

PfSense Firewall Router Network Configuration

By Brennen Tse

Purpose:

Install PfSense to use as a firewall/router for two Linux desktops.

Background:

PfSense is a version of the FreeBSD OS. The version we're using today is open source and designed to be installed on a virtual machine to make a firewall and router for the network. Setting up PfSense is really easy with low hardware requirements. PfSense can follow either default or custom rules when it filters traffic separately. Whether it's from the internal LAN or the Internet, you can use PfSense to set different rules and policies for each. It's also flexible enough to be added upon with additional code to make it more useable. For example, you can include intrusion detection and prevention with PfSense (IPS/IDS).

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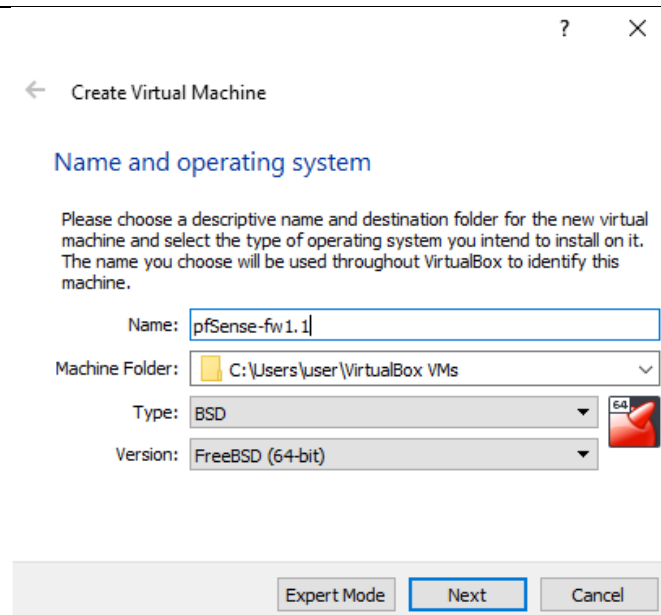
Prerequisites:

Download [Pfsense](#)

Install Linux Mint or Ubuntu or Other Linux VM

Installing PfSense:

Name the pfSense VM and select BSD.



← Create Virtual Machine

Name and operating system

Please choose a descriptive name and destination folder for the new virtual machine and select the type of operating system you intend to install on it. The name you choose will be used throughout VirtualBox to identify this machine.

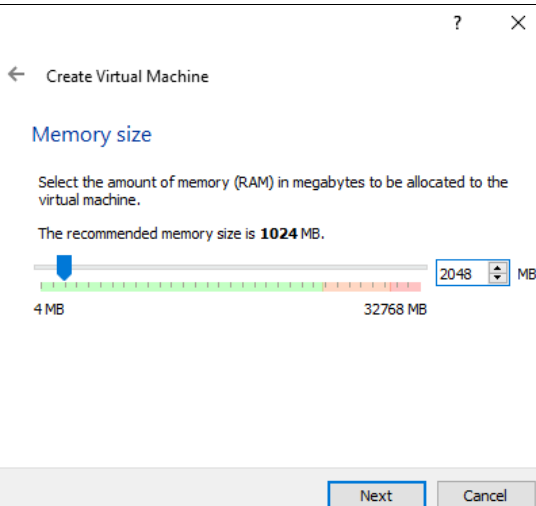
Name:

Machine Folder:

Type:

Version:

Expert Mode **Next** Cancel



← Create Virtual Machine

Memory size

Select the amount of memory (RAM) in megabytes to be allocated to the virtual machine.

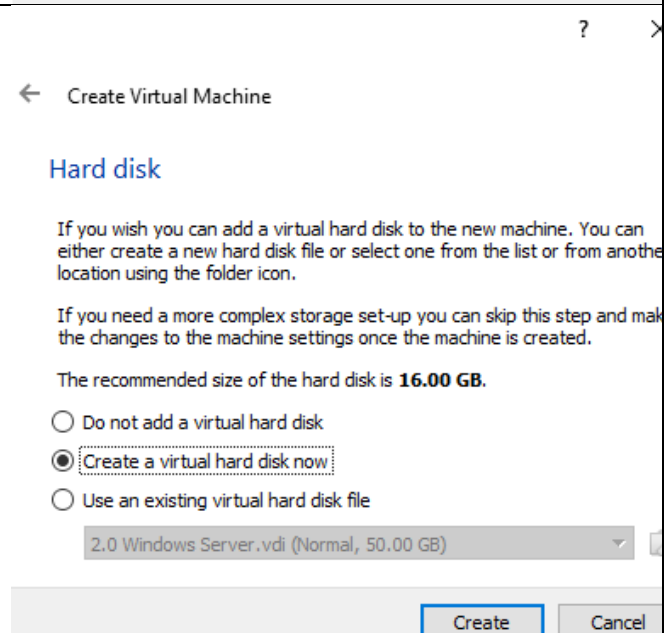
The recommended memory size is **1024 MB**.

MB

4 MB 32768 MB

Next Cancel

Assign 2048MB of memory



← Create Virtual Machine

Hard disk

If you wish you can add a virtual hard disk to the new machine. You can either create a new hard disk file or select one from the list or from another location using the folder icon.

If you need a more complex storage set-up you can skip this step and make the changes to the machine settings once the machine is created.

The recommended size of the hard disk is **16.00 GB**.

