Virtualization Assignment #1 - Virtualization Concepts
Explain Virtualization in your own words, distinguish the different types and state their purposes.

Virtualization can be described as the technology that facilitates the ability to have multiple computer systems inside one computer. The goal of virtualization is to be able to launch different dedicated computer resources from one computer system. It is like having a huge car garage and, instead of using the entire garage for just one brand of car, you divide it into sections. Each section holds different brands of cars and you can access and utilize each section of the garage without one section hindering you from being able to access and use other sections. In summary, virtualization refers to the technology that makes the running of multiple independent computer operations from one device possible, all while providing scalability and security.

Type 1 Hypervisors are host-based. They run directly on the physical hardware. Thus, they have direct access to the device, which makes them faster and more efficient. Here, there is no need for a middleman. As a result they are mostly common in business settings where system performance and resource optimization are priorities. An example is Hyper-V.

Type 2 Hypervisors, on the other hand, need an operating system to run. Hence, the presence of an additional layer between the device and the virtual machine (VM). Here, the hypervisor functions similarly to other applications on the host device, which makes it somewhat easier to install compared to the Type 1 Hypervisor, and more user-friendly. An example is Oracle VirtualBox.

Containers run on the same level as the operating system. They have everything an app requires to run efficiently. Because they share the same OS as the host device, they require lesser resources to function compared to VMs. Despite sharing OS with other apps on the device, a container is always isolated from them. An example is Docker.

Due to their high efficiency, Type 1 Hypervisors are used in large-scale enterprise environments. Type 2 Hypervisors are typically used in testing environments, while containers are common in microservices architecture and scalable applications.

Virtualization Assignment #2 - Virtualization Concepts

Resource Allocation: this entails giving each VM the right amount of resources to ensure it functions just right. This prevents it from running slow or crashing due to CPU overload. This also ensures that other vms are well taken care too resource-wise.

Isolation: like the name implies, this is ensuring that each VM is absolutely independent. Whatever is going on with VM1 should not in any way be able to affect or alter the operations of VM2, regardless of the fact that they are both running on the same device.

Snapshotting: this is like taking pictures to preserve memories. Snapshots capture VMs usually in a good operational state. Should the VM fail due to a system upgrade or misconfigurations, the VM can be returned to a previous operational state captured and preserved by the snapshotting feature. It is like saving your progress in the middle of a game so you can restart from that point when need be, rather than starting all over from the beginning. This feature saves time and resources.

Live Migration: this feature helps to move a running VM among servers without interrupting their operations. It is just like driving a car from one state to another. Even though you are changing location, the car still works the same and the engines keep running uninterrupted.

Cloning: this is like making a photocopy of a document in order to be able to submit the same document to two different entities. In a way it is similar to snapshotting as it can also be used as backup. They are frequently used in test environments.

Virtualization Assignment #3 - Virtualization Concepts

Golden Image: this can be simply explained to be a template that serves as the standard for other VMs. A golden image is like a car prototype created by a manufacturing team. Just like how the prototype serves as a blueprint for mass production, a golden image contains a well configured template of a VM that helps to speed up the deployment of VMs.

To create a golden image, a VM is set up, configured appropriately, and adequately equipped to perform the intended task. After this is done, a clone is made to provide a benchmark for how other VMs performing similar functions should be configured to ensure optimal functionality and security. It is a blueprint for VM set up. Adhering to or using a golden image saves time and resources and ensures that all VMs are configured alike.

Virtualization Assignment #4 - Virtualization Concepts

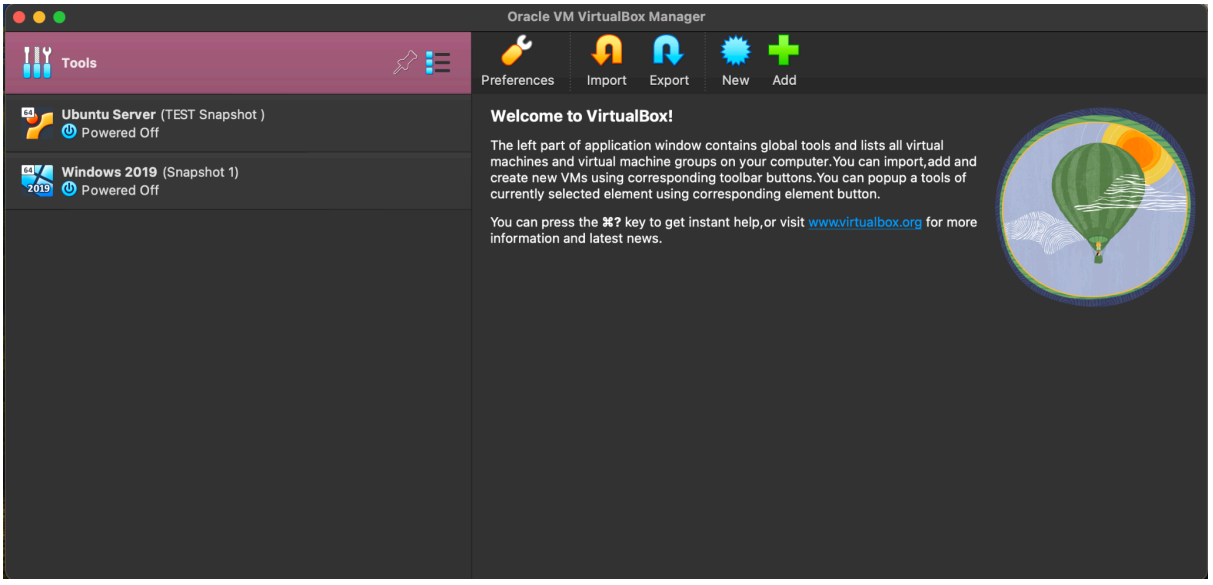
ISO File: this is a file that carries everything needed to install and run a software or operating system on a computer. It is like the traditional CDs and DVDs carrying software that can be copied to, installed and run on a computer. An ISO file can be described as the digital version of those Software CDs. They can be downloaded over the internet and installed on a computer. The virtual nature of ISO files makes software easily available, and speeds up the installation process.

ISO files can also be used as backups for CDs or DVDs. When virtualization is concerned, ISOs can be used to boot VMs or download and install software on them.

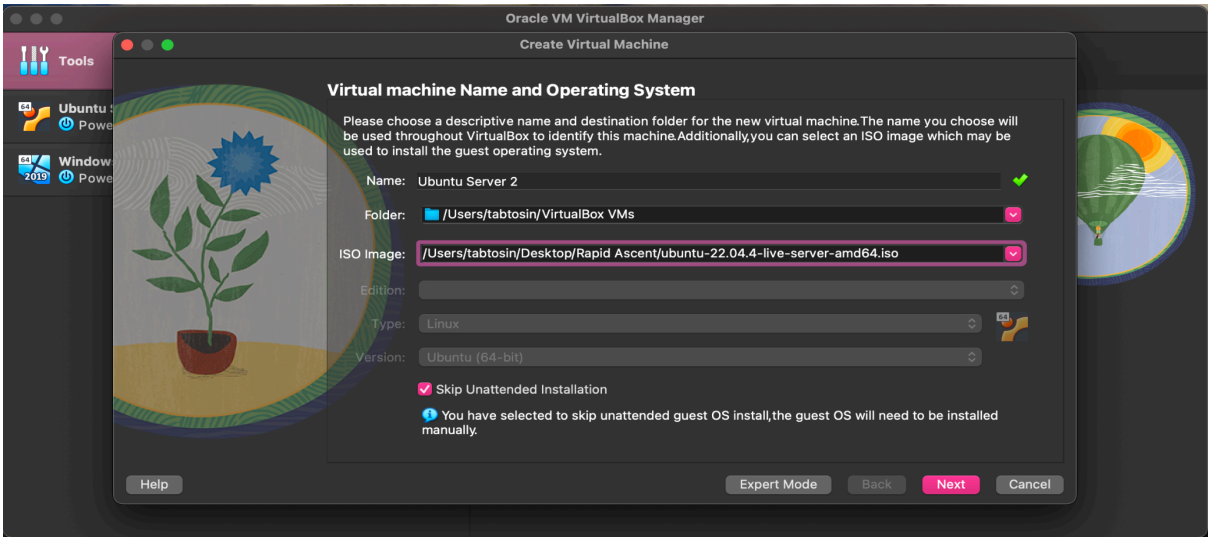
Virtualization Assignment #5 - Live Class Exercise
The Linux Installation process

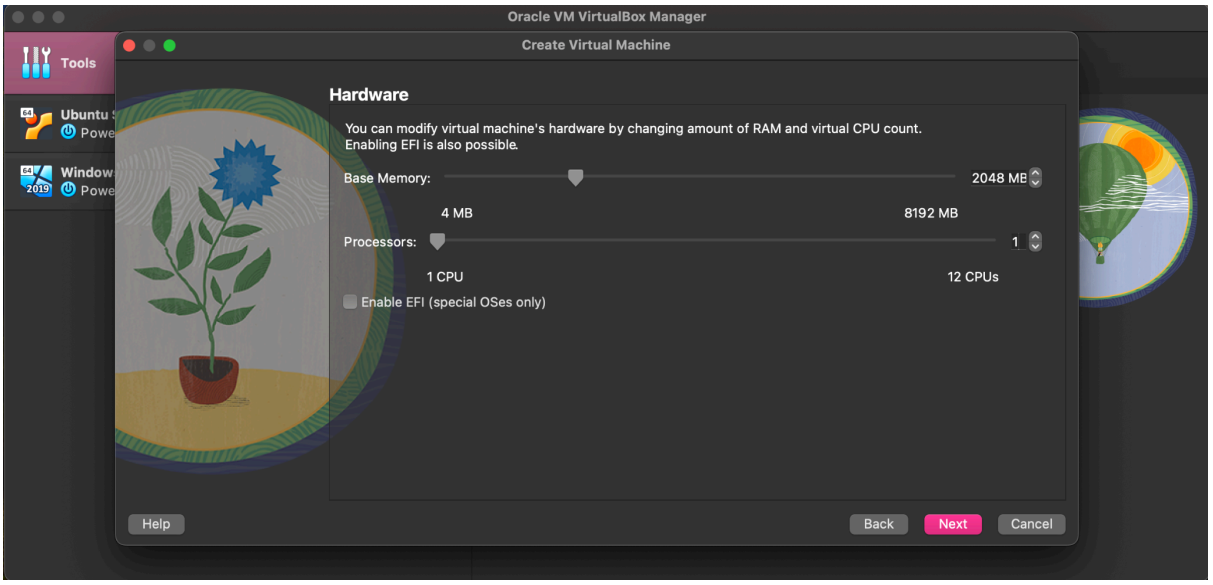
For this demonstration, I'll be using the VirtualBox to install a Linux Server.

