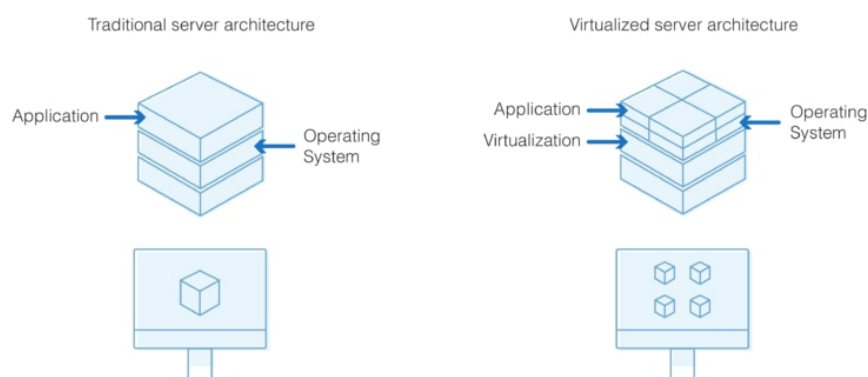


# Lab 1 - Introduction to Virtualization and Hypervisors

## What is Virtualization?

Virtualization, in layman's terms, is like creating multiple computers within a single physical computer. Imagine you have one powerful computer, and you want to run different tasks or even completely different operating systems on it, like having a Windows computer and a Linux computer at the same time. Virtualization allows you to do this by creating isolated virtual machines (VMs) that act like independent computers. Each VM can run its own software, applications, and even have its own settings, as if you had several physical computers in one. It's like having a bunch of computers all living inside your main computer, and they share its resources like memory and processor power while remaining separate from each other. This technology is useful for saving space, energy, and resources, and it's commonly used in data centers and for testing different software configurations without the need for multiple physical machines.

## What is Server Virtualization?



## Benefits of Virtualization

Virtualization is beneficial in several real-world computational tasks. A few of these benefits are as follows:

- Resource Efficiency
- Cost Savings
- Isolation and Security
- Flexibility and Scalability

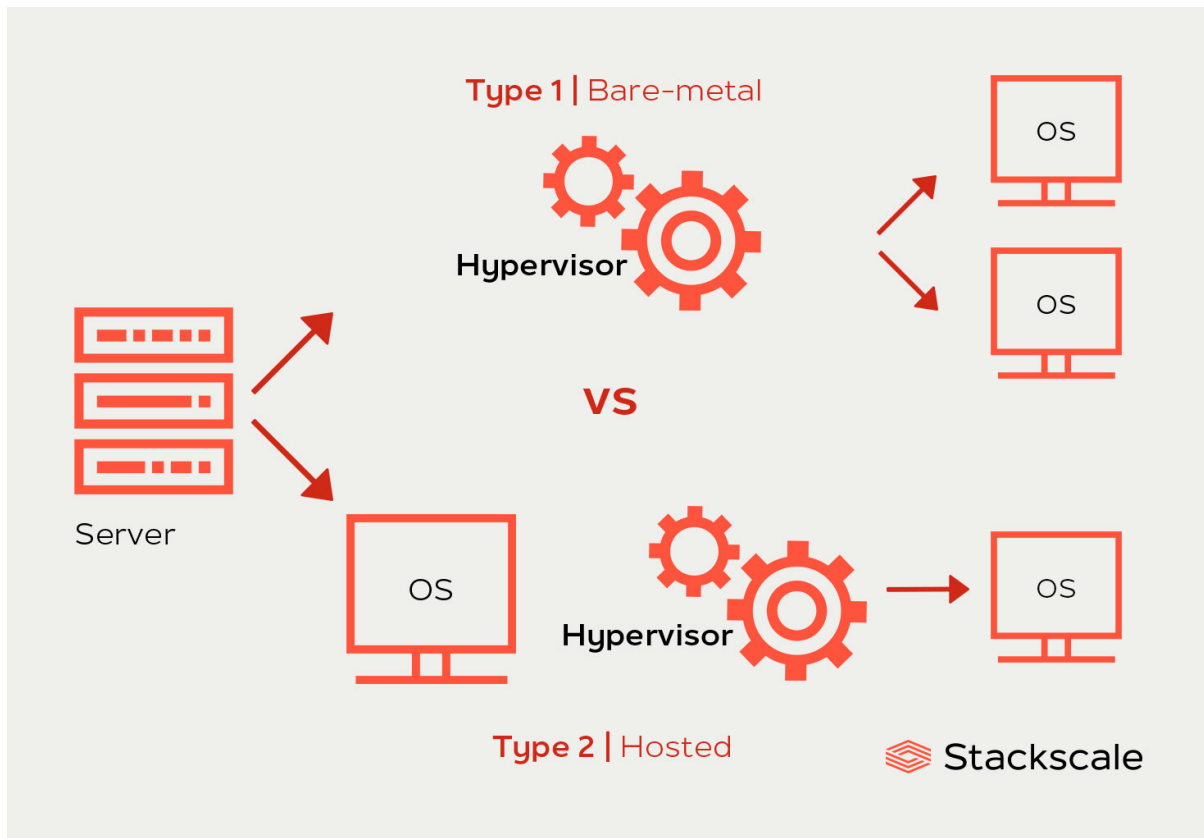
## What is a Hypervisor

A hypervisor, often referred to as a Virtual Machine Monitor (VMM), is a software or hardware component that enables virtualization. It is a critical part of the virtualization infrastructure and serves as the intermediary layer between the physical hardware and virtual machines (VMs).

## Types of Hypervisor

There are two main types of hypervisors:

1. **Type 1 Hypervisor (Bare-Metal Hypervisor):** This hypervisor runs directly on the physical hardware of the host system, without the need for a traditional operating system. It is typically considered more efficient and secure than Type 2 hypervisors. Examples of Type 1 hypervisors include VMware vSphere/ESXi, Microsoft Hyper-V, and KVM.
2. **Type 2 Hypervisor (Hosted Hypervisor):** Type 2 hypervisors run on top of an existing operating system, acting as an application. They are commonly used for development, testing, or desktop virtualization scenarios. Examples include Oracle VirtualBox, VMware Workstation, and Parallels Desktop.



In this course, we will be using `Virtualbox` .

▼ **NOTE:** For Virtualization to work, you need to enable it in the BIOS Settings of your computer. You may need to google it. The prompt would be similar to `How to enable virtualization in <your motherboard/laptop model>` .

If you don't know your motherboard/laptop model, you can use tools like CPU-Z and HWMonitor.

## Setting up Virtualbox

Once Virtualization is enabled, we will download Virtualbox

## Download VirtualBox

Here you will find links to VirtualBox binaries and its source code.

### VirtualBox binaries

By downloading, you agree to the terms and conditions of the respective license.

If you're looking for the latest VirtualBox 6.1 packages, see [VirtualBox 6.1 builds](#). Version 6.1 will remain supported until December 2023.

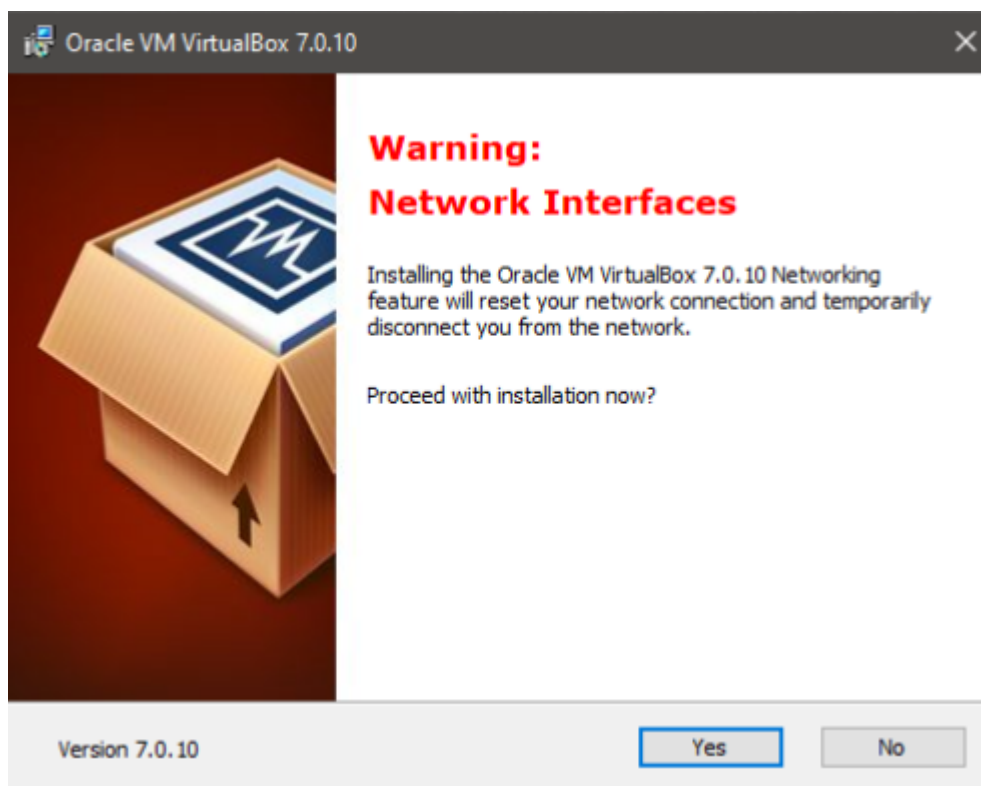
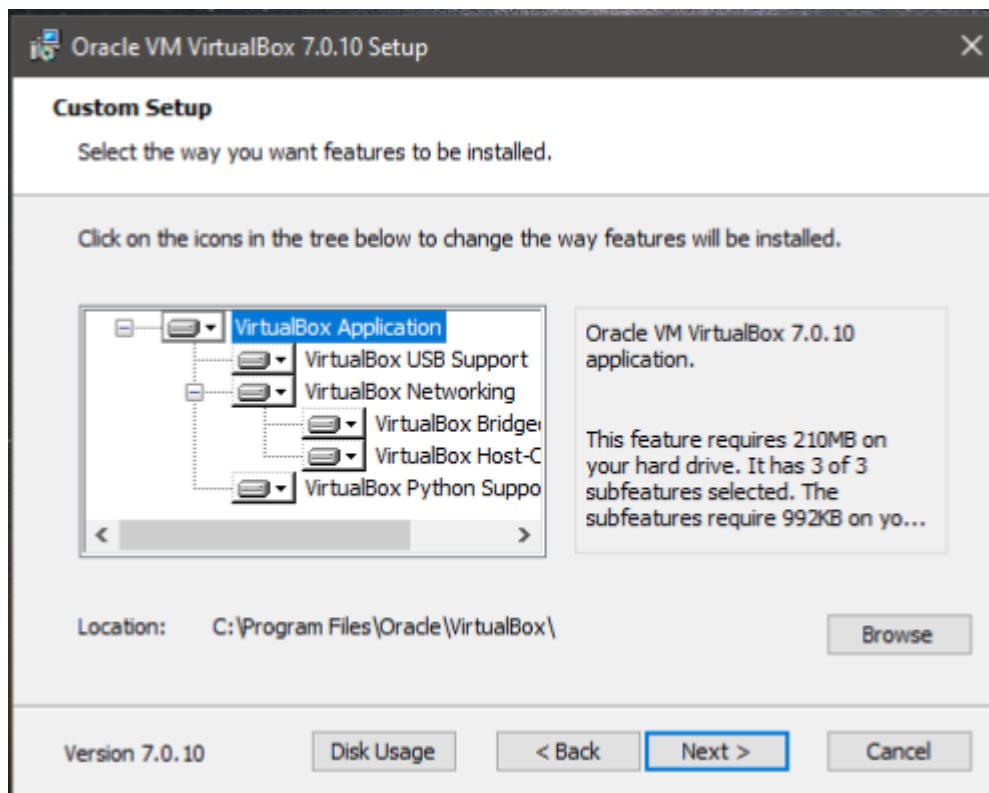
### VirtualBox 7.0.10 platform packages

