BAHIR DAR UNIVERSITY
BAHIR DAR INSTITUTE OF TECHNOLOGY
FACULTY OF COMPUTING
DEPARTMENT OF SOFTWARE ENGINEERING

Course Name : Operating system and system programming

Individual assignment

Section B

Name	ID
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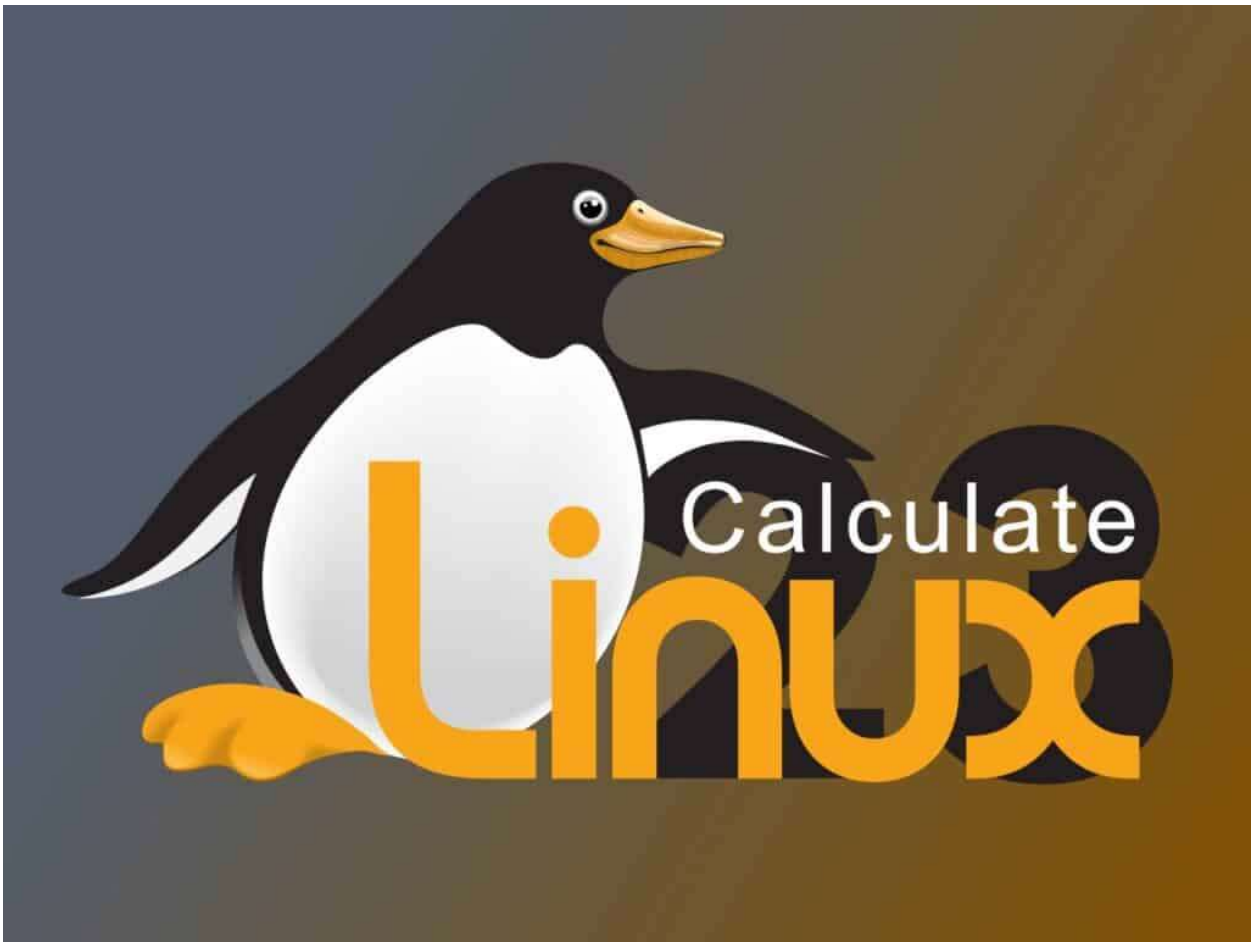
SUBMITTED TO: MR. wendimu
Submission Date:30/08/2017E.C



I Introduction

Calculate Linux OS, a Gentoo-based distribution, is tailored for corporate environments with a focus on rapid deployment and centralized management. It comes in various flavors, such as Desktop (CLD), Directory Server (CDS), Scratch Server (CSS), and many preconfigured functions. Cinnamon, KDE Plasma, LXQt, MATE or XFCE.

Brings the complexity of Gentoo to the average Linux user in a convenient and easy-to-use box. In other words, it is an excellent way to get started in the Gentoo ecosystem without compiling everything.

designed for desktops, servers, and workstations. It offers flexibility, stability, and customization, making it suitable for various environments. The motivation behind using Calculate Linux lies in its ability to provide a robust and efficient platform for advanced users and developers.

2. **Objectives**

The primary objectives of this documentation are:

To provide a comprehensive guide for installing Calculate Linux OS in a virtual environment.

To address challenges faced during installation and offer solutions.

To explore filesystem support and evaluate the advantages and disadvantages of the OS.

