlabpass123!` and click the **SIGN IN** button.

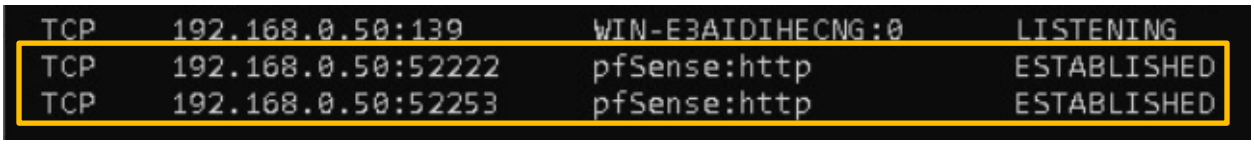


13. You will be presented with the *Dashboard* for the *pfSense* firewall.



14. Set the focus to the command prompt window and run *netstat* again by typing:

```
netstat -a -p tcp
```

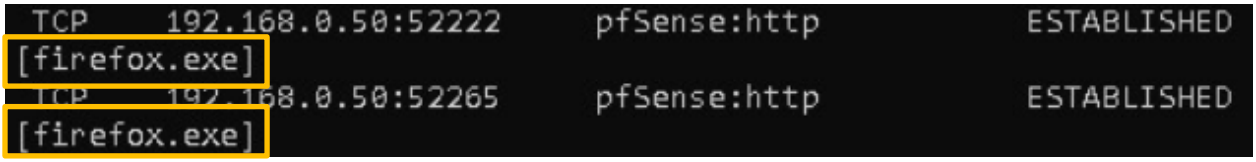


Looking at the results, the *WinOS* computer has an *ESTABLISHED* connection with the pfSense web server on *http:* (Port 80) and *https:* (Port 443).

The **-p tcp** option is used to specify that you are only interested in *TCP* ports.

15. Type the following *netstat* command to examine which processes are utilizing certain ports. Note that the service name (firefox.exe) is listed on the left side for each port with an *ESTABLISHED* status.

```
netstat -b
```



16. Type the following *netstat* command to see the *TCP port* and the *Process ID* that was given to the *pfsense:http* web server listed in the previous scan. The *Process ID* is a unique number that is used to identify each process that is currently running in memory. Notice you are provided with the process ID for each *ESTABLISHED* port on the right side.

```
netstat -o
```

```
C:\Users\Administrator>netstat -o

Active Connections

  Proto  Local Address          Foreign Address        State           PID
  TCP    127.0.0.1:52200        WIN-E3AIDIHECNG:52201  ESTABLISHED     388
  TCP    127.0.0.1:52201        WIN-E3AIDIHECNG:52200  ESTABLISHED     388
  TCP    127.0.0.1:52202        WIN-E3AIDIHECNG:52203  ESTABLISHED     5856
  TCP    127.0.0.1:52203        WIN-E3AIDIHECNG:52202  ESTABLISHED     5856
  TCP    127.0.0.1:52204        WIN-E3AIDIHECNG:52205  ESTABLISHED     5904
  TCP    127.0.0.1:52205        WIN-E3AIDIHECNG:52204  ESTABLISHED     5904
  TCP    127.0.0.1:52208        WIN-E3AIDIHECNG:52209  ESTABLISHED     5048
  TCP    127.0.0.1:52209        WIN-E3AIDIHECNG:52208  ESTABLISHED     5048
  TCP    127.0.0.1:52212        WIN-E3AIDIHECNG:52213  ESTABLISHED     6140
  TCP    127.0.0.1:52213        WIN-E3AIDIHECNG:52212  ESTABLISHED     6140
  TCP    127.0.0.1:52219        WIN-E3AIDIHECNG:52220  ESTABLISHED     4728
  TCP    127.0.0.1:52220        WIN-E3AIDIHECNG:52219  ESTABLISHED     4728
  TCP    127.0.0.1:52232        WIN-E3AIDIHECNG:52233  ESTABLISHED     2104
  TCP    127.0.0.1:52233        WIN-E3AIDIHECNG:52232  ESTABLISHED     2104
  TCP    127.0.0.1:52236        WIN-E3AIDIHECNG:52237  ESTABLISHED     5936
  TCP    127.0.0.1:52237        WIN-E3AIDIHECNG:52236  ESTABLISHED     5936
  TCP    192.168.0.50:52222     pfSense:http           ESTABLISHED     388
```

17. The following *netstat* command is used to check the routing table. The routing table will tell you which destination traffic is being directed through which interface, along with the metric for that destination. You will also see that the default route for this device is listed as *192.168.0.1,* which is configured as the default gateway connecting to the *pfSense* router.

```
netstat -r
```

```
C:\Users\Administrator>netstat -r
===========================================================================
Interface List
 12...00 50 56 99 56 8c ......vmxnet3 Ethernet Adapter
  1...........................Software Loopback Interface 1
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0      192.168.0.1    192.168.0.50    271
        127.0.0.0        255.0.0.0         On-link       127.0.0.1    331
        127.0.0.1  255.255.255.255         On-link       127.0.0.1    331
  127.255.255.255  255.255.255.255         On-link       127.0.0.1    331
      192.168.0.0    255.255.255.0         On-link    192.168.0.50    271
     192.168.0.50  255.255.255.255         On-link    192.168.0.50    271
    192.168.0.255  255.255.255.255         On-link    192.168.0.50    271
        224.0.0.0        240.0.0.0         On-link       127.0.0.1    331
        224.0.0.0        240.0.0.0         On-link    192.168.0.50    271
  255.255.255.255  255.255.255.255         On-link       127.0.0.1    331
  255.255.255.255  255.255.255.255         On-link    192.168.0.50    271
===========================================================================
Persistent Routes:
  Network Address          Netmask  Gateway Address  Metric
          0.0.0.0          0.0.0.0      192.168.0.1  Default
===========================================================================
```

You can also use the command:
`route print`
to display the routing table.

18. Close the command prompt window and minimize the web browser.

2 Performing Network Scans with nmap

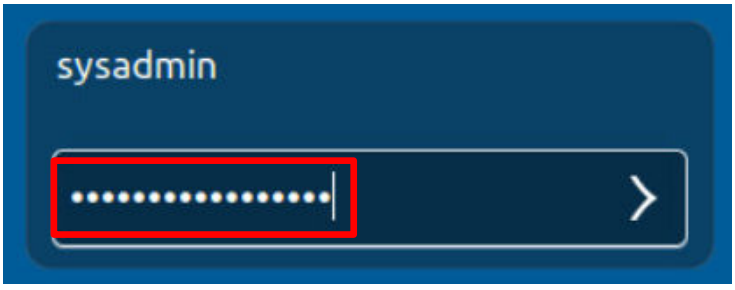
2.1 Basic nmap Features/Functions and Scanning from Internal Hosts

The *nmap* tool is often used in security analysis for network discovery and security auditing. *nmap* uses raw IP packets to determine hosts that are available on the network, services that those hosts are offering, operating systems and versions, packet filters and firewalls that are being used, and many other useful bits of information.

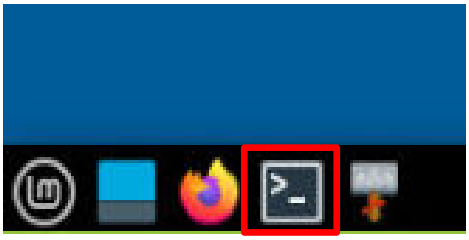
nmap is so powerful and ubiquitous in the security and forensics fields (not to mention the hacker community) that it was named the "Security Product of the Year" by various journals. The tool is so commonly seen that it has been used in several movies such as "The Matrix", "Die Hard 4", "Girl with the Dragon Tattoo" and "The Bourne Ultimatum".

In this task, you will use *nmap* to scan hosts that are on the LAN and DMZ networks and discover which hosts are available, what ports they have open and listening, what OS they are running, and other details that an intruder may be able to detect with a rogue device.

1. Change focus to the **MintOS** computer.
2. Log in as the *sysadmin* using the password: `NDGlabpass123!`

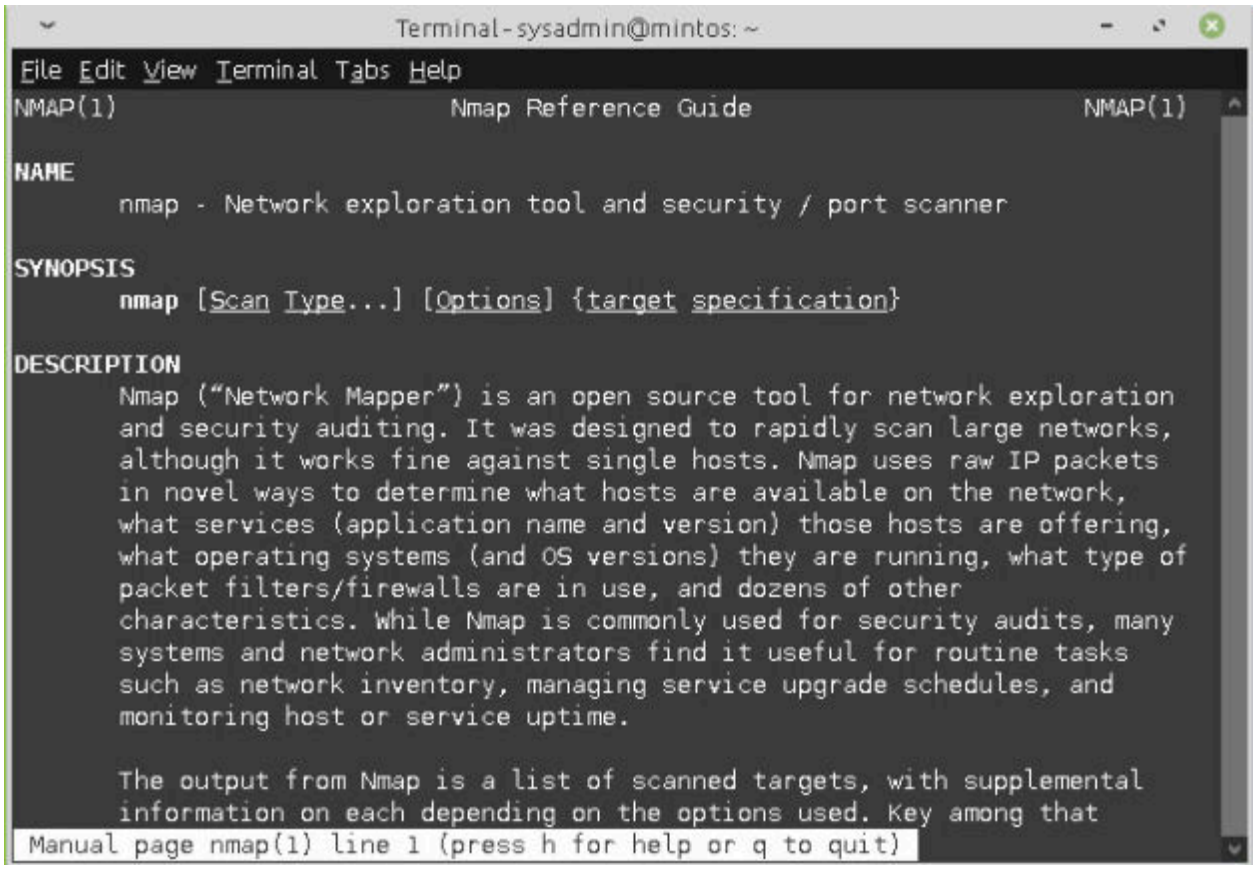


3. Open a terminal session by clicking on the **Terminal** icon located at the bottom of the page.



4. Open and review *nmap's* manual by typing the command below.

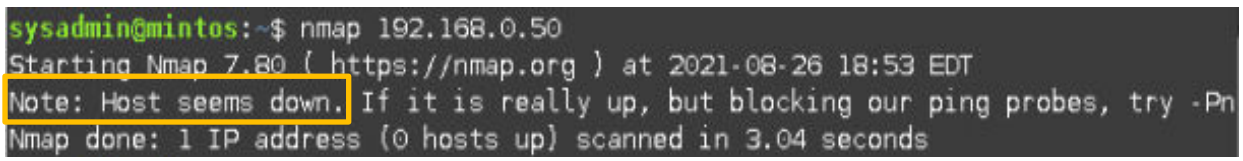
```
man nmap
```



nmap has many options, including its own scripting engine. Review the man pages to get familiar with the switches and options. Press the Spacebar to go to the next page or press Enter to go to the next line.

5. Once finished reviewing the man page, press **Q** to quit and bring the shell prompt back.
6. Let's scan the *WinOS* host using an *nmap* scan with no options by entering the command:

```
nmap 192.168.0.50
```



7. The host seems to be down, but it might actually be up and blocking the host discovery packets. Perform the following *nmap* scan, but this time with the **–Pn** option, which will assume the *WinOS* computer is up and will scan the first 1000 TCP/UDP ports:

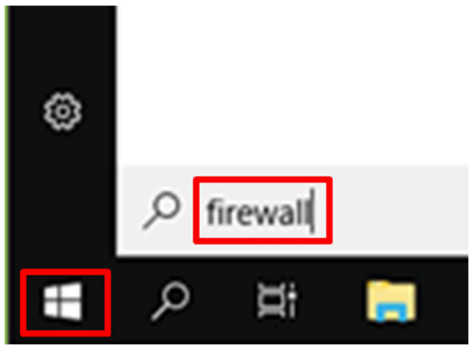
```
nmap 192.168.0.50 -Pn
```

```
sysadmin@mintos:~$ nmap 192.168.0.50 -Pn
Starting Nmap 7.80 ( https://nmap.org ) at 2021-10-15 12:39 EDT
Nmap scan report for 192.168.0.50
Host is up.
All 1000 scanned ports on 192.168.0.50 are filtered

Nmap done: 1 IP address (1 host up) scanned in 201.34 seconds
```

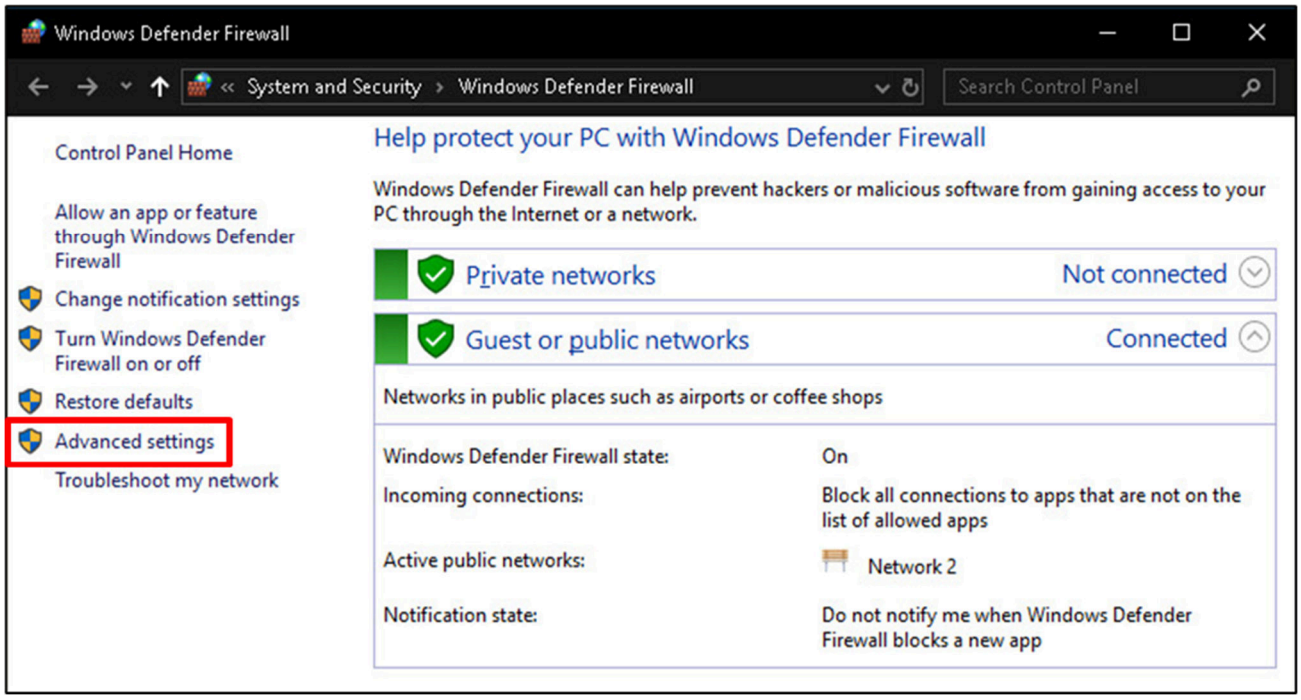
The *nmap* scan might take as long as 4 minutes to complete.