- [Windows hosts](#)
- [macOS / Intel hosts](#)
- [Linux distributions](#)
- [Solaris hosts](#)
- [Solaris 11 IPS hosts](#)

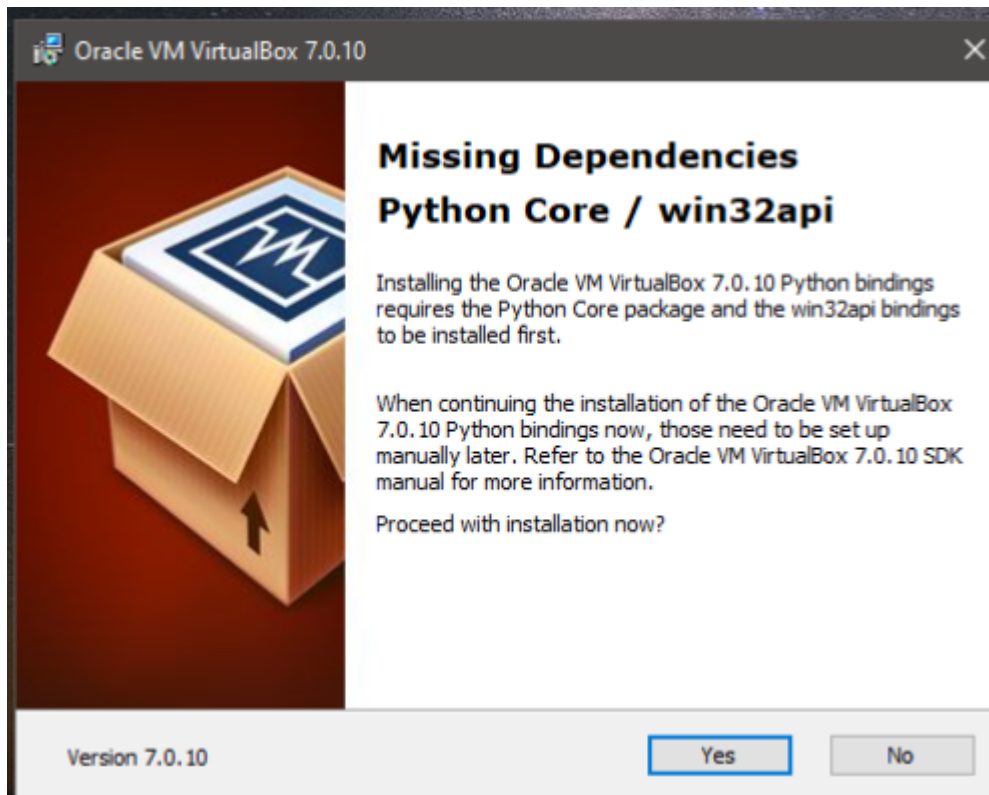
Once downloaded, we will now install Virtualbox



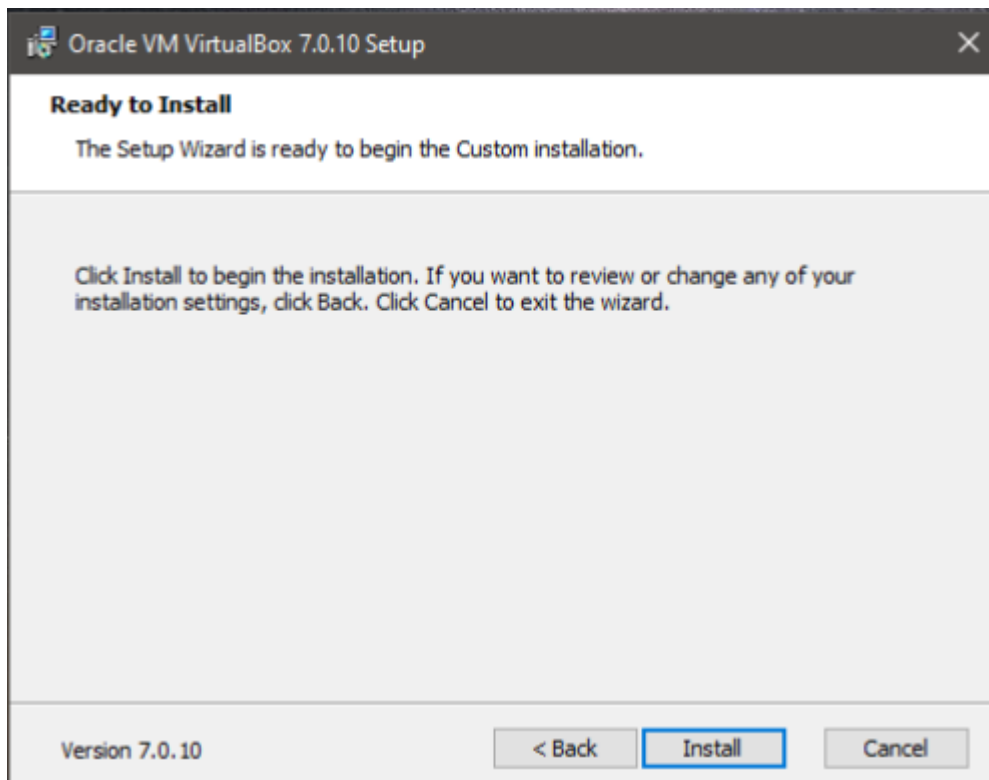
Here, we can change the installation location, but I'd recommend that you stick with the default



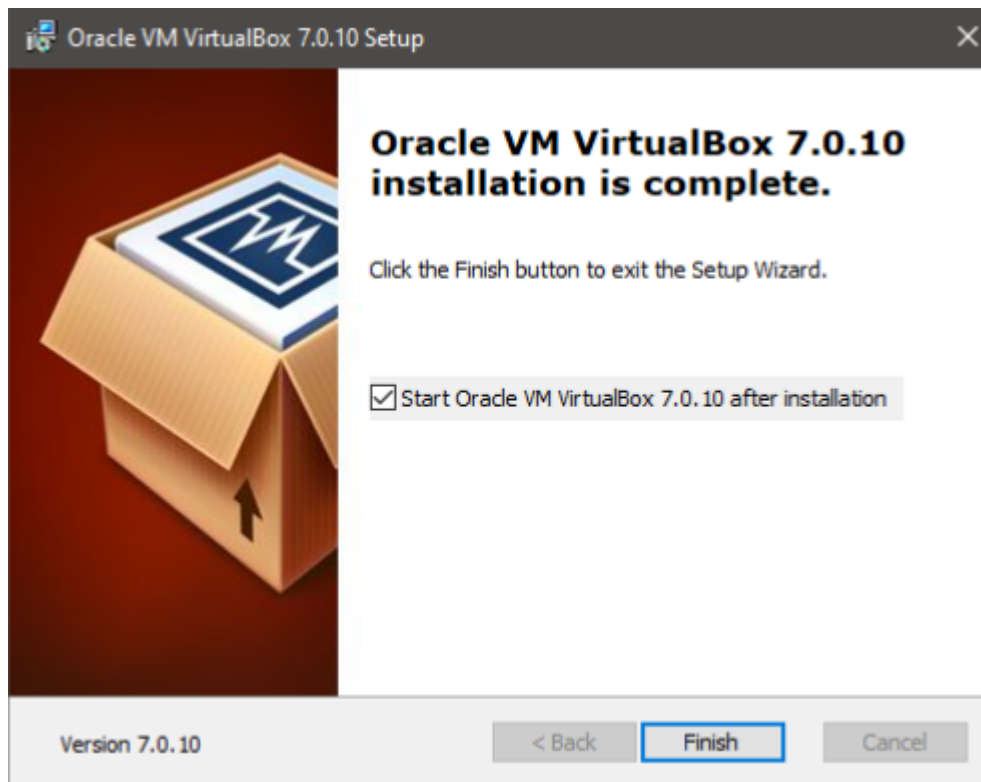
In case of dependencies issues, Virtualbox will handle it itself



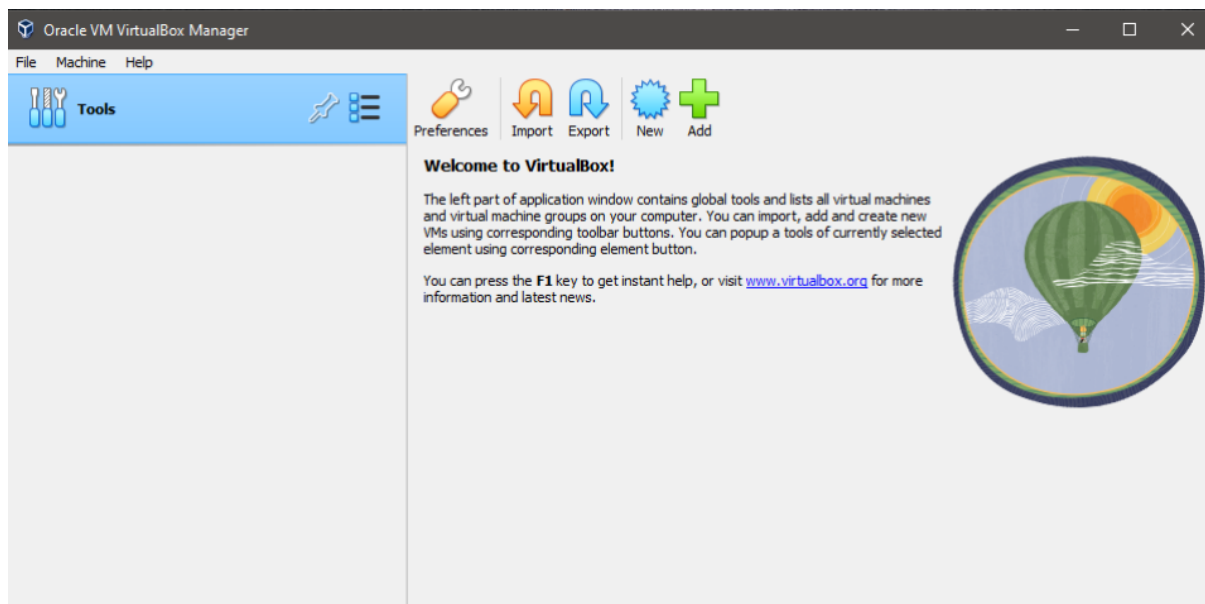
Once everything is ready, we can click on **Install** to kick off the installation process



The installation may take some time to complete but once done, we'll be greeted with this final screen:

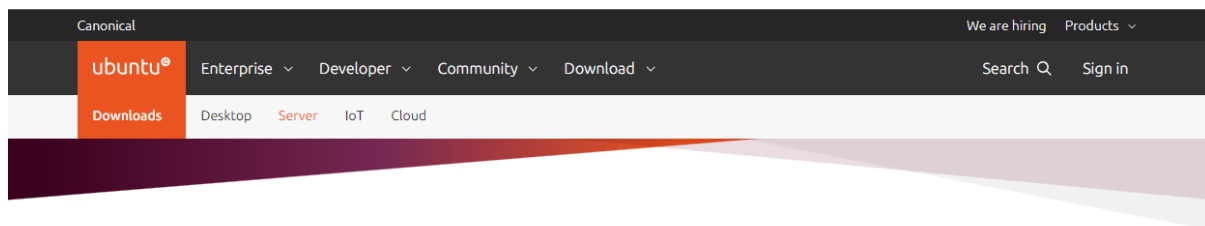


After clicking on Finish, we're greeted with the following screen



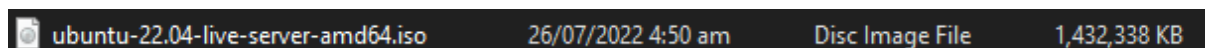
## Setting up Ubuntu Server on Virtualbox

Firstly, we'll download the .iso file from <https://ubuntu.com/download/server>

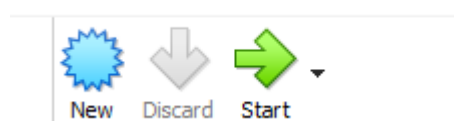


▼ **NOTE:** We can also choose **Option 2 - Instant Ubuntu VMs** but, in order to understand more about the Linux installation process, we will choose **Manual server installation**

Once download, you will have a **.iso** file.



