

## Creating a Virtual Network with Virt-manager

Our goal today will be to create three virtual machines on our host machine, network them together using virtual bridges, and pass some very simple traffic between them. This small network will operate in the same manner as a physical network, and will help us to better understand how the larger networks we use every day (including the Internet) function.

To create virtual machines, we will use QEMU/KVM and Virtual Machine Manager (VMM), which are already installed on your computer. QEMU/KVM is a virtualization software that will allow a guest operating system to run on our host operating system. VMM is a set of tools that will allow us to create, start, stop, and interact with guest machines.

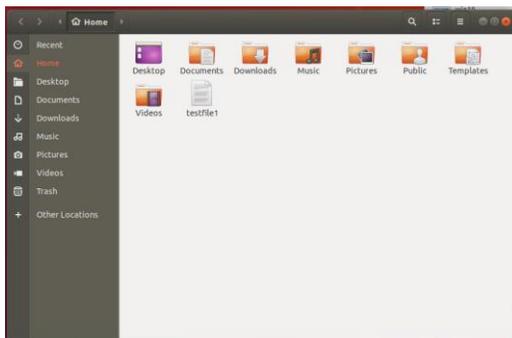
To connect virtual machines together to form a network, we will use OpenVswitch, which is also installed on your computer. OpenVswitch is a software that will simulate a switch (or bridge) that will allow us to form a link between two different machines.

Our guest operating system is Ubuntu 18.04 Linux. Our guest machines will be Kali Linux. We use Kali because it is lightweight, simple, and comes with a number of networking tools pre-installed. To begin, we will need a disk image of Kali known as an ISO (kali-linux-2018.2-amd64.iso). An ISO file is basically a simulation of an optical disk, and can be booted from within your virtual machine. To save time (this file is about 2.7 GB), a copy of the kali ISO is on the server and can be quickly copied to your local file system.

Go to the file manager in Ubuntu

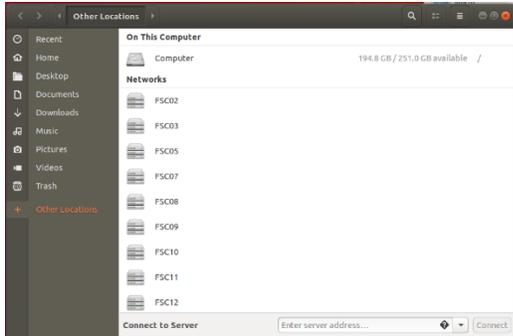


and click on “Other Locations” at the bottom right of the screen

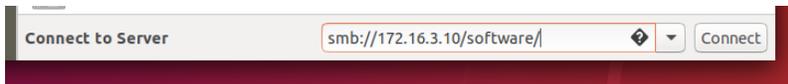


At the bottom of the new screen enter In the field provided:

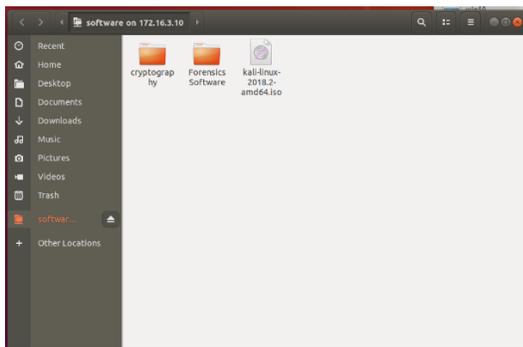
`smb://172.16.3.10/software`



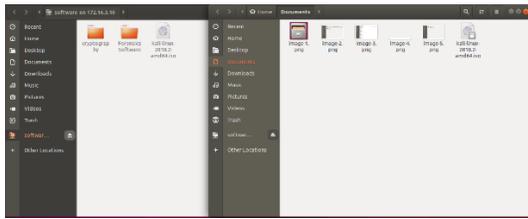
and select “Connect to Server”



When prompted, check the box next to “Registered user”, and enter your credentials. This creates a connection between your machine and the server, and allows you to see files stored there