This time, *nmap* confirms that the host is up, but the Windows Defender Firewall is blocking all inbound traffic. This is the purpose of a firewall, namely to block incoming and outgoing traffic based on IP addresses, TCP/UDP ports, and/or applications.

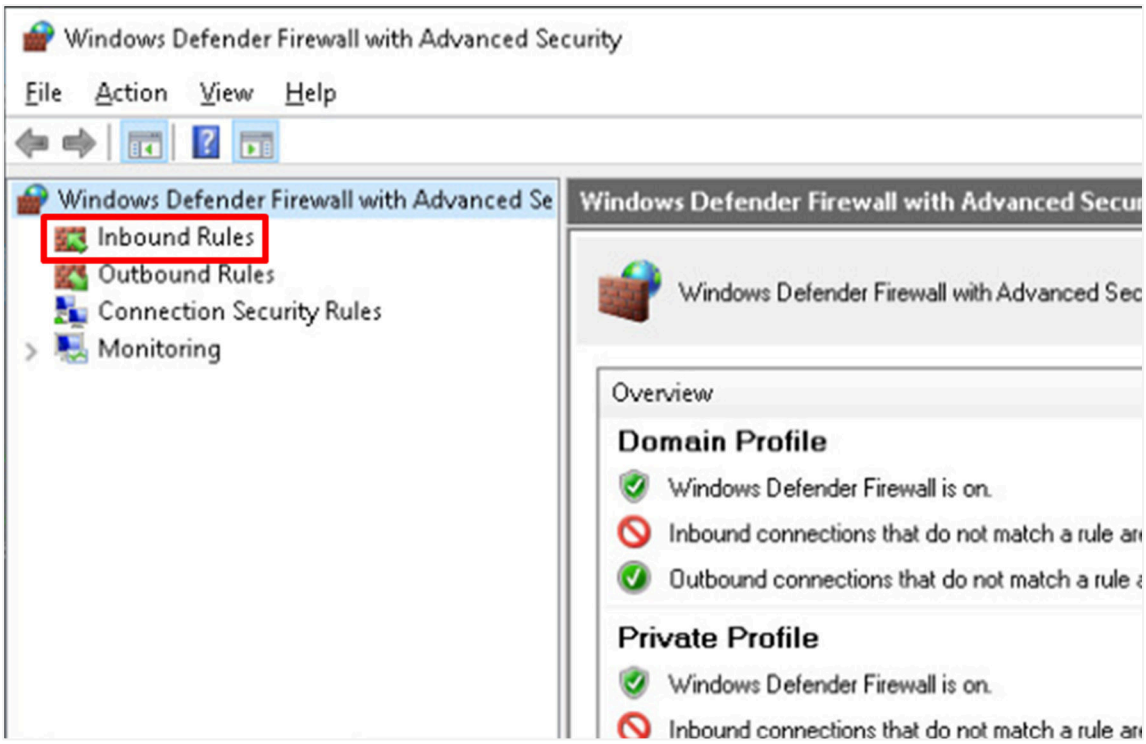
8. The firewall uses a set of rules, to control the traffic. In the next step, we will add a rule to the Firewall Rule Table that will allow traffic from the IP address of the *MintOS* computer only. Change focus to the **WinOS** computer.
9. Click on the **Windows Start** button in the bottom-left corner, type `firewall` and press **Enter.**



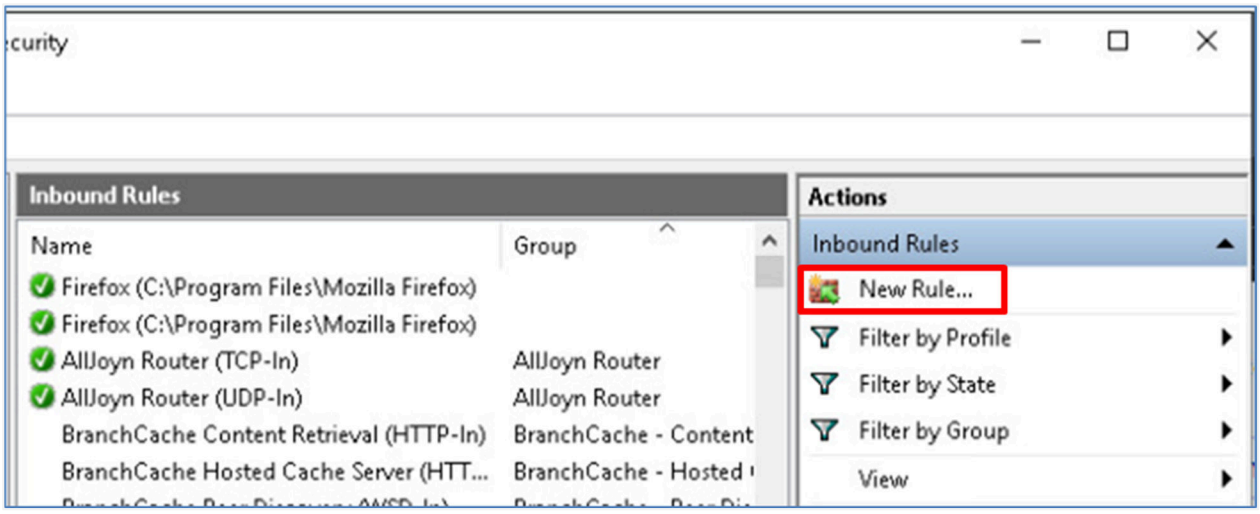
10. On the left side of the window, click on **Advanced Settings**.



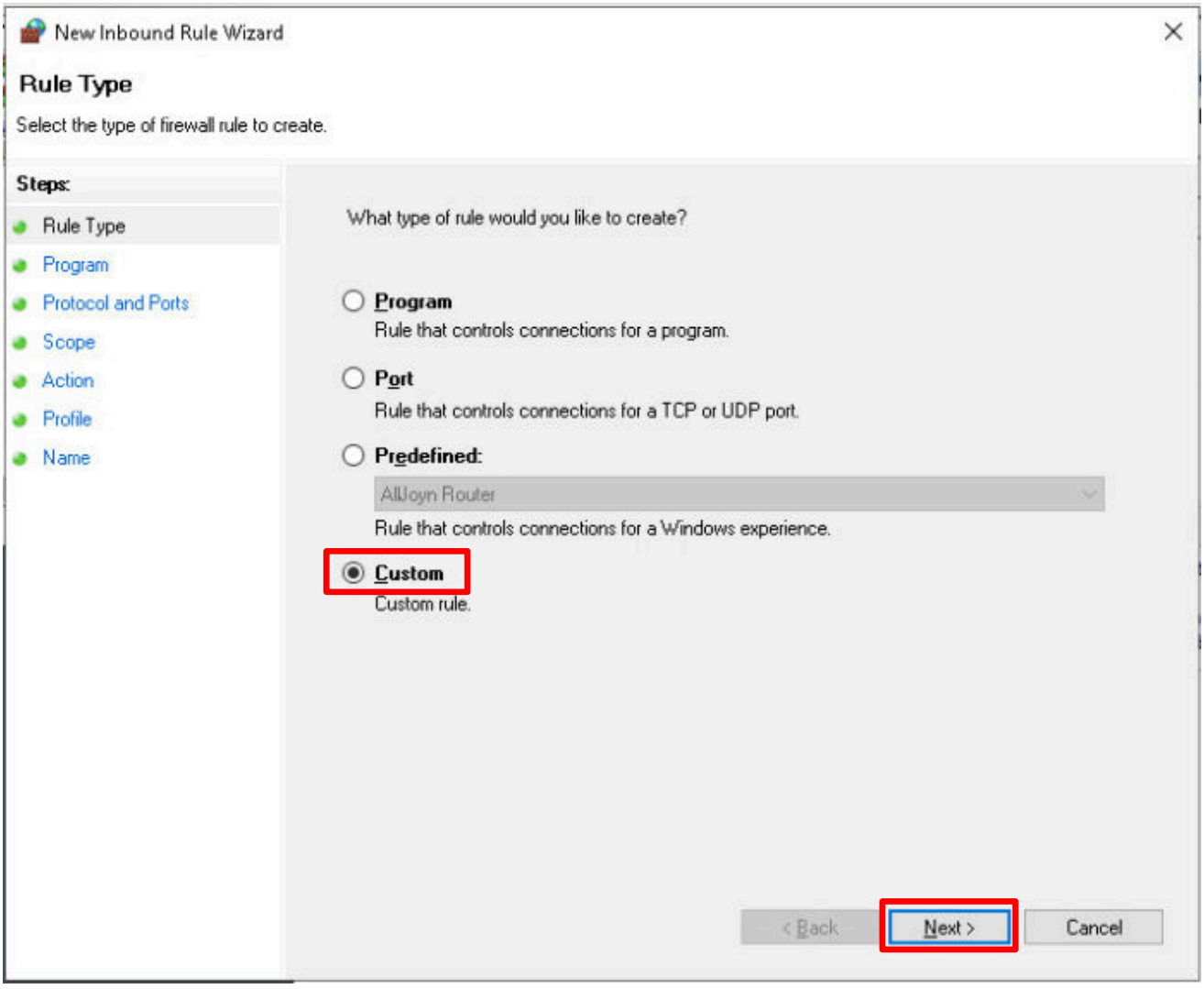
11. On the left panel, click on **Inbound Rules**.



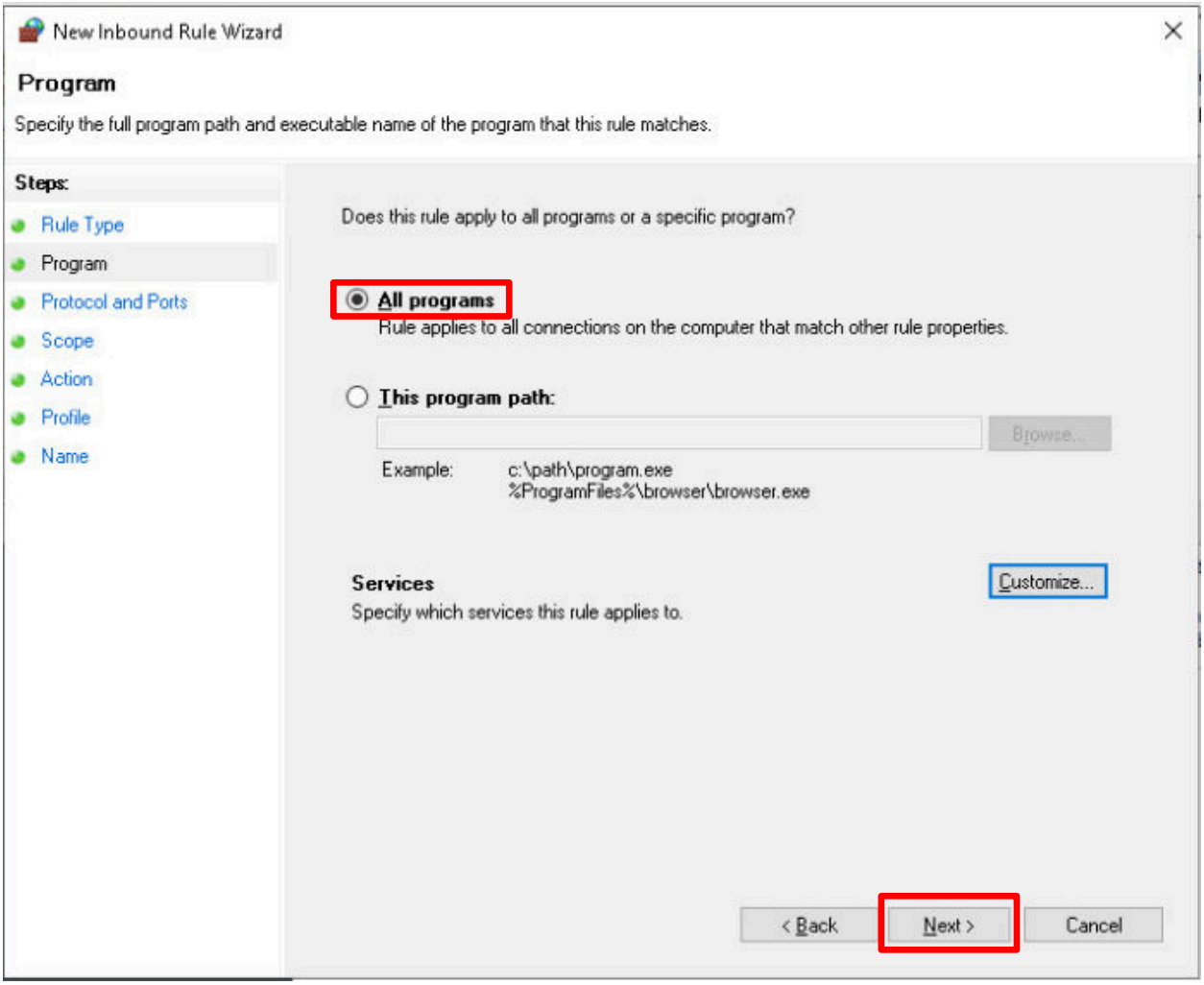
12. On the right panel, click on **New Rule**.



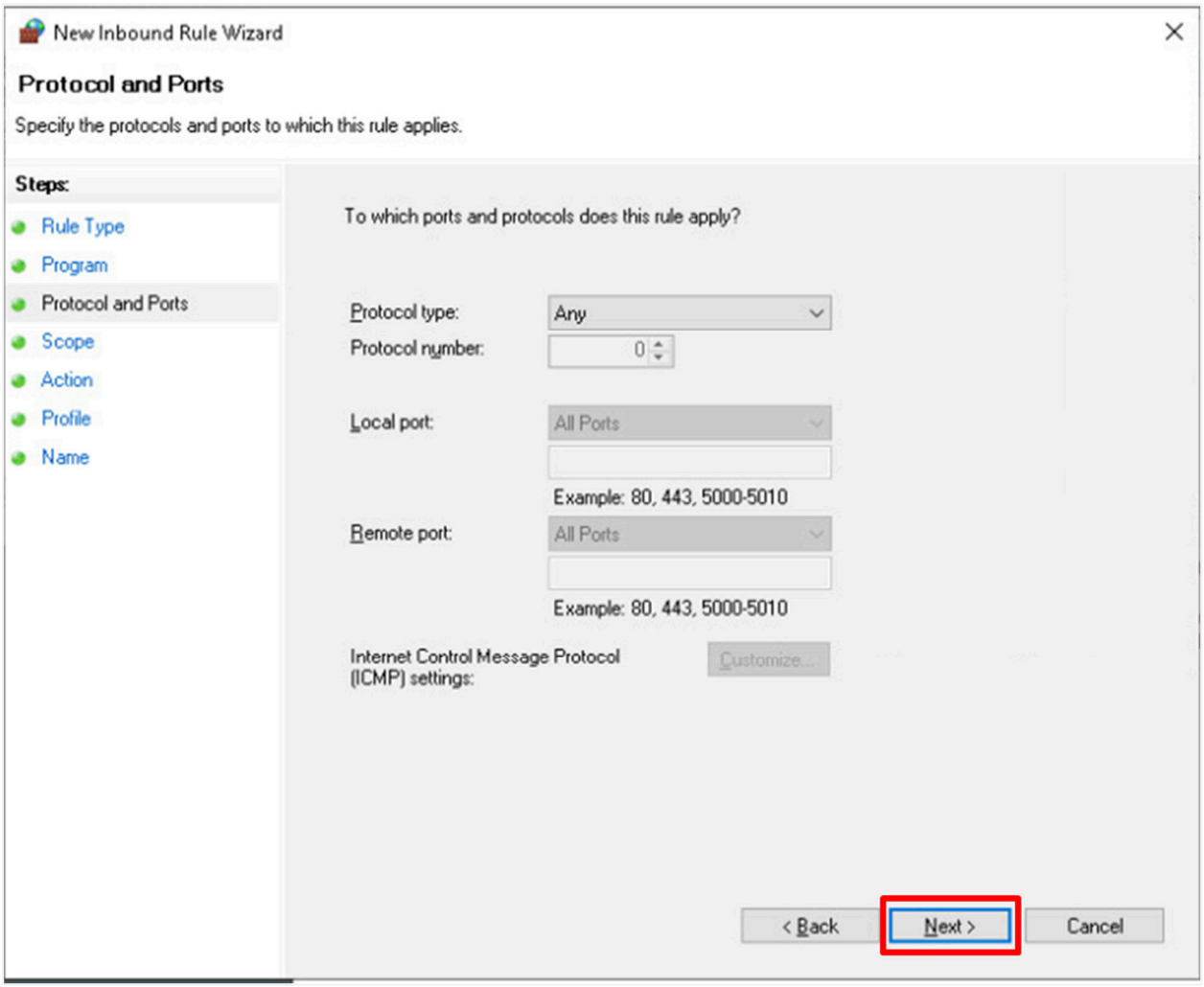
13. In the *New Inbound Rule Wizard,* in the *Rule Type* step, click on the **Custom** radio button and then click the **Next** button.