In Virtualbox, you will click on **New**:



Now, you will be presented with a VM setup menu



← Create Virtual Machine

Name and operating system

Name:

Machine Folder: C:\Users\alita\VirtualBox VMs

Type: Linux

Version: Ubuntu (64-bit)

Memory size

4 MB 1024 MB 32768 MB

Hard disk

☐ Do not add a virtual hard disk

☒ Create a virtual hard disk now

☐ Use an existing virtual hard disk file

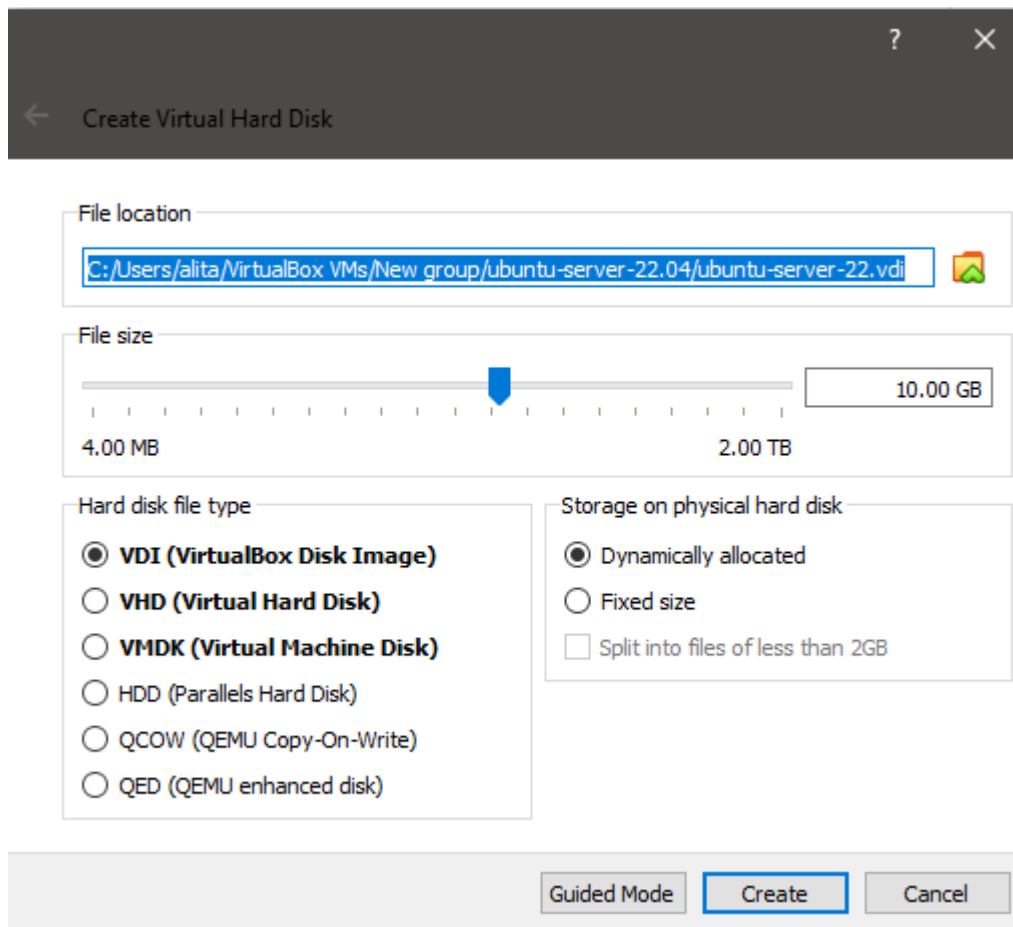
data.vmdk (Normal, 12.79 GB)

Guided Mode Create Cancel

Here, we will setup the VM as follows:

```
Name: "ubuntu-server-22.04"
Machine Folder: "<Whatever Directory you want to save it in>"
Type: "Linux"
Version: "Ubuntu (64-bit)"
# In case you don't have Ubuntu (64-bit) option, Ubuntu(x86) or Other Linux is fine.
Memory size: 1024
# You can also give 2048 (2GB) if your pc allows
Hard disk: "Create a virtual hard disk now"
```

Once done, you will now click on **create**

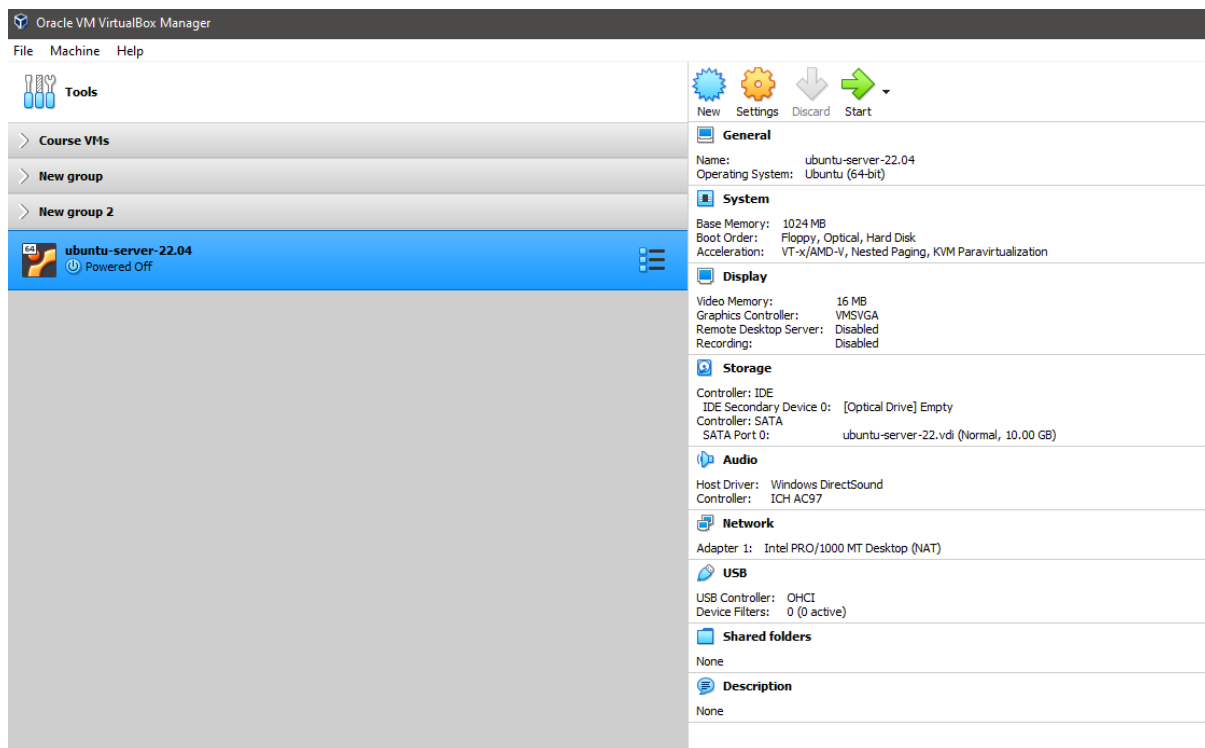


Here, you will select **10.00GB** as the size, you can also increase the size if you want to further mess around and install different things in the VM. The other settings will be

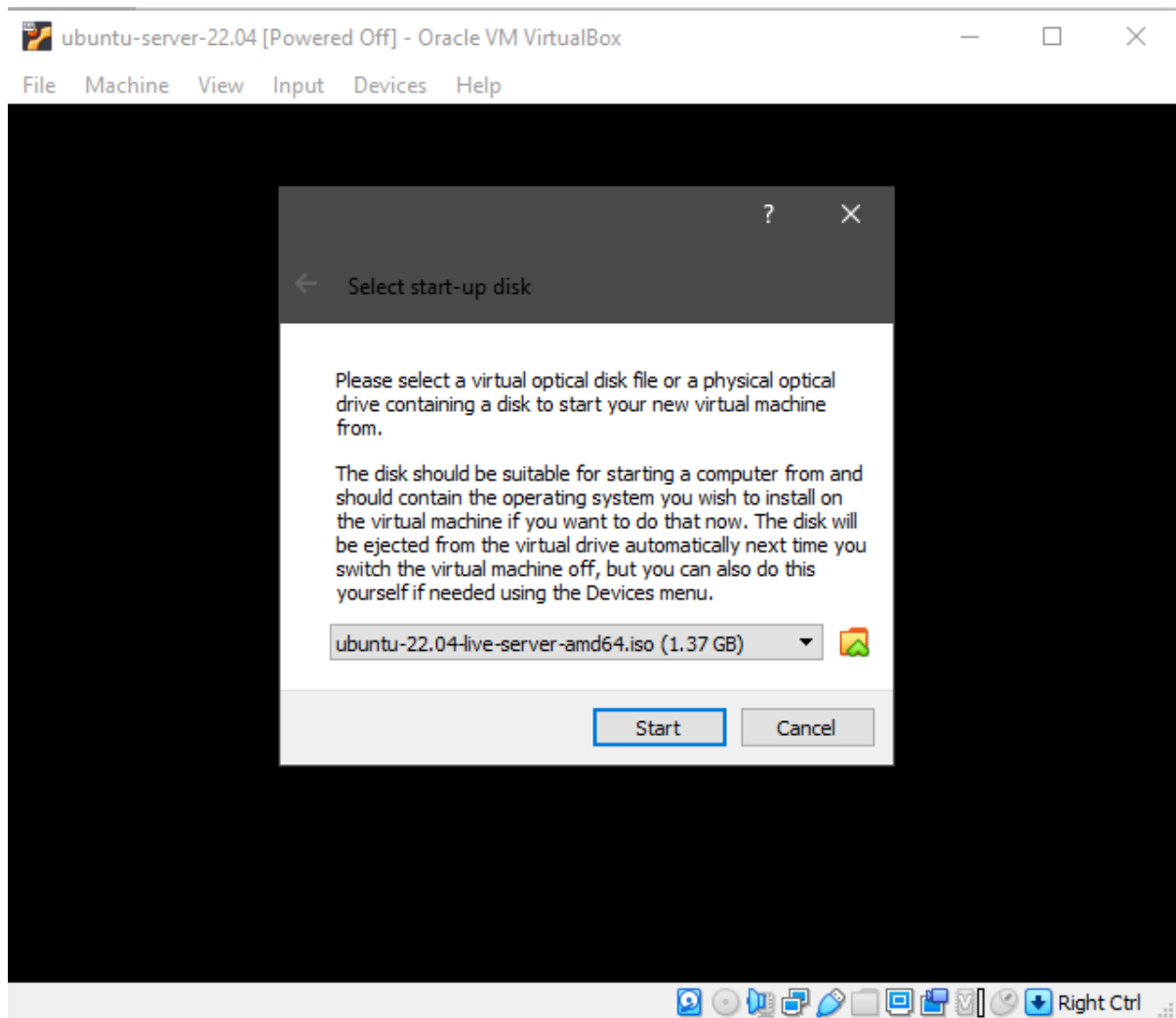
```
File size: 10.00
Hard disk file type: VDI (VirtualBox Disk Image)
Storage on physical hard disk: Dynamically allocated
```