The picture below shows the home page of the VirtualBox app. To install a new Linux server, you click on the "new" icon at the top-middle of the screen.

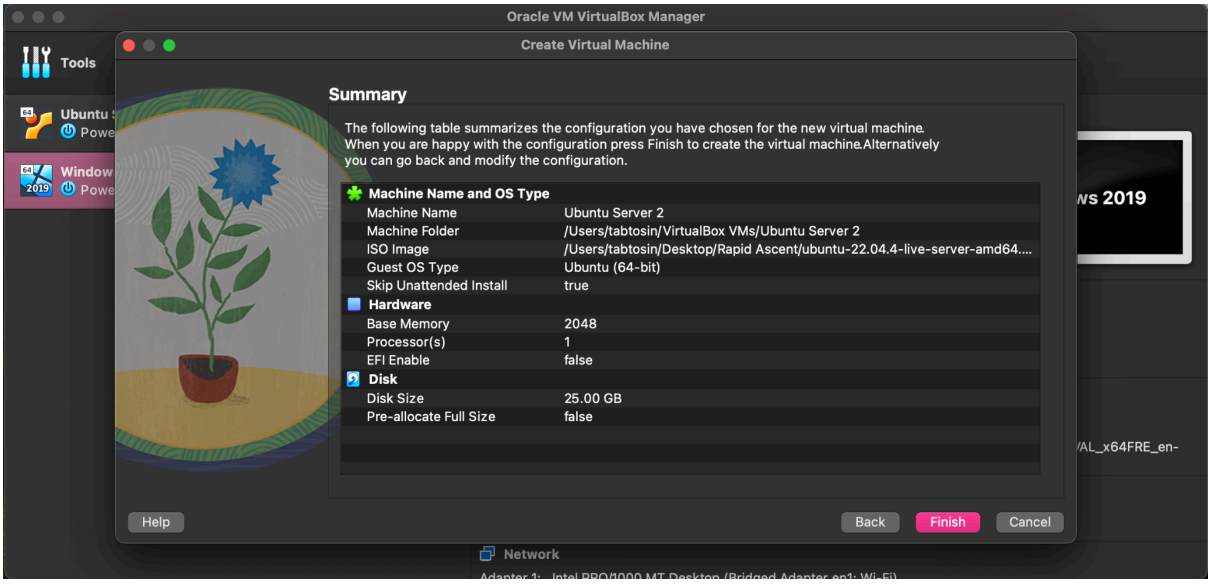


After clicking on the "new" icon the page depicted in the picture below pops up. On this page, you can name your server and choose the ISO image carrying the required files and configurations to set up your server. After selecting the appropriate ISO file, the 'type' and 'version' field auto-populates themselves. Also, the "skip unintended installation" box should be checked. This avoids the installation of unnecessary or unwanted software packages. When all of these are done, click "next".

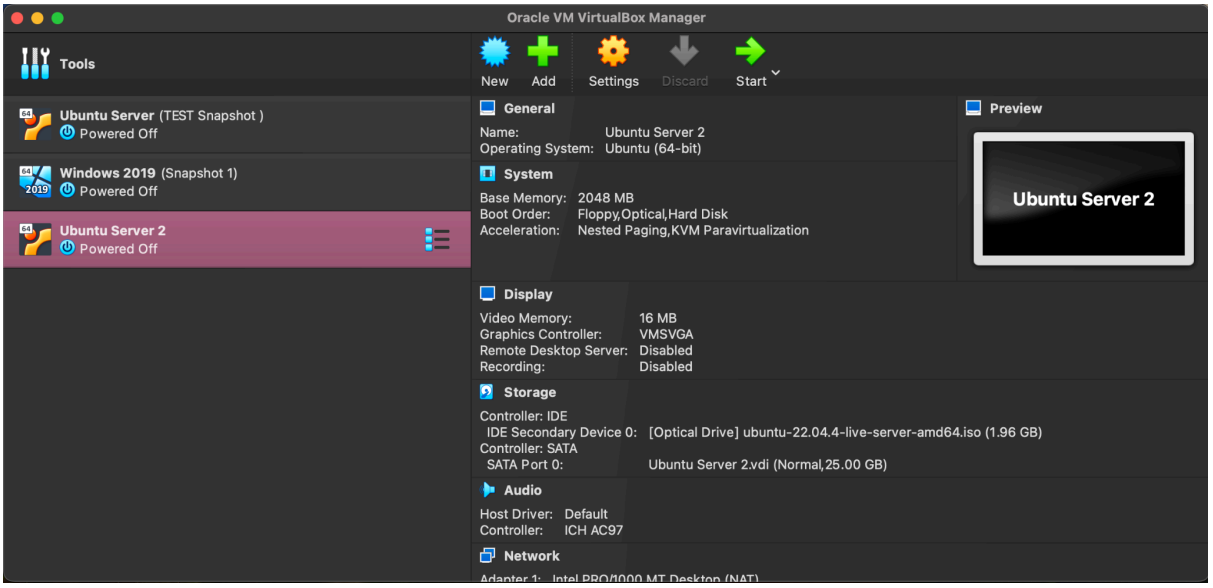




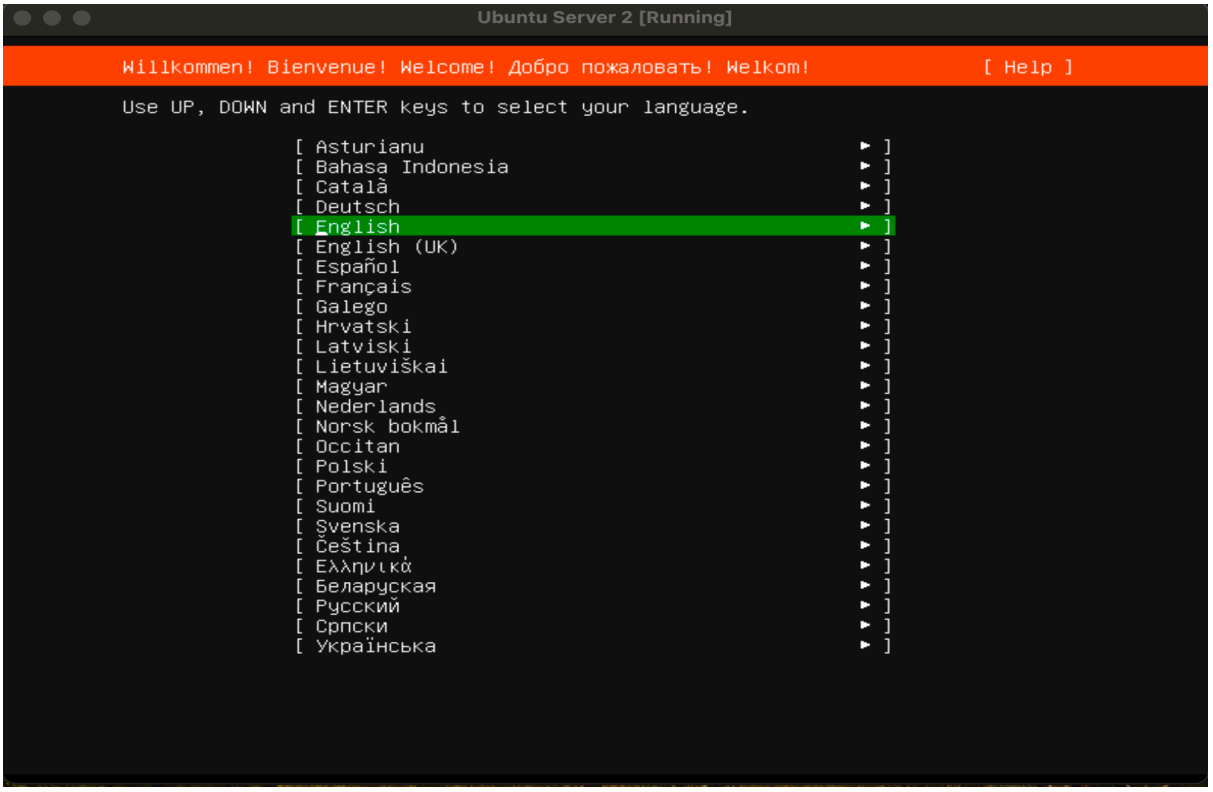
After clicking “next”, the hardware page pops up. Here space can be allocated to the VM based on available resources and the need of the VM. One has to be careful not to crash the host system by allocating too much space to the VM. At the same time, not allocating adequate space can cause the VM to run very slowly. Therefore, it is imperative that one finds a sweet spot to ensure availability and speed. When this sweet spot is decided, click the “next” option.