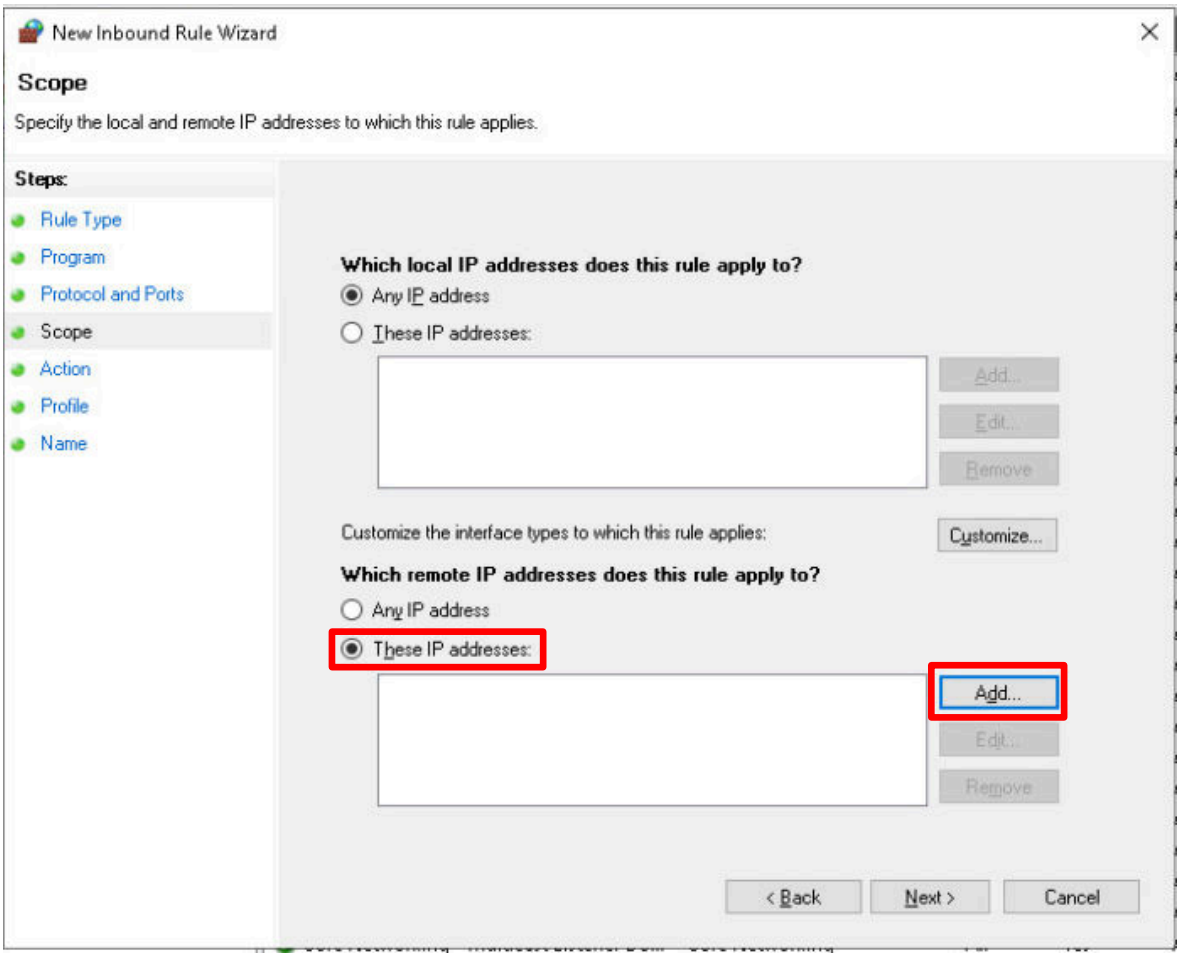
14. In the *Program* step, if it is not already selected, click on the **All Programs** radio button and then click the **Next** button.



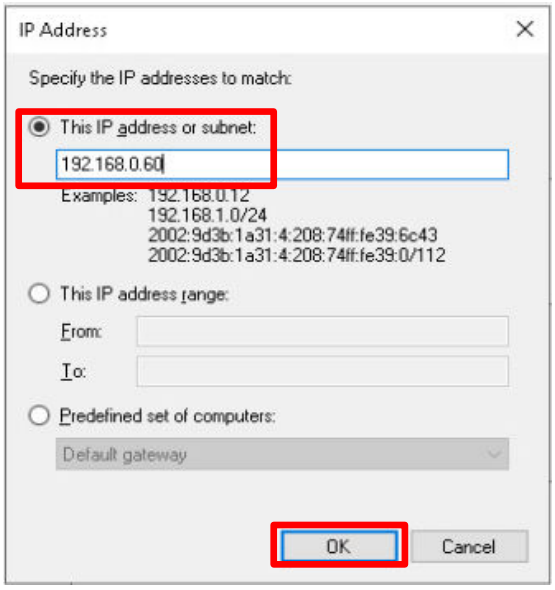
15. In the *Protocol and Ports* step, leave all the entries at their default values and click the **Next** button.



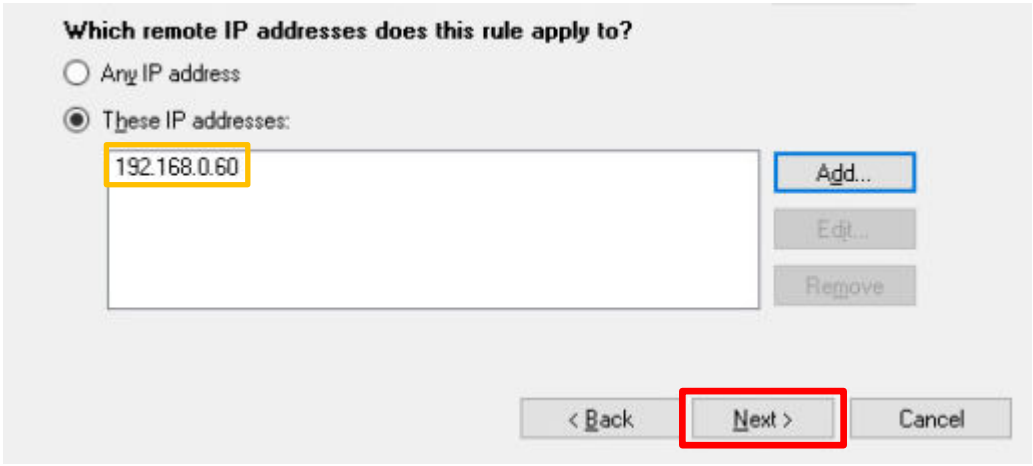
16. In the *Scope* step, in the lower-right pane under the *Which remote IP addresses does this rule apply to?* section, click the **These IP addresses** radio button and then click the **Add** button:



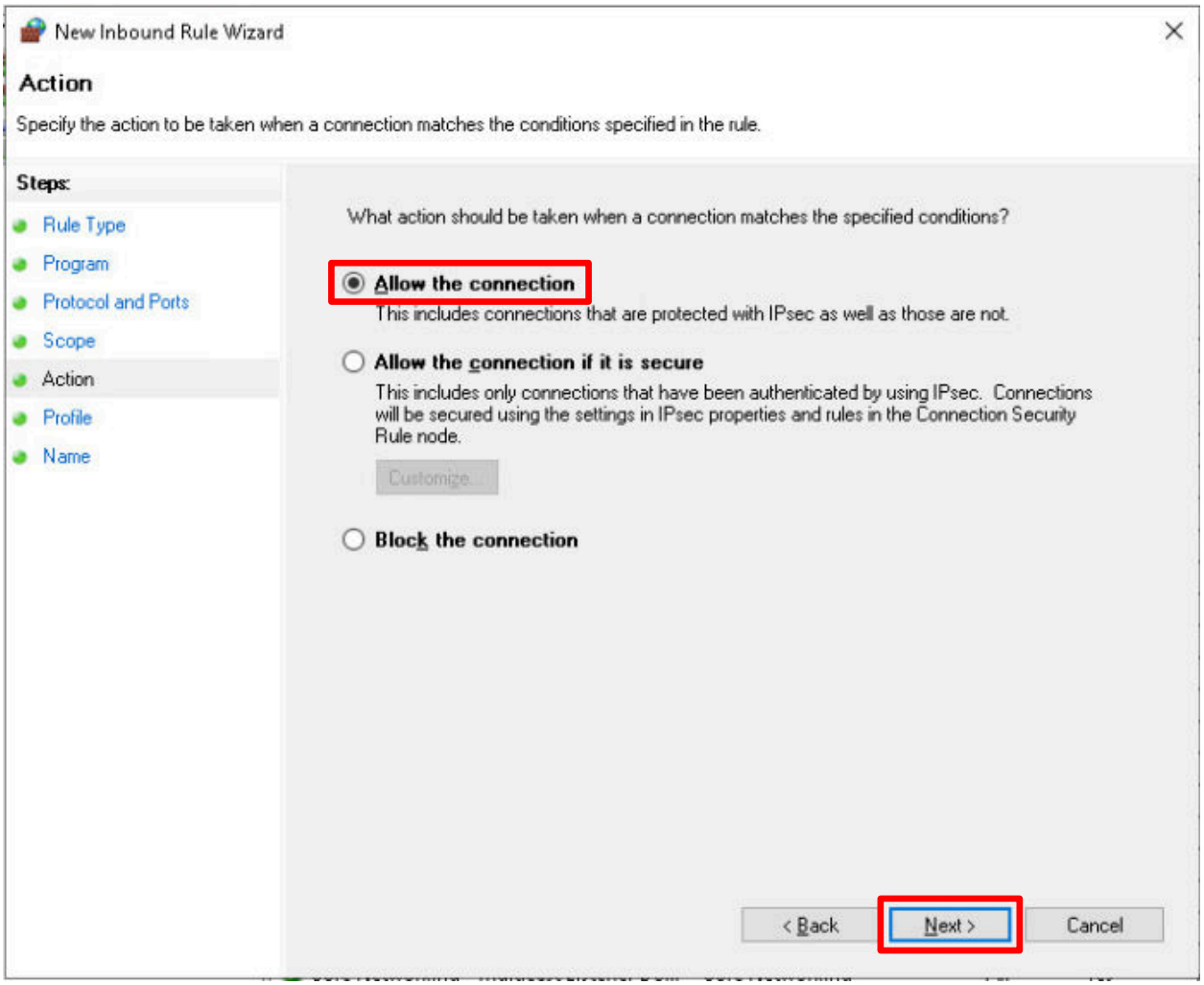
17. In the *IP Address* popup box, confirm the **This IP address or subnet** radio button is selected and enter `192.168.0.60`, which is the IP address of the *MintOS* computer, and click **OK**.



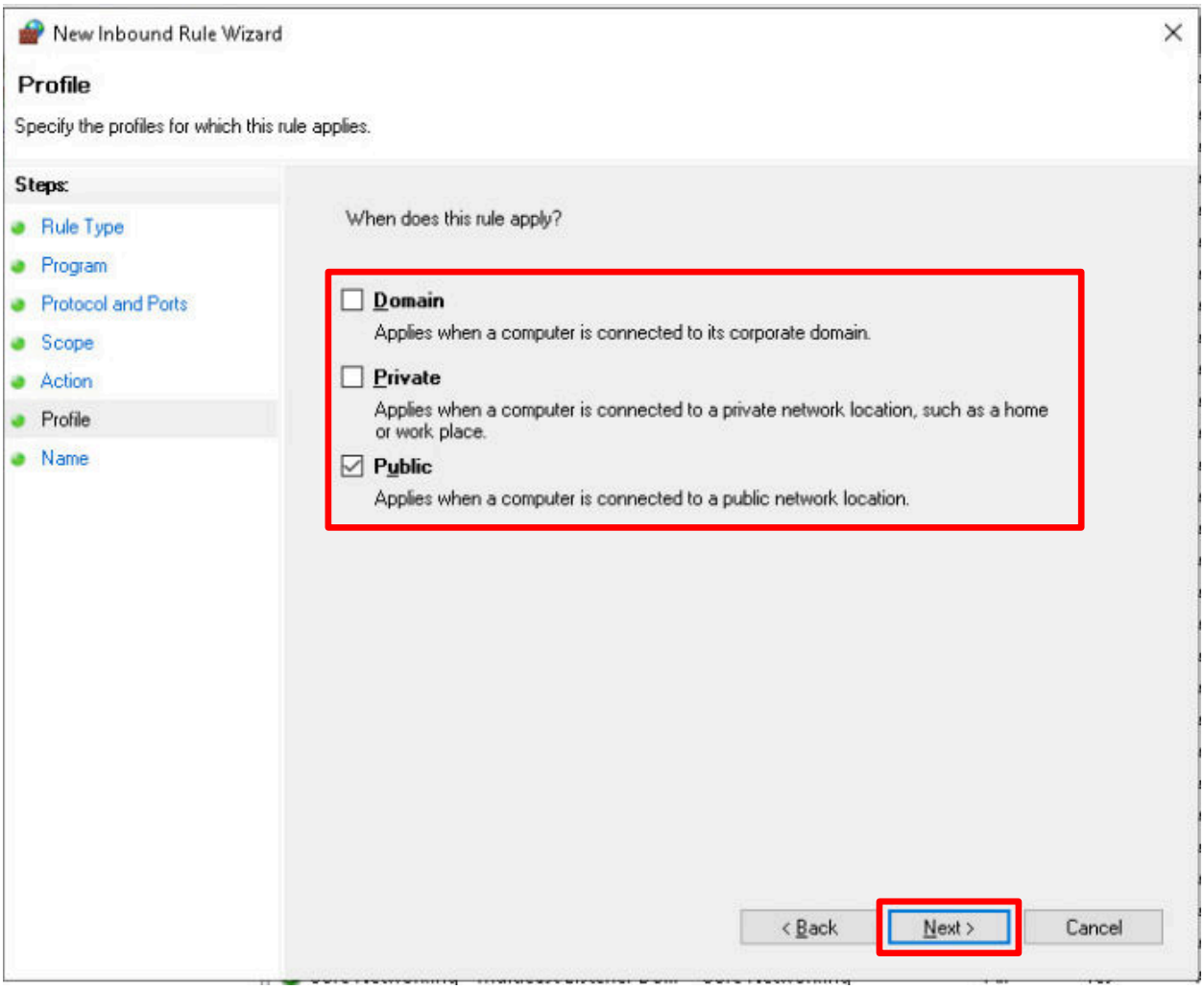
18. When you return to the *Scope* window, confirm that the **MintOS** IP address is in the box and click the **Next** button.