The key difference between **Dynamically allocated** and **Fixed size** is that in **DA**, the host hard disk will slowly increase when the VM's hard disk increases in size, however, in Fixed size, the entire **File size** is allocated at once, meaning that if we provide **10gb**, then that 10gb is allocated at once on the hard drive. Once this is done, we will now click on **create**

Once done, we will see something like this, now we will double click on **ubuntu-server-22.04** to start the VM



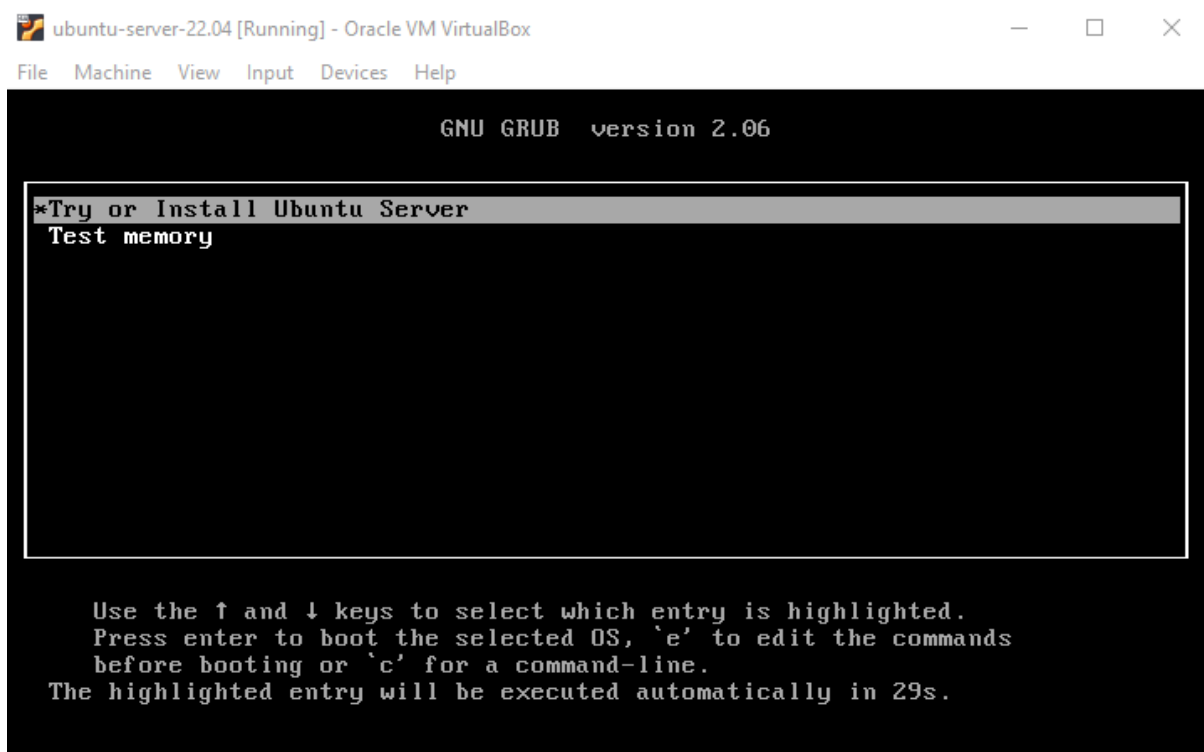
Once powered on, you will be greeted with the Image selection menu



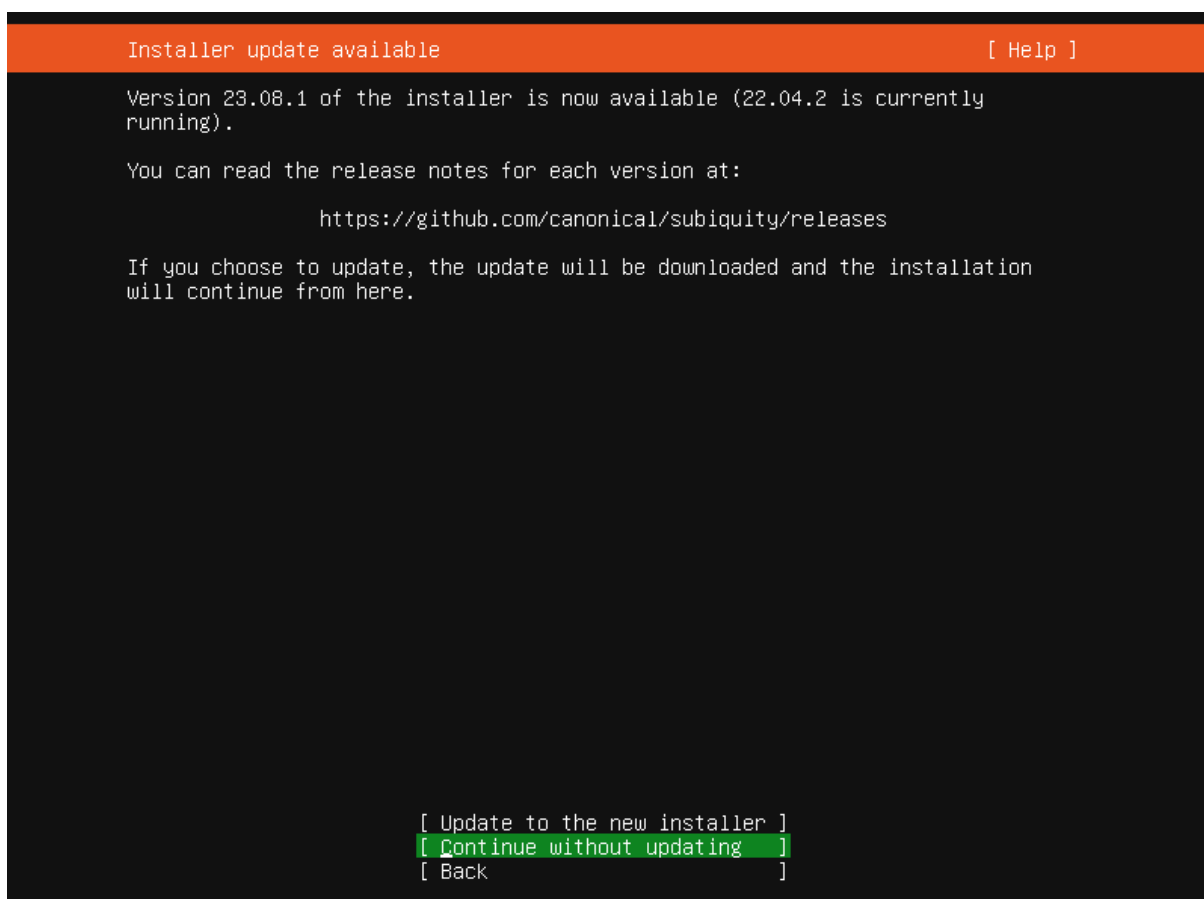
In case Virtualbox doesn't have the iso file selected, you will click on the folder icon and then select the iso file, once done, you will click on **start**

Once that's done, you will be greeted with this **GRUB** menu. Here, you will select **Try or install Ubuntu Server**

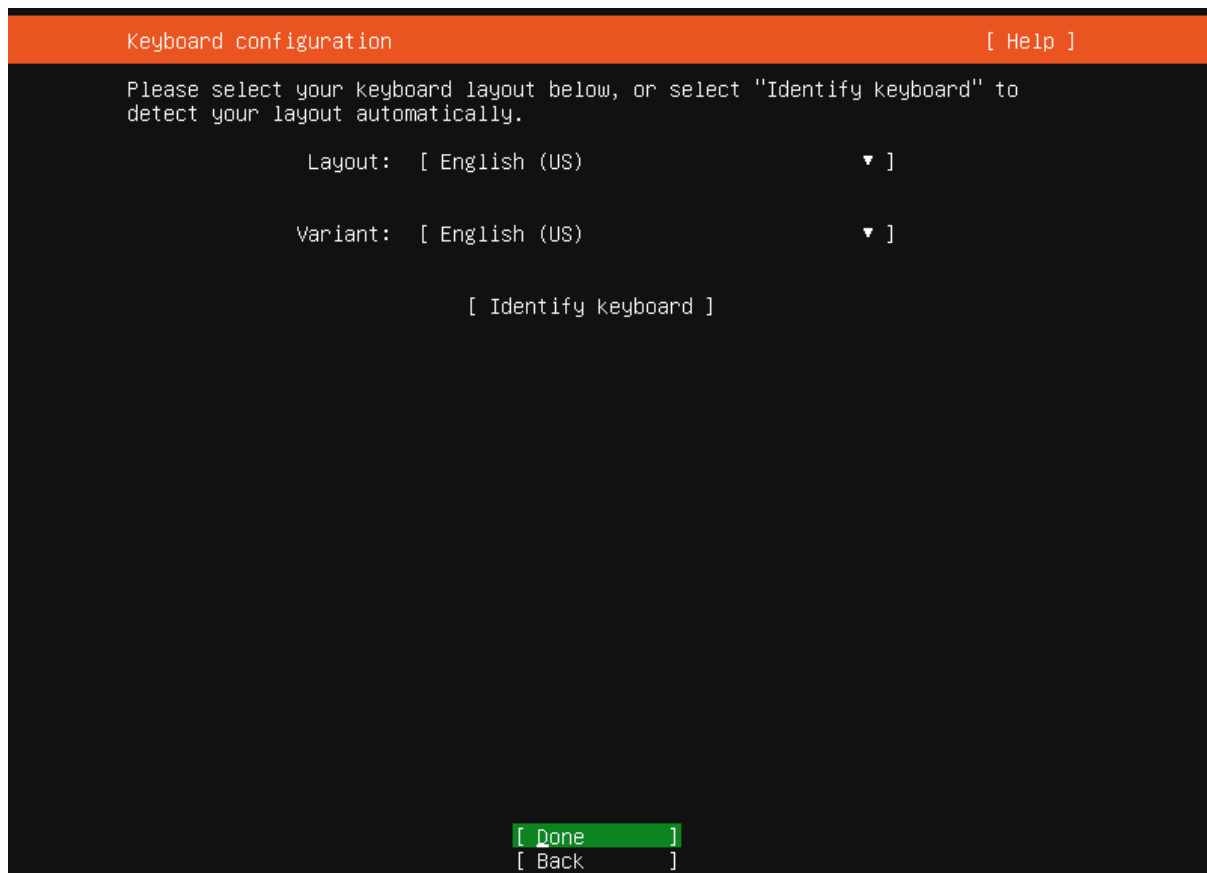
▼ **NOTE:** To move around in installer, we can use **TAB** and **Arrow Keys**, and to select options, we can use either **Spacebar** or **Enter** key.