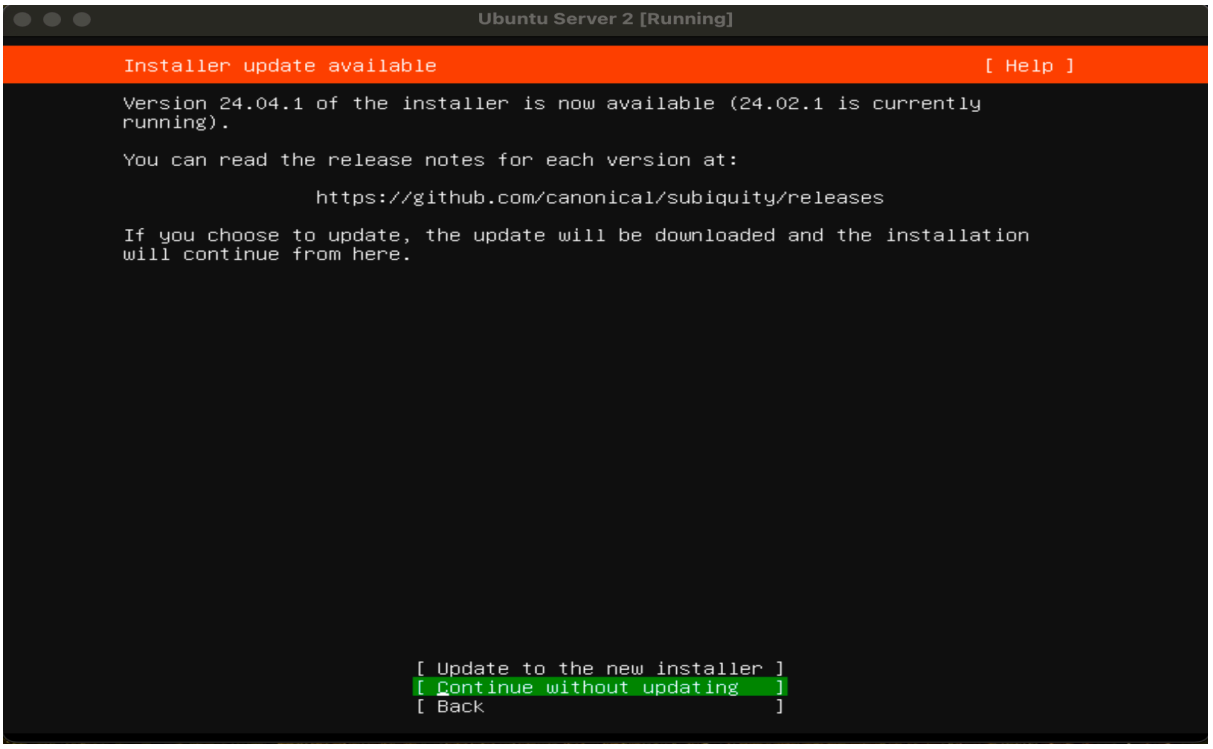
The next page is a summary page that carries all the information pertaining to the installation of the Linux server thus far. View the picture above for reference.
After looking over the details of the summary page, click the “finish” option.



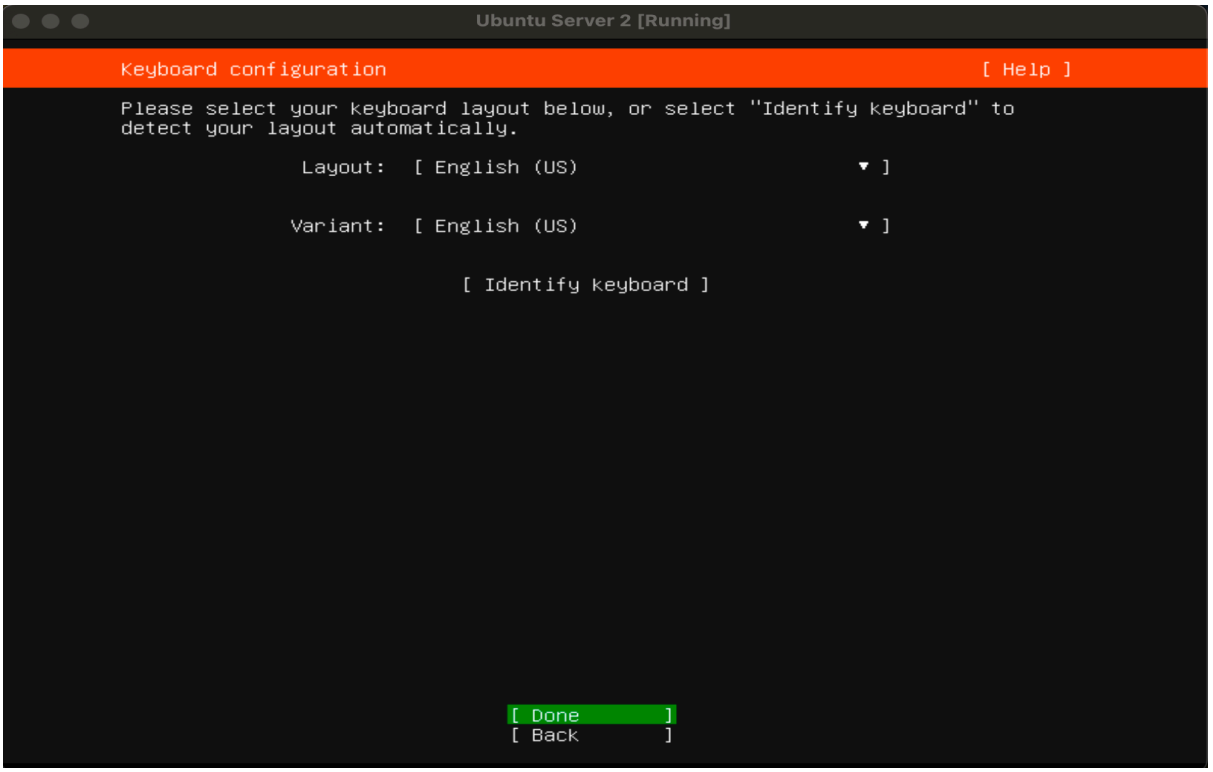
Now that that is done, the server is ready to be run. Click the “start” icon to launch the server. It is worthy of note that once the server launch begins, the mouse becomes useless as far as the server interface is concerned. Use the direction keys and the ‘tab’ button to navigate through and the ‘return’ key to select options.



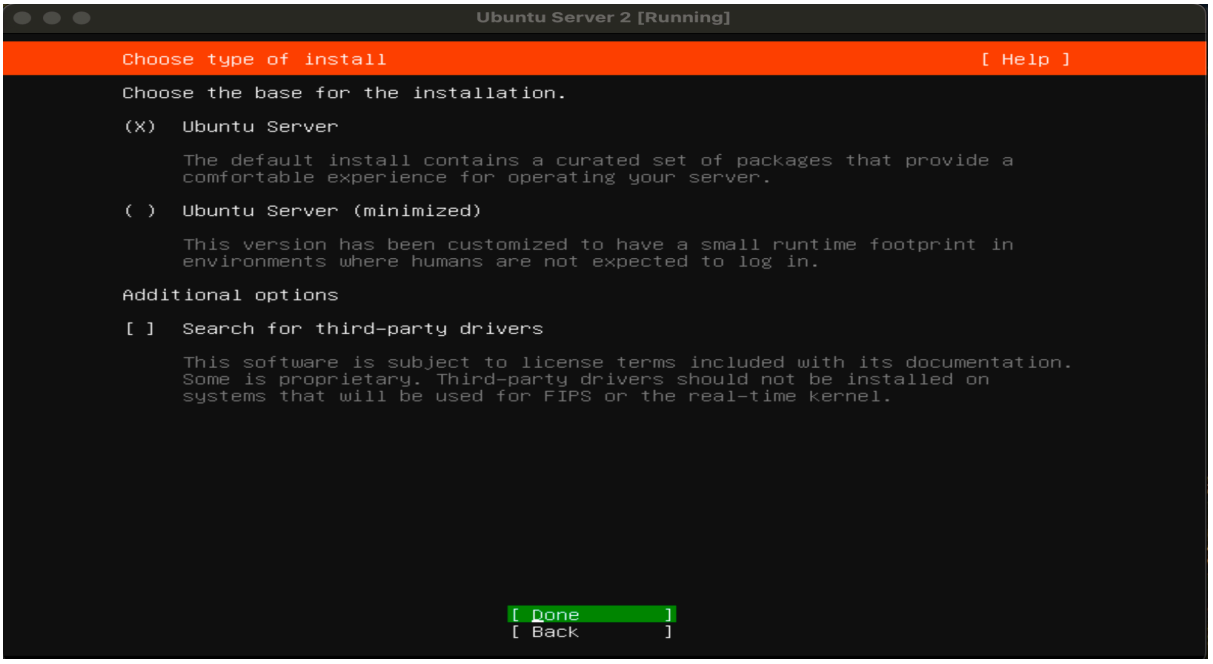
Select your desired language.



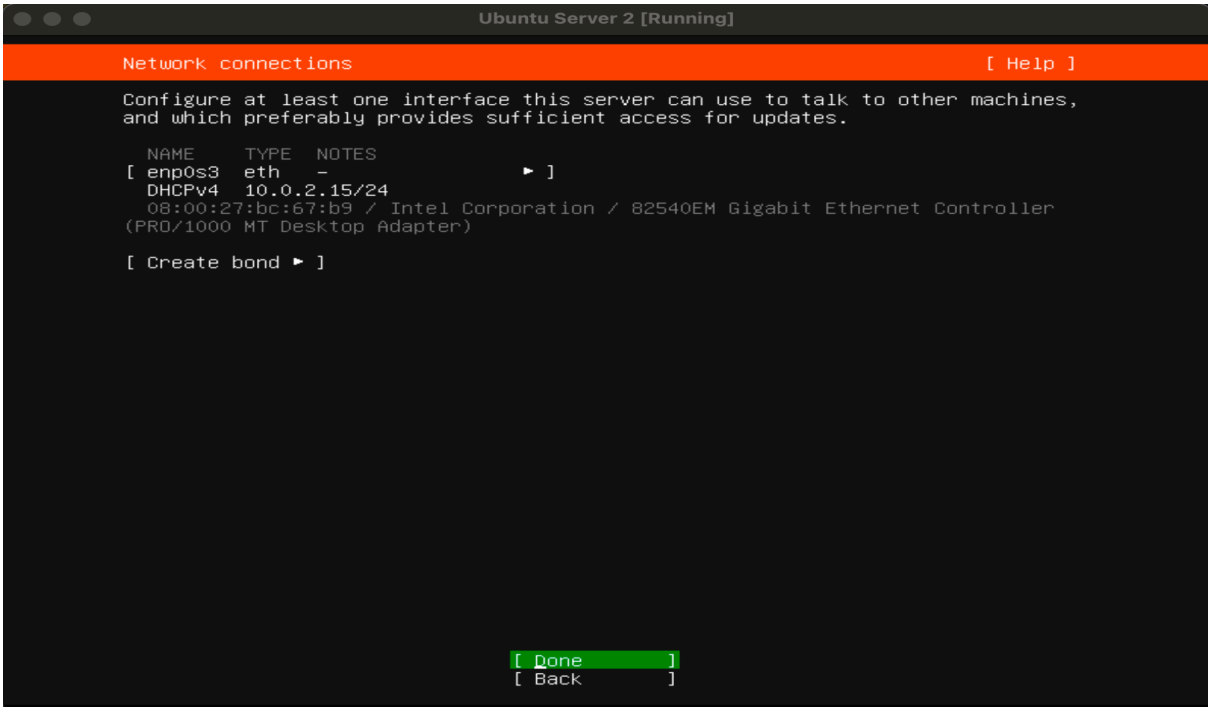
Click on “continue without updating”. Selecting this option will skip downloading the new version of the installer. This helps to save time and the installer download can be done at a later time.