3. Requirements

i. Hardware

Minimum 2 GHz processor.

At least 2 GB RAM (4 GB recommended).

20 GB of free disk space.

A stable internet connection.

ii. Software

VMware Workstation or VirtualBox.

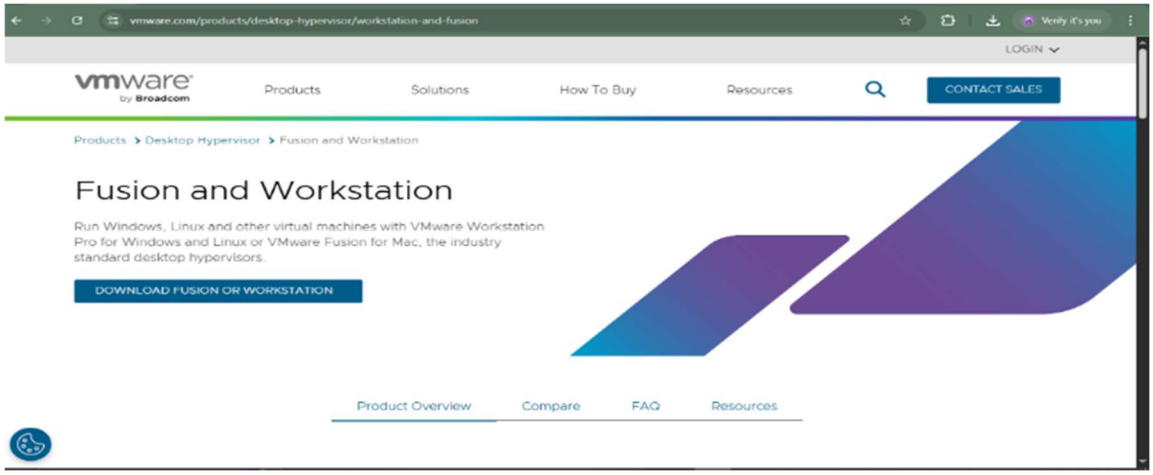
Calculate Linux OS ISO file.

A bootable USB creation tool (e.g., Rufus).

4.Installation Steps

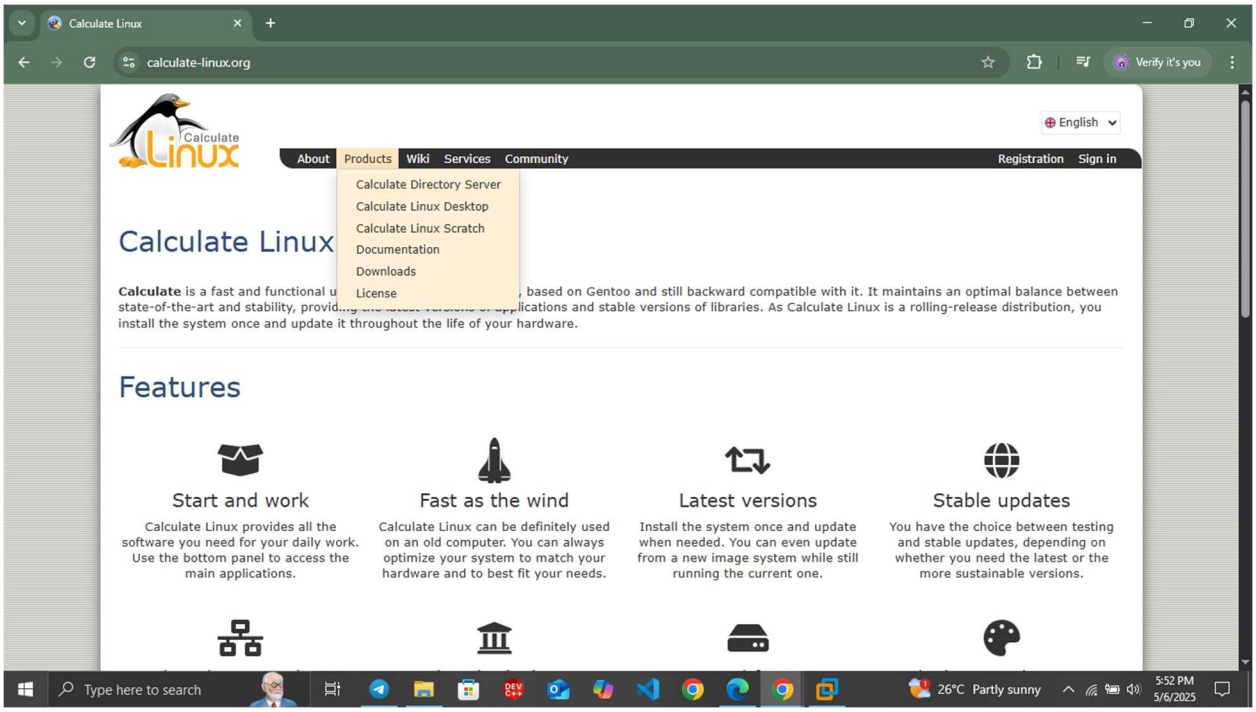
i. Setting Up VMware

Download and install VMware Workstation from its official website.(Choose the version compatible with your operating system.)