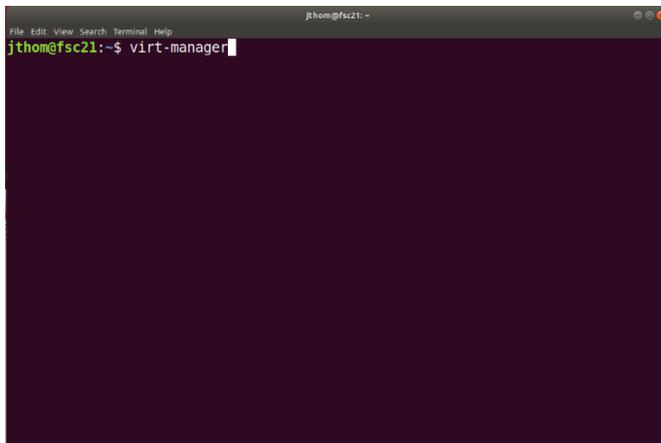
Now right-click on the “Documents” tab in you file browser, and choose “Open in a new window”



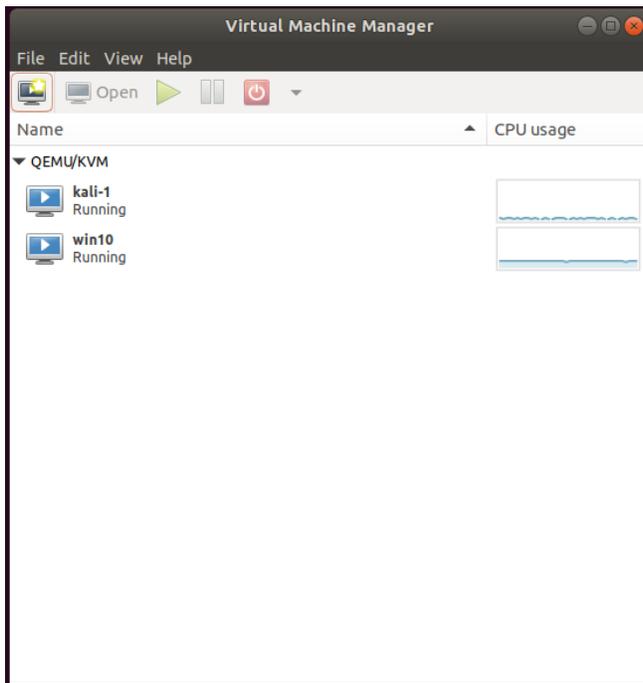
This will open another window with your Documents file open. Click and drag the kali.iso icon from the server to your documents window and copy the kali image to your local file system. You now have a copy of kali to work with, close the windows and continue.

Open a terminal on your host machine by pressing “control-alt-t”. The terminal is a tool that allows you to interact directly with your Linux operating system. In the terminal you will see “yourname@thismachine \$”. The ‘\$’ this is your command prompt, letting you know you are in the terminal and ready to enter commands. For clarity, I will place commands in double quotes, but do not type the double quotes, just the command.

To start the Virtual Machine Manager, enter “virt-manager”



This will open a graphic window for the Virtual Machine Manager that you can interact with

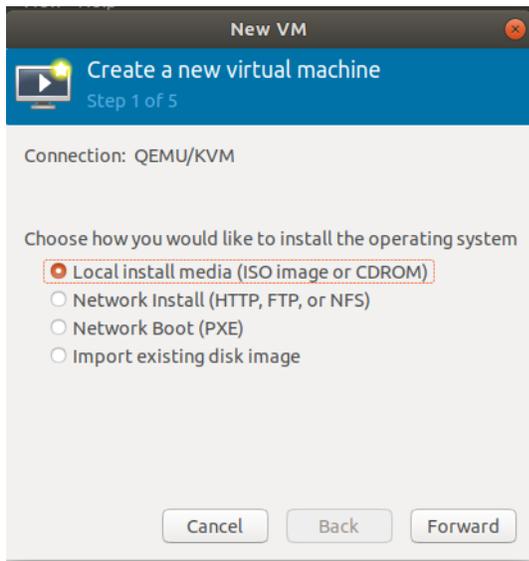


In the upper right-hand corner of the graphic window is a computer icon, click on this to begin creating a new virtual machine

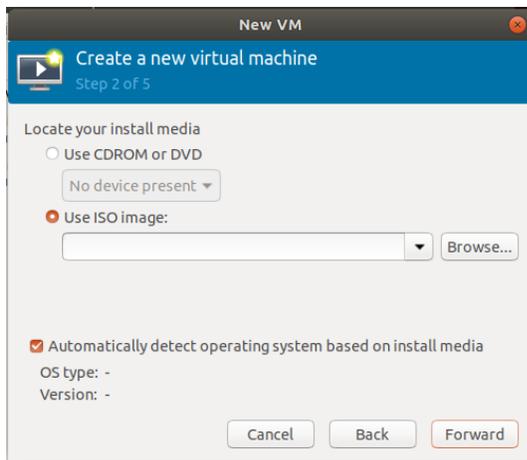


The following steps will guide you through the process of creating your machine. Repeat this three times giving each machine a unique name (Kali-1, Kali-2, Kali-3).