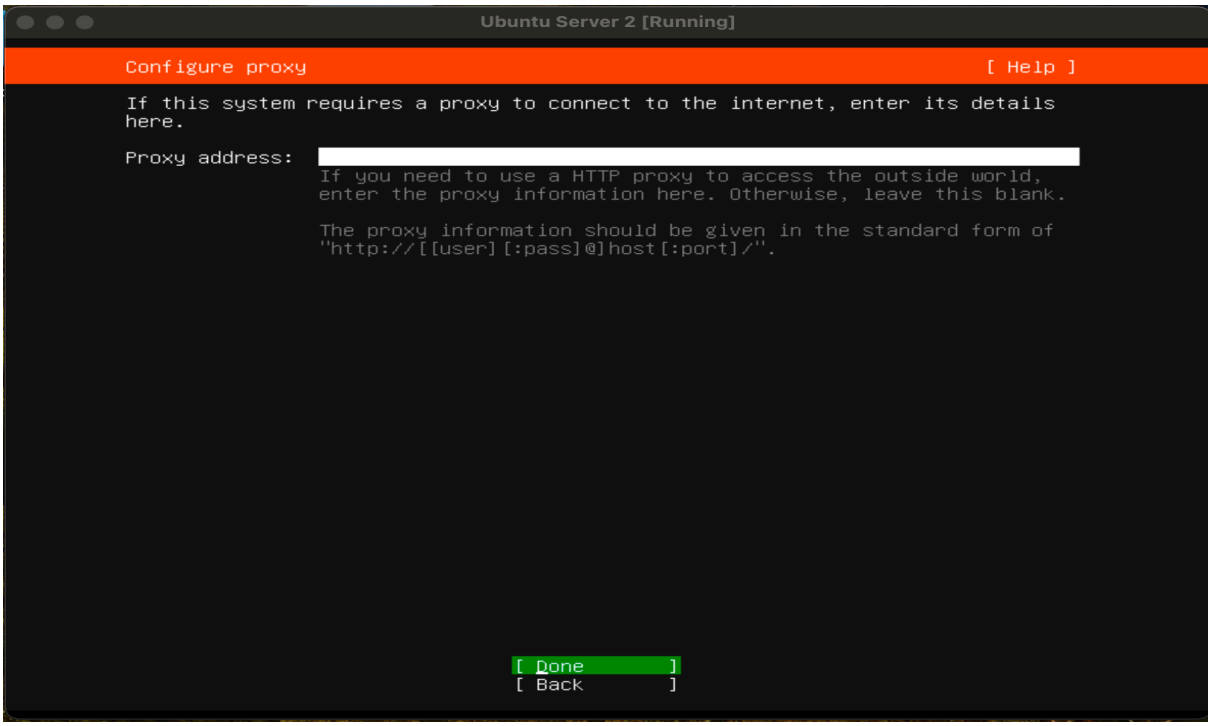
Click ‘done’ to confirm your Keyboard Configuration.



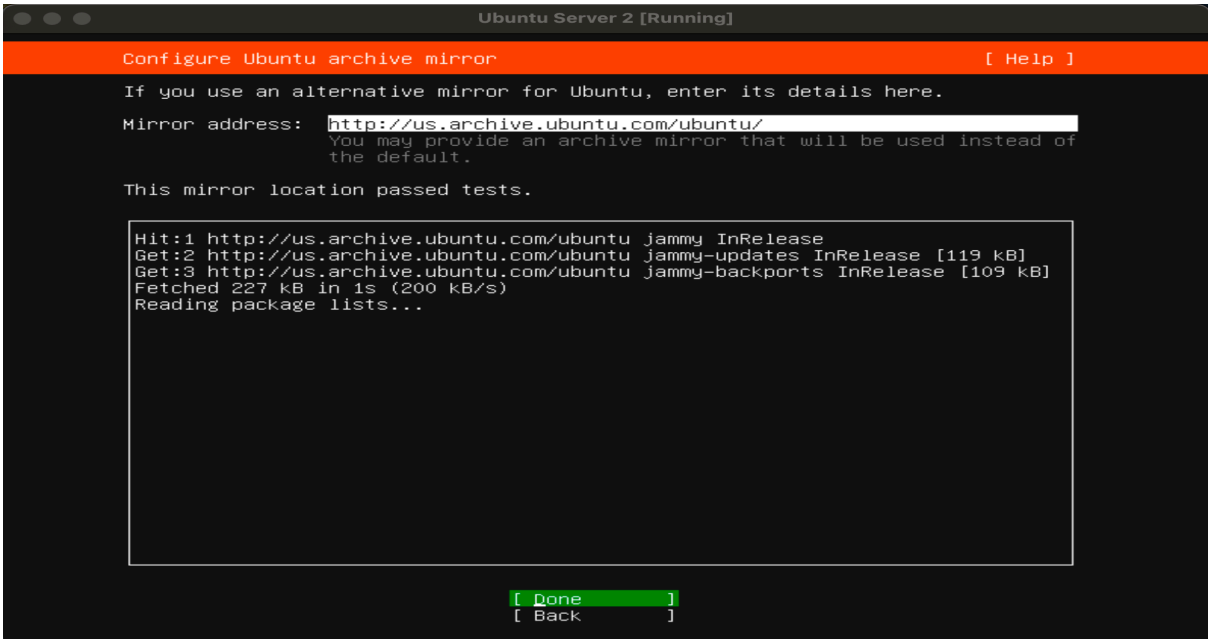
Leave the Ubuntu Server option checked (use the spacebar to select options) and select done.



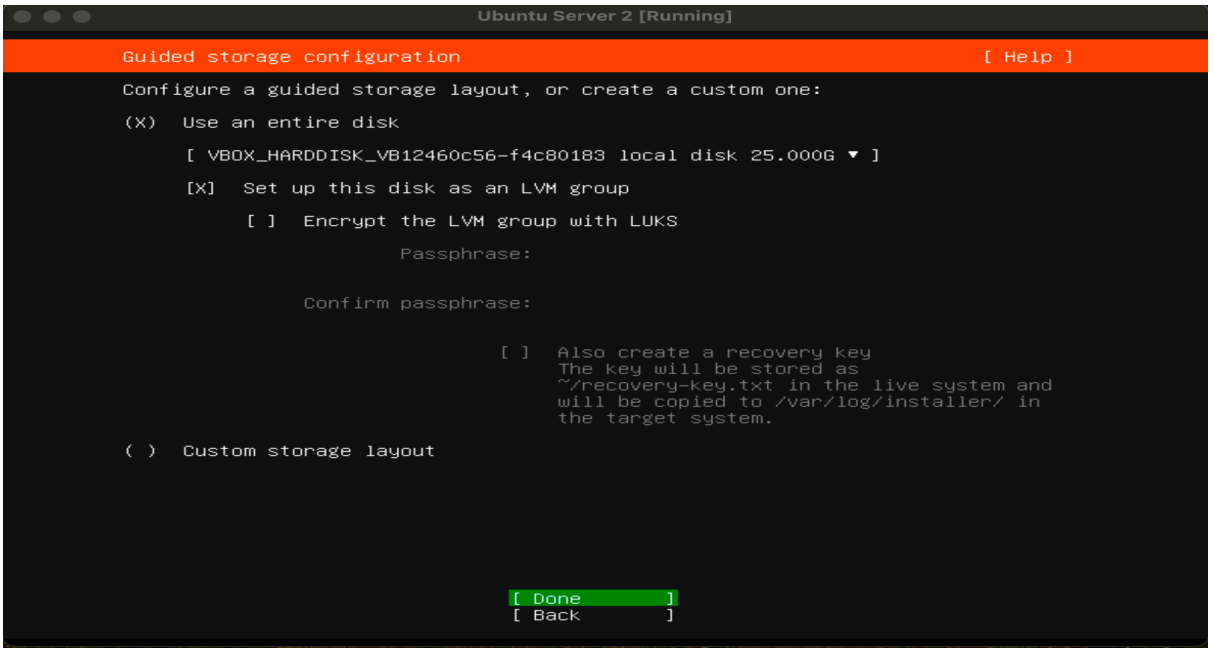
This page shows the Network Connection interface. Select ‘done’ to proceed to the next page.