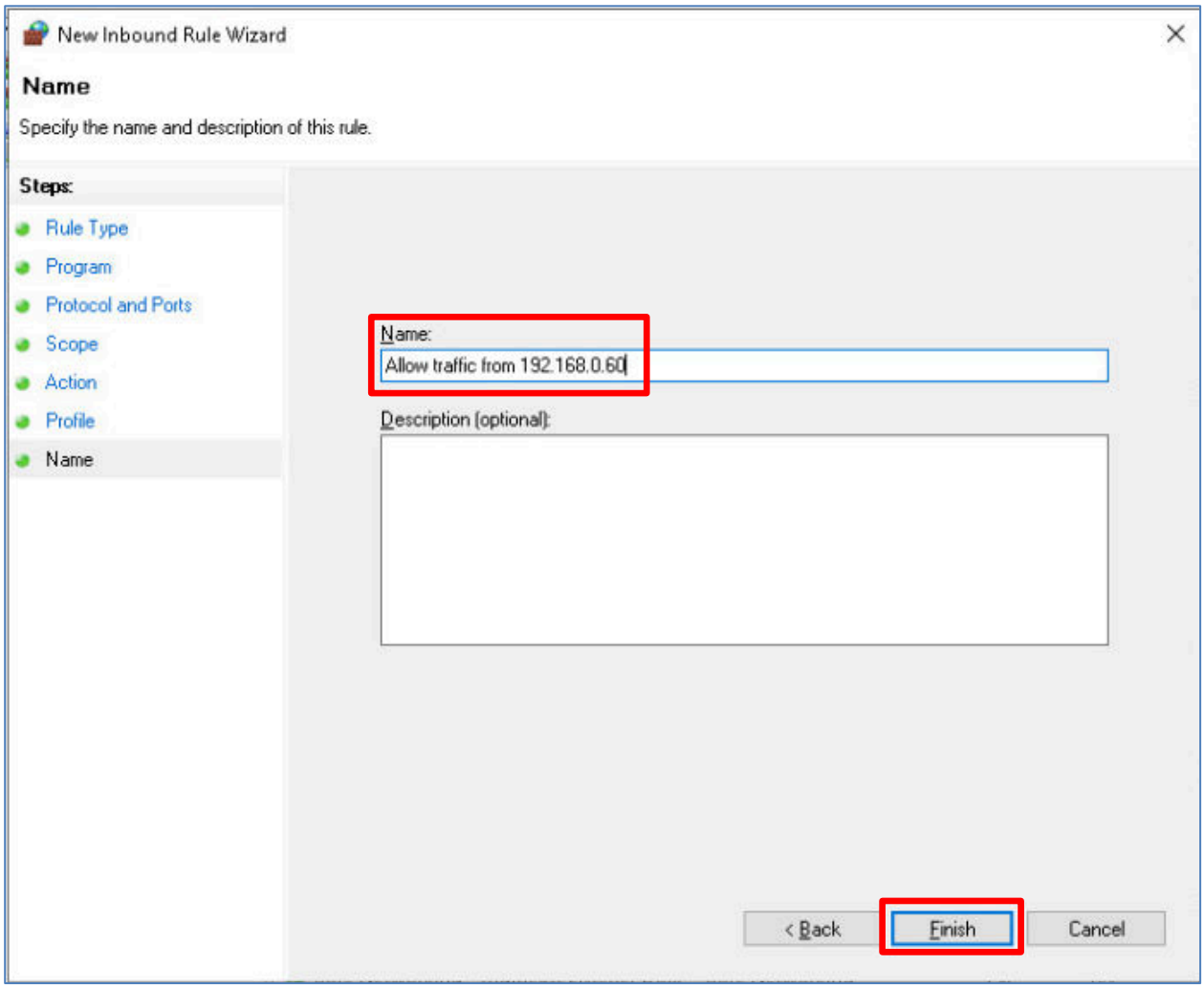
19. On the *Action* step, confirm the **Allow the connection** radio button is selected and click the **Next** button.



20. In the *Profile* step, uncheck the **Domain** and **Private** checkboxes (leaving the **Public** checkbox selected) and click **Next**.



21. In the *Name* step, enter `Allow traffic from 192.168.0.60` and click **Finish**.



22. Close the **Windows Defender Firewall with Advanced Security** window, and then close the **Windows Defender Firewall** window.
23. Return to the **MintOS** computer.
24. Now execute the *nmap* command with the **–Pn** option again targeting the **WinOS** host.

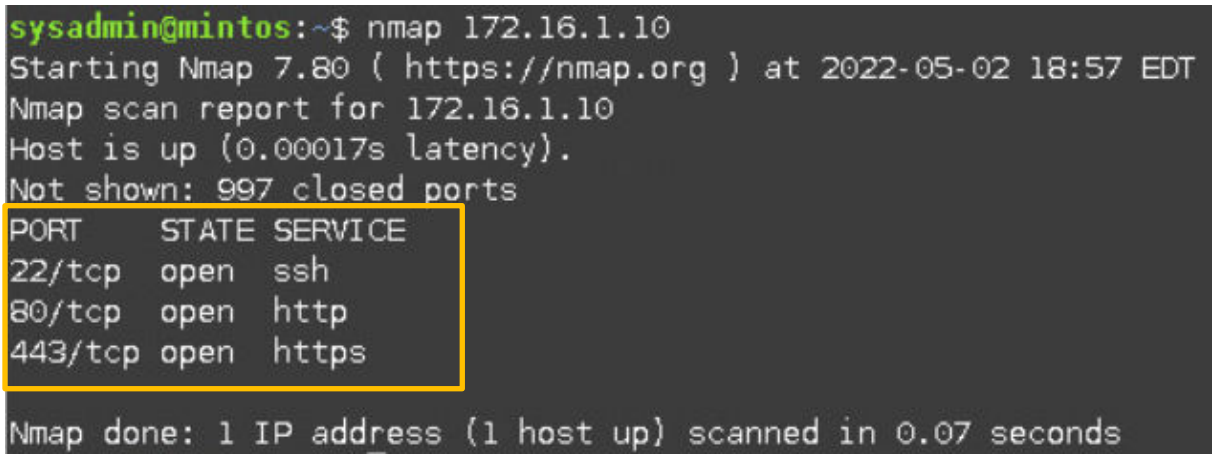
```
nmap 192.168.0.50 -Pn
```

```
sysadmin@mintos:~$ nmap 192.168.0.50 -Pn
Starting Nmap 7.80 ( https://nmap.org ) at 2022-07-31 14:52 EDT
Nmap scan report for 192.168.0.50
Host is up (0.00064s latency).
Not shown: 997 filtered ports
PORT    STATE SERVICE
135/tcp open  msrpc
139/tcp open  netbios-ssn
445/tcp open  microsoft-ds
```


This time, *nmap* will identify open ports on the *WinOS* host since the firewall table has been set to allow connections from the *MintOS* computer. Notice there are very few ports that are open on the *WinOS* host. You want as few ports open on a host as possible. Every open port presents an opportunity for hackers to break into your system. It's like leaving the front door wide open.

25. Let's try running *nmap* against **UbuntuSRV** in the DMZ. Type the following command:

```
nmap 172.16.1.10
```



Once again, notice that there are only three ports, **TCP Port 22**, which is used for **SSH Remote Access**, **TCP Port 80,** which is **HTTP:** and **TCP Port 443,** which is **HTTPS:**

The *UbuntuSRV* shows that **Port 80** and **Port 443** is open since the Apache web server is running.

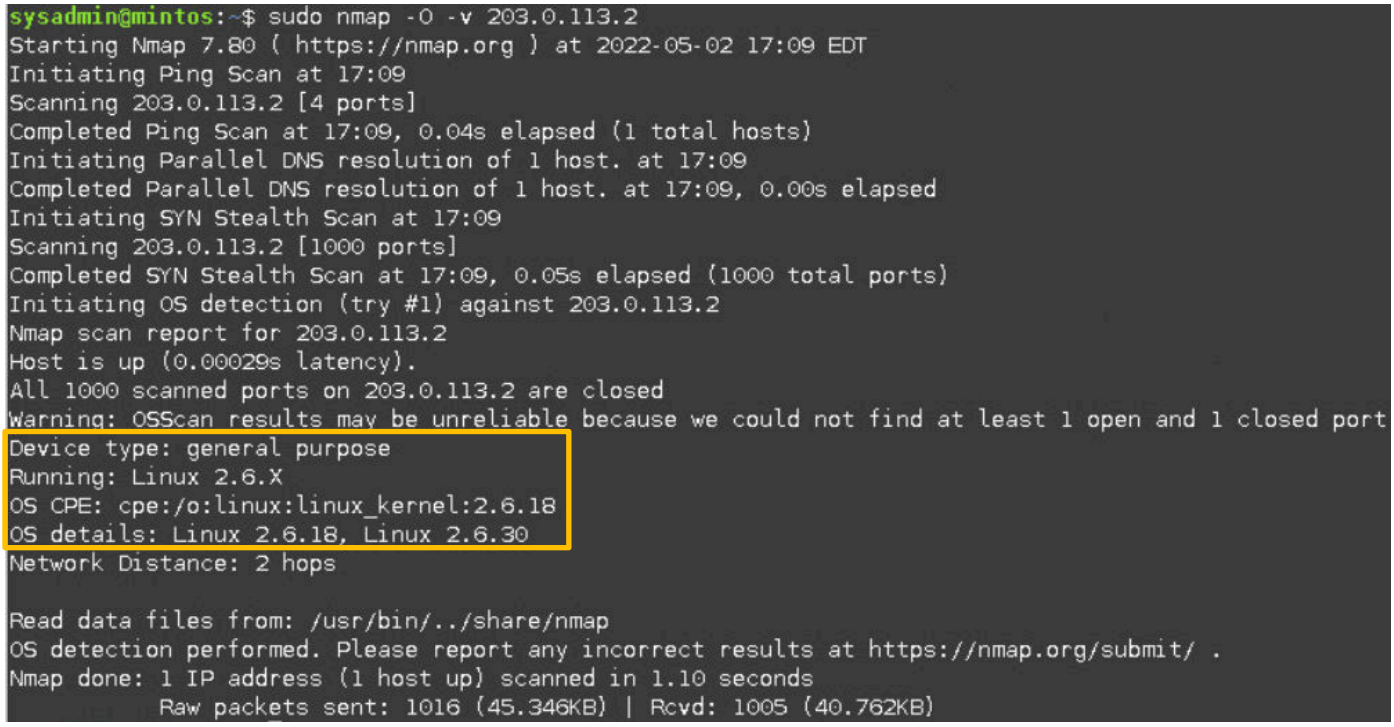
26. Remain on the *MintOS* computer and continue to the next step.

2.2 Perform OS Fingerprinting from nmap

Remote operating system detection is a common way for a potential hacker to discover what types of hosts are running on the network. One method is called **OS Fingerprinting,** which collects detailed information from the TCP/IP stack of the hosts. *nmap* gathers fingerprint data by simply adding the **–O** option to the scan. You can also view the processes from the scan with the **–v** (verbose mode) option.

1. Enter the following command to run an *nmap* fingerprint against the **Kali** computer. You must use **sudo** because this *nmap* option requires root privileges. When asked for the **[sudo] password**, enter: `NDGlabpass123!`

```
sudo nmap –O –v 203.0.113.2/32
```



Notice a *Linux* operating system was detected.

2. Type the following command to scan and fingerprint the *WinOS* host (you must use **sudo** because this *nmap* option requires root privileges).

```
sudo nmap -O -v 192.168.0.50/32
```

Notice that the *nmap* fingerprint does not get an OS match.

```
sysadmin@mintos:~$ sudo nmap -O -v 192.168.0.50/32
Starting Nmap 7.80 ( https://nmap.org ) at 2022-08-01 00:43 EDT
Initiating ARP Ping Scan at 00:43
Scanning 192.168.0.50 [1 port]
Completed ARP Ping Scan at 00:43, 0.04s elapsed (1 total hosts)
Initiating Parallel DNS resolution of 1 host. at 00:43
Completed Parallel DNS resolution of 1 host. at 00:43, 0.00s elapsed
Initiating SYN Stealth Scan at 00:43
Scanning 192.168.0.50 [1000 ports]
Discovered open port 445/tcp on 192.168.0.50
Discovered open port 139/tcp on 192.168.0.50
Discovered open port 135/tcp on 192.168.0.50
Completed SYN Stealth Scan at 00:43, 4.45s elapsed (1000 total ports)
Initiating OS detection (try #1) against 192.168.0.50
Retrying OS detection (try #2) against 192.168.0.50
Nmap scan report for 192.168.0.50
Host is up (0.00041s latency).
Not shown: 997 filtered ports
PORT    STATE SERVICE
135/tcp open  msrpc
139/tcp open  netbios-ssn
445/tcp open  microsoft-ds
MAC Address: 00:50:56:99:56:8C (VMware)
Warning: OSScan results may be unreliable because we could not find at least 1 open and 1 closed port
OS fingerprint not ideal because: Missing a closed TCP port so results incomplete
No OS matches for host
Network Distance: 1 hop
TCP Sequence Prediction: Difficulty=257 (Good luck!)
IP ID Sequence Generation: Incremental
```

3. This time, scan and fingerprint the *UbuntuSRV* computer.

```
sudo nmap -O 172.16.1.10
```

```
sysadmin@mintos:~$ sudo nmap -O 172.16.1.10
Starting Nmap 7.80 ( https://nmap.org ) at 2022-05-02 19:35 EDT
Nmap scan report for 172.16.1.10
Host is up (0.00046s latency).
Not shown: 997 closed ports
PORT    STATE SERVICE
22/tcp  open  ssh
80/tcp  open  http
443/tcp open  https
No exact OS matches for host (If you know what OS is running on it, see https://nmap.org/submit/ ).
TCP/IP fingerprint:
OS:SCAN(V=7.80%E=4%D=5/2%OT=22%CT=1%CU=36282%PV=Y%DS=2%DC=I%G=Y%TM=62706AC3
OS:%P=x86_64-pc-linux-gnu)SEQ(SP=F5%GCD=1%ISR=104%TI=Z%II=I%TS=A)OPS(O1=M5B
OS:4ST11NW7%O2=M5B4ST11NW7%O3=M5B4NNT11NW7%O4=M5B4ST11NW7%O5=M5B4ST11NW7%O6
OS:=M5B4ST11)WIN(W1=FE88%W2=FE88%W3=FE88%W4=FE88%W5=FE88%W6=FE88)ECN(R=Y%DF
OS:=Y%T=40%W=FAF0%O=M5B4NNSNW7%CC=Y%Q=)T1(R=Y%DF=Y%T=40%S=O%A=S+%F=AS%RD=0%
OS:Q=)T2(R=N)T3(R=N)T4(R=N)T5(R=Y%DF=Y%T=40%W=0%S=Z%A=S+%F=AR%O=%RD=0%Q=)T6
OS:(R=N)T7(R=N)U1(R=Y%DF=N%T=40%IPL=164%UN=0%RIPL=G%RID=G%RIPCK=G%RUCK=G%RU
OS:D=G)IE(R=Y%DFI=N%T=40%CD=S)

Network Distance: 2 hops

OS detection performed. Please report any incorrect results at https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 12.44 seconds
```

This time, *nmap* generated a special ASCII-encoded version of the operating system.

The fingerprint contains relevant information that *nmap* was able to glean from the host. It is formatted in such a way that it can be submitted to nmap.org where it can be used to add the OS information to the *nmap* database. With some simple editing, the fingerprint can be "cleaned-up" and easier to decipher.

4. Type the following *nmap* command with the –A option to show additional information about the *WinOS* computer:

```
sudo nmap -A 192.168.0.50
```

```
sysadmin@mintos:~$ sudo nmap -A 192.168.0.50
Starting Nmap 7.80 ( https://nmap.org ) at 2022-05-02 19:16 EDT
Nmap scan report for 192.168.0.50
Host is up (0.00028s latency).
Not shown: 995 filtered ports
PORT    STATE SERVICE         VERSION
135/tcp open  msrpc           Microsoft Windows RPC
139/tcp open  netbios-ssn     Microsoft Windows netbios-ssn
445/tcp open  microsoft-ds?
902/tcp open  ssl/vmware-auth VMware Authentication Daemon 1.10 (Uses VNC, SOAP)
912/tcp open  vmware-auth     VMware Authentication Daemon 1.0 (Uses VNC, SOAP)
MAC Address: 00:50:56:99:56:8C (VMware)
Warning: OSScan results may be unreliable because we could not find at least 1 open and 1 closed port
OS fingerprint not ideal because: Missing a closed TCP port so results incomplete
No OS matches for host
Network Distance: 1 hop
Service Info: OS: Windows; CPE: cpe:/o:microsoft:windows

Host script results:
|_nbstat: NetBIOS name: WIN-E3AIDIHECNG, NetBIOS user: <unknown>, NetBIOS MAC: 00:50:56:99:56:8c (VMware)
| smb2-security-mode:
|   2.02:
|_    Message signing enabled but not required
| smb2-time:
|   date: 2022-05-02T23:16:50
|_  start_date: N/A

TRACEROUTE
HOP RTT     ADDRESS
1   0.28 ms 192.168.0.50

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 114.95 seconds
```

In the example, you will see that *nmap* has identified the *Windows* operating system (using the Service Info), the *NetBIOS* name of the computer, the *MAC Address* and the *NIC*'s manufacturer, and even the version of SMB that is running on the *WinOS* computer. That's quite a bit of information that can be gleaned.