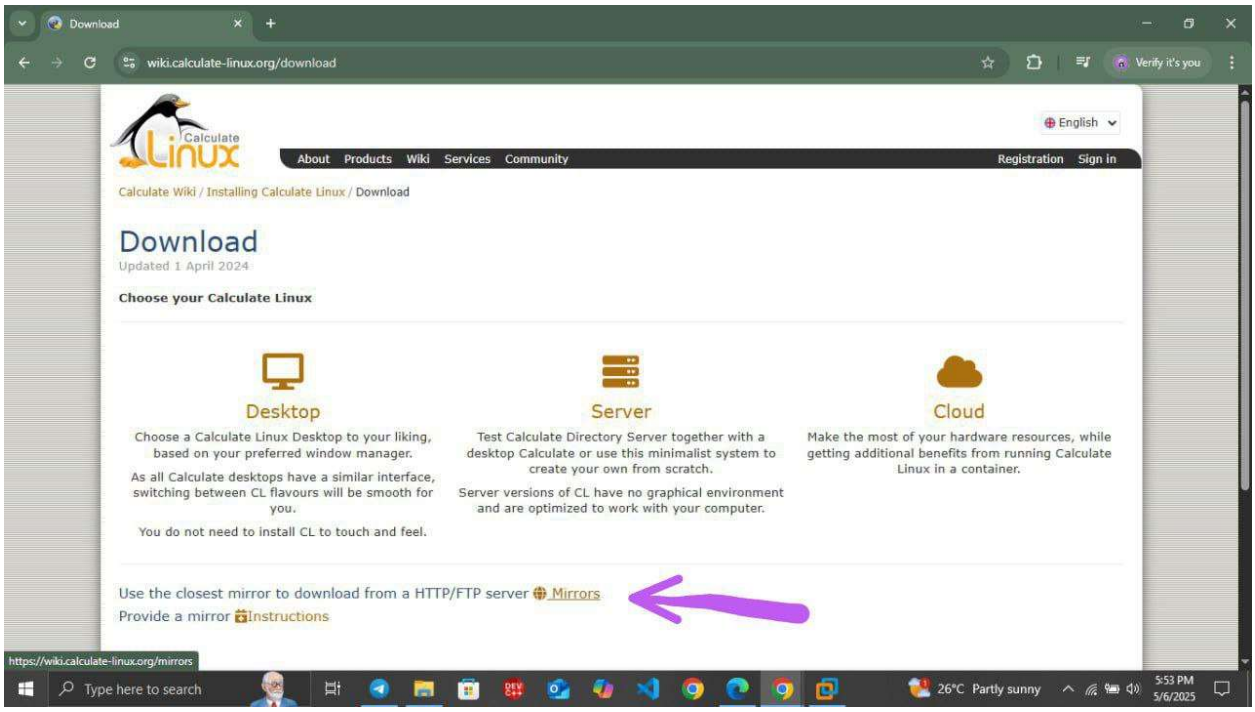


ii. download the calculate Linux os iso file

1. go to calculate linux os official website



1. click on download and select mirrors