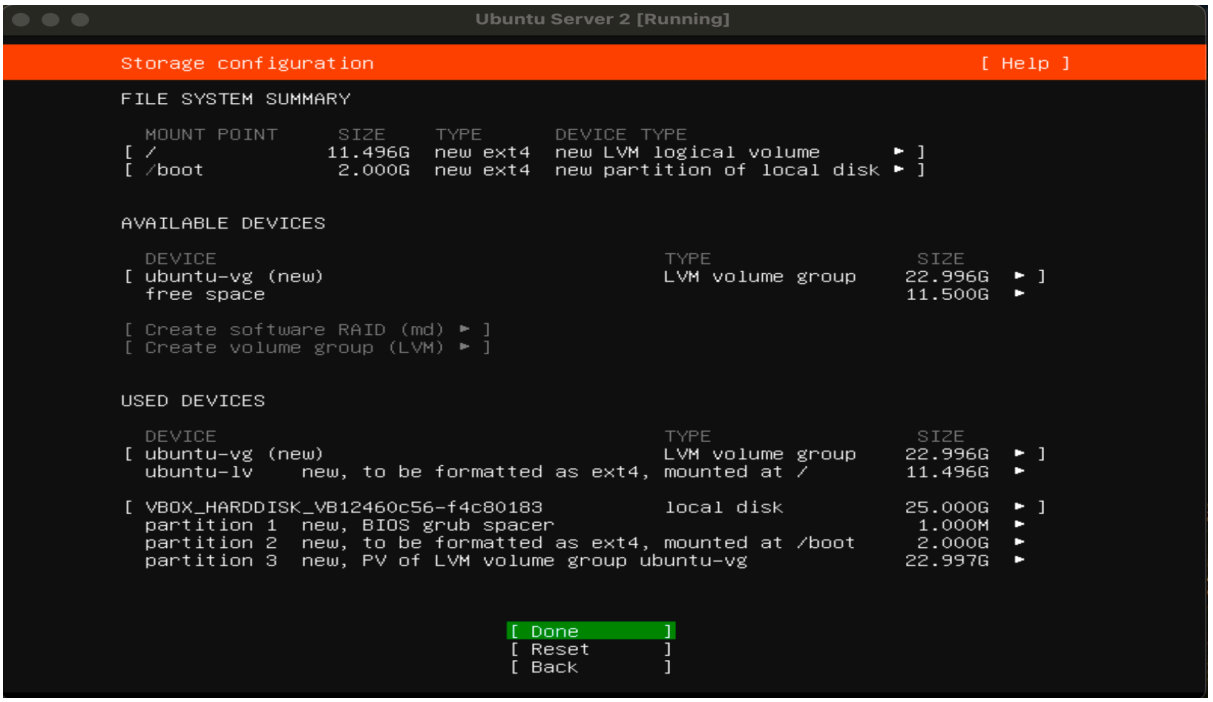
The next page asks for a proxy address if one is needed to access external networks. For the purpose of this demonstration, we do not need to access external networks so the proxy address tab will be left blank, and the done option will be selected.



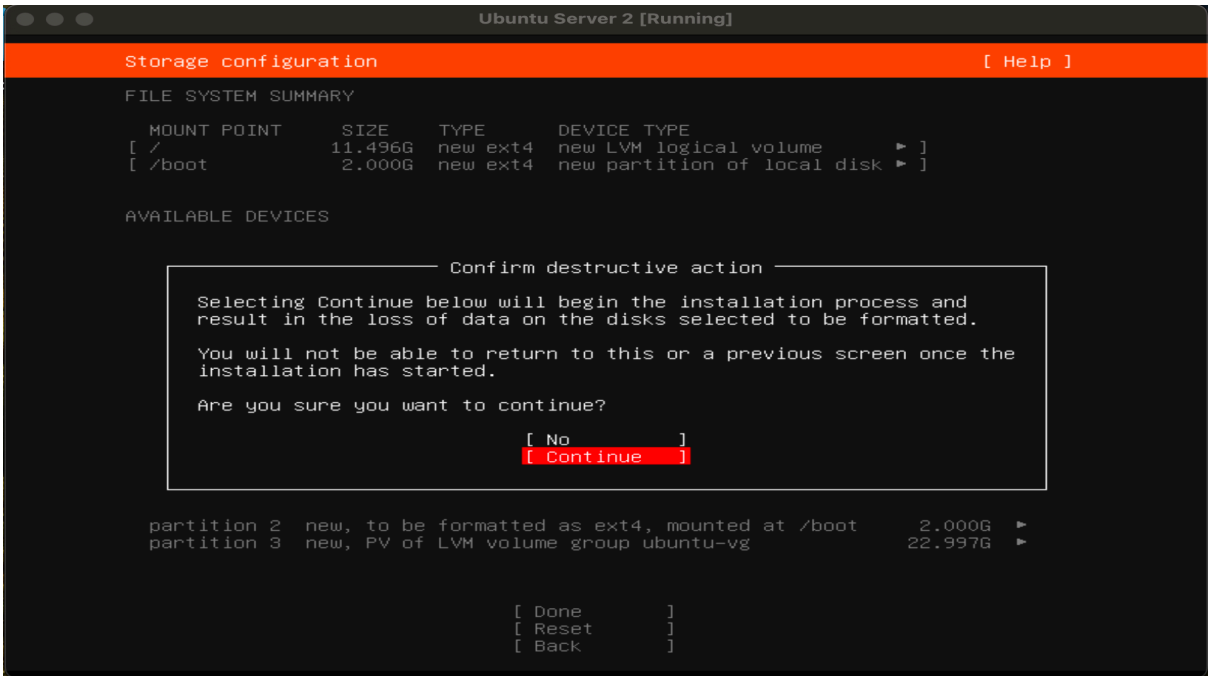
The above page shows the Ubuntu archive mirror. The Mirror address self-populates. Wait for the mirror location test to conclude before selecting the done option.



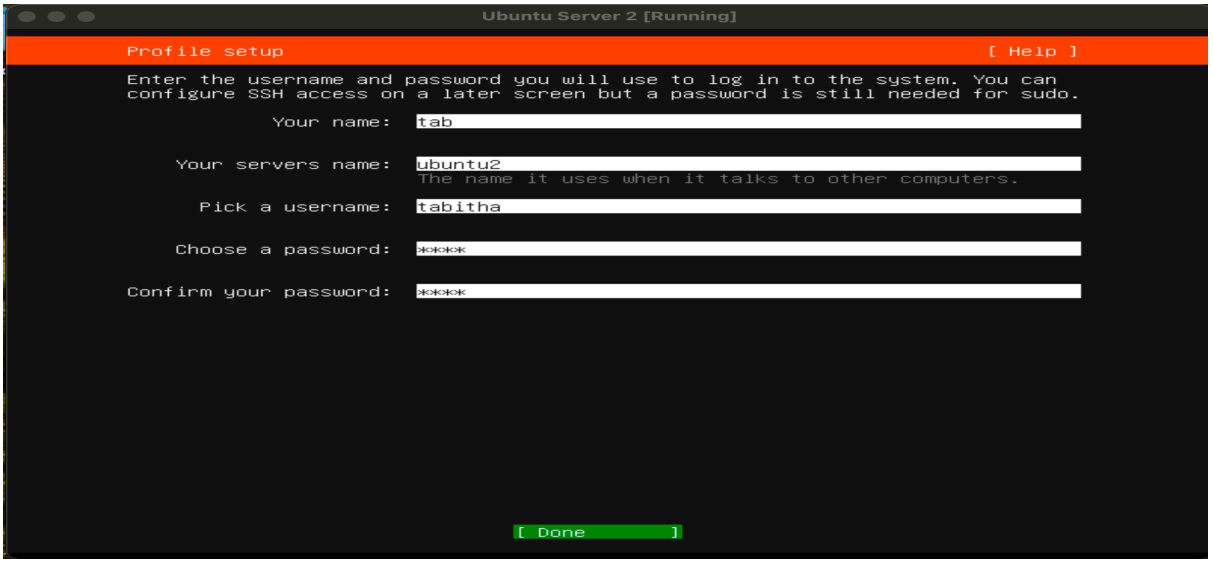
This page highlights the Guided Storage configuration, specifying what storage will be used. VirtualBox has an inbuilt harddisk that will be utilized by this server. Setting up a disk as an LVM (Logical Volume Manager) group means configuring the disk to be managed by the LVM system on Linux. This allows for flexible disk space management.



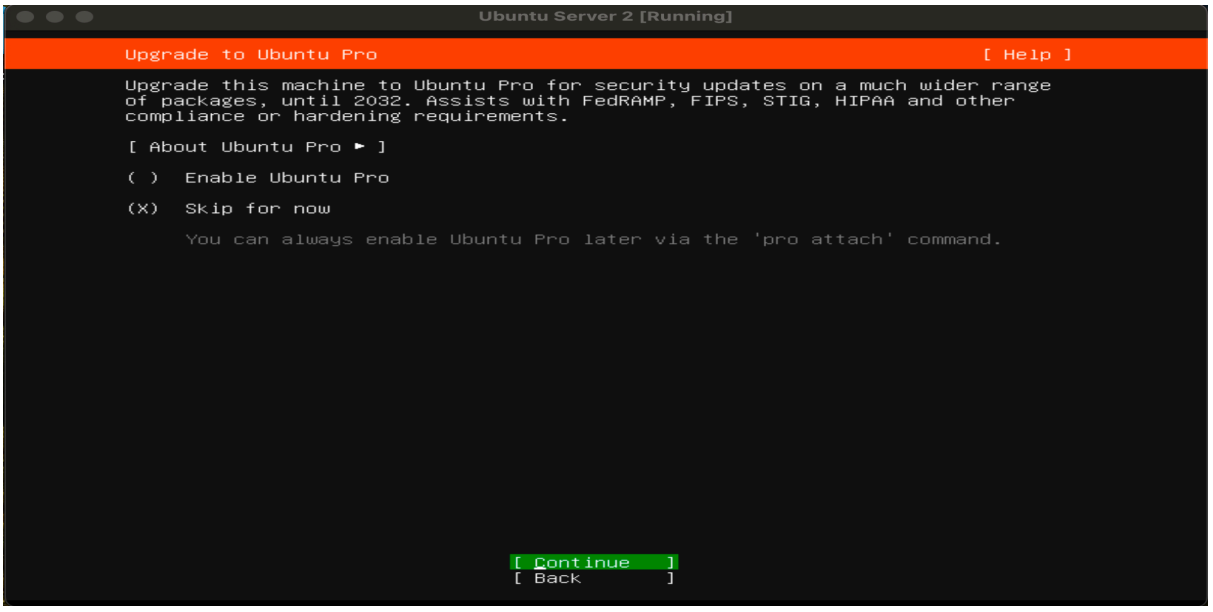
The next page shows the storage configuration page containing the file system summary, available, and used devices. Select the ‘done’ option to proceed.