5. Now, let's use *nmap* to try to identify versions of software running on the ports on the *UbuntuSRV*. Type the following command:

```
sudo nmap -A 172.16.1.10
```

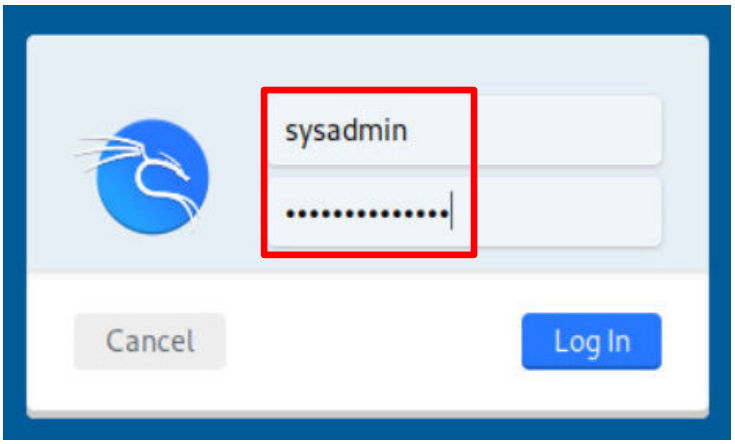
Once again, you will see that *nmap* has identified the operating system as Ubuntu Linux and the version details on the service ports that were discovered.

```
sysadmin@mintos:~$ sudo nmap -A 172.16.1.10
[sudo] password for sysadmin:
Starting Nmap 7.80 ( https://nmap.org ) at 2022-05-02 20:02 EDT
Nmap scan report for 172.16.1.10
Host is up (0.00052s latency).
Not shown: 997 closed ports
PORT    STATE SERVICE  VERSION
22/tcp  open  ssh      OpenSSH 8.2p1 Ubuntu 4ubuntu0.4 (Ubuntu Linux; protocol 2.0)
80/tcp  open  ssl/http Apache httpd 2.4.41 ((Ubuntu))
|_http-server-header: Apache/2.4.41 (Ubuntu)
|_http-title: Apache2 Ubuntu Default Page: It works
| ssl-cert: Subject: commonName=172.16.1.10/organizationName=NDG/stateOrProvinceName=California/co
| Not valid before: 2021-09-14T05:44:10
|_Not valid after:  2022-09-14T05:44:10
| tls-alpn:
|_  http/1.1
443/tcp open  ssl/http Apache httpd 2.4.41 ((Ubuntu))
|_http-server-header: Apache/2.4.41 (Ubuntu)
|_http-title: Apache2 Ubuntu Default Page: It works
| ssl-cert: Subject: commonName=172.16.1.10/organizationName=NDG/stateOrProvinceName=California/co
| Not valid before: 2021-09-14T05:44:10
|_Not valid after:  2022-09-14T05:44:10
| tls-alpn:
|_  http/1.1
No exact OS matches for host (If you know what OS is running on it, see https://nmap.org/submit/ ).
TCP/IP fingerprint:
OS:SCAN(V=7.80%E=4%D=5/2%OT=22%CT=1%CU=30112%PV=Y%DS=2%DC=T%G=Y%TM=62707129
OS:%P=x86_64-pc-linux-gnu)SEQ(SP=107%GCD=1%ISR=10F%TI=Z%II=I%TS=A)OPS(O1=M5
OS:B4ST11NW7%O2=M5B4ST11NW7%O3=M5B4NNT11NW7%O4=M5B4ST11NW7%O5=M5B4ST11NW7%O
OS:6=M5B4ST11)WIN(W1=FE88%W2=FE88%W3=FE88%W4=FE88%W5=FE88%W6=FE88)ECN(R=Y%D
OS:F=Y%T=40%W=FAF0%O=M5B4NNSNW7%CC=Y%Q=)T1(R=Y%DF=Y%T=40%S=O%A=S+%F=AS%RD=0
OS:%Q=)T2(R=N)T3(R=N)T4(R=N)T5(R=Y%DF=Y%T=40%W=0%S=Z%A=S+%F=AR%O=%RD=0%Q=)T
OS:6(R=N)T7(R=N)U1(R=Y%DF=N%T=40%IPL=164%UN=0%RIPL=G%RID=G%RIPCK=G%RUCK=G%R
OS:UD=G)IE(R=Y%DFI=N%T=40%CD=S)

Network Distance: 2 hops
Service Info: OS: Linux; CPE: cpe:/o:linux:linux_kernel

TRACEROUTE (using port 8888/tcp)
HOP RTT     ADDRESS
1   0.24 ms pfSense.home.arpa (192.168.0.1)
2   0.65 ms 172.16.1.10
```

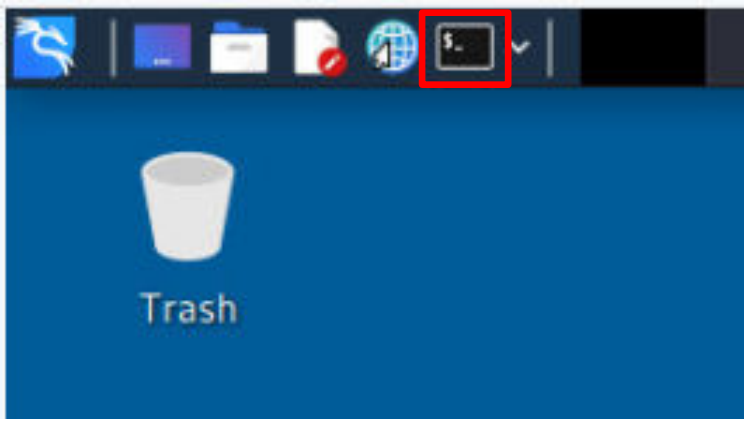
2.3 Using nmap to Scan Hosts from an External Network

Hackers will most likely perform reconnaissance from outside an organization's LAN and/or DMZ. This section will use a *Kali Linux* attack computer located on the exterior network to probe the hosts on the LAN and DMZ networks.

1. Change the focus to the **Kali** computer.
2. Log in as `sysadmin` using the password: `NDGlabpass123!`



3. Click on the **Terminal** icon in the taskbar at the top of the screen.



4. Let's scan the **192.168.0.0/24** network using *nmap*.

```
nmap 192.168.0.0/24
```

```
┌──(sysadmin㉿kali)-[~]
└─$ nmap 192.168.0.0/24
Starting Nmap 7.91 ( https://nmap.org ) at 2021-08-26 20:56 EDT
Nmap done: 256 IP addresses (0 hosts up) scanned in 104.30 seconds
```

There will be no response from the *192.168.0.0/24* network. This is because there is a firewall between the External network and the LAN and DMZ. This firewall will block all traffic using RFC1918 which stops all traffic from public IP addresses from being routed to private IP addresses.

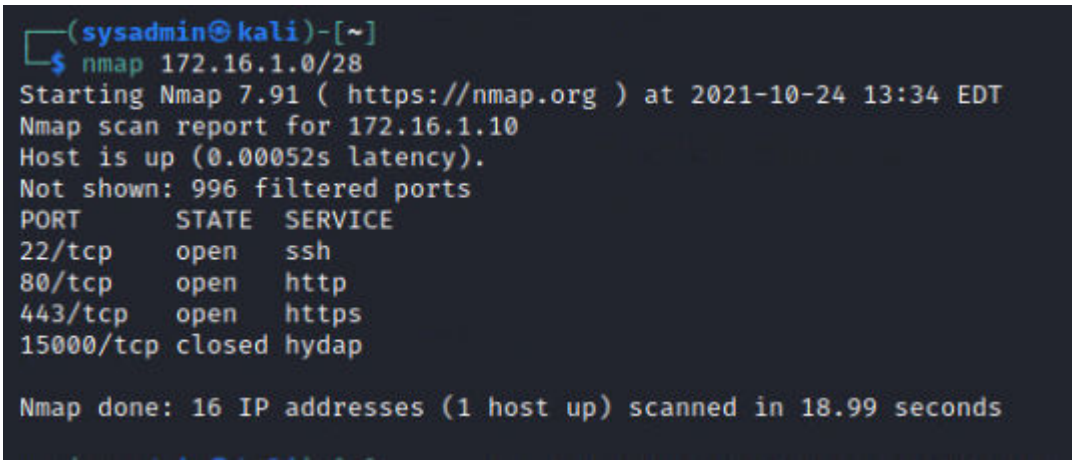
RFC1918 was originally intended to allow for conservation of IPv4 address space by allowing organizations to have networks of non-internet routable addresses and when combined with the NAT/PAT protocol could allow inside, private address hosts to route packets to the public internet and receive directed replies.

It also provided a natural firewall that could be used to block all unsolicited traffic from the public network into the private network.

This is an excellent first wall of defense.

5. Let's try the scan on the *172.16.1.0/28* network by entering the command:

```
nmap 172.16.1.0/28
```



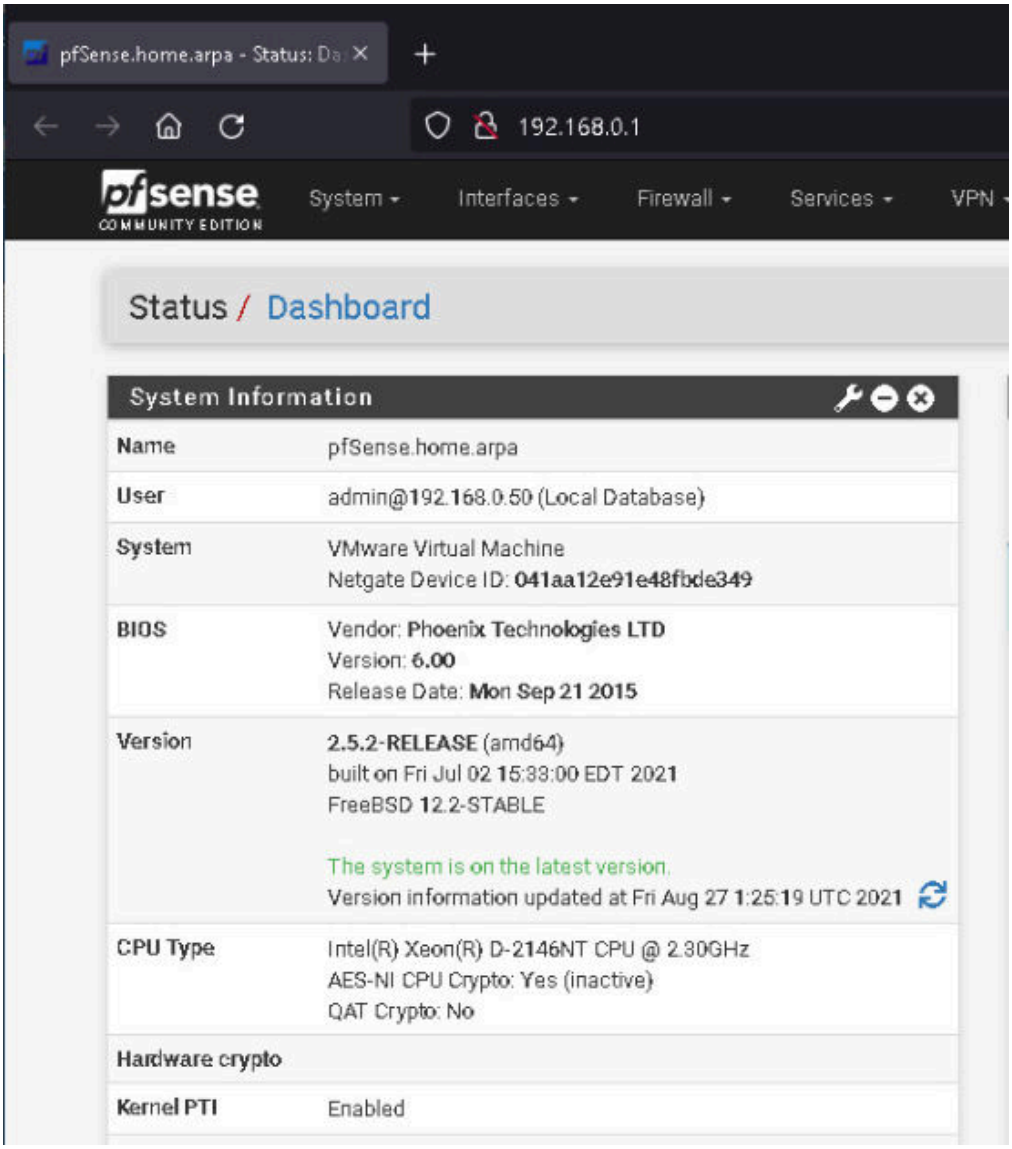
The scan will show that there are open ports on the 172.16.1.10 host (*UbuntuSRV*). Even though this is a private network, the firewall has been configured to forward packets on ports 22, 80, 443, and 15000. The *UbuntuSRV* computer is hosting a Web Server on a DMZ network and will need ports 22 (SSH), 80 (HTTP), and 443 (HTTPS) open for access from the internet. Port 15000 has been forwarded by the firewall to accommodate a lab that will exploit an exposed and unprotected port.

For this next part of the task, we will need to allow traffic from the public network into the 192.168.0.0/24 private network.

6. Change focus to the **WinOS** computer.
7. Restore the **Firefox** web browser.

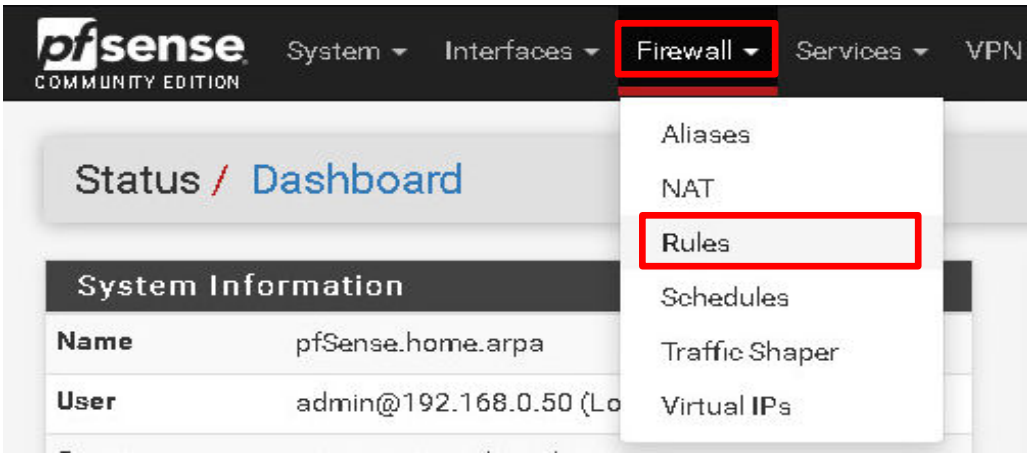
You should **NEVER** consider doing this on a production firewall as it will expose your entire private network to all kinds of threats.

You should see the **Dashboard** for the *pfSense* firewall.

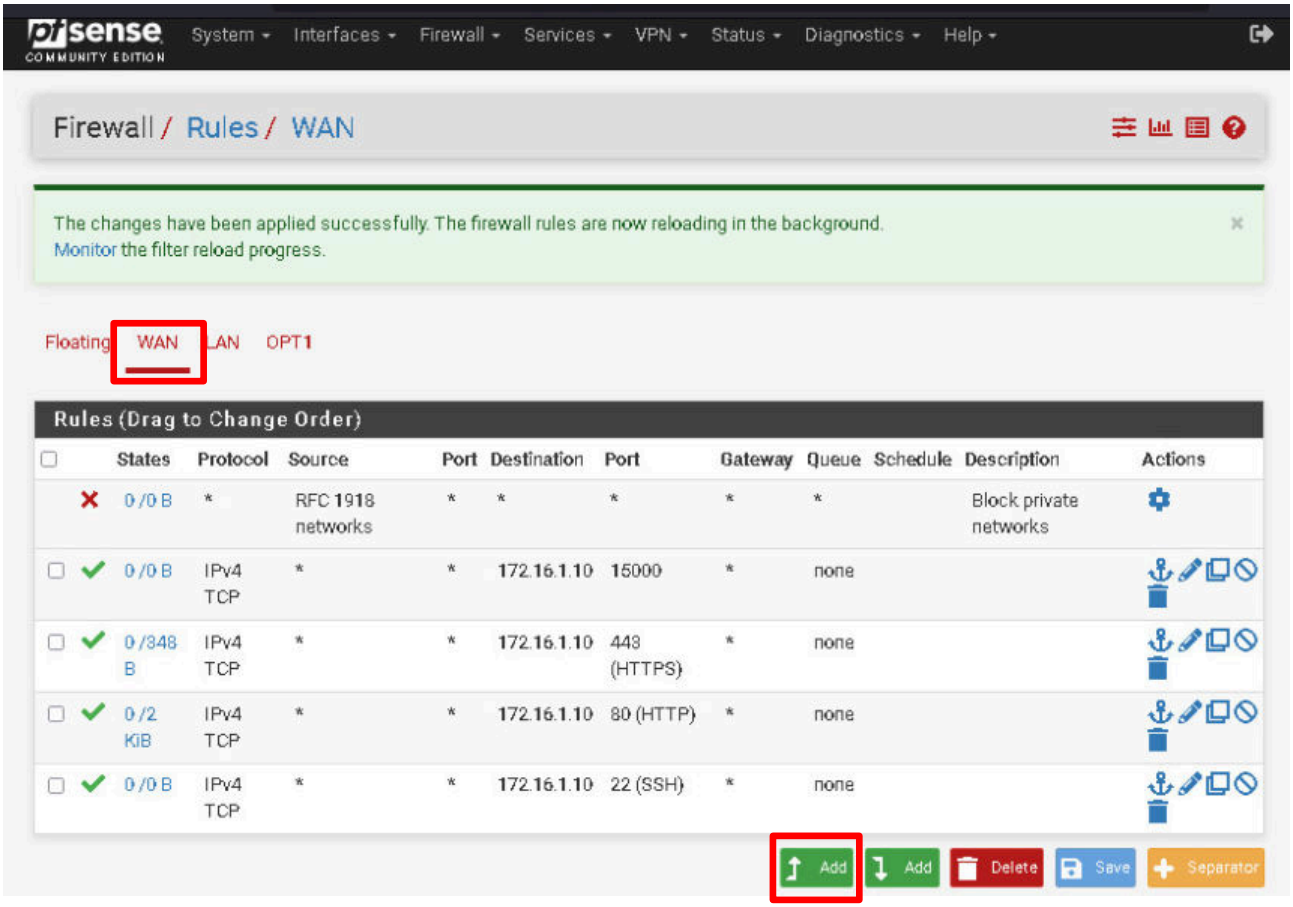


We need to add a rule to allow inbound and outbound traffic to be passed to and from the External network to the LAN and DMZ.

8. Click on the **Firewall** menu item and then click on **Rules.**

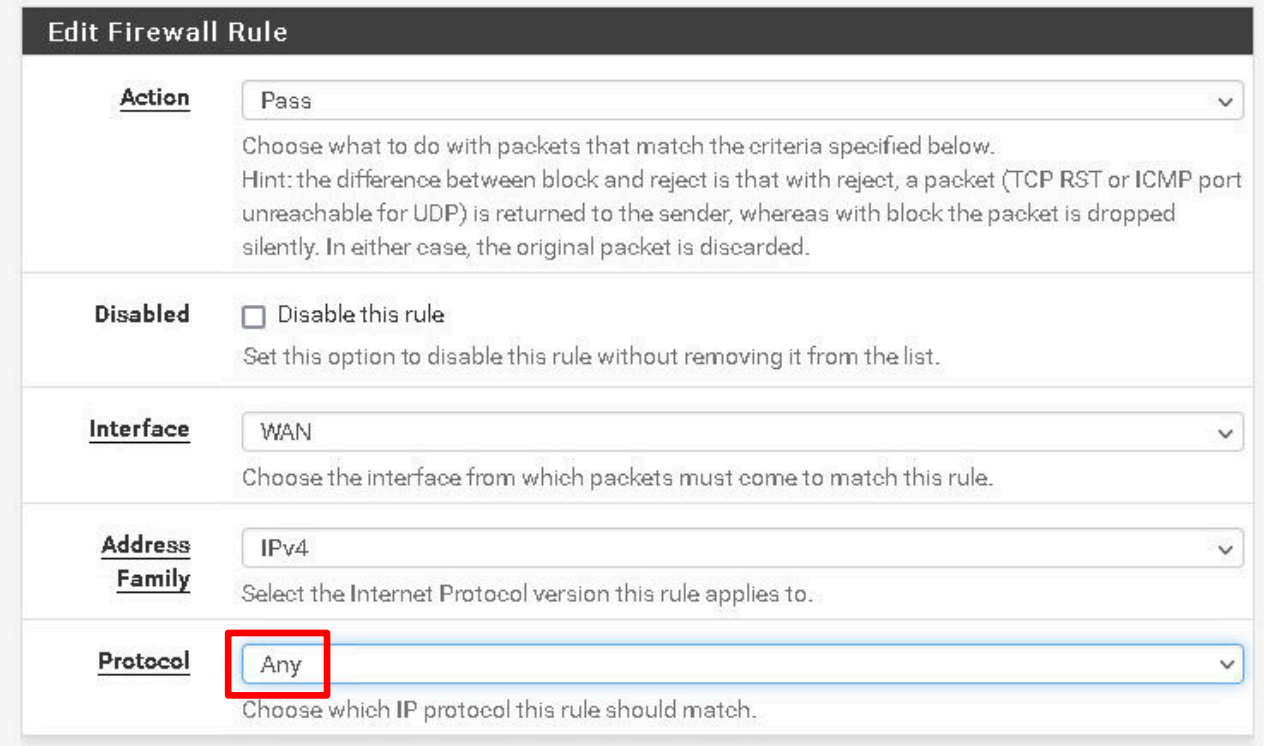


9. Make sure the **WAN** item is selected and click the **Add to Top** button.

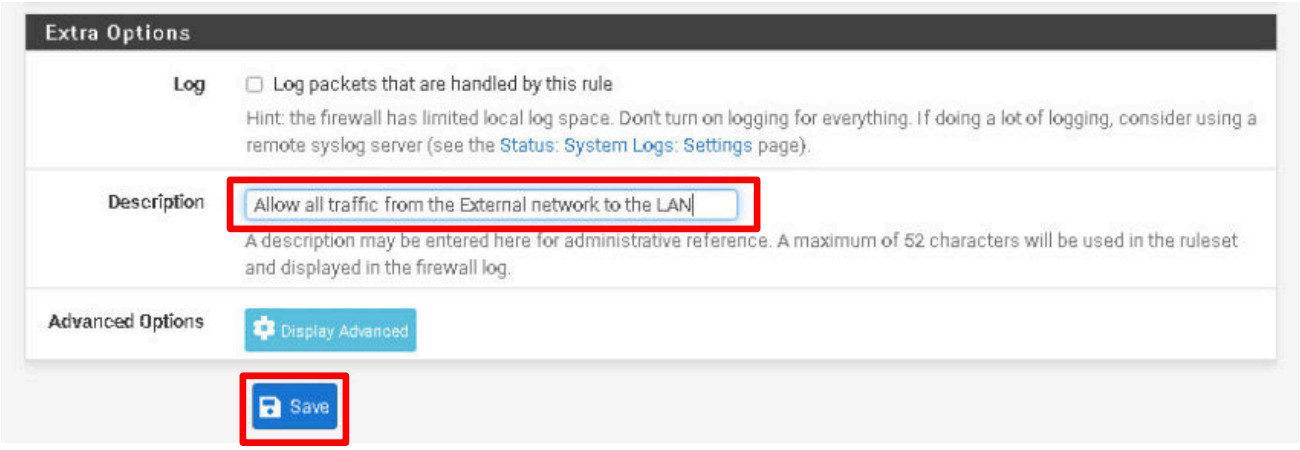


You will see in the list of firewall rules the four TCP ports that are being forwarded to the *UbuntuSRV* computer.

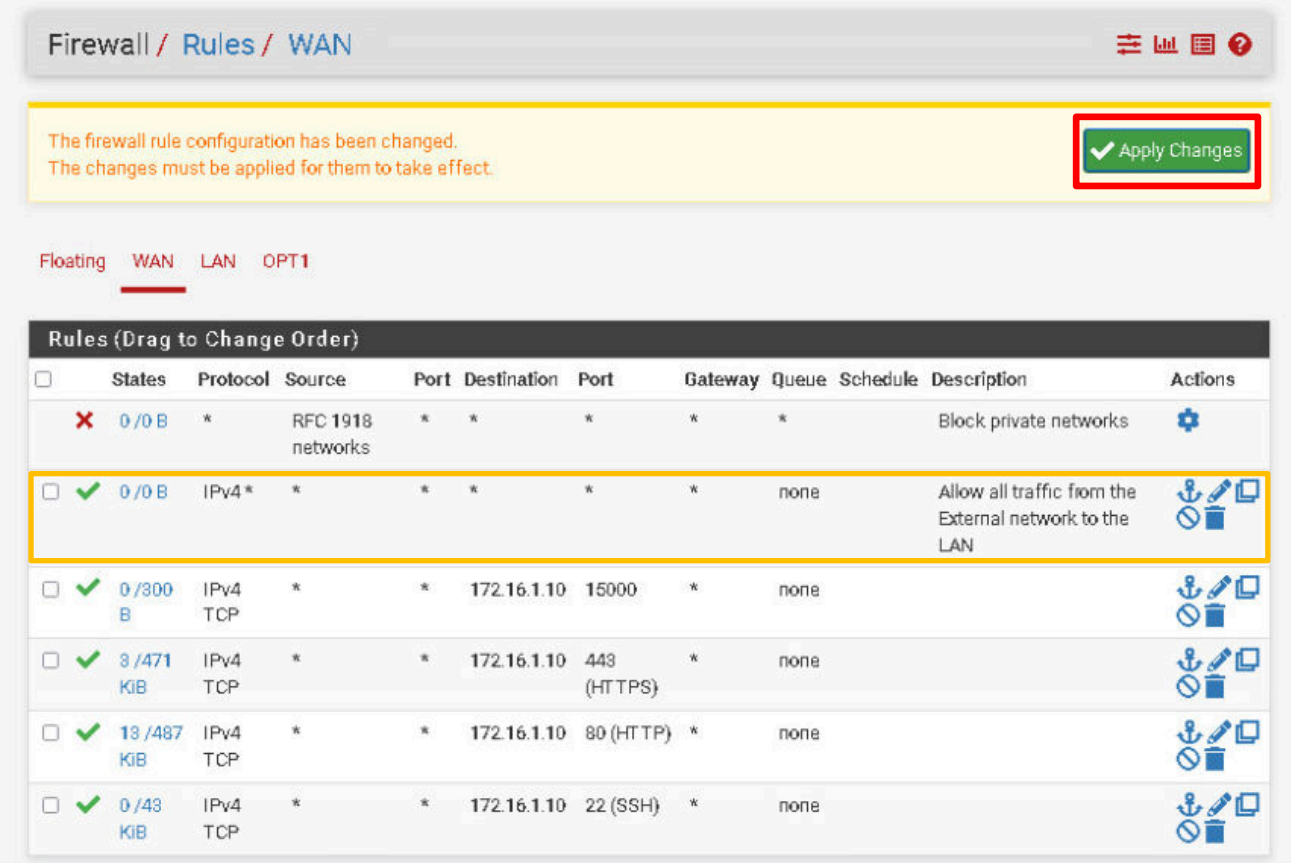
10. In the *Edit Firewall Rule* section, use the list arrow to change the *Protocol* to **Any.**



11. Scroll down to the lower half of the window.
12. In the *Extra Options* section, change the description to `Allow all traffic from the External network to the LAN`. Then, click the **Save** button at the bottom of the window.

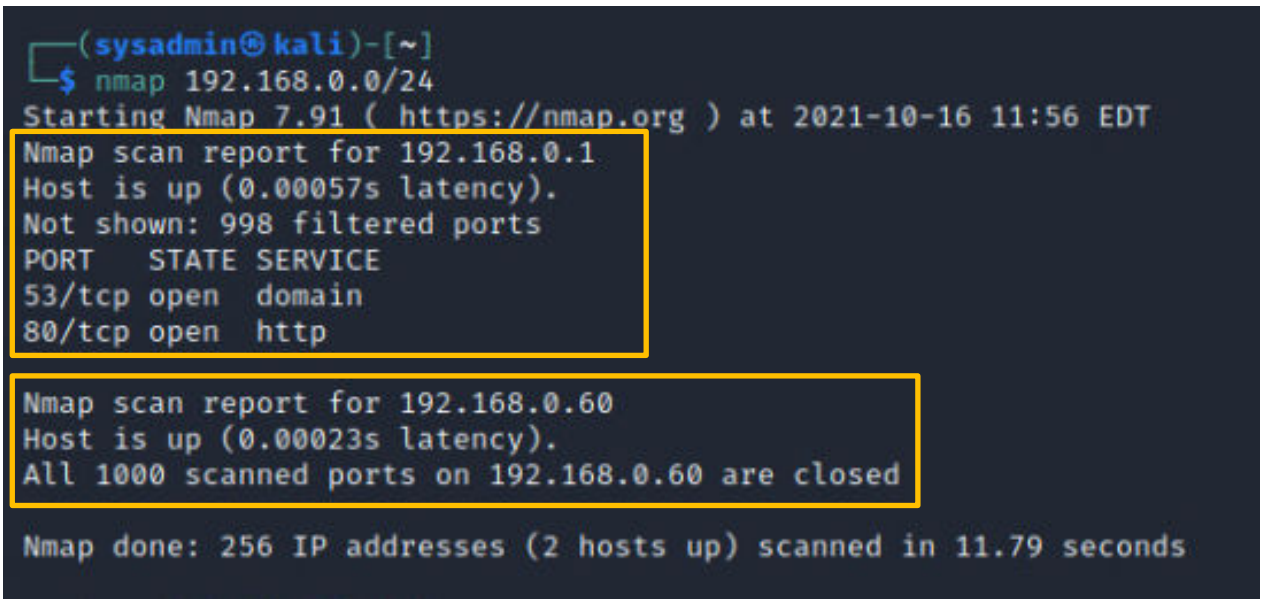


13. Note the new rule has been added to the list. Click the **Apply Changes** button.



14. Change focus back to the **Kali** computer.
15. Let's scan the whole *192.168.0.0/24* network again using *nmap* to see which ports are open on the hosts in the LAN.

```
nmap 192.168.0.0/24
```



Notice that the *WinOS* computer, which is set to the IP address **192.168.0.50** is missing from the scan. That's because the *Windows Defender Firewall* is blocking traffic. In the previous step, we only allowed traffic from the *MintOS* computer at **192.168.0.60**.

16. Let's take a look at the DMZ. In the terminal window, enter the following command:

```
nmap 172.16.1.0/28
```

```
┌──(sysadmin㉿kali)-[~]
└─$ nmap 172.16.1.0/28
Starting Nmap 7.91 ( https://nmap.org ) at 2021-10-16 12:06 EDT
Nmap scan report for 172.16.1.1
Host is up (0.00048s latency).
Not shown: 998 filtered ports
PORT   STATE SERVICE
53/tcp open  domain
80/tcp open  http

Nmap scan report for 172.16.1.10
Host is up (0.00024s latency).
Not shown: 997 closed ports
PORT    STATE SERVICE
22/tcp  open  ssh
80/tcp  open  http
443/tcp open  https

Nmap done: 16 IP addresses (2 hosts up) scanned in 6.10 seconds
```

Once again, notice which ports are open on every host in the DMZ (including the *pfSense* firewall). Every open port presents an opportunity for hackers to break into your system. Without the firewall between the exterior and interior networks we would be dangerously exposed.

17. Leave the *Kali* machine open and continue to the next task.

2.4 Exporting Scan Logs from nmap

Now that you have run *nmap* on several hosts and networks, let's export the results of the scans for further analysis and documentation. *nmap* provides five different output formats for saving the scans. They are:

- **Interactive:** The default
- **Normal**: Similar to Interactive, but without the extra runtime information and is used for more in-depth analysis
- **XML:** Can be converted into an HTML page and can be imported into databases
- **Greppable**: Used to output the target host's scan on a single line
- **ScRipT KIdd|3 oUTpuT**: A humorous way of displaying the output

The two most commonly used for documentation and analysis are **Normal** and **XML**.

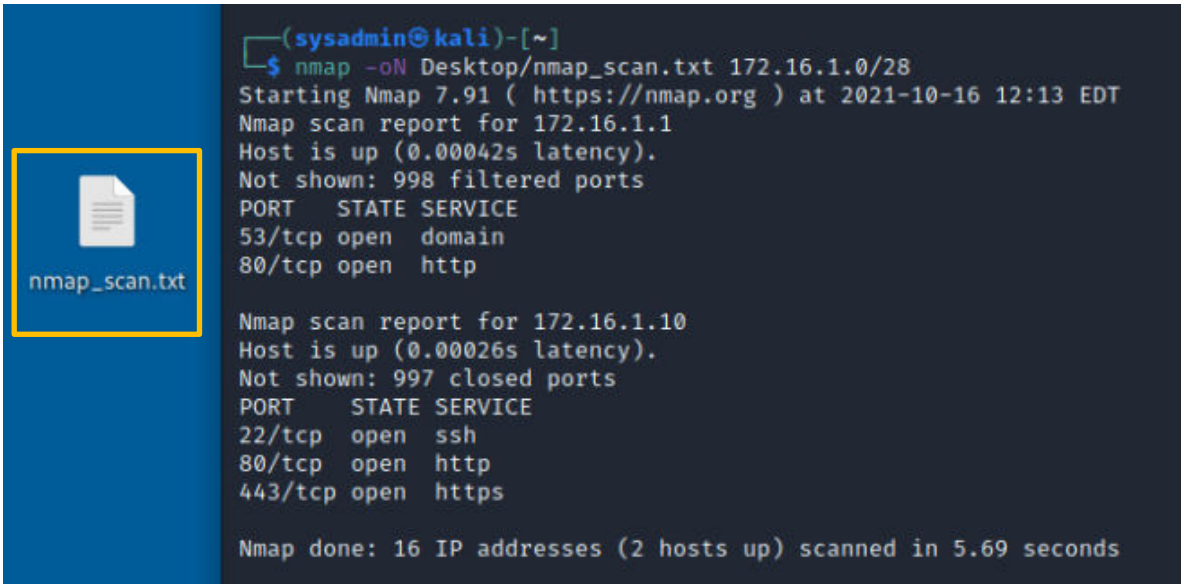
From the nmap.org website:

"Any security tool is only as useful as the output it generates. Complex tests and algorithms are of little value if they aren't presented in an organized and comprehensible fashion. Given the number of ways nmap is used by people and other software, no single format can please everyone. So nmap offers several formats, including the interactive mode for humans to read directly and XML for easy parsing by software."

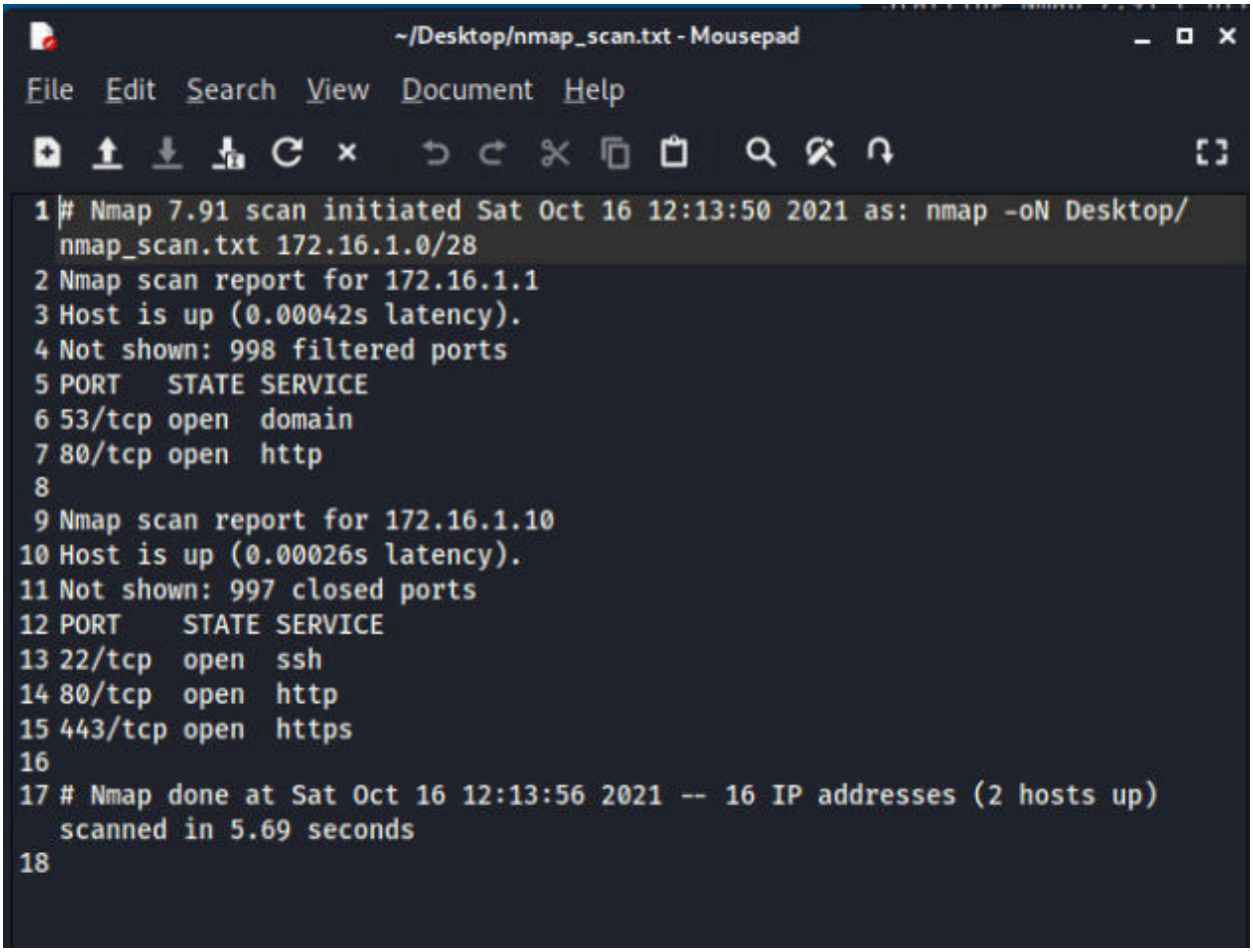
https://nmap.org/book/man-output.html

1. Open a terminal session if there is not one already open.
2. Type the following command to generate the output to a text file on the desktop:

```
nmap -oN Desktop/nmap_scan.txt 172.16.1.0/28
```



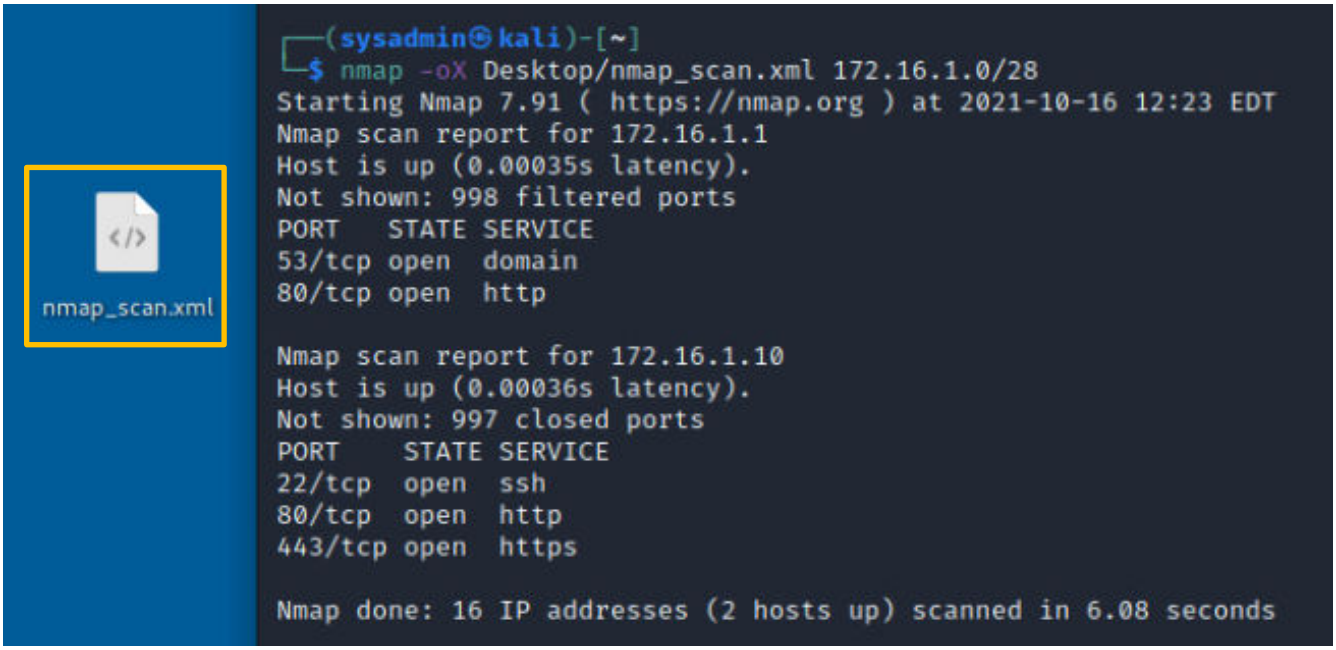
3. On the desktop, you should see a file named *nmap_scan.txt*. This file contains the **Normal** output from the *nmap* scan. Double-click on the **nmap_scan.txt file**, and it will open in a text editor.



4. Close the text editor window by clicking the **X** in the upper-right corner.

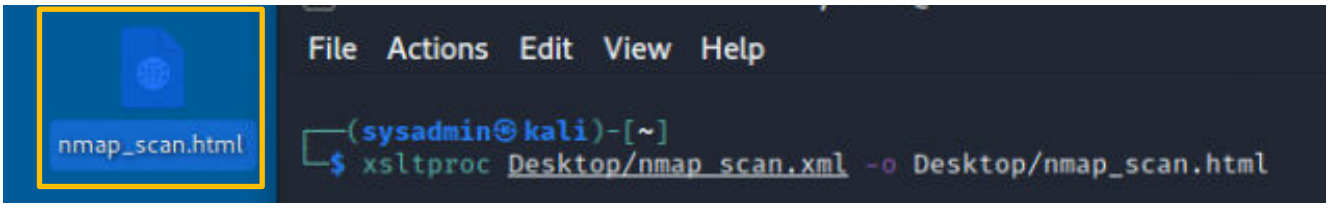
5. Exporting the scan to an XML file, then converting the file to HTML will produce much more detailed output in a format that can be used for more extensive analysis and documentation. Type the following command to generate the output to an XML file on the desktop. On the desktop, you should see a file named *nmap_scan.xml*. This file contains the output from the *nmap* scan in XML format.

```
nmap -oX Desktop/nmap_scan.xml 172.16.1.0/28
```

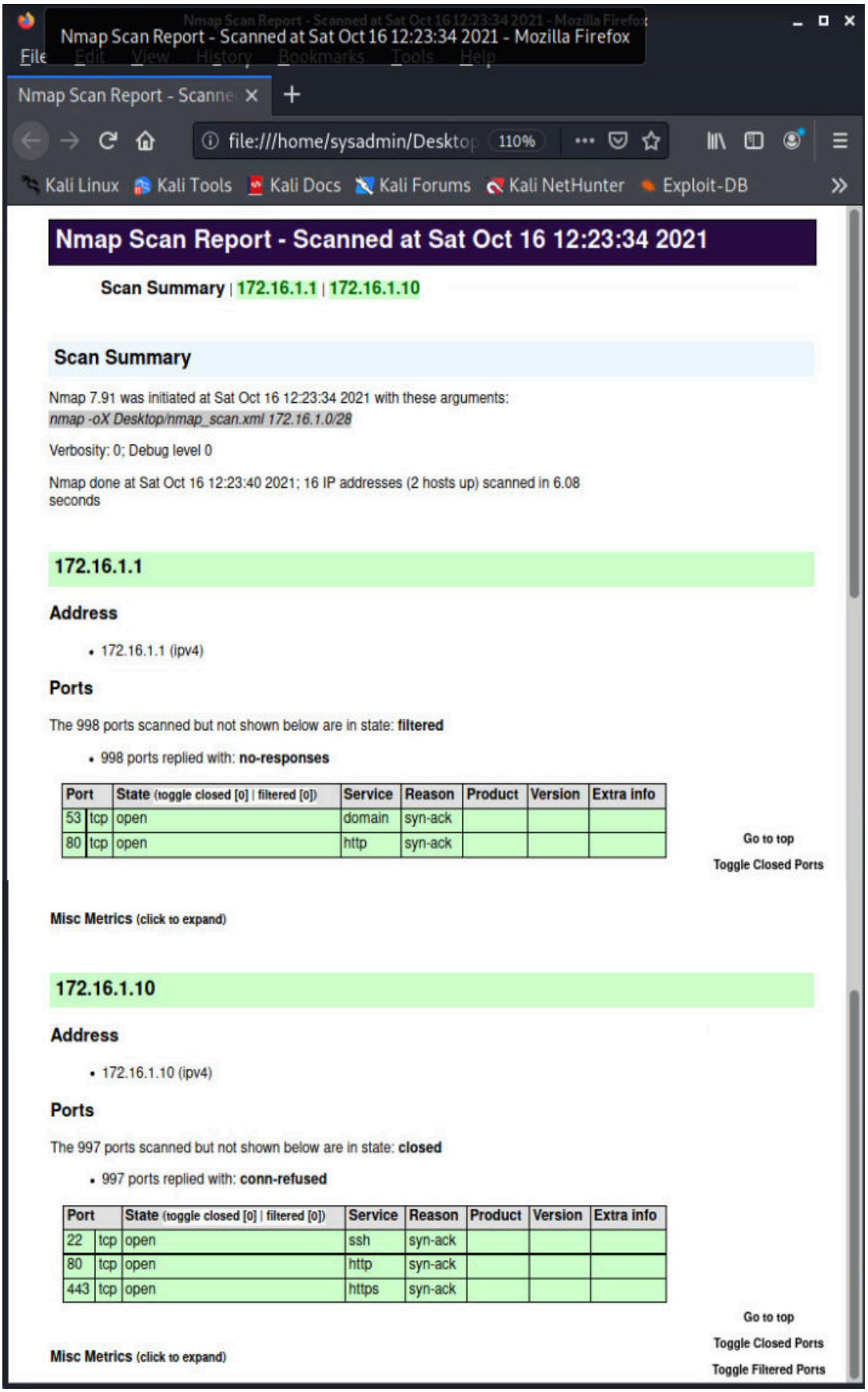


6. To convert the XML to HTML, use the **xlstproc** command. Type the following command. On the desktop, you should see a file named *nmap_scan.html*. This file contains the converted XML file.

```
xsltproc Desktop/nmap_scan.xml -o Desktop/nmap_scan.html
```



7. Double-click on the **nmap_scan.html** file and it will open in a web browser window.



8. Close the *Firefox* browser window and the terminal window.
9. Leave the *Kali* machine open and continue to the next task.