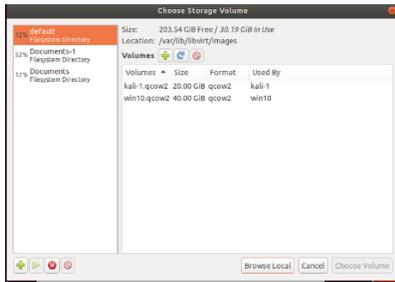
After clicking on the “create a new virtual machine” tab you will see the following window:



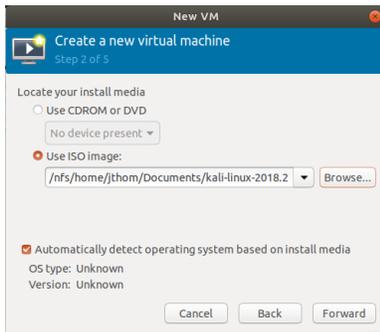
Select “Local install media” (this is the default), and click “forward”



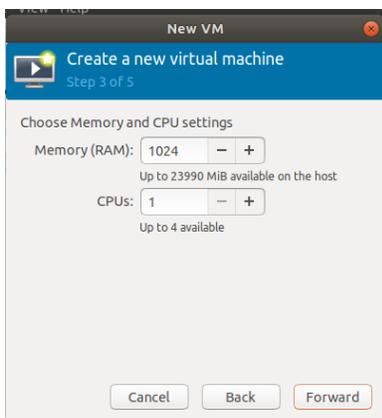
Chose “browse”, then “browse local”



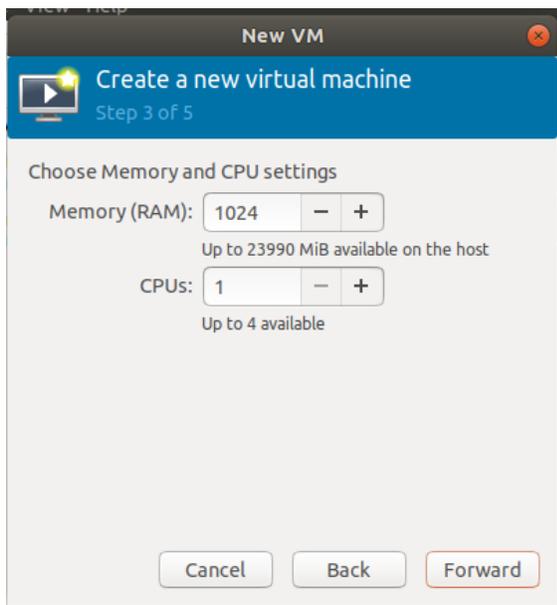
Look in “Documents” and find the kali.iso that you copied from the server in a previous step. Double click on this file and you will be returned to the original screen



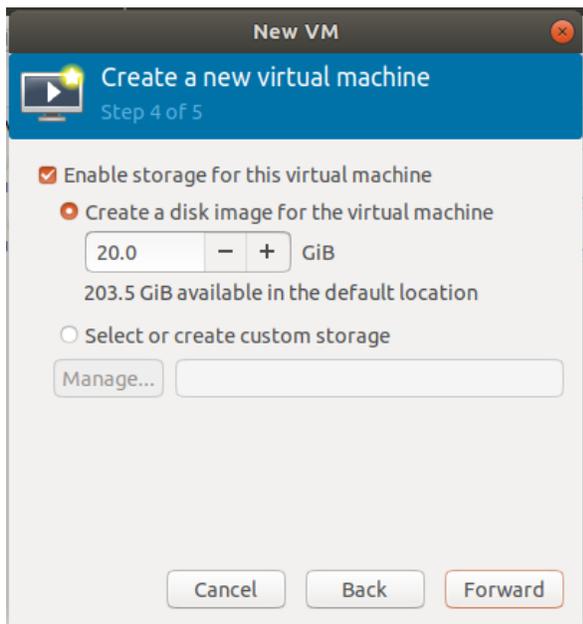
Accept all defaults and click “forward”. This screen will give options for memory size, accept defaults and click “forward”