☐ Do not add a virtual hard disk

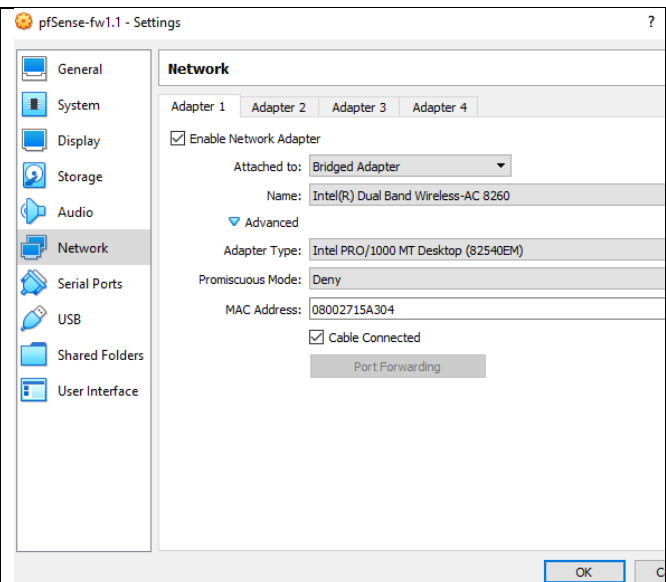
☒ **Create a virtual hard disk now**

☐ Use an existing virtual hard disk file

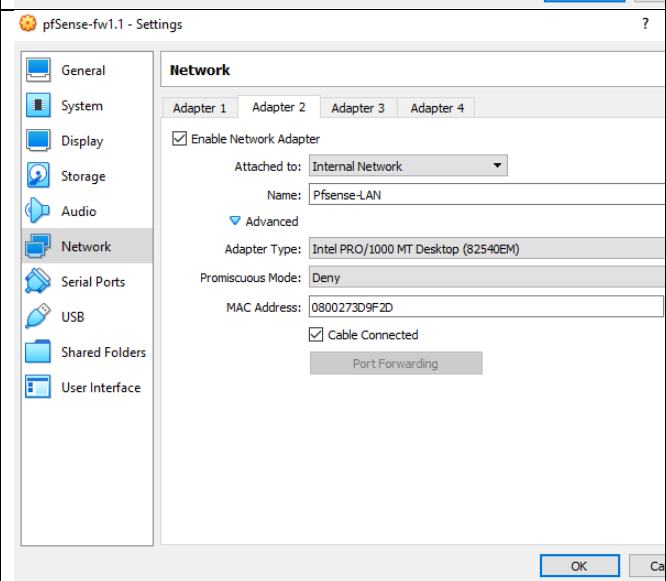
Create Cancel

Create a virtual hard disk

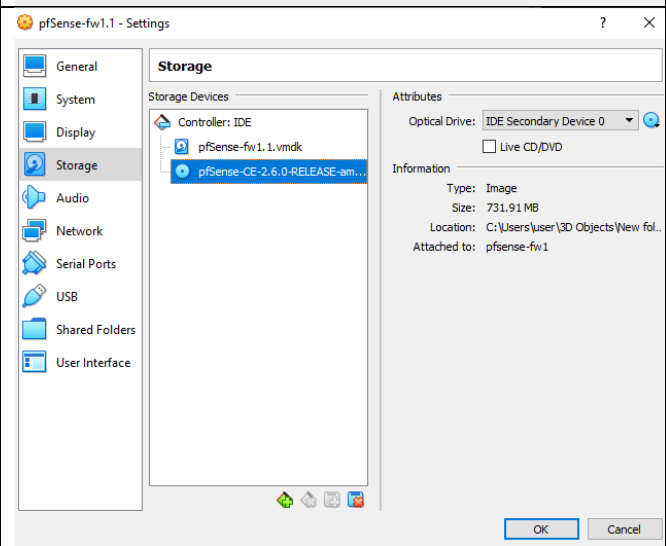
Set adapter 1 of the VM's network to bridged adapter for wireless.



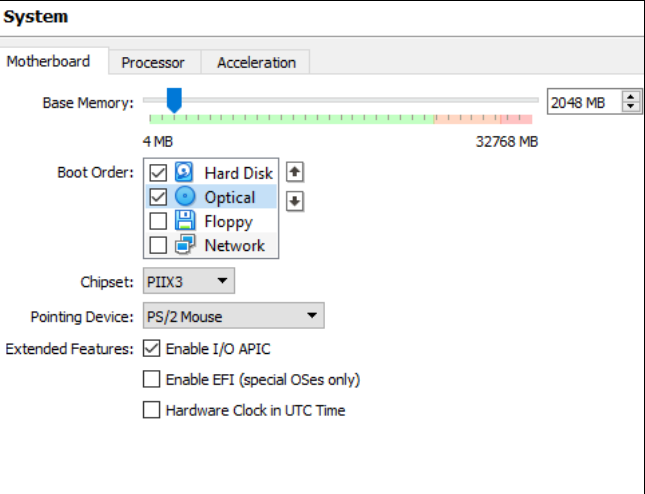
Set adapter 2 of the VM's network to the internal PfSense-LAN. This is where the VM's will connect to and be routed through PfSense.



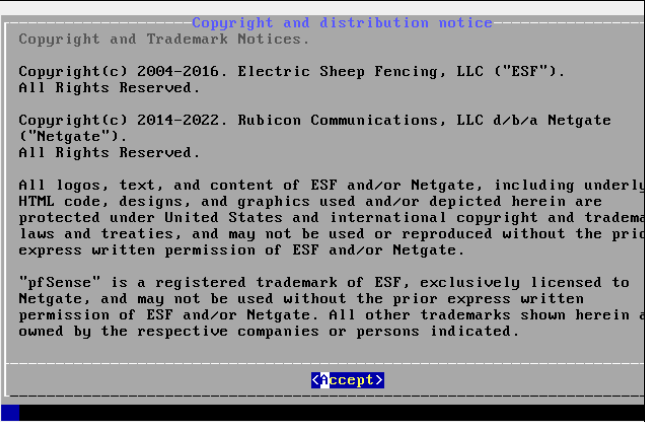
Add the Pfsense ISO Image you downloaded earlier to the storage optical drive.