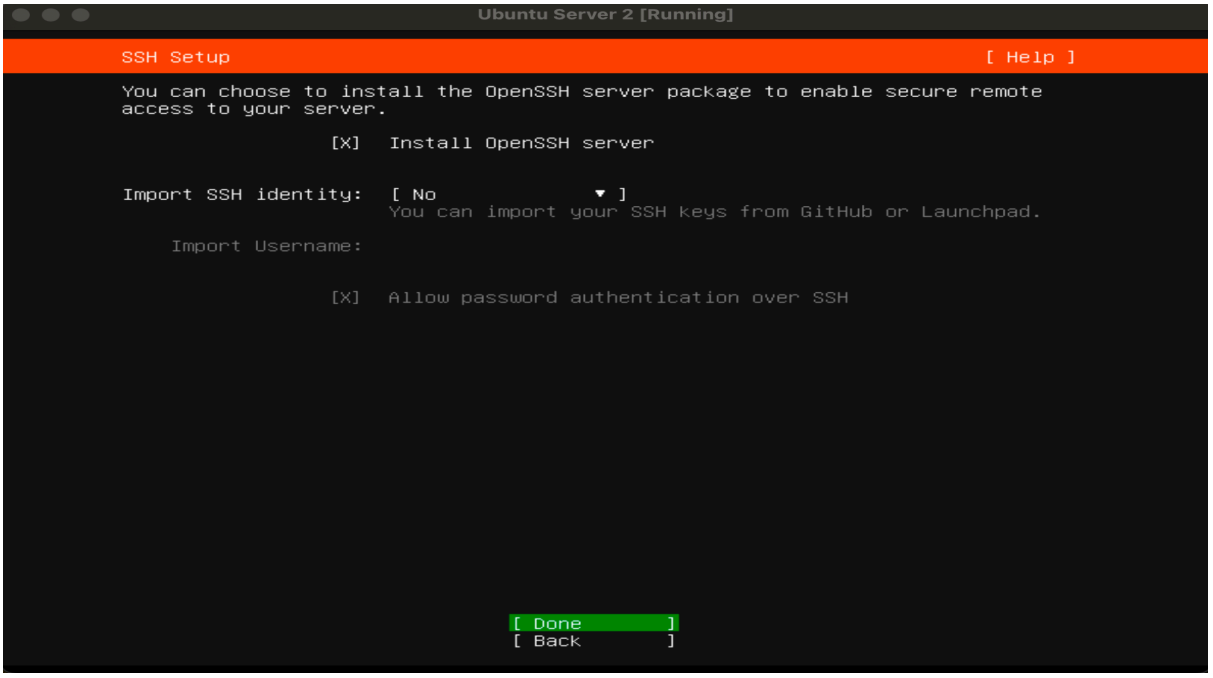
Confirming destructive action only authorizes the server to format the disk on which the configuration settings will be stored. Select ‘continue’.



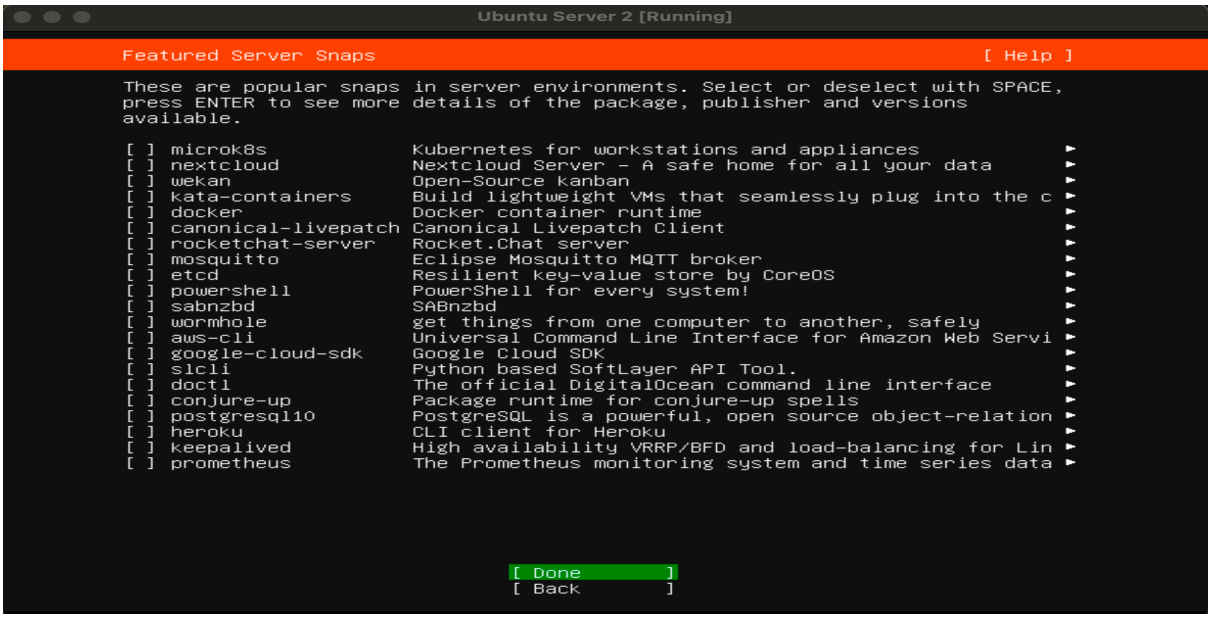
The next page is the profile set up. Fill it out appropriately and select the ‘done’ option.



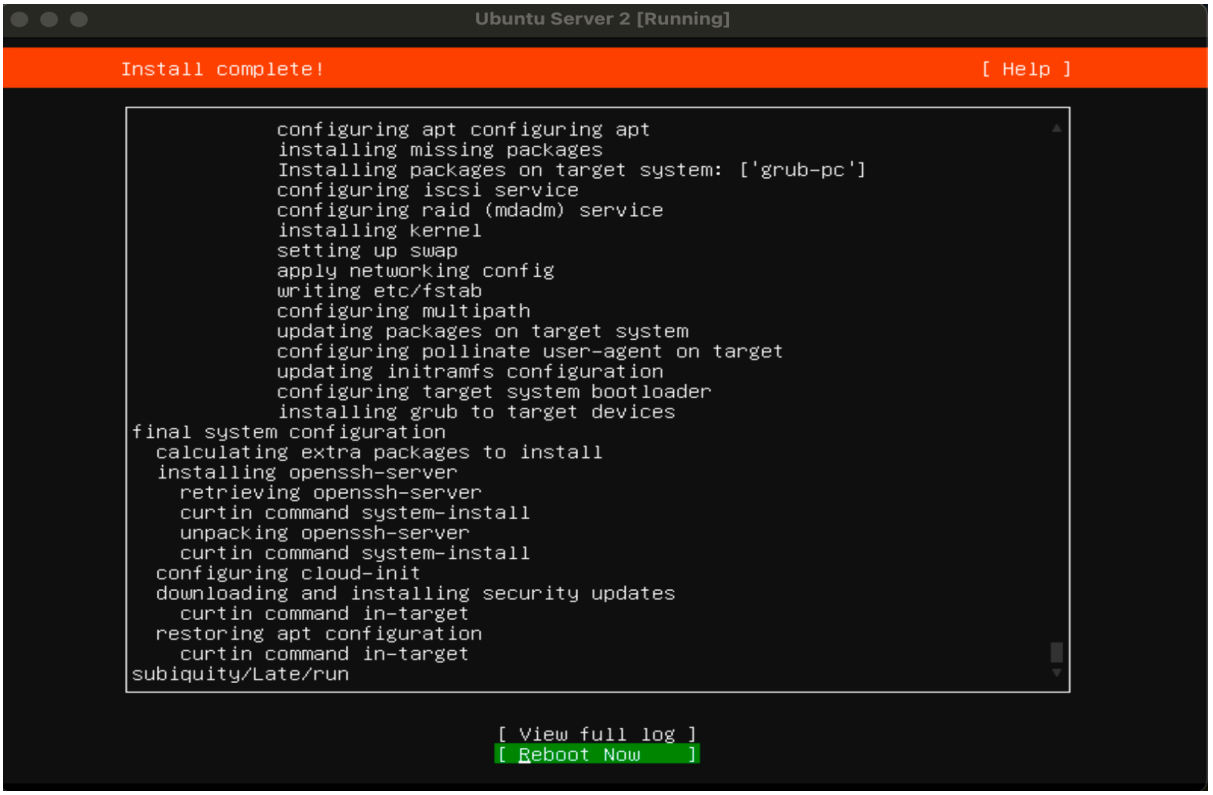
The Ubuntu Pro is a more sophisticated version but we won't be needing that for this demonstration. As a result, select the 'skip for now' option and continue.