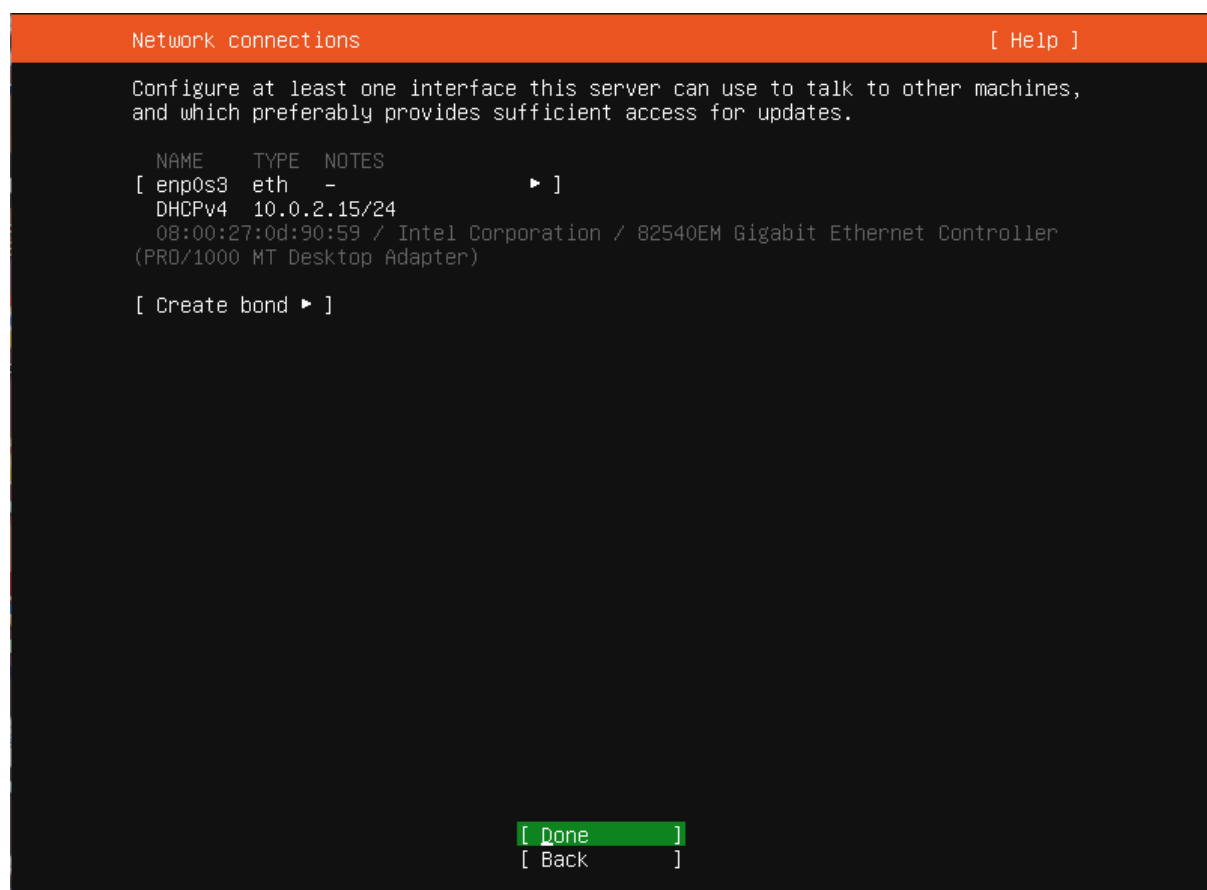
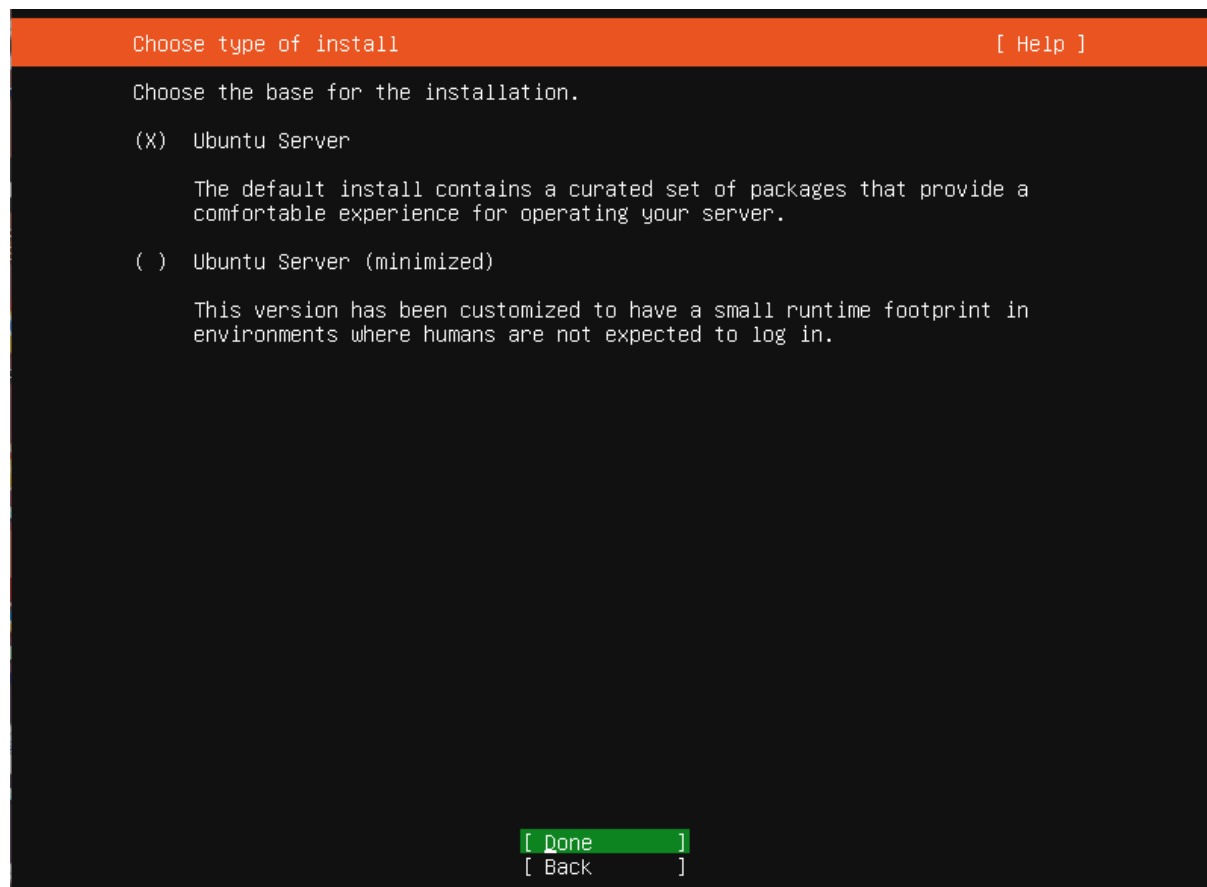
In case we're using an older installer, we'll be greeted with the following screen



Here, we'll click on `Continue without updating` because in our scenario, we do not necessarily need the latest version, we're simply setting up a test bench



Here we'll be selecting the Ubuntu Server



Configure proxy

[ Help ]

If this system requires a proxy to connect to the internet, enter its details here.

Proxy address:

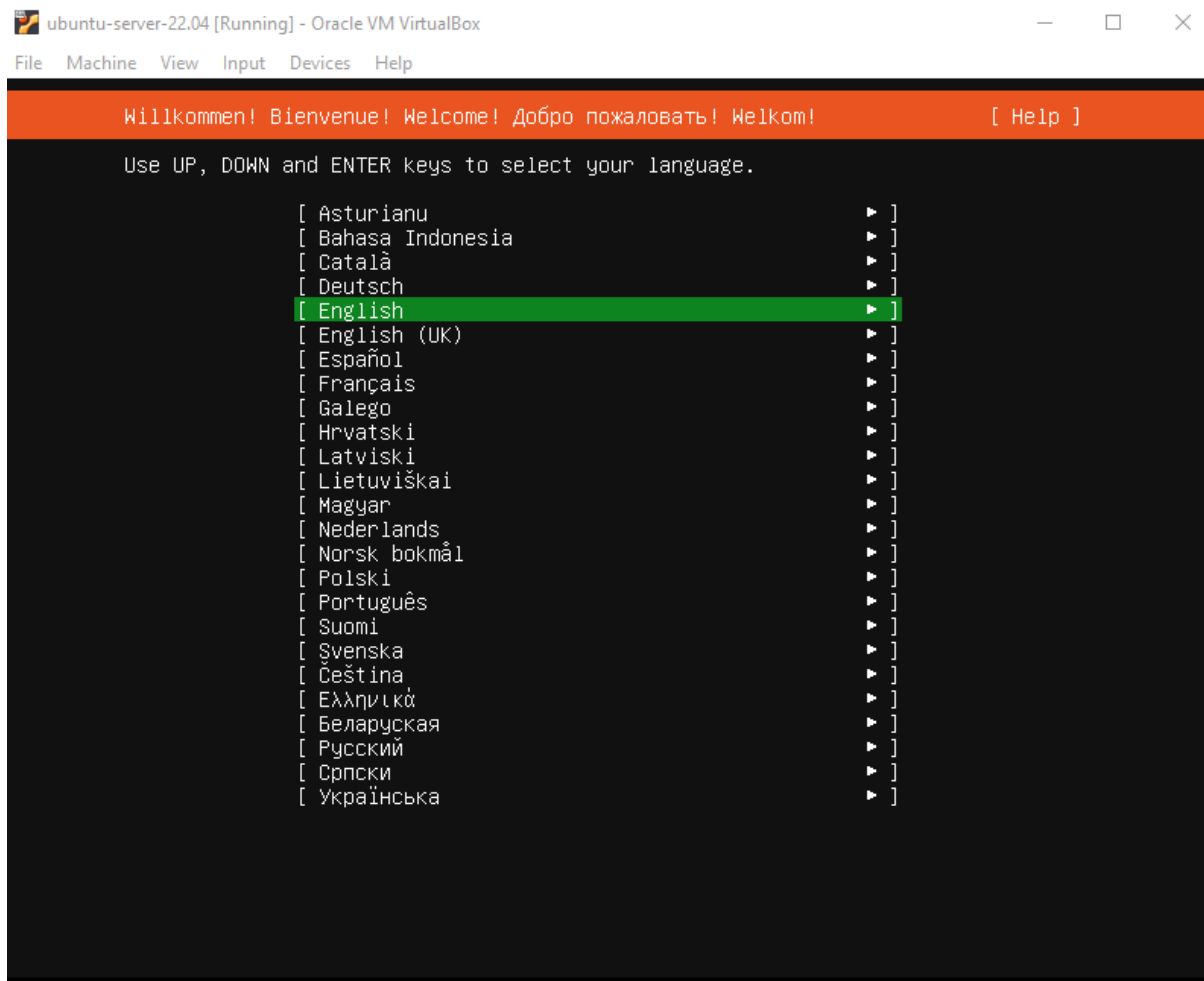
If you need to use a HTTP proxy to access the outside world, enter the proxy information here. Otherwise, leave this blank.