The next screen will give options for storage disk size, accept defaults and click “forward”



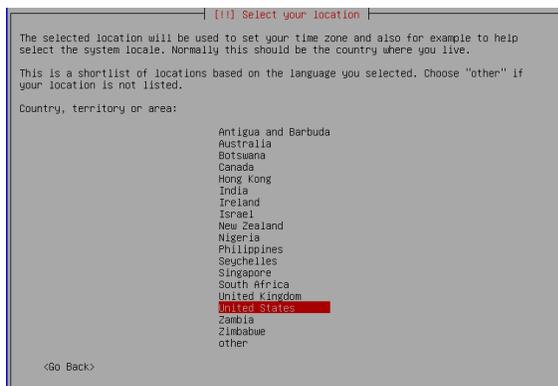
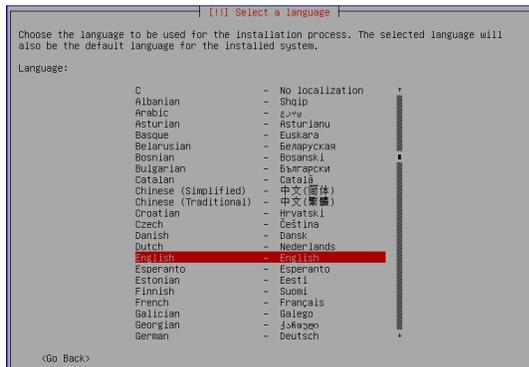
The next screen will allow you to name your machine, so give it an appropriate name (kali-1, kali-2, kali-3), accept the other defaults for now and click “finish”.



In the Kali window that pops up next, scroll down to “install” and click enter.

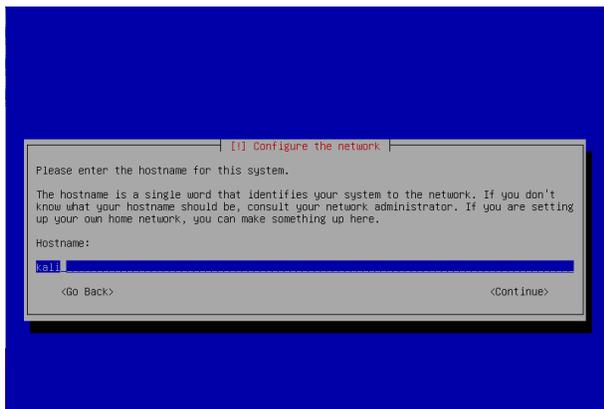


In the next 3 screens accept the defaults and click enter.

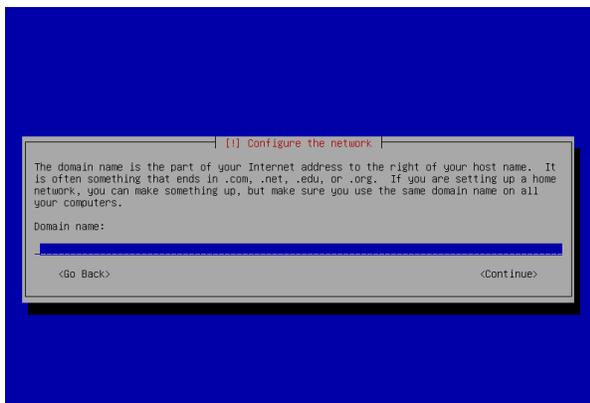




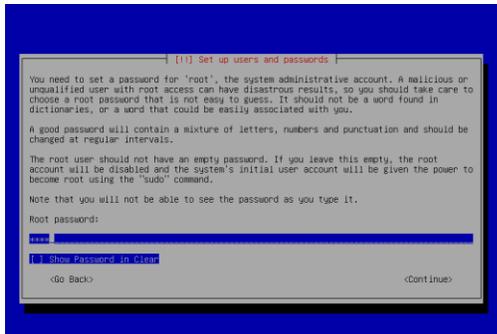
In the next screen you will be prompted for a hostname, accept the default and hit enter



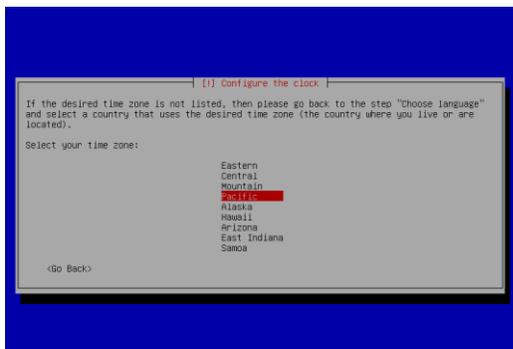
In the next screen you will be prompted for a domain name. Leave this field blank and hit enter