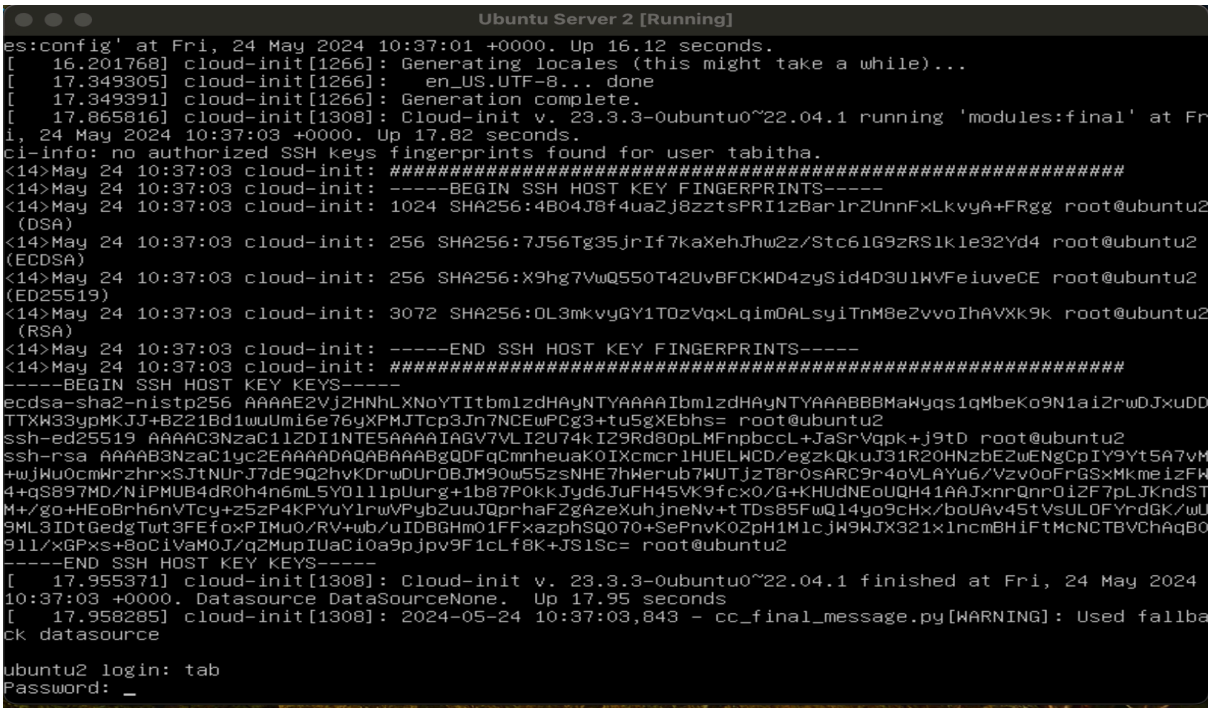
Here, the option to install the OpenSSH server is displayed. OpenSSH is useful for the task at hand so select the 'Install OpenSSH server' option and select the done option.



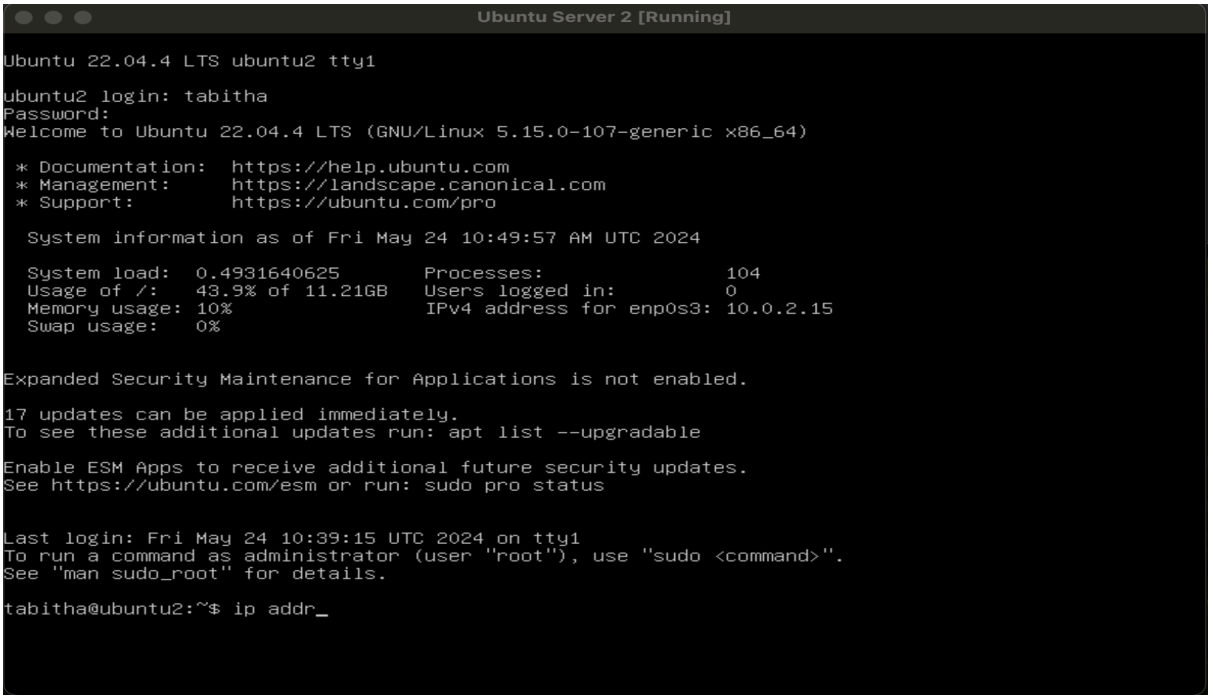
The Linux server offers numerous snaps available. But for the purpose of this demo, no snaps will be tampered with. Select the 'done' option.



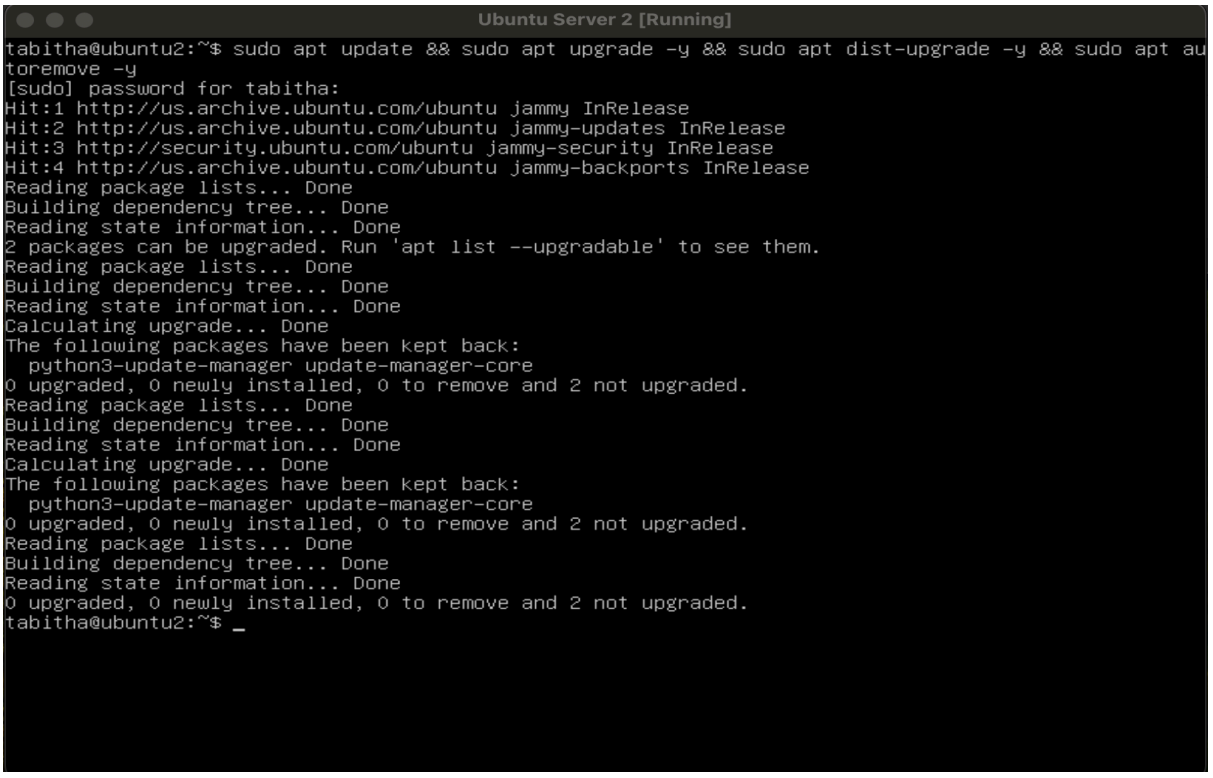
This page shows the installation process. Wait to see the 'installation complete' prompt at the top of the screen before selecting the 'reboot now' option. The Linux server needs to be rebooted after a successful installation process.



After a reboot, the Linux server is launched and the created user can successfully log into the server.



The picture above depicts a successful login into the Linux server. The Linux server installation is successful!



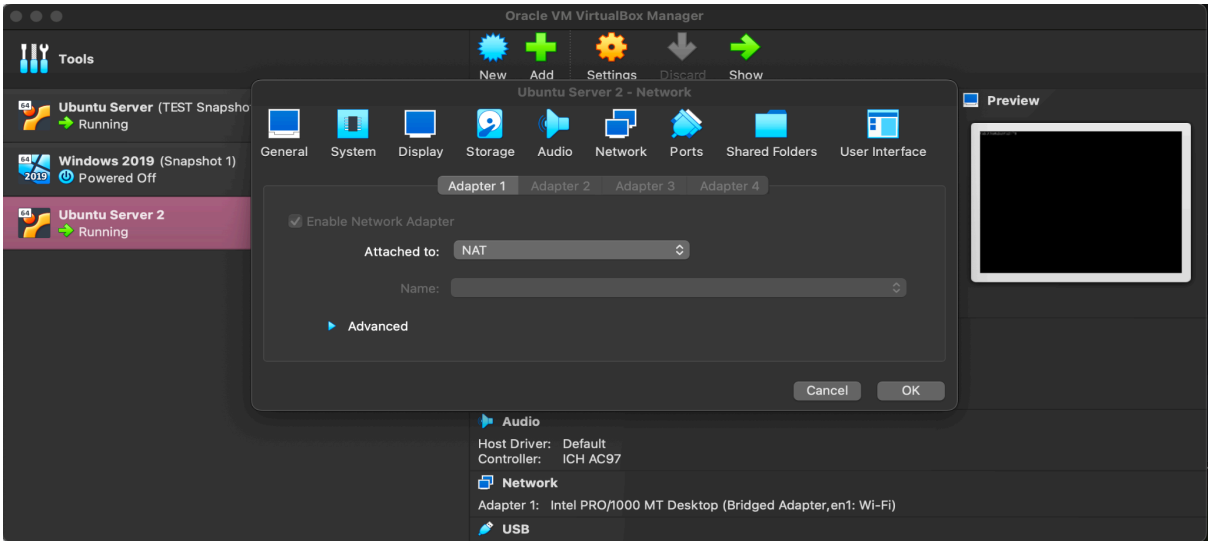
To ensure the Linux server is up to date with the most recent package versions, it is imperative to run the ‘sudo apt update’ command. Also installed packages should be upgraded to their latest versions using the ‘sudo apt upgrade’ command. The ‘sudo apt dist-upgrade’ performs the same function. Lastly, the ‘sudo apt autoremove’ command is used to remove packages that were automatically installed to satisfy dependencies for other packages but are no longer needed.