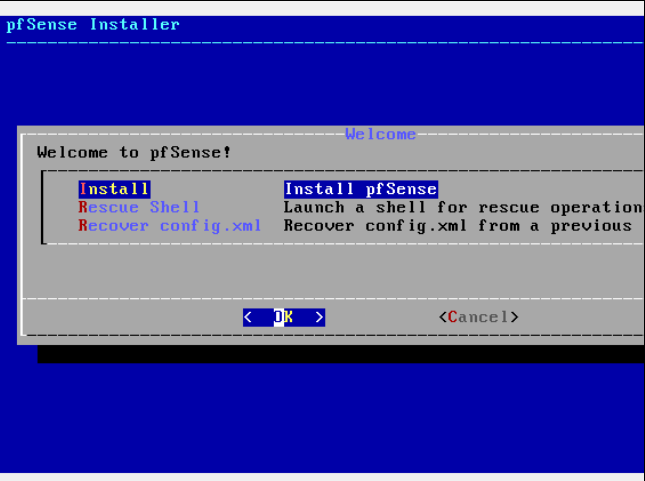
Rearrange the boot order so that hard disk is on top and floppy is not selected.



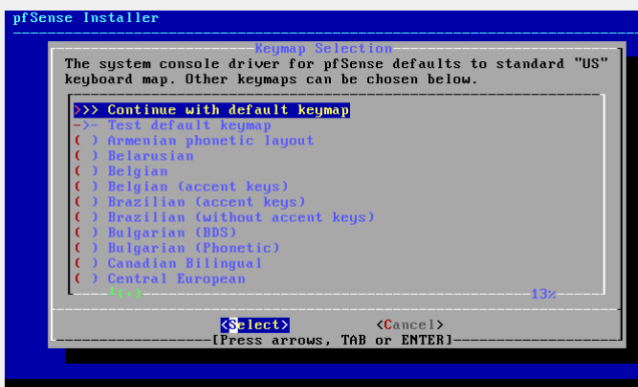
Once all these settings have been configured, click the green start arrow to start the VM. You will be greeted by this screen. Read and click accept.



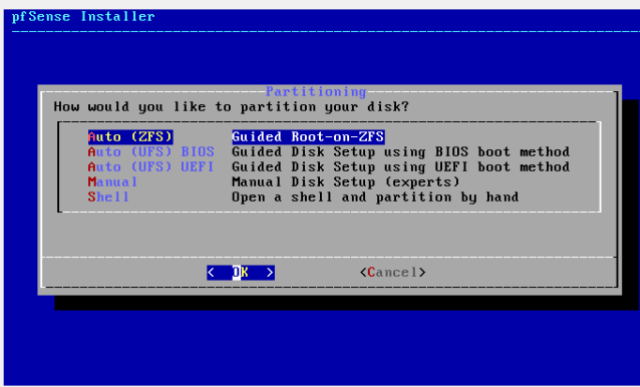
Click Install to Install Pfsense.



Click Continue with default keymap.



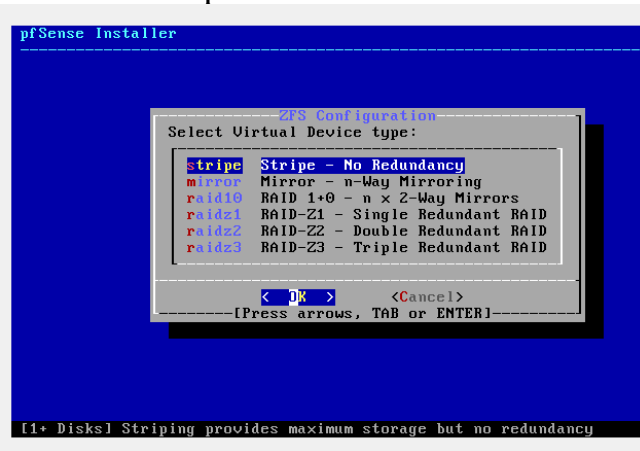
Select the Auto ZFS partition.



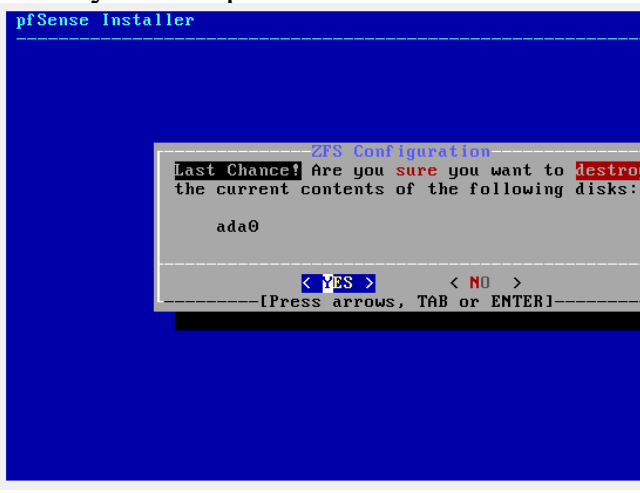
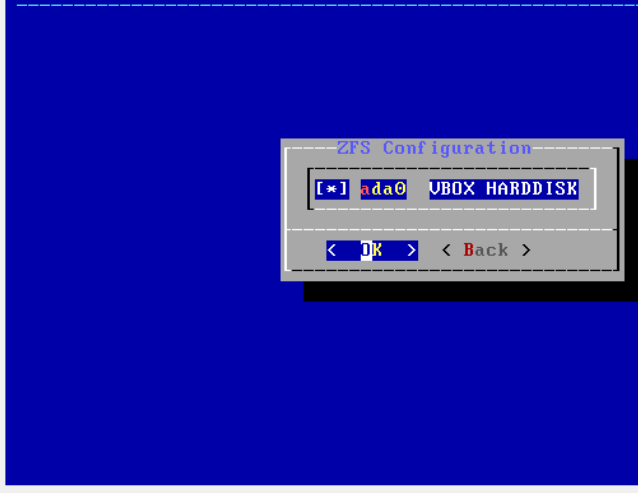
Install.