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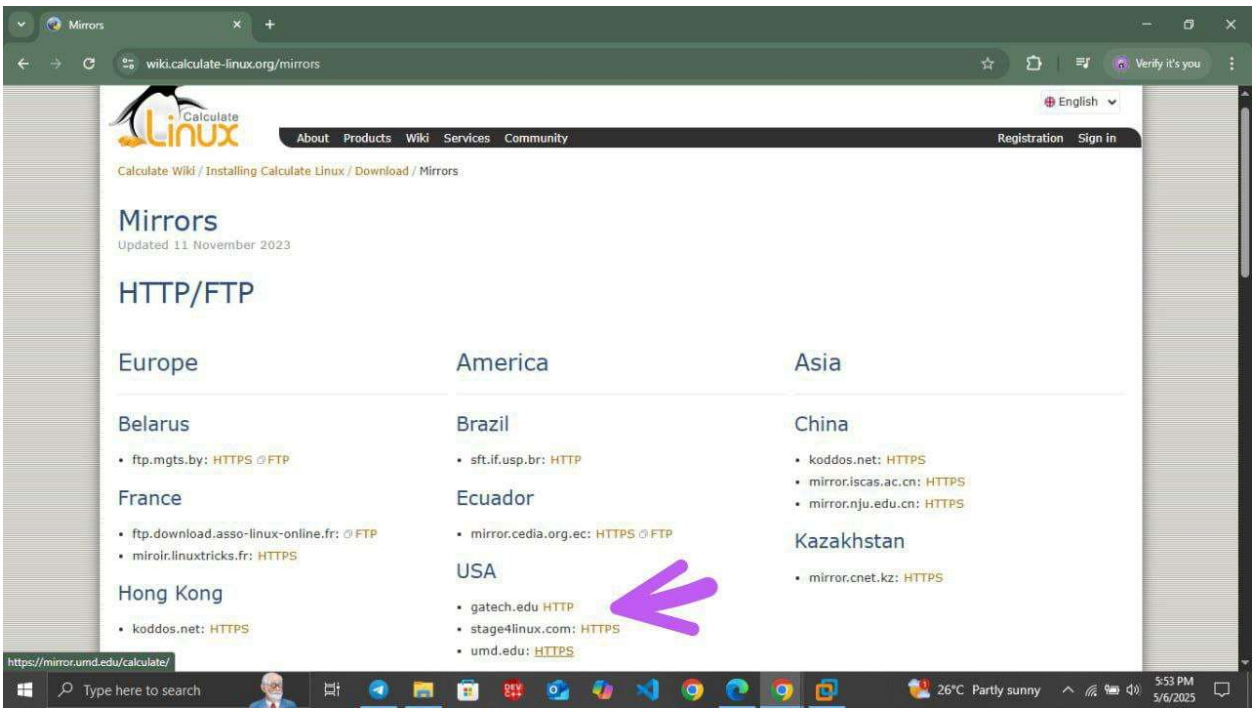
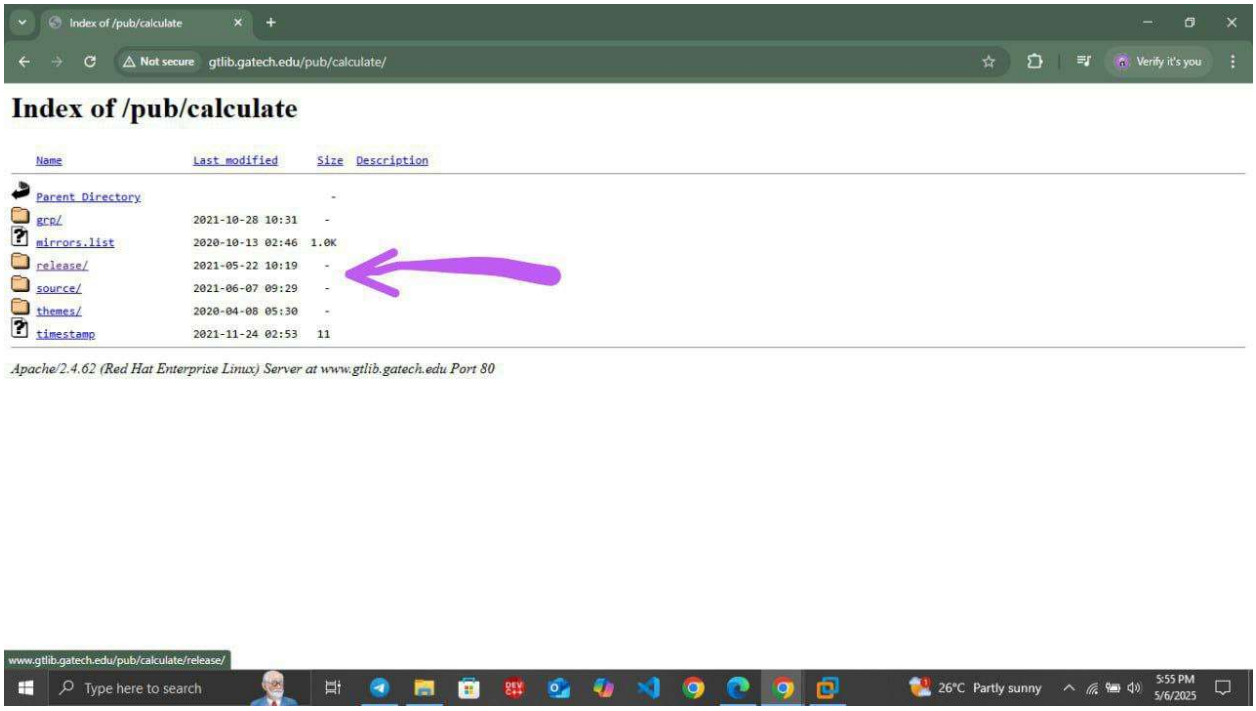
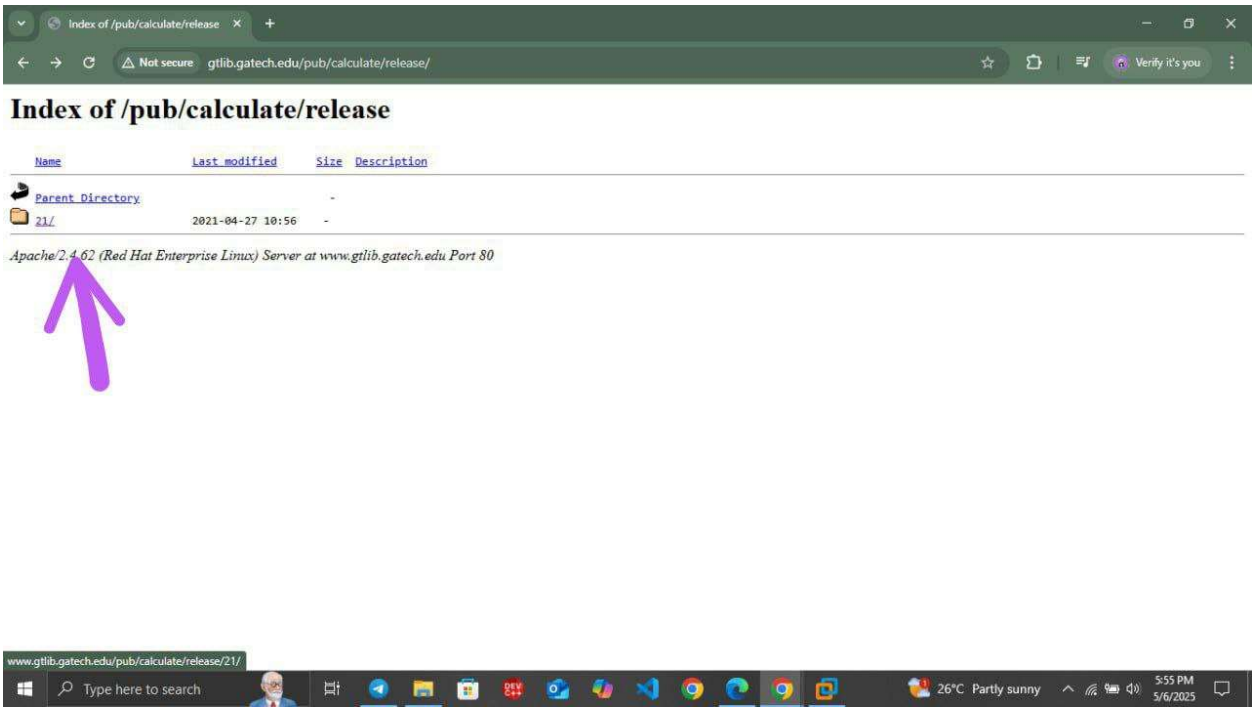