Running these commands ensure the Linux server is healthy and efficient.

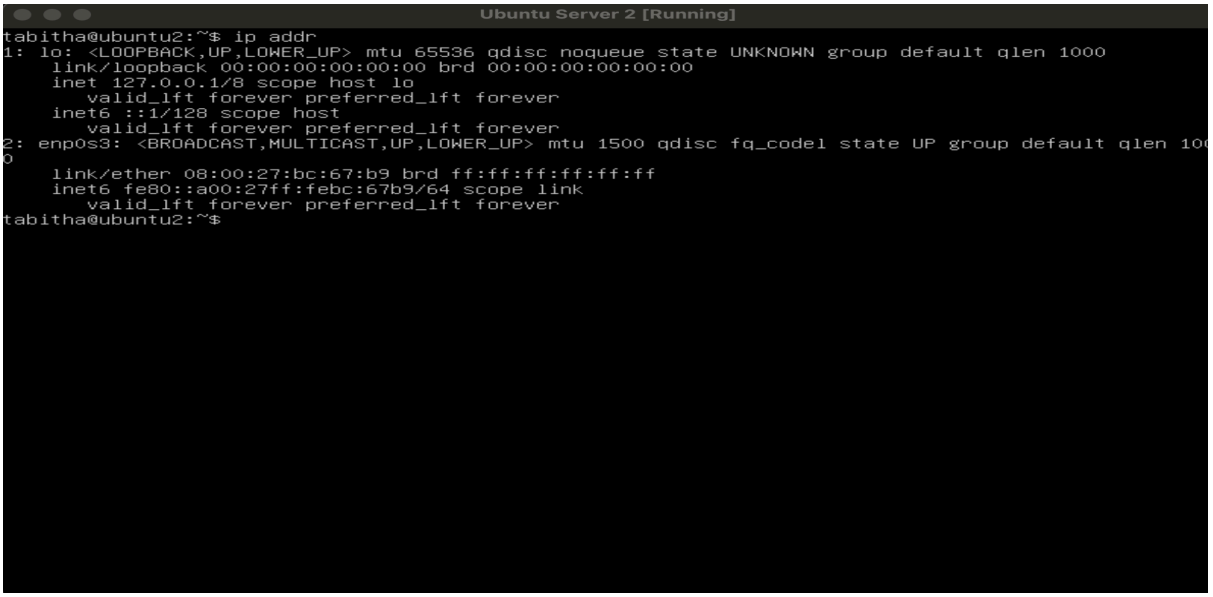
Virtualization Assignment #4 - Live Class Exercise - Discovery
Explain network modes and their purpose.

Network modes determine how different devices and interfaces on a network interact with one another. The most common network is the Managed mode wherein a computer connects to a wireless network such as a wifi. Ad-hoc mode is when two computers connect to one another directly without the need for a router. This can occur via bluetooth connection. Another network mode is Monitor, wherein a network captures all available wireless traffic without necessarily connecting to any. The opposite of this mode is the Promiscuous mode, where, like the name implies, a network interface captures every and any network traffic it can see. Lastly, Bridge mode. Here, the network interface combines multiple networks together to perform as a single network.

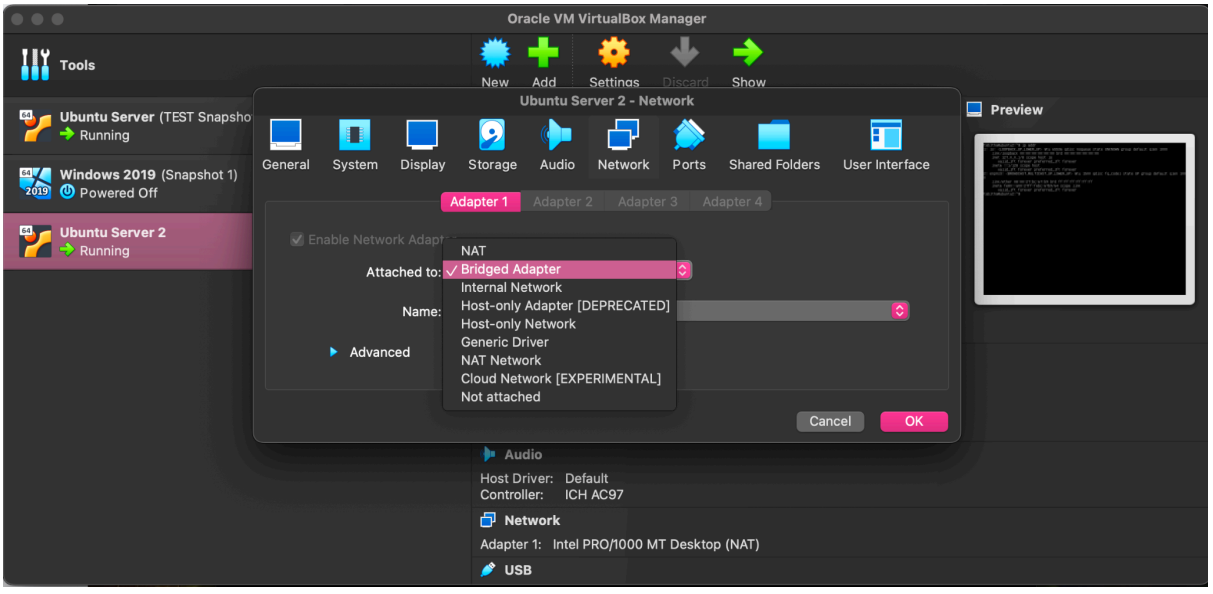
Changing between NAT and Bridge Network Modes



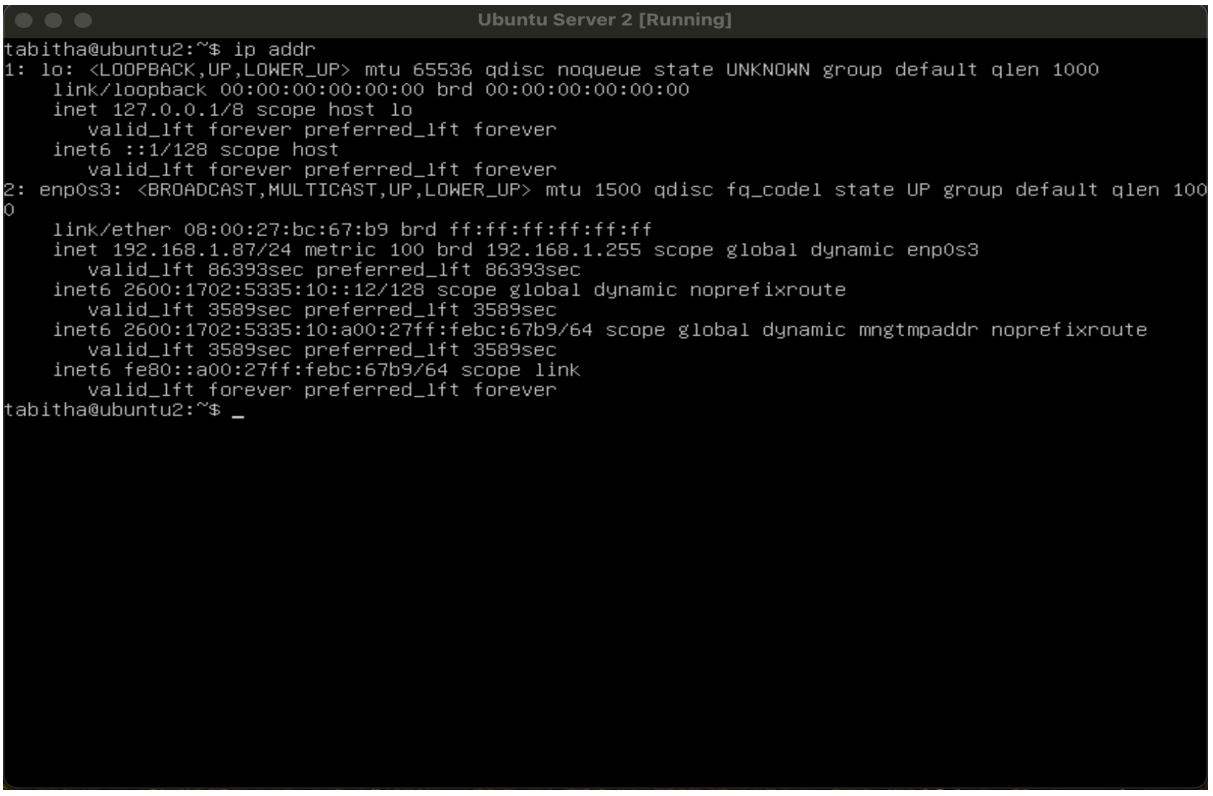
Using VirtualBox, network modes can be changed using the GUI. As shown above, the first step is to select the desired server, click on the settings icon in the middle of the screen and select the network option. The resulting page shows what network mode the server is currently attached to.



When a VM is attached to NAT, it uses the host's IP address to communicate with the external network or the internet. As shown in the picture above, the ip address of the Linux server reflects that of the host machine.



As shown in the picture above, to switch into the Bridged Adapter network, the first step is repeated. The desired server is selected, followed by the settings, then the dropdown to change network mode to show the available network modes. Here, the bridged adapter option is selected and saved.



When the “ip addr” is run again to check the address of the VM, it is evident that the ip address of the VM has changed. With the bridged adapter network mode, the VM connects directly to the host’s physical network. With this in place, the VM appears as a separate device from the host device on the network.