Select the stripe as the Virtual Device.



Click yes to wipe the disk.



<p>Click No, then reboot.</p>	
<p>Configuration Validation: Once the Pfsense firewall has been rebooted, it should automatically get an IP address. However this leads to both the WAN and the LAN being in the same network. To change that press 2.</p>	
<p>After choosing 8, select the interface and press 2 again. Enter in the default gateway you want to use and press enter after you've chosen the subnet mask (/24)</p>	

Since this lab is not using IPV6, just ignore the following prompts. We will also need to configure a DHCP address, so press y, and enter the range of the client DHCP will use for addresses.

```
Enter the new LAN IPv4 address. Press <ENTER> for none:
> 10.1.1.1

Subnet masks are entered as bit counts (as in CIDR notation) in pfSense.
e.g. 255.255.255.0 = 24
    255.255.0.0    = 16
    255.0.0.0      = 8

Enter the new LAN IPv4 subnet bit count (1 to 32):
> 24

For a WAN, enter the new LAN IPv4 upstream gateway address.
For a LAN, press <ENTER> for none:
>

Enter the new LAN IPv6 address. Press <ENTER> for none:
>

Do you want to enable the DHCP server on LAN? (y/n) y
Enter the start address of the IPv4 client address range: 10.1.1.10
Enter the end address of the IPv4 client address range: 10.1.1.255
Disabling IPv6 DHCPD...

Do you want to revert to HTTP as the webConfigurator protocol? (y/n) n
```

Now we can see that the LAN and WAN are in different networks which is what we want.

```
The IPv4 LAN address has been set to 10.1.1.1/24
You can now access the webConfigurator by opening the following URL
in your browser:

    https://10.1.1.1/

Press <ENTER> to continue.
VirtualBox Virtual Machine - Metgate Device ID: da3383e72702c28cf70

*** Welcome to pfSense 2.6.0-RELEASE (amd64) on pfSense ***

WAN (wan)      -> em0      -> v4/DHCP4: 192.168.40.162/23
LAN (lan)      -> em1      -> v4: 10.1.1.1/24

0) Logout (SSH only)          9) pfTop
1) Assign Interfaces          10) Filter Logs
2) Set interface(s) IP address 11) Restart webConfigurator
3) Reset webConfigurator password 12) PHP shell + pfSense tools
4) Reset to factory defaults   13) Update from console
5) Reboot system              14) Enable Secure Shell (ssh)
6) Halt system                15) Restore recent configuration
7) Ping host                  16) Restart PHP-FPM
8) Shell

Enter an option:
```