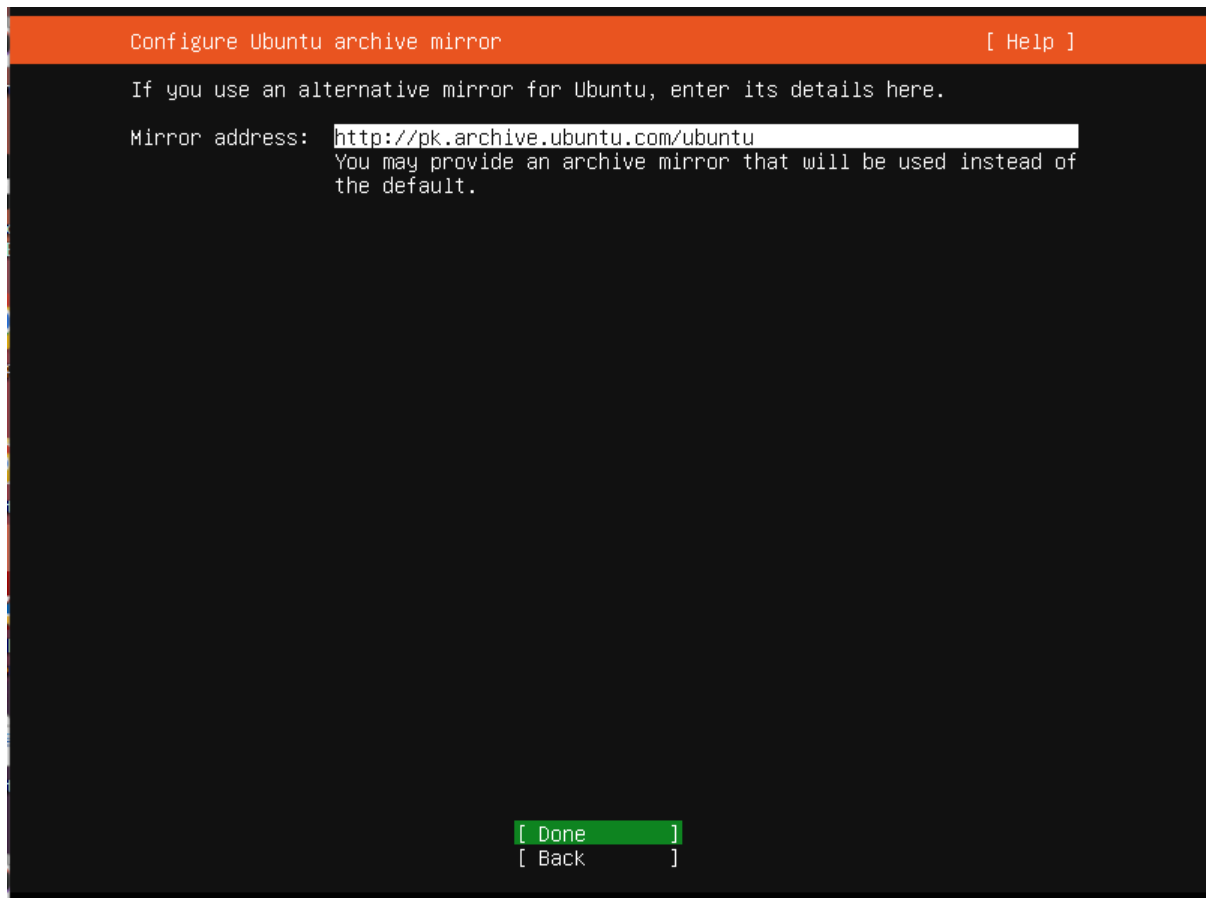
The proxy information should be given in the standard form of "http://[[user] [:pass]@]host[:port]/".

[ Done ]

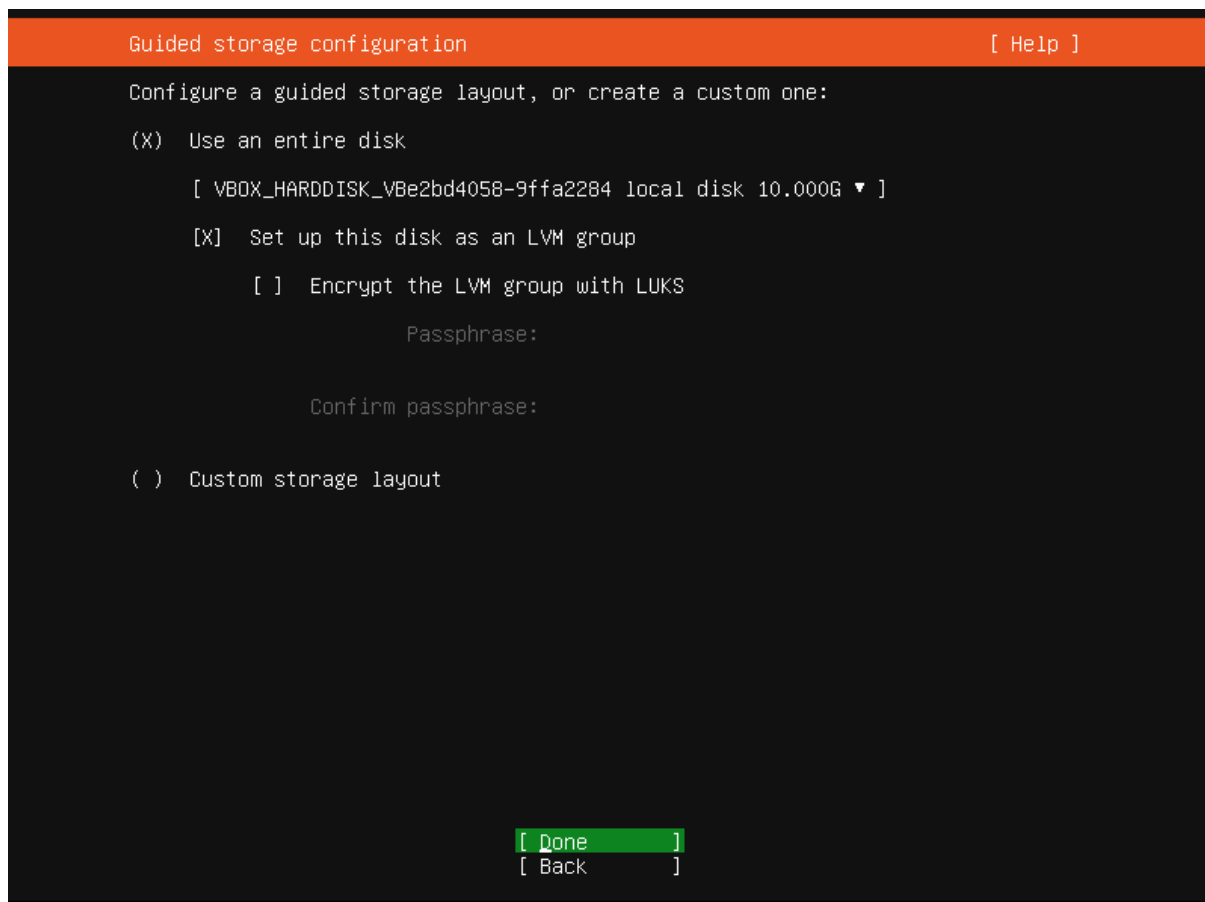
[ Back ]



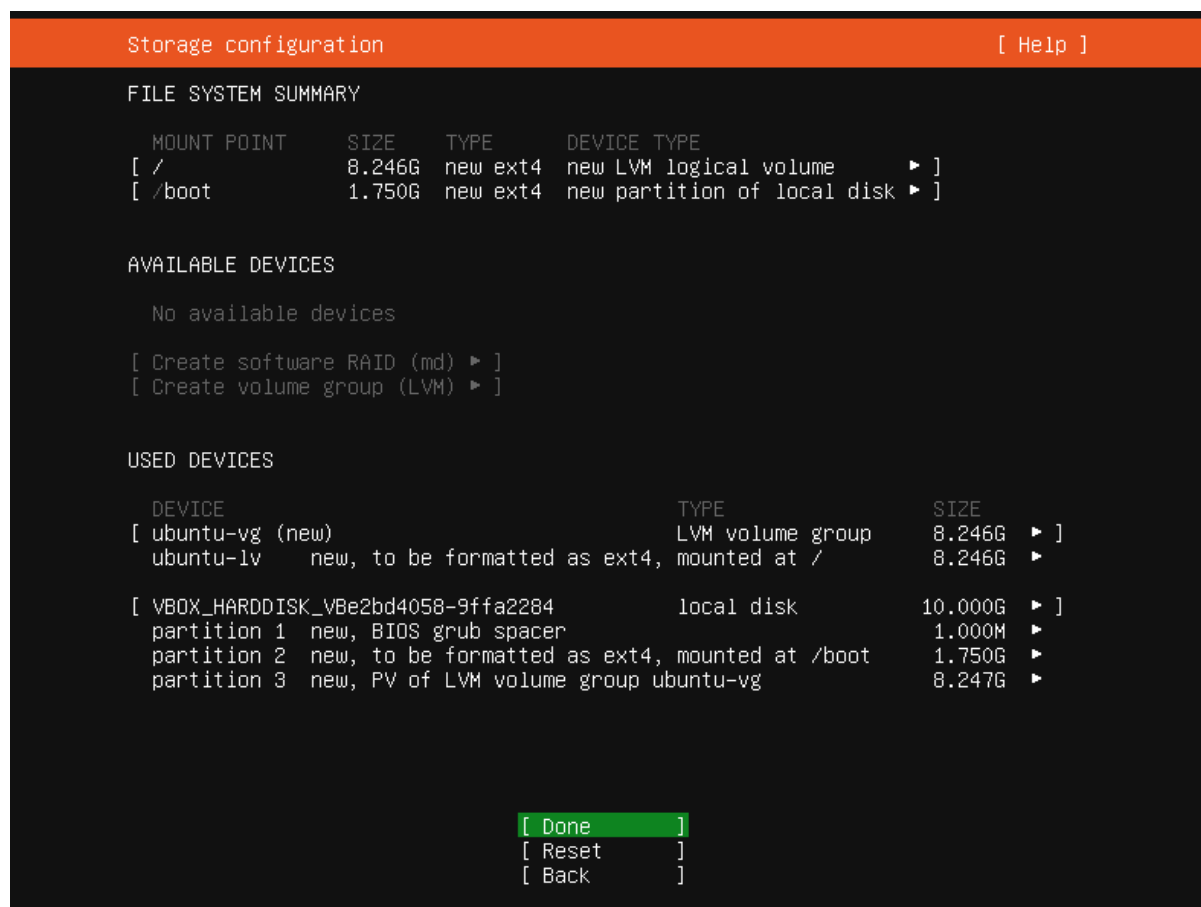




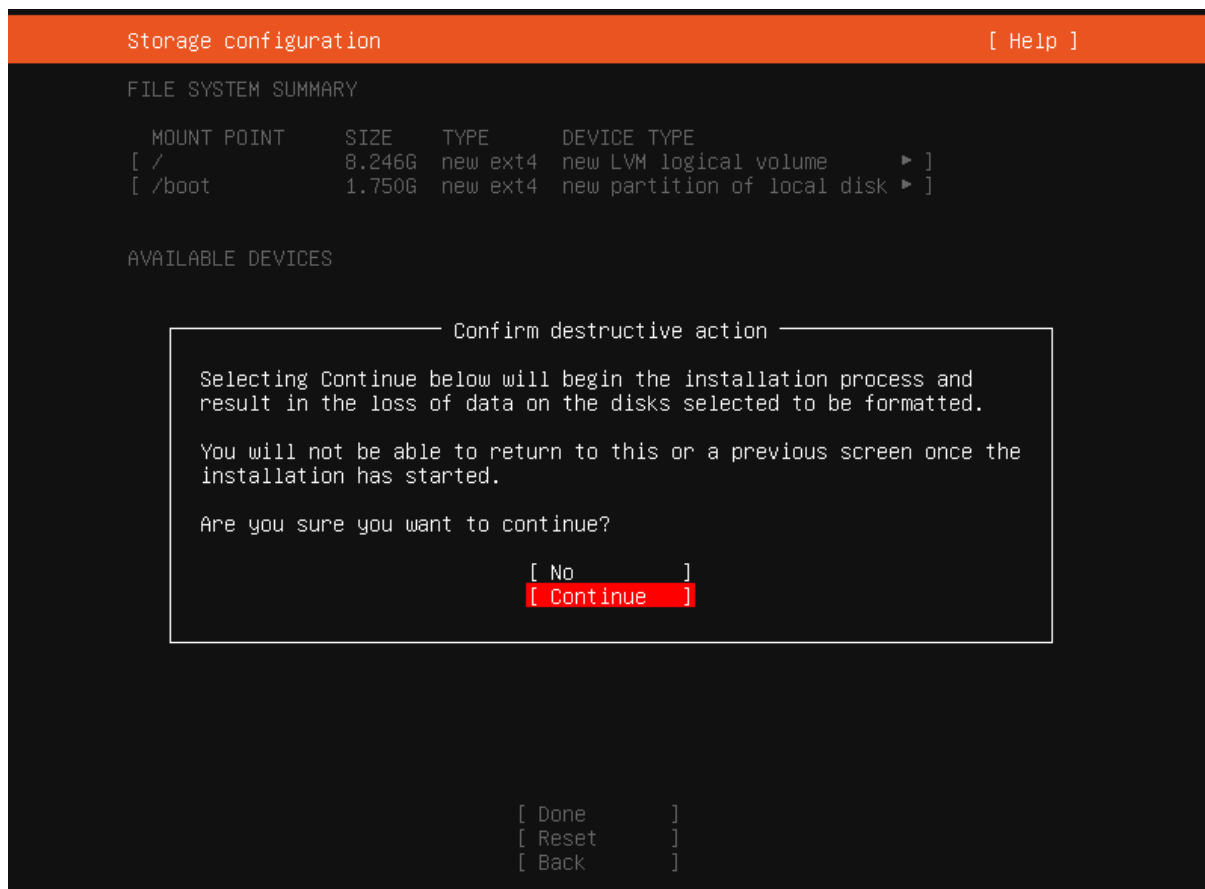
Here, we'll select the **Use an entire disk** option and then click on done