Index of /pub/calculate
Not secure
gtlib.gatech.edu/pub/calculate/
Verify it's you
Index of /pub/calculate
Name
Last modified
Size
Description
Parent Directory -
gcp/ 2021-10-28 10:31 -
mirrors.list 2020-10-13 02:46 1.0K
release/ 2021-05-22 10:19 -
source/ 2021-06-07 09:29 -
themes/ 2020-04-08 05:30 -
timestamp 2021-11-24 02:53 11
Apache/2.4.62 (Red Hat Enterprise Linux) Server at www.gtlib.gatech.edu Port 80
www.gtlib.gatech.edu/pub/calculate/release/
Type here to search
26°C Partly sunny
5:55 PM
5/6/2025


Index of /pub/calculate/release
Not secure
gtlib.gatech.edu/pub/calculate/release/
Verify it's you
Index of /pub/calculate/release
Name
Last modified
Size
Description
Parent Directory -
21/ 2021-04-27 10:56 -
Apache/2.4.62 (Red Hat Enterprise Linux) Server at www.gtlib.gatech.edu Port 80
www.gtlib.gatech.edu/pub/calculate/release/21/
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26°C Partly sunny
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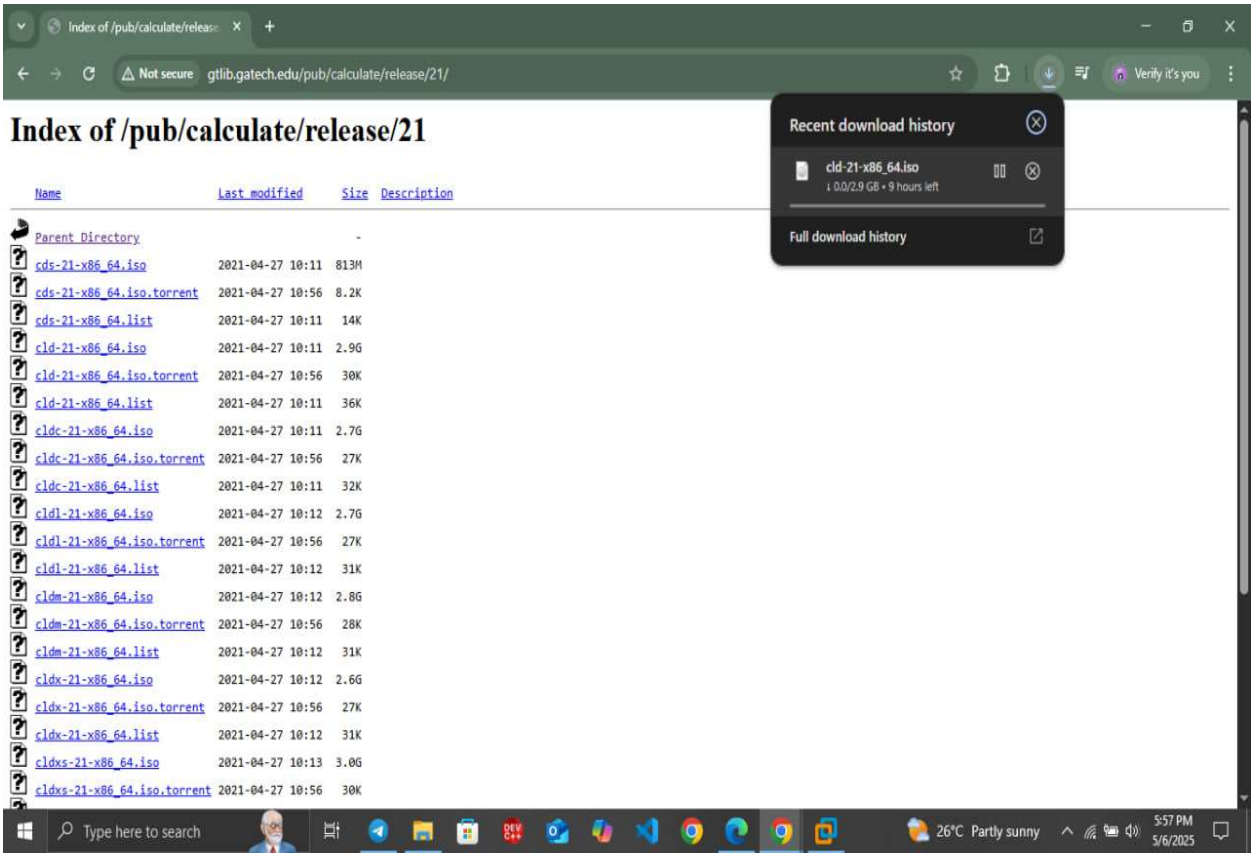
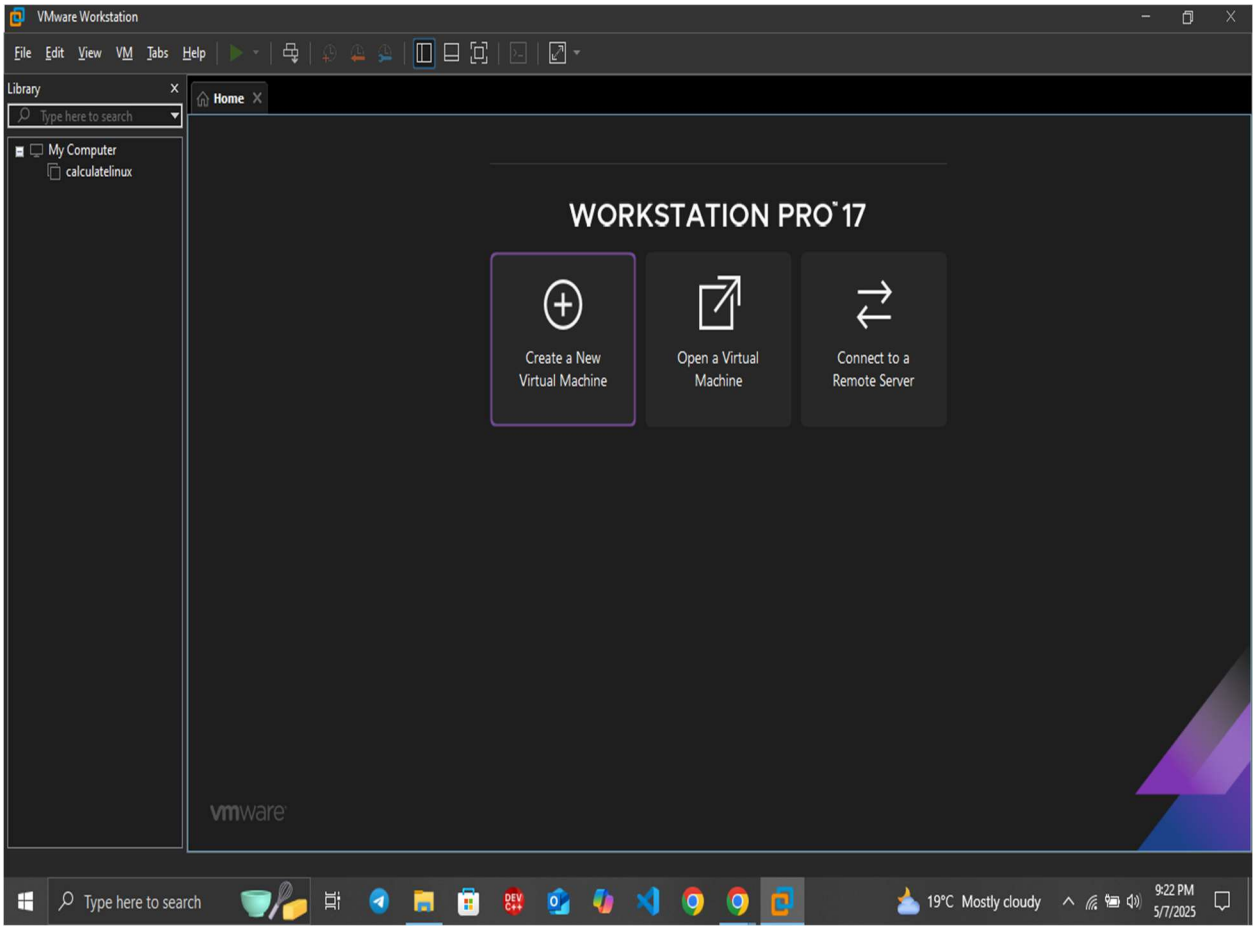
5/6/2025