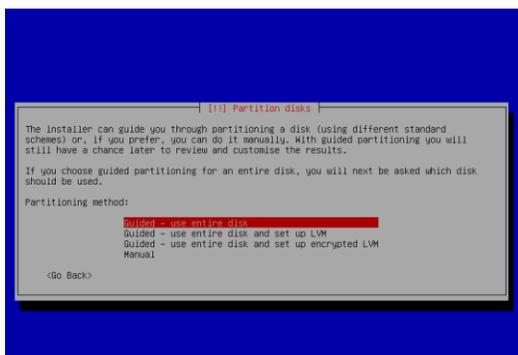
In the next screen you will be prompted for a root password. Enter the password “toor” (that’s ‘root’ spelled backwards) and hit enter



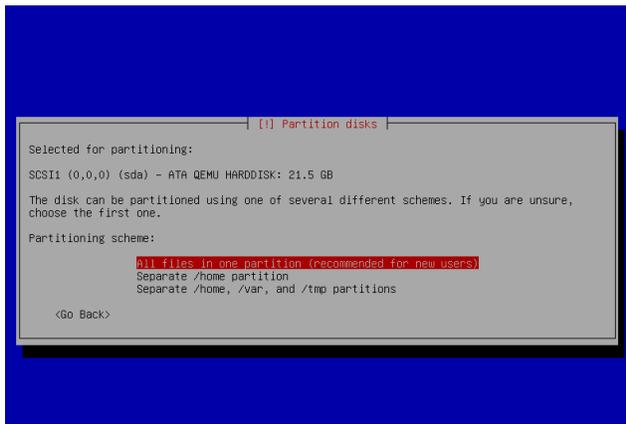
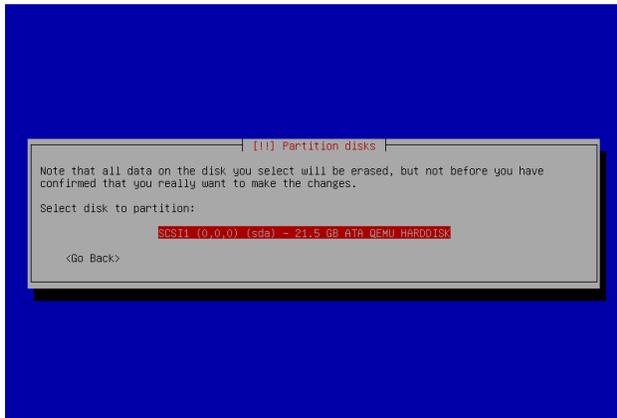
You will then be asked to re-enter this password. The next screen will ask for a time zone, choose ‘pacific’



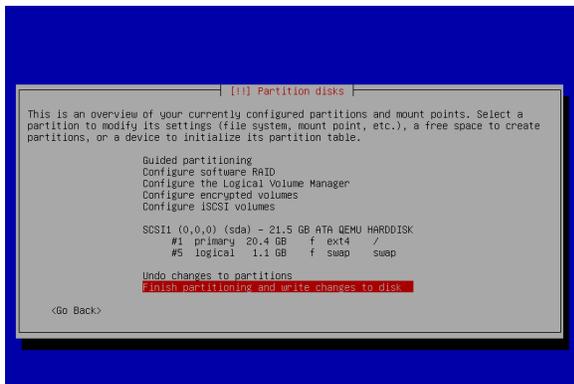
On the next screen, choose “Guided-use entire disk”



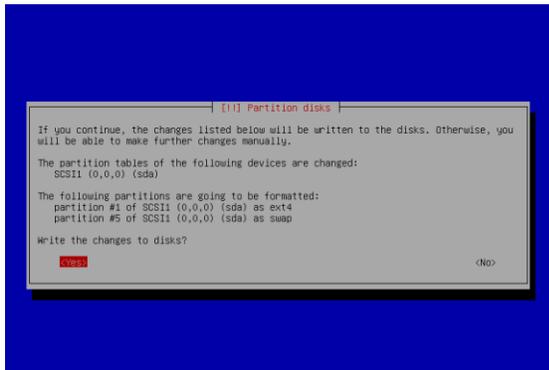
Accept the defaults on the next screens accept the defaults