Once again, without actually worrying about everything, we'll simply click on Done



Once we get the pop-up menu, we'll click on continue



Now, in the profile setup, you will setup the basic information about you. I highly expect you to follow this naming convention as it will really help you in the quizzes, assignments and exams.

```
Your name: Full Name
## Example: Ali Taqi Wajid
Your server's name: ubuntu-srv-cy1021
Pick a username: firstName-rollNumber
## Example: Ali-190792
Choose a password: <Whatever you want>
Confirm your password: <Whatever you want>
```

Profile setup

[ Help ]

Enter the username and password you will use to log in to the system. You can configure SSH access on the next screen but a password is still needed for sudo.

Your name:

Your server's name:   
The name it uses when it talks to other computers.

Pick a username:

Choose a password:

Confirm your password:

[ Done ]

Now, you will select the **Install OpenSSH server** option

SSH Setup [ Help ]

You can choose to install the OpenSSH server package to enable secure remote access to your server.

[X] Install OpenSSH server

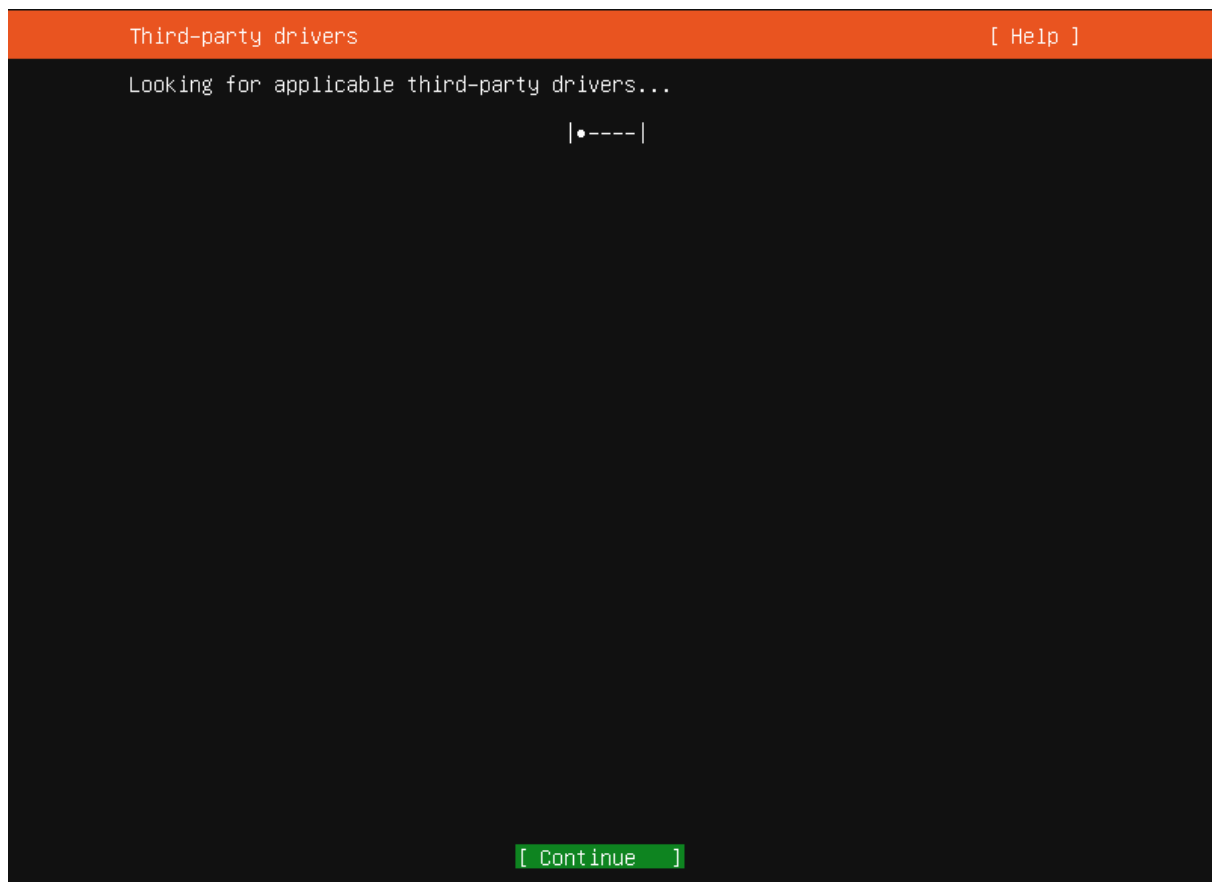
Import SSH identity: [ No ▼ ]  
You can import your SSH keys from GitHub or Launchpad.

Import Username:

[X] Allow password authentication over SSH

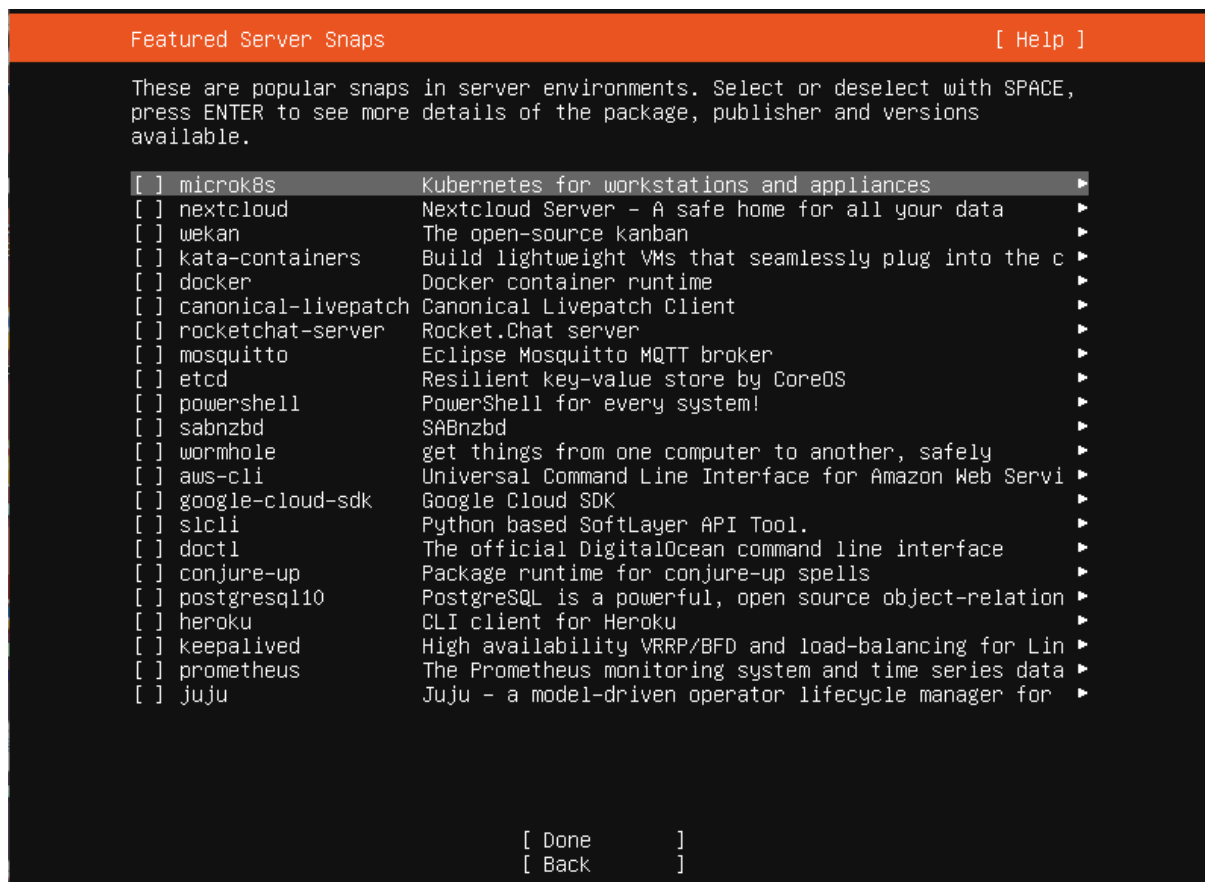
[ Done ]  
[ Back ]

Now, on **Looking for Third Party drivers**, you will simply click on continue as you won't be needing any Third Party drivers