3. Select the specific iso file for your os and download

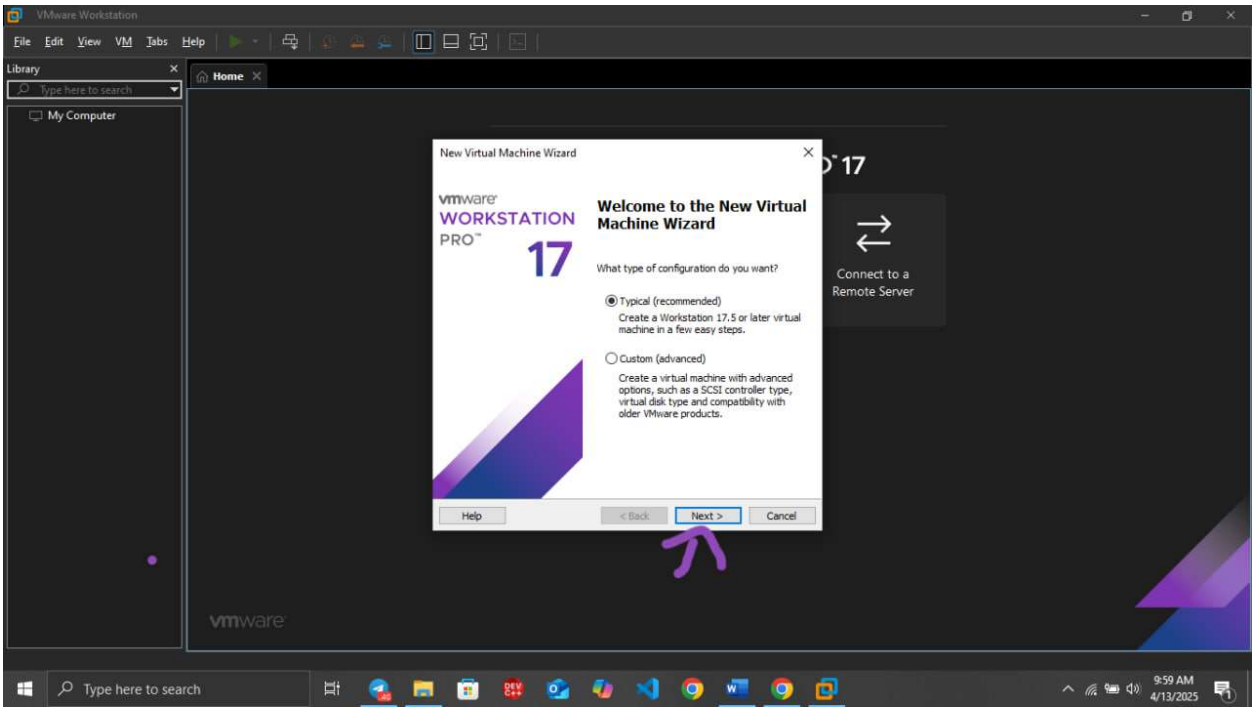


❖ AFTER DOWNLOADING THE ISO FILE IT'S TIME TO CREATE A VIRTUAL MACHINE ON VMWARE

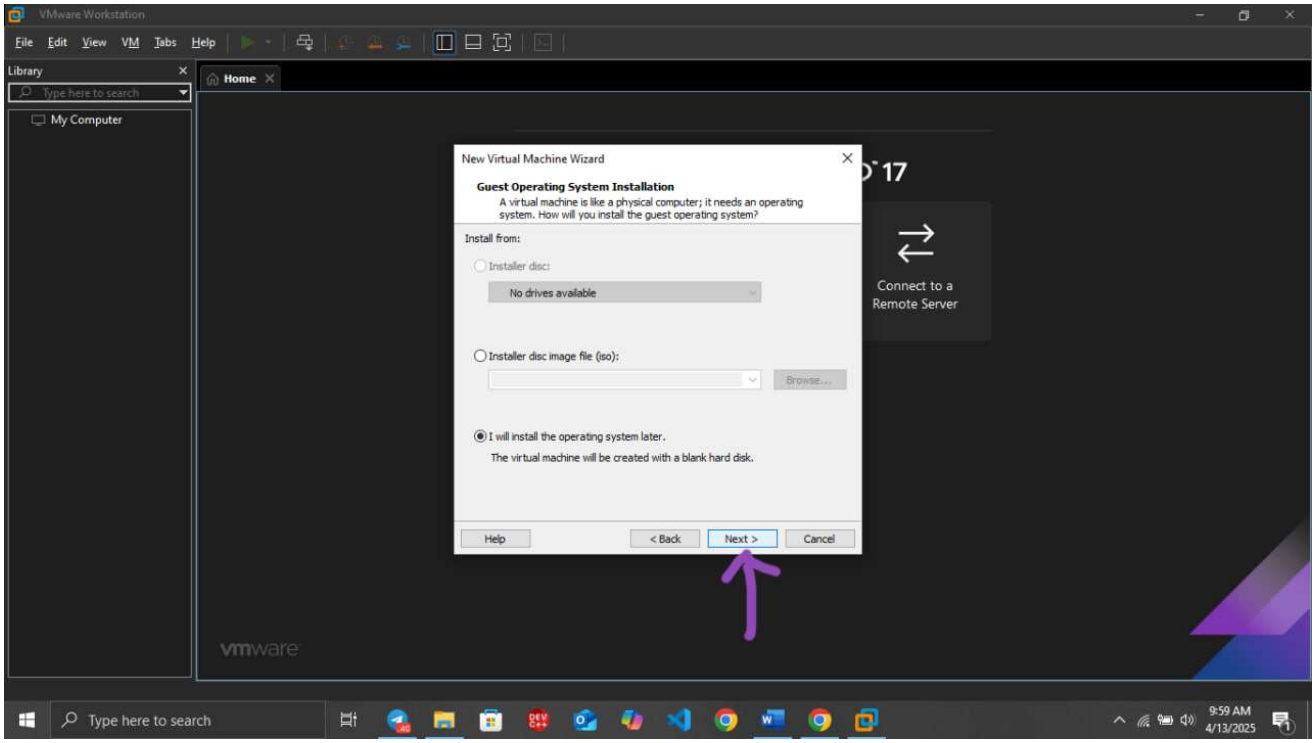
1. Create a new virtual machine and allocate resources (RAM, disk space,etc.).
   Click on "Create a New Virtual Machine" on the main VMware