Can we reach the Internet though? To run a test I selected 7 and the general IP address of the internet (8.8.8.8) and you should be able to successfully reach and ping.

```
1) Assign Interfaces          10) Filter Logs
2) Set interface(s) IP address 11) Restart webConfigurator
3) Reset webConfigurator password 12) PHP shell + pfSense tools
4) Reset to factory defaults   13) Update from console
5) Reboot system              14) Enable Secure Shell (ssh)
6) Halt system                15) Restore recent configuration
7) Ping host                  16) Restart PHP-FPM
8) Shell

Enter an option: 7

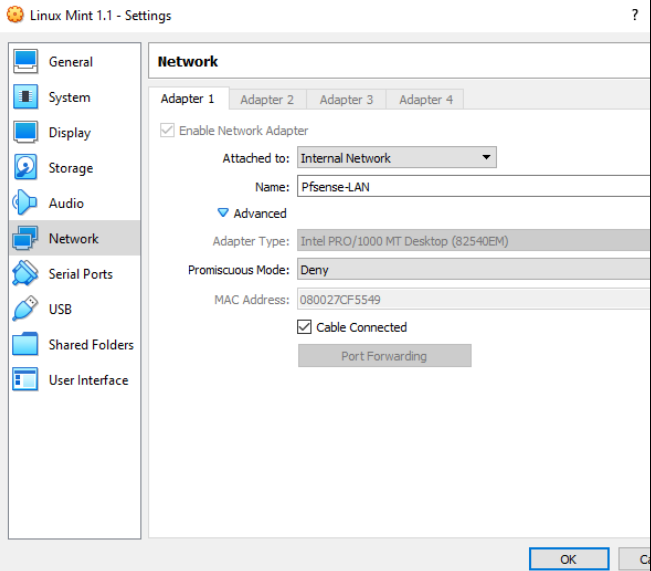
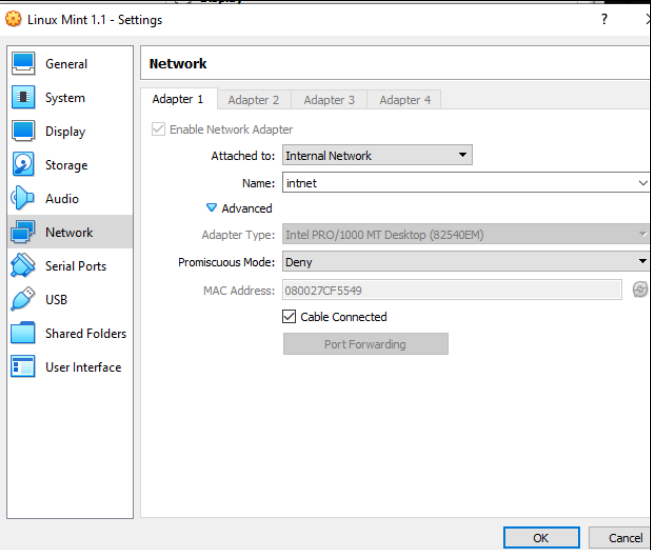
Enter a host name or IP address: 8.8.8.8

PING 8.8.8.8 (8.8.8.8): 56 data bytes
64 bytes from 8.8.8.8: icmp_seq=0 ttl=55 time=17.437 ms
64 bytes from 8.8.8.8: icmp_seq=1 ttl=55 time=17.526 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=55 time=18.714 ms

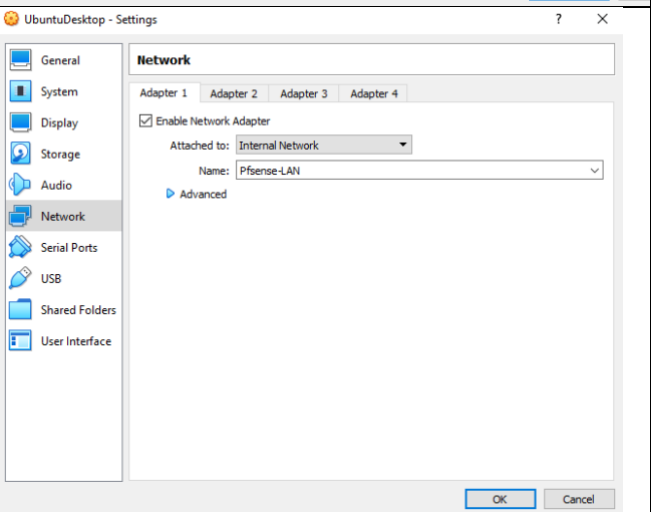
--- 8.8.8.8 ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 17.437/17.892/18.714/0.582 ms

Press ENTER to continue.
```


Now we go back to our Linux VM's that we configured in the last lab. Change Linux mint's network from intent to Pfsense-Lan to be inside the Pfsense LAN.

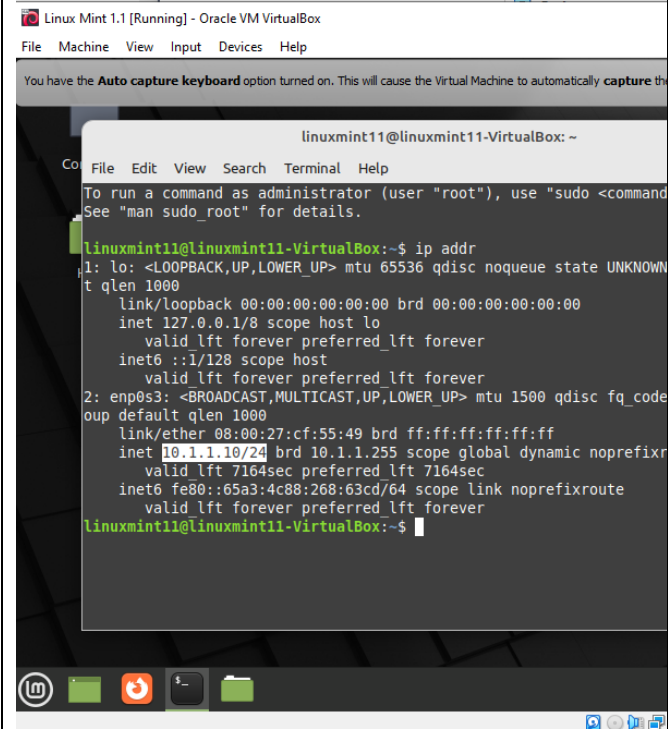


Do the same for the Ubuntu Desktop.



Verify IP Address:

To verify the IP address, type in `ip addr`, which should display a DHCP assigned ip address within the selected range.



```
Linux Mint 1.1 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

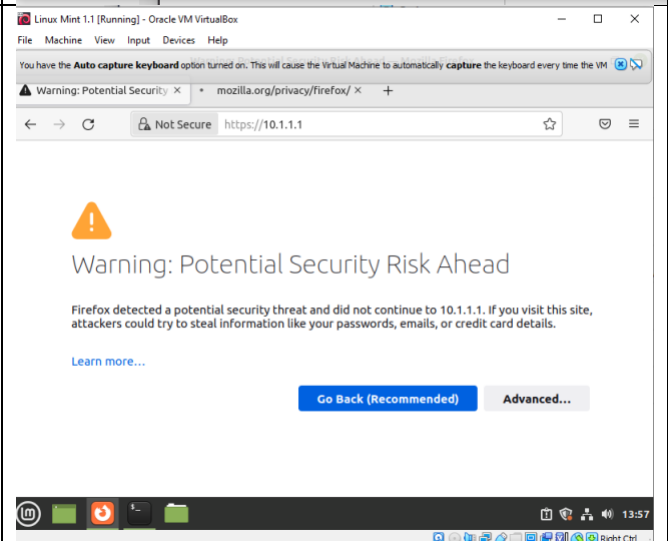
You have the Auto capture keyboard option turned on. This will cause the Virtual Machine to automatically capture the keyboard every time the VM is active.

linuxmint11@linuxmint11-VirtualBox: ~
File Edit View Search Terminal Help

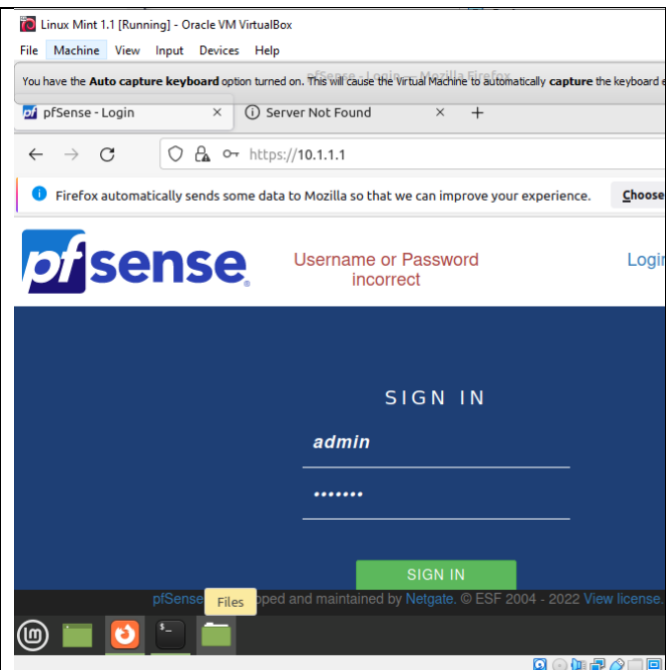
To run a command as administrator (user "root"), use "sudo <command>". See "man sudo_root" for details.

linuxmint11@linuxmint11-VirtualBox:~$ ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP
    link/ether 08:00:27:cf:55:49 brd ff:ff:ff:ff:ff:ff
    inet 10.1.1.10/24 brd 10.1.1.255 scope global dynamic noprefixroute
        valid_lft 7164sec preferred_lft 7164sec
    inet6 fe80::65a3:4c88:268:63cd/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
linuxmint11@linuxmint11-VirtualBox:~$
```

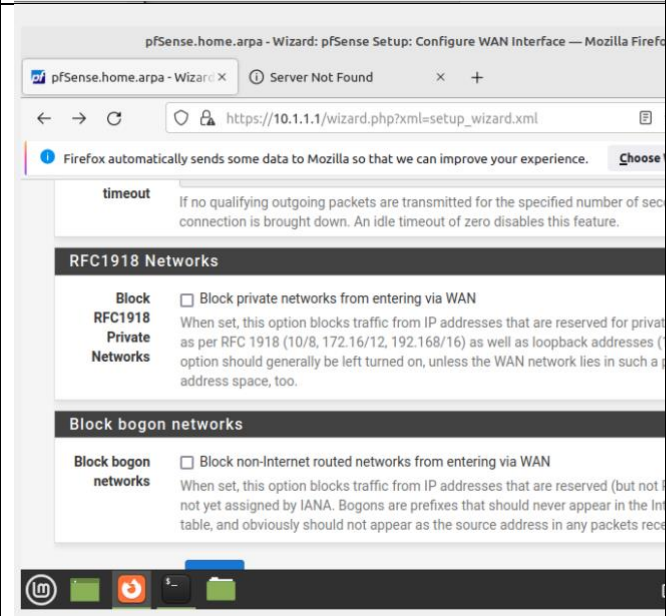
Access the pfSense GUI through <https://10.1.1.1>



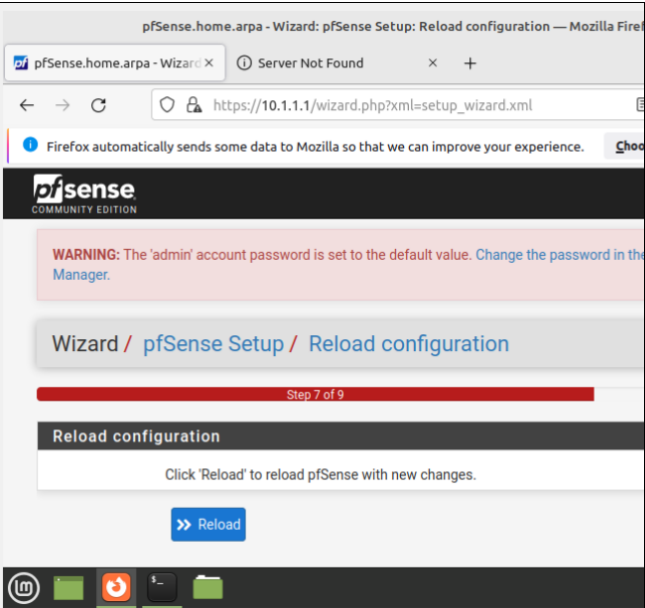
Use the general username and password of admin and admin to login to pfsense and start configuring.



Configure the default commands for Pfsense except for page 4, where you must ensure that the Block Private Networks remains unchecked to allow for network traffic and Internet connectivity on the local LAN.



Once you have finished setting up, reload the configuration to save your changes.