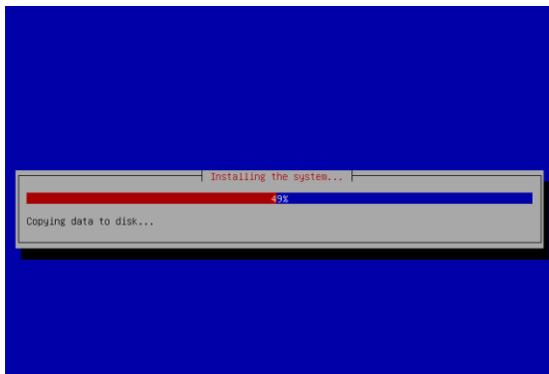
On the next screen accept the default



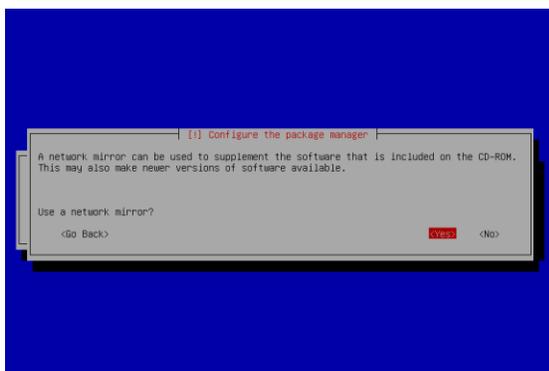
and select 'yes'



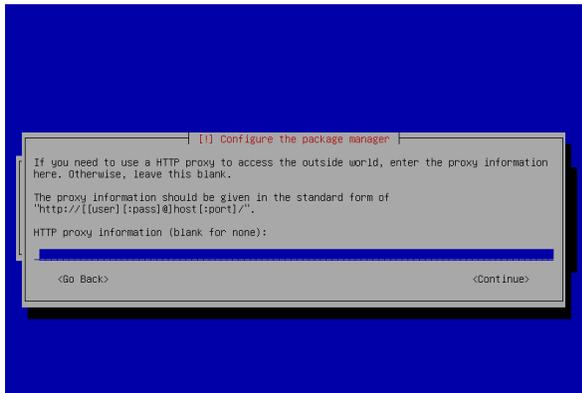
The disk image will now be written to your virtual machine's disk



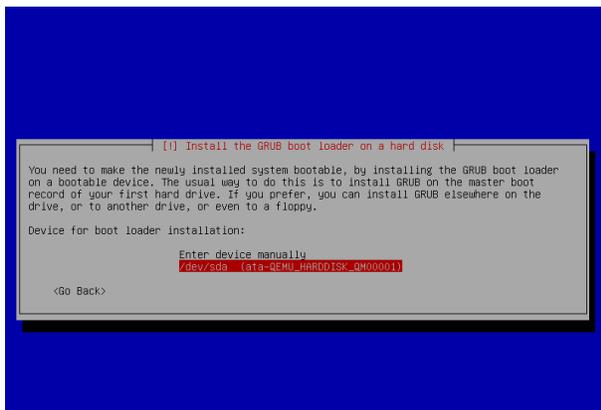
Next you will be asked if you would like to use a network mirror



Select 'yes' and click enter. Accept the defaults on the next screen



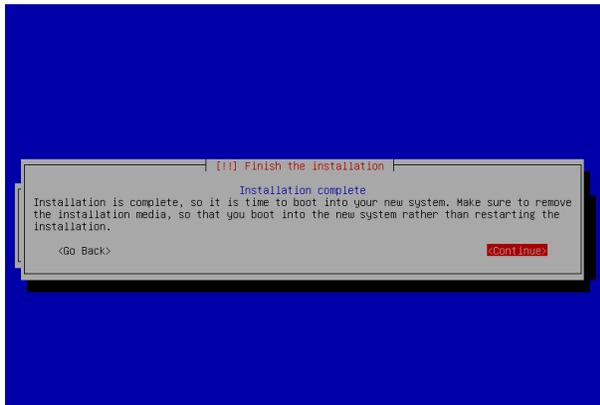
and click enter. Kali will now access a network mirror and update itself as it is being installed. When this is finished, you will be asked if you would like to install the GRUB menu to the master boot record



Choose 'yes' and click enter. In the next screen scroll down to '/dev/sda' and click enter