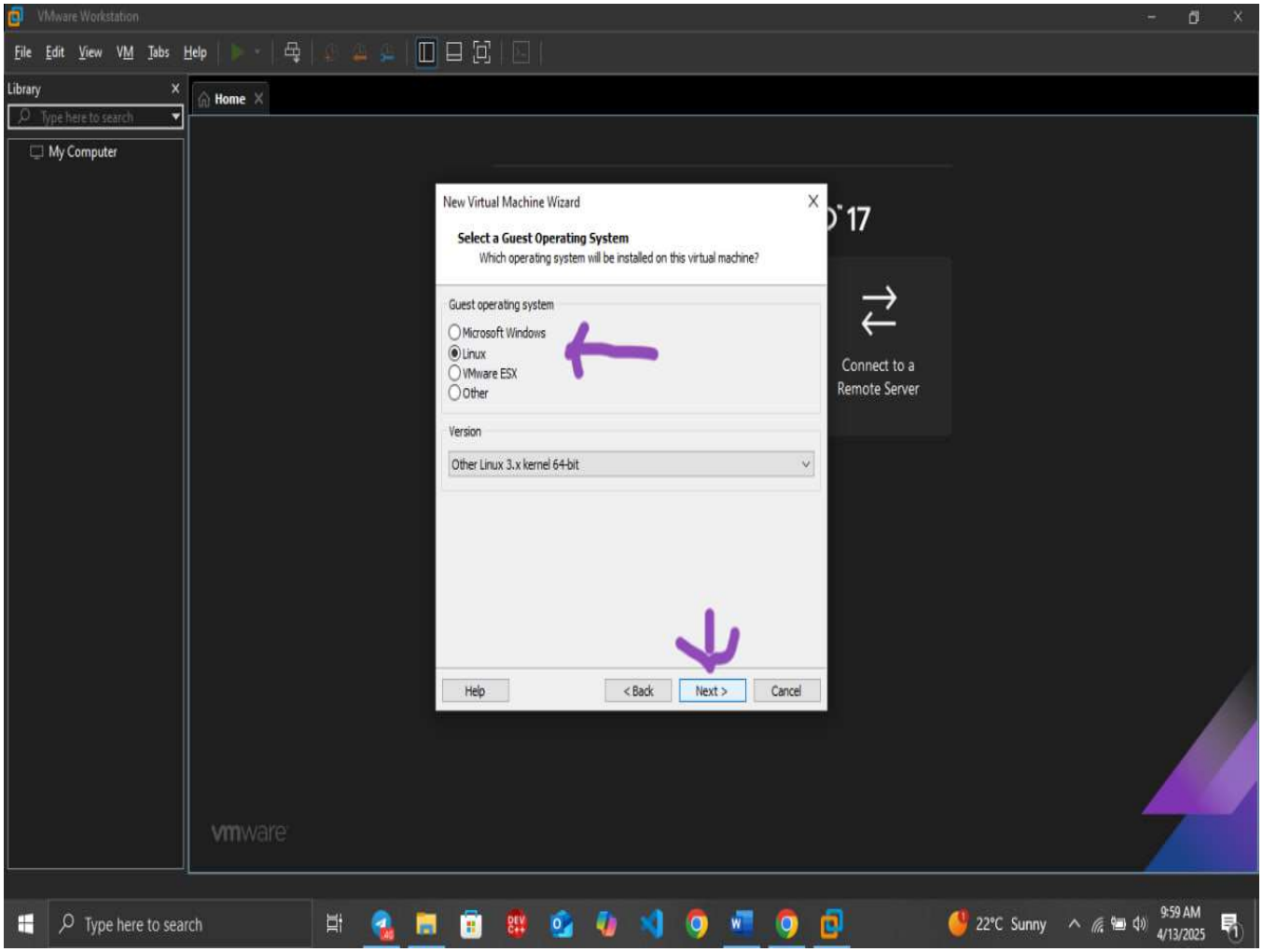
2. select the typical option and click on next



3. Follow the on-screen instructions to complete the installation process.