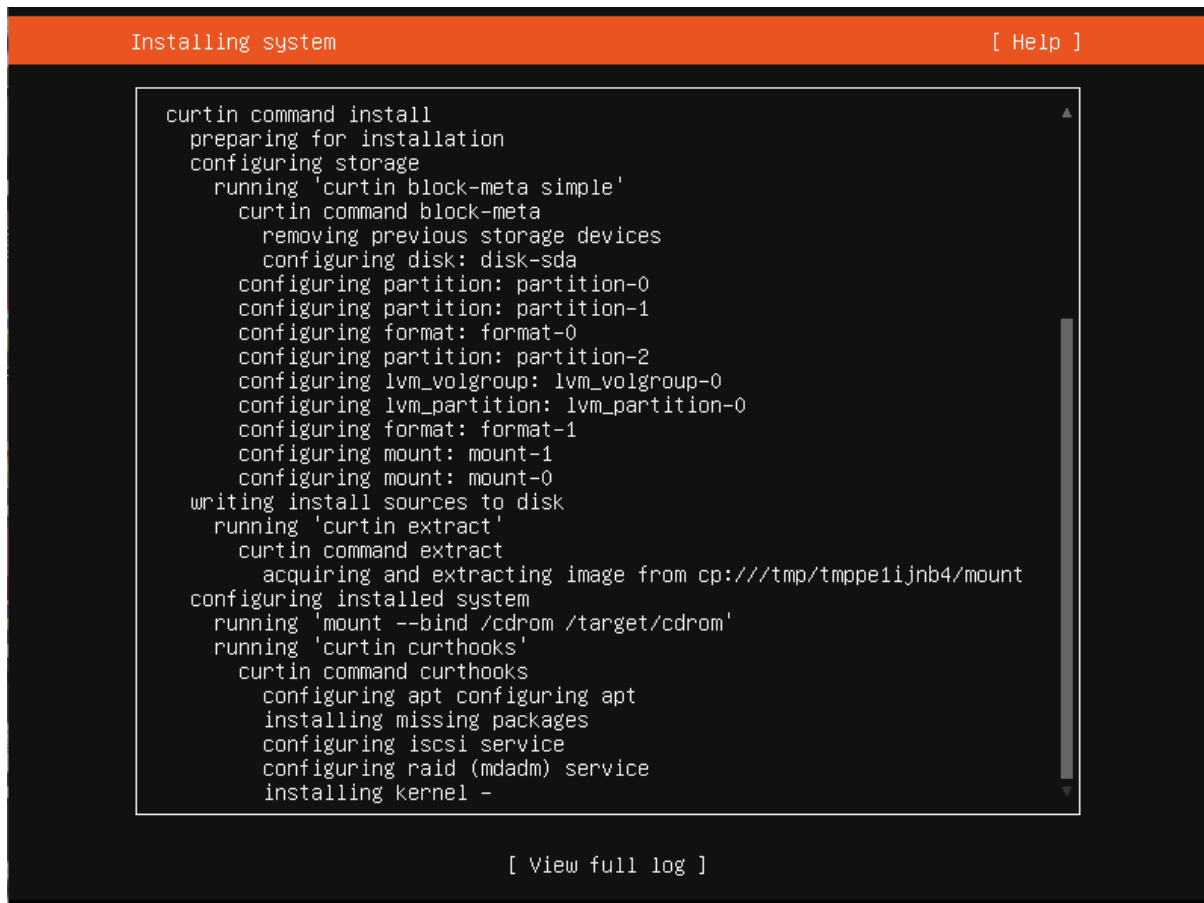


Now, in this menu, you don't necessarily have to select anything to install as we will install the tools that we need later on





Once you click on **Done**, you will be greeted with the **Installing System** menu. This step takes sometime so go ahead and do some other work while the installation is going on

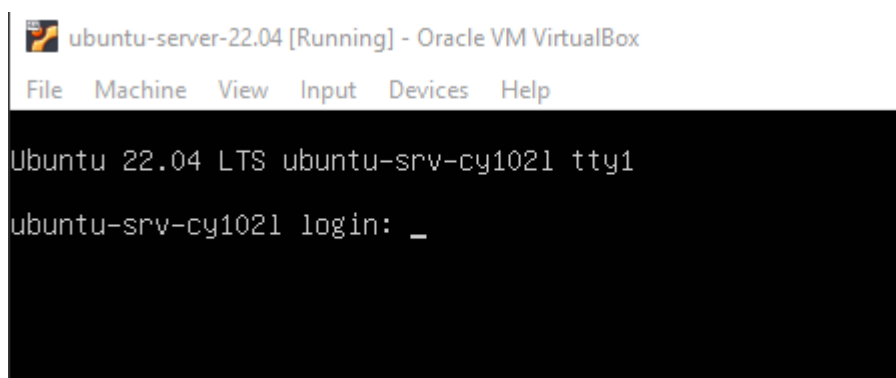


```
Installing system [ Help ]

curtin command install
preparing for installation
configuring storage
  running 'curtin block-meta simple'
    curtin command block-meta
      removing previous storage devices
      configuring disk: disk-sda
      configuring partition: partition-0
      configuring partition: partition-1
      configuring format: format-0
      configuring partition: partition-2
      configuring lvm_volgroup: lvm_volgroup-0
      configuring lvm_partition: lvm_partition-0
      configuring format: format-1
      configuring mount: mount-1
      configuring mount: mount-0
writing install sources to disk
  running 'curtin extract'
    curtin command extract
      acquiring and extracting image from cp:///tmp/tmppe1ijnb4/mount
configuring installed system
  running 'mount --bind /cdrom /target/cdrom'
  running 'curtin curthooks'
    curtin command curthooks
      configuring apt configuring apt
      installing missing packages
      configuring iscsi service
      configuring raid (mdadm) service
      installing kernel -
```

[ View full log ]

Once the installation has completed, you will be asked to reboot and you'll be greeted with the following screen



```
ubuntu-server-22.04 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

Ubuntu 22.04 LTS ubuntu-srv-cy1021 tty1
ubuntu-srv-cy1021 login: _
```

Here, you will type your username and password.

▼ **NOTE:** The password won't be echoed back to you on the screen so don't worry, just type and press enter

```

ubuntu-srv-cy1021 login: ali-190792
Password:
Welcome to Ubuntu 22.04 LTS (GNU/Linux 5.15.0-83-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

System information as of Wed Sep 13 10:39:22 PM UTC 2023

System load:  0.39990234375   Processes:            104
Usage of /:   51.2% of 8.02GB   Users logged in:      0
Memory usage: 21%             IPv4 address for enp0s3: 10.0.2.15
Swap usage:   0%

207 updates can be applied immediately.
135 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

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

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

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

ali-190792@ubuntu-srv-cy1021:~$

```

This concludes the installation. We will now shutdown the VM using `shutdown` command.

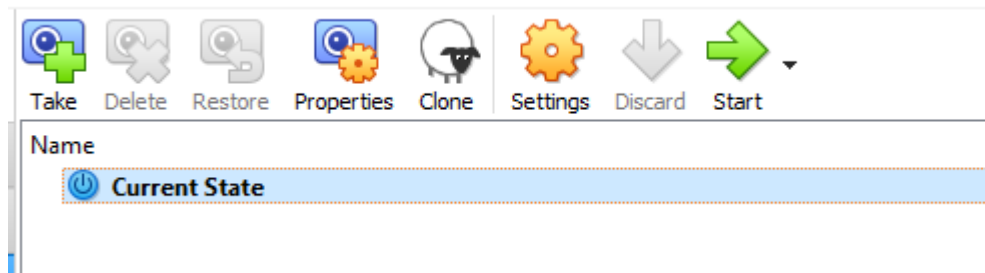
## Snapshots and Reverts in VMs

In VirtualBox, snapshots are a powerful and convenient feature that allows you to capture the current state of a virtual machine (VM) at a specific point in time. Think of snapshots as "save points" or checkpoints that record the exact configuration, data, and the entire state of a VM, including its RAM contents, disk, and settings. Reverts simply refer to restoring the Virtual Machine to a previous snapshot.

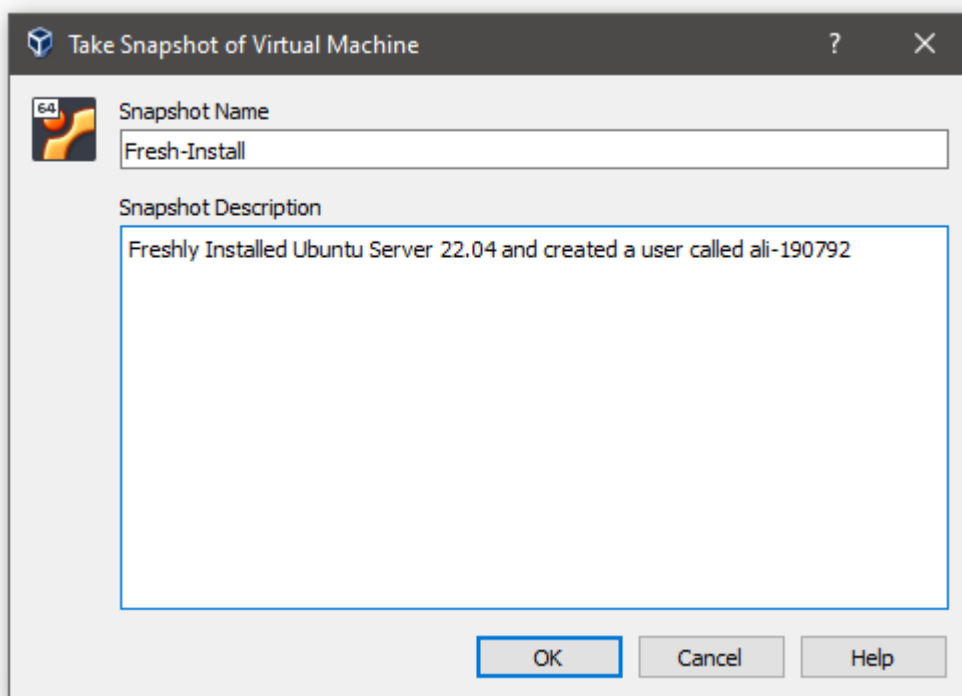
In order to take a snapshot of a VM, we must first shutdown the VM (It is recommended to shutdown the VM, however a snapshot of a running VM can also be taken)



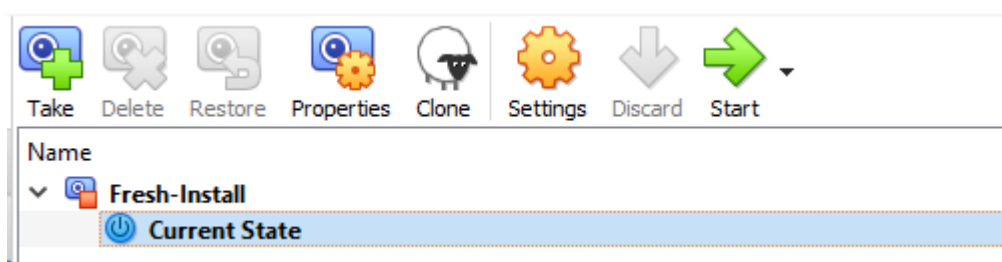
You can click on `Take` to take a snapshot of the current state of the Virtual Machine



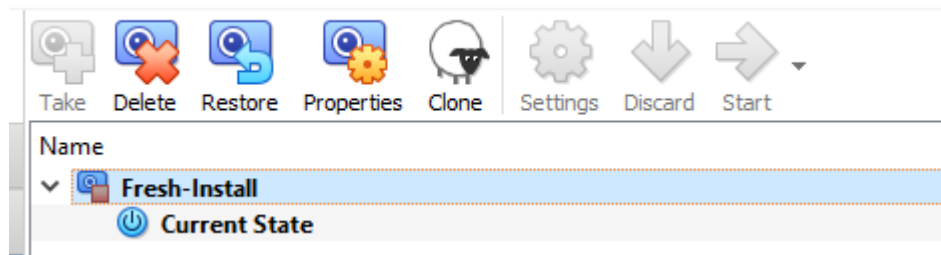
It is highly recommended that you name your snapshots concisely so they have a meaning



Once you click on **ok** :



Similarly, if you now click on **Fresh-Install** you can see that the greyed-out **Restore** option can be used and the VM can be restored to this specific snapshot



## Note Taking

In the field of Cyber Security, Note Taking and Keeping is an art. No one can remember all the commands of the top of their dome and they require that they document their knowledge to later take a peek and recall again. For this specific purpose, I will recommend you utilize the one of the following two software

1. [Notion.so](#) - One of the best note-taking software out there. Can be installed on Windows, MacOS, iOS and Android (even Linux with slight tweaks)
2. [Obsidian.md](#) - Really amazing but lacks remote sync (Comes in paid version)

I personally use Notion as it has free sync and it can also make use of `Markdown` syntax which can speed up the workflow.

At the end of the day, it doesn't matter what software you use, you can even use Notepad or Word if you're comfortable enough; it's about getting the job done and staying organized.

## Conclusion

This is the first lab and this is just setting up stuff and completing the pre-requisites before we dive head first into the water. We must first learn to float before we can swim.

⇒ **Few Advices:**

1. You will firstly try and google what ever your question is. Asking a question is an art which one must learn as I will tolerate and even answer poorly asked question but the world won't. So make sure you understand the question you're trying to ask and ask properly.
2. Make Google your best friend and it will never disappoint you.