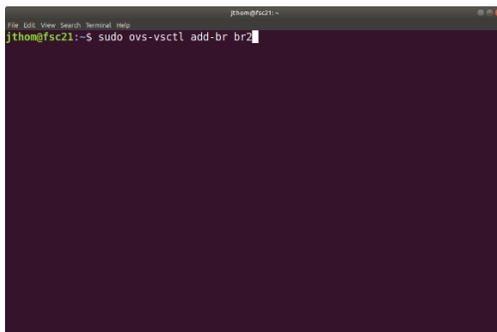
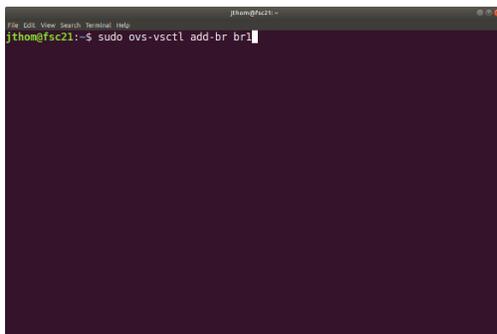
(image-33)

Finally, you will be asked to reboot the system



Select 'continue'. Your kali virtual machine is now up and running. The default network for the machine is 'NAT', which is a translated address from the host. We will be creating our own private network instead, so the following steps will guide you through the process of instantiating two virtual bridges using OpenVswitch.

Open a terminal using "control-alt-t" as you did before, and enter the command "sudo ovs-vsctl add-br br1". The command "sudo" gives you administrative access to the program, "ovs-vsctl" is the precursor to all OpenVswitch commands, "add-br br1" tells the program to create a bridge called 'br1'



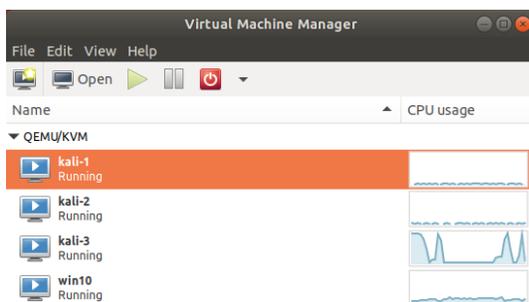
To see a listing of the bridges you created, enter the command “sudo ovs-vsctl show”

```
jthom@fsc21:~$ sudo ovs-vsctl show
a3399f97-ba82-4f92-a054-d8ac2879e278
Bridge "br1"
  Port "br1"
    Interface "br1"
      type: internal
Bridge "br2"
  Port "br2"
    Interface "br2"
      type: internal
ovs version: "2.9.0"
jthom@fsc21:~$
```

and you will see a listing of all virtual bridges in your host.

To connect computers to one another, a network interface card is used. We refer to this device as a NIC. Just as we can add additional NIC's to a physical computer, we can add virtual NIC's to our virtual computers. Think of a NIC as you think of a LAN port on the back of your computer. By default, your kali machines will be created with a single NIC called ens0, which is simply the name given to the NIC so that it can be uniquely identified. For Kali-1 and Kali-3, this is all we need. However, for Kali-2 to be connected to both Kali-1 and Kali-3, it will need 2 NIC's.

In the VMM window (it should still be open, if not, open it with the virt-manager command) select your kali-1 machine



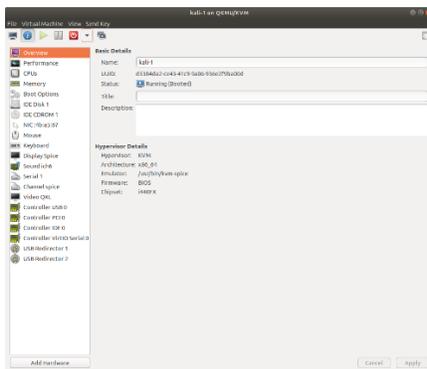
and click on the icon to open the VM



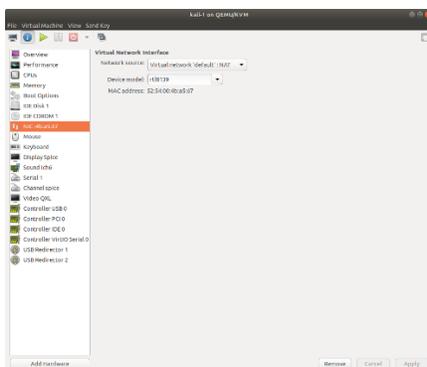
Shut the machine down by selecting the arrow next to the red on-off button