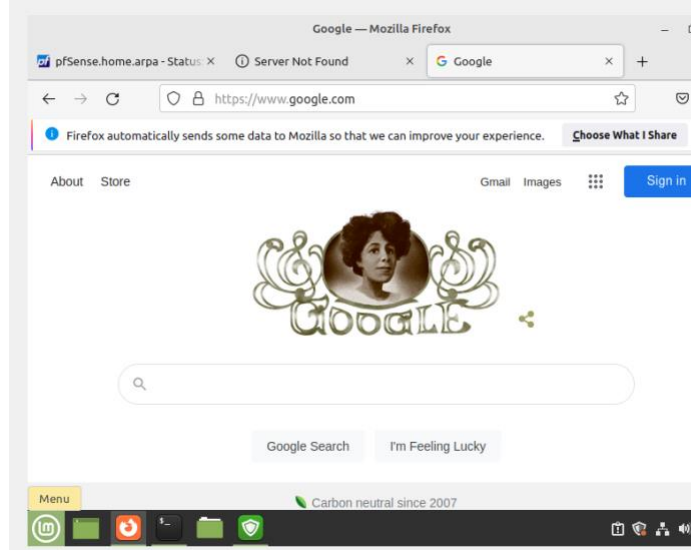


Test connectivity:

The IP addresses should be from the DHCP server, and pinging the public IP address of 8.8.8.8 should work and be successful.

```
linuxmint11@linuxmint11-VirtualBox: ~  
File Edit View Search Terminal Help  
t qlen 1000  
link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00  
inet 127.0.0.1/8 scope host lo  
    valid_lft forever preferred_lft forever  
inet6 ::1/128 scope host  
    valid_lft forever preferred_lft forever  
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel  
    link/ether 08:00:27:cf:55:49 brd ff:ff:ff:ff:ff:ff  
    inet 10.1.1.10/24 brd 10.1.1.255 scope global dynamic noprefixroute  
        valid_lft 7164sec preferred_lft 7164sec  
    inet6 fe80::65a3:4c88:268:63cd/64 scope link noprefixroute  
        valid_lft forever preferred_lft forever  
linuxmint11@linuxmint11-VirtualBox:~$ ping 8.8.8.8 -c 4  
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data:  
64 bytes from 8.8.8.8: icmp_seq=1 ttl=54 time=23.8 ms  
64 bytes from 8.8.8.8: icmp_seq=2 ttl=54 time=14.0 ms  
64 bytes from 8.8.8.8: icmp_seq=3 ttl=54 time=21.6 ms  
64 bytes from 8.8.8.8: icmp_seq=4 ttl=54 time=19.0 ms  
--- 8.8.8.8 ping statistics ---  
4 packets transmitted, 4 received, 0% packet loss, time 3005ms  
rtt min/avg/max/mdev = 13.964/19.581/23.766/3.656 ms  
linuxmint11@linuxmint11-VirtualBox:~$
```

You can also browse the internet.



Ubuntu Connectivity Test:

You can also check the Ubuntu Desktop as it too should have a DHCP address. If you ping the public IP it should go through.

```
Activities Terminal Jun 20 08:42
ubuntu@ubuntu: ~
ubuntu@ubuntu:~$ ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel
    link/ether 08:00:27:80:ea:27 brd ff:ff:ff:ff:ff:ff
    inet 10.1.1.11/24 brd 10.1.1.255 scope global dynamic noprefixroute
        valid_lft 6675sec preferred_lft 6675sec
    inet6 fe80::220e:340b:efb2:d7a1/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
ubuntu@ubuntu:~$ ping 8.8.8.8 -c 4
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=54 time=15.0 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=54 time=14.2 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=54 time=19.0 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=54 time=16.3 ms

--- 8.8.8.8 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3003ms
rtt min/avg/max/mdev = 14.190/16.123/18.964/1.809 ms
ubuntu@ubuntu:~$
```

To make doubly sure, you can do a traceroute command to see the path, and we can see that it goes through the PFSense firewall at pfsense.home.arpa.

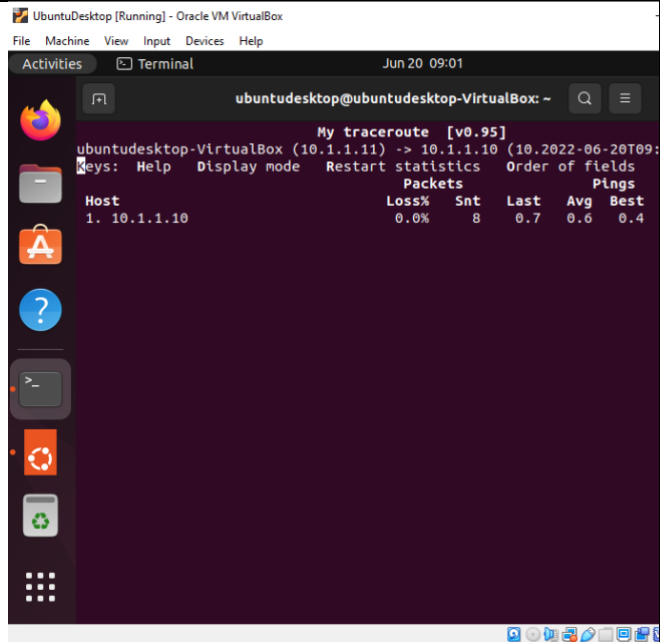
```
UbuntuDesktop [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
You have the Auto capture keyboard option turned on. This will cause the Virtual Machine to automatically capture the keyboard every time the VM is focused.

ubuntu@ubuntu:~$ my traceroute [v0.95]
2022-06-17T15:40:11-0700
Hosts: Help Display mode Restart statistics Order of fields quit
Packets
Loss% Snt Last Avg Best Wrst StDev
1. pfsense.home.arpa 0.0% 17 0.7 0.6 0.4 0.8 0.1
2. 192.168.40.1 0.0% 17 88.7 7.5 1.1 88.7 21.0
3. 172.28.128.1 5.9% 17 16.8 3.7 1.9 16.8 3.9
4. 192.168.15.1 0.0% 17 12.0 4.5 2.6 12.8 3.2
5. 10.61.242.194 0.0% 16 35.8 30.2 17.5 53.3 12.2
6. 24.153.84.161 0.0% 16 11.1 16.6 11.1 25.8 4.2
7. 96.216.61.78 0.0% 16 20.3 15.9 10.2 20.5 3.1
8. 96.216.61.61 0.0% 16 16.2 13.8 9.3 19.8 2.8
9. 24.124.128.89 0.0% 16 13.1 16.3 11.9 23.7 3.3
10. 24.124.128.122 0.0% 16 17.1 19.0 11.3 38.2 6.9
11. 50.222.176.214 0.0% 16 24.0 18.2 13.6 29.5 4.2
12. 142.251.50.45 0.0% 16 18.5 19.0 13.1 45.1 7.5
13. 142.251.55.199 0.0% 16 15.5 17.9 12.5 26.2 3.5
14. 8.8.8.8 0.0% 16 102.5 20.5 11.2 102.5 22.0
```