3 Performing Host Scans with Legion

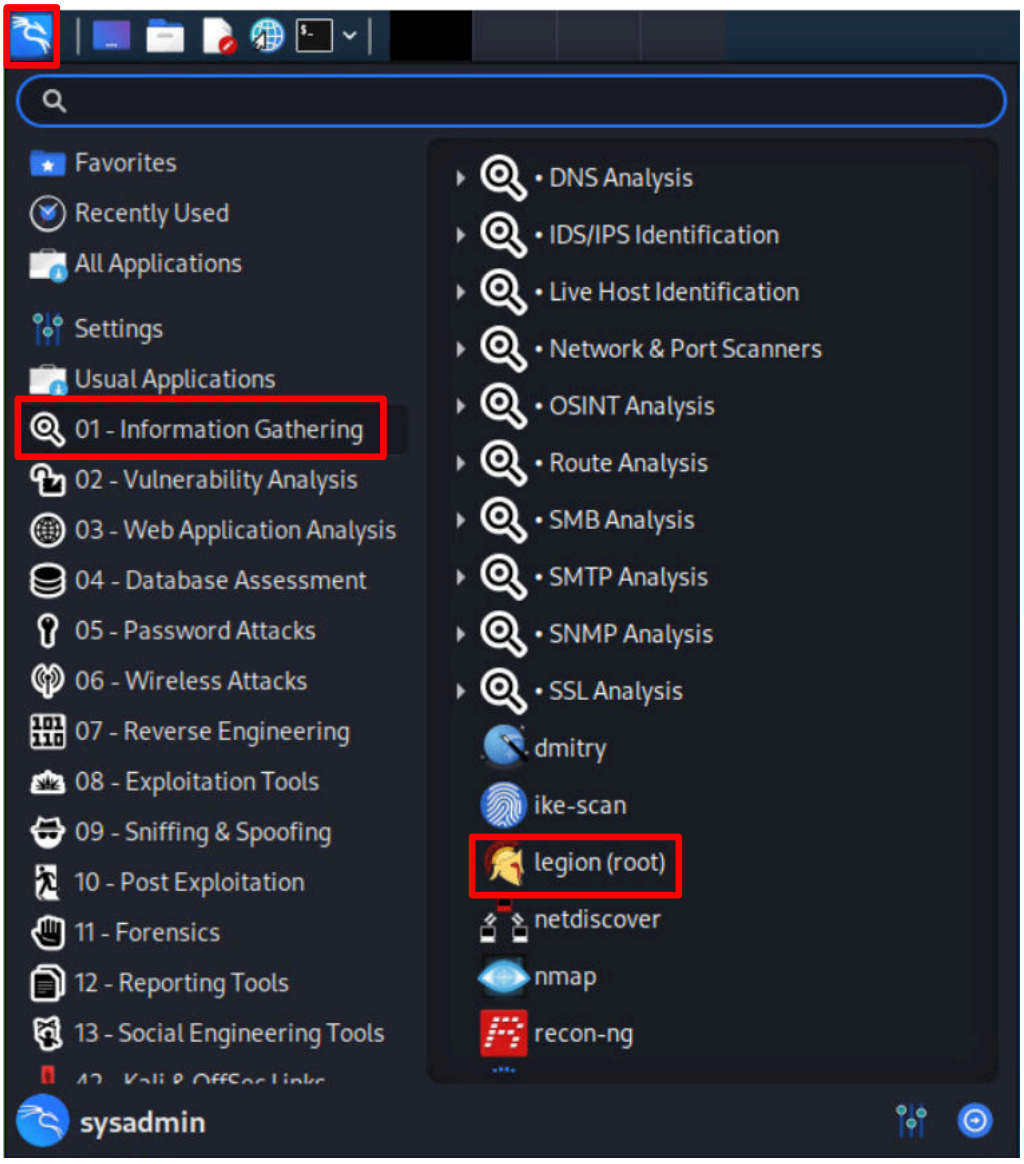
Legion is a very powerful GUI tool that you use to script different port scans and output the results for analysis and documentation.

From the *Kali Linux* Tutorial Site:

"Legion, a fork of SECFORCE's Sparta, is an open source, easy-to-use, super-extensible and semi-automated network penetration testing framework that aids in discovery, reconnaissance and exploitation of information systems."

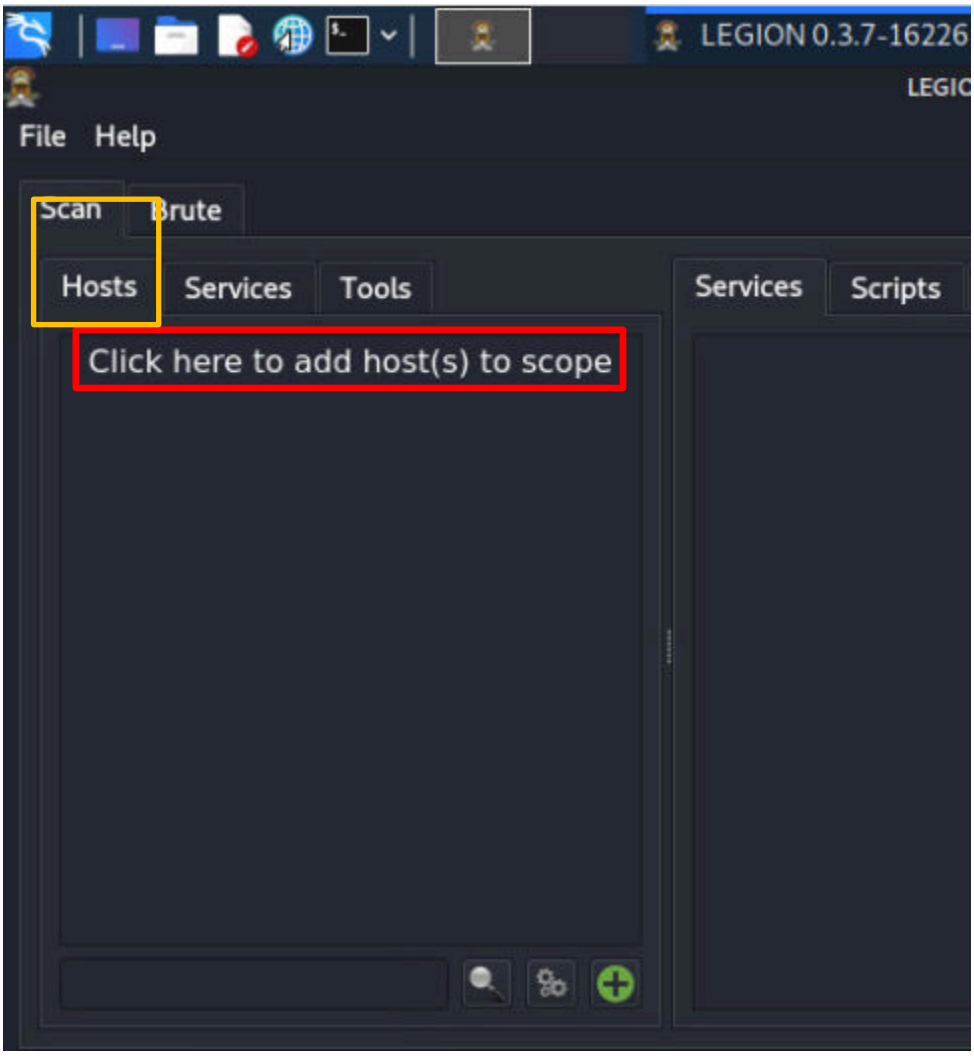
https://kalilinuxtutorials.com/legion-penetration-testing/

1. Click on the **Start** button in the upper-left corner of the window, click **01 Information Gathering** from the menu and select **legion (root)** from the submenu. When asked for the password for the password, use: `NDGlabpass123!`

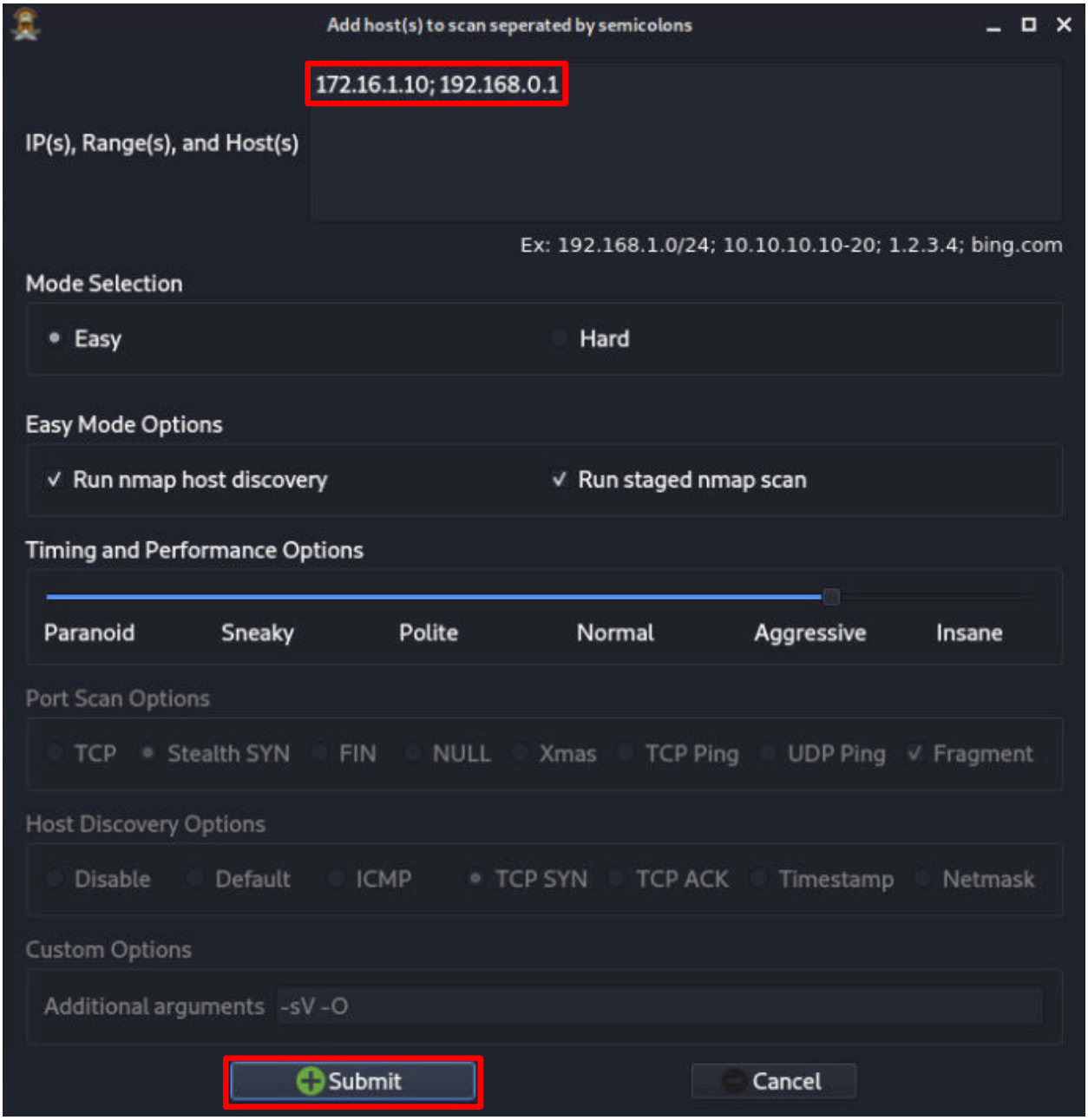


The Legion window may open and be too large for the desktop space. If this happens, right-click on the LEGION entry in the taskbar and select **Maximize**.

2. With the **Scan** tab and **Hosts** tab selected, click on the text that says: **Click here to add host(s) to scope** in the upper-left box**.**

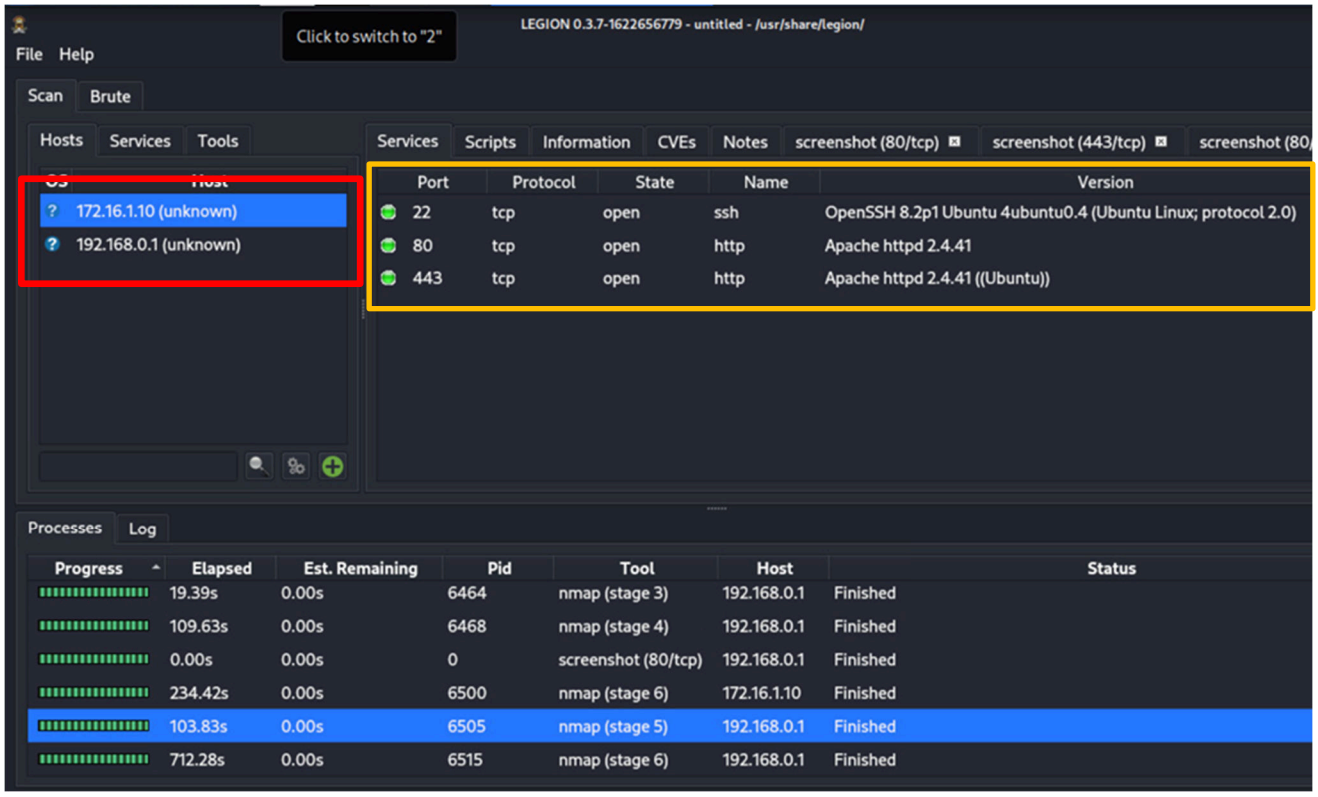


3. In the *Add Host(s) to Scan* window, in the box for *IP(s), Range(s) and Host(s),* type `172.16.1.10; 192.168.0.1`. Leave all the other settings at their default values and press the **Submit** button.

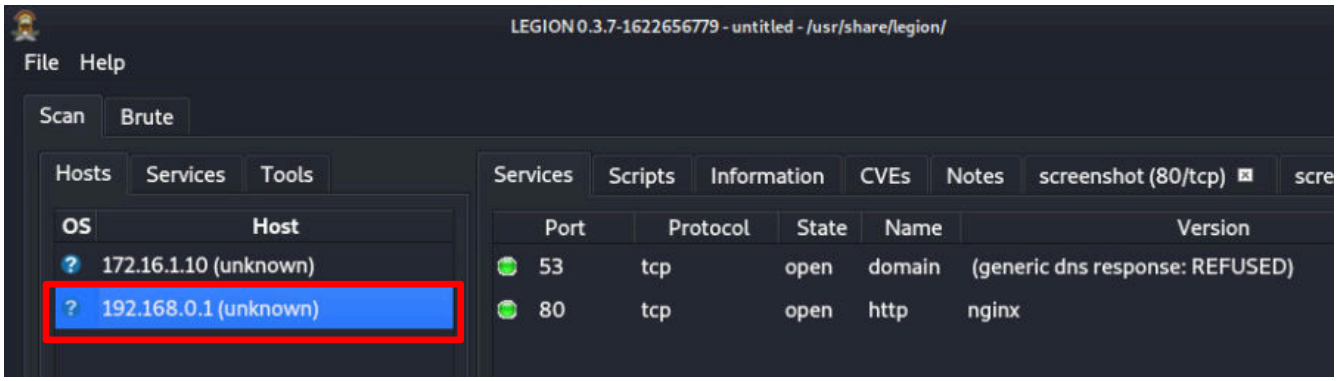


4. Once the scan is complete, click on the **172.16.1.10** host (which is *UbuntuSRV*) and under the *Services* tab you will see what ports are open, in this case, **443**, which is *HTTPS*, **80**, which is *HTTP* and **22**, which is *SSH*.

For each host, there are 6 *nmap* stages and it can take as long as 20 minutes to run all of the scans.



5. Click on **192.168.0.1** host (which is the *pfSense* firewall), and under the *Services* tab, you will see what ports are open, in this case, **53**, which is **DNS,** and **80**, which is **HTTP.**



6. The lab is now complete; you may end the reservation.