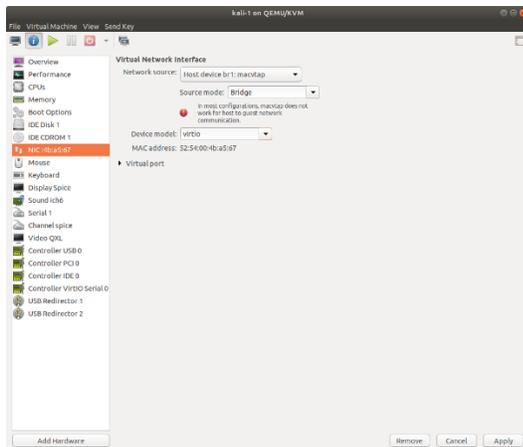
and select “shut down”. Once your machine has shut down, click on the ‘I’ button



and choose the “NIC” tab in the menu



In the network source tab select “Host device br1: macvtap” to choose the bridge we created. In the Source mode tab select “Bridge”, and in the Device model tab choose “virtio”

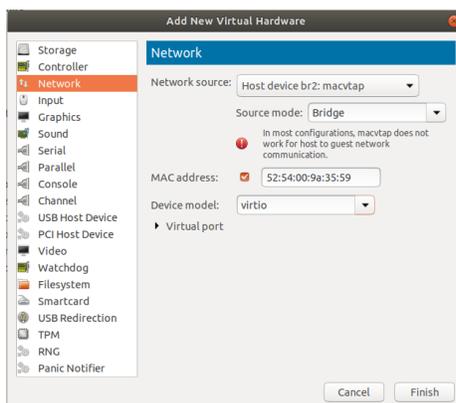


Click “Apply” in the lower right corner, open the machine in the upper left corner, and restart the machine using the arrow icon



Repeat this process for kali-3, except connect it to “br2” instead.

This will allow kali-1 and kali-3 to connect, but for kali-2 (our middle machine), we will need to add an additional NIC. Follow the same steps as above to make changes to networks and bridging, and attach the existing NIC to br1. After this we will add an additional NIC by choosing the tab at the bottom of the menu to “Add Hardware”



We will add a Network device, connect it to br2, select 'Bridge', and 'virtio', then click 'Finish'

We now have a kali-2 machine with two NIC's.

To attach our 3 computers using the 2 virtual bridges we created, follow these instructions:

We now have a small network of 3 computers that are connected by virtual bridges. However, for these computers to communicate with one another, each NIC needs to have an address associated with it so that other computers will know how to reach it. This address is an Internet Protocol, or IP address, which you are already familiar with. All devices on the Internet, or on a network that is intended to interact with the Internet are given an IP address. You can think of an IP address in the same way you think of your home address...if someone wants to send you mail, this address uniquely identifies the place the mail should be sent. There are certain rules which must be followed, just as there are rules for your postal address.

First, for two computers to communicate directly with one another, they must be in the same sub-network (subnet). An IP address is made up of two parts; a network address and a host address. The network address uniquely identifies a network, and a host address uniquely identifies a particular host device (computer) on that network. We use Classless Inter Domain Routing (CIDR) notation as a method for allocating IP addresses to networks and hosts on the Internet. There are certain IP ranges that are designated as private, and are used for networks that are not a part of the public Internet. In other words, these addresses will only appear on private networks, and cannot be exchanged by routers on the public Internet. CIDR notation works like this:

To give the NIC's on our small network their own unique addresses, we will use a tool called "ifconfig". If you open a terminal on your host machine and enter the command "ifconfig", you will get a listing of all interfaces on your machine, along with their specific identifiers (MAC addresses), and any IP addresses that have been assigned to them. We can also use ifconfig to temporarily assign an address to a particular NIC. To permanently assign an address to a NIC that will persist between re-boots, a file found at "/etc/network/interfaces" must be edited with the appropriate information. For now, this temporary method will meet our needs.

Let's start with kali-2. Enter "ifconfig" and you will see that there are two NIC's; eth0 and eth1. As in the drawing on the whiteboard, we will set eth0 to the address 192.168.1.1 and eth1 to the address 10.0.1.1. This is done by entering the command "ifconfig eth0 192.168.1.1" and "ifconfig eth1 10.0.1.1". We can now move to kali-1 and kali-3, and follow these steps again to set eth0 on kali-1 to 192.168.1.10 and eth0 on kali-3 to 10.0.1.10. If you enter the command "ifconfig" again, you can verify these interfaces have been properly set.