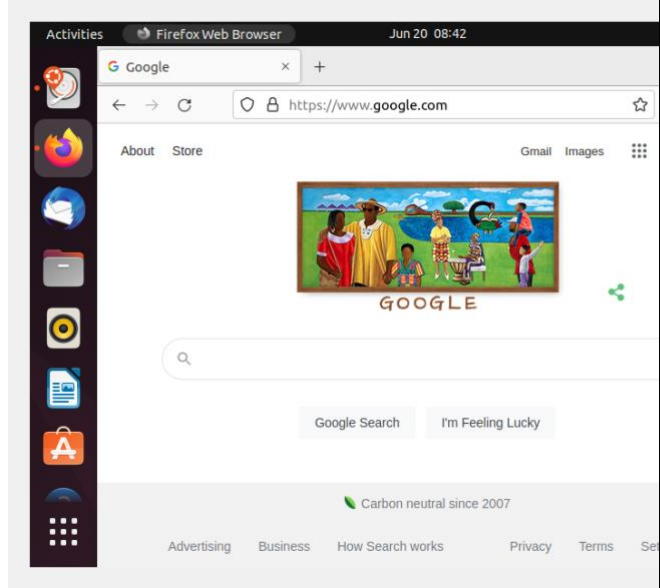
You can also ping the Linux Mint VM from the Ubuntu Desktop too.

```
ubuntudesktop@ubuntudesktop-VirtualBox:~$ ping 10.1.1.10
PING 10.1.1.10 (10.1.1.10) 56(84) bytes of data.
64 bytes from 10.1.1.10: icmp_seq=1 ttl=64 time=0.0 ms
64 bytes from 10.1.1.10: icmp_seq=2 ttl=64 time=0.0 ms
64 bytes from 10.1.1.10: icmp_seq=3 ttl=64 time=0.0 ms
64 bytes from 10.1.1.10: icmp_seq=4 ttl=64 time=0.0 ms
64 bytes from 10.1.1.10: icmp_seq=5 ttl=64 time=0.0 ms
```

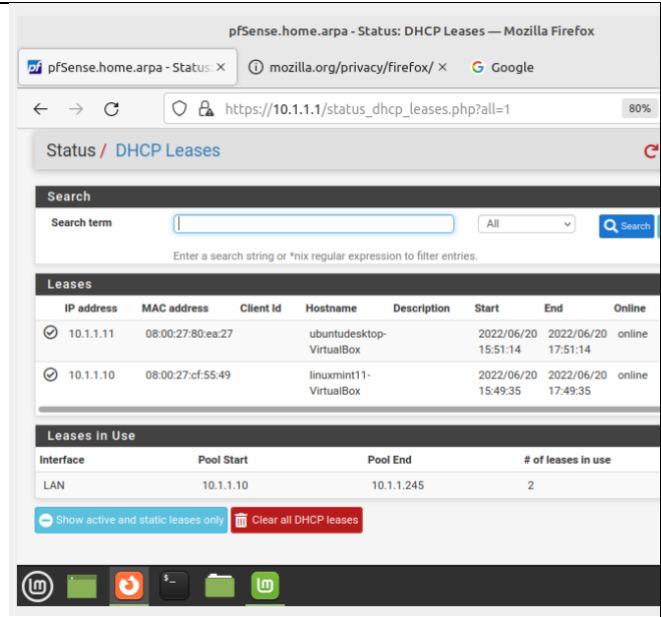
Since both are on the Internal LAN, the traffic is not routed through the Pfsense Internet interface.



We can also access google through Ubuntu desktop.



As one final check, we can see through the Pfsense DHCP leases that both VM's are online and working.



Problems:

The main problems I had with PfSense were with the DHCP server and connectivity. The DHCP server was originally not distributing IP addresses and I wasn't sure what the problem was. I then discovered that the range for the IP addresses it was assigned was erroneous and prevented any addresses from being assigned. Second, the Linux Mint machine was using the wrong adapter instead of PfSense_Lan it was using the old one of Intnet which prevented pinging across.

Conclusion:

PfSense is a strong candidate for those looking for a flexible and impressive alternative to physical routers and firewalls. With its ease of use, low hardware requirements and extensive firewall settings, any operator using virtual machines may want to consider using PfSense to strengthen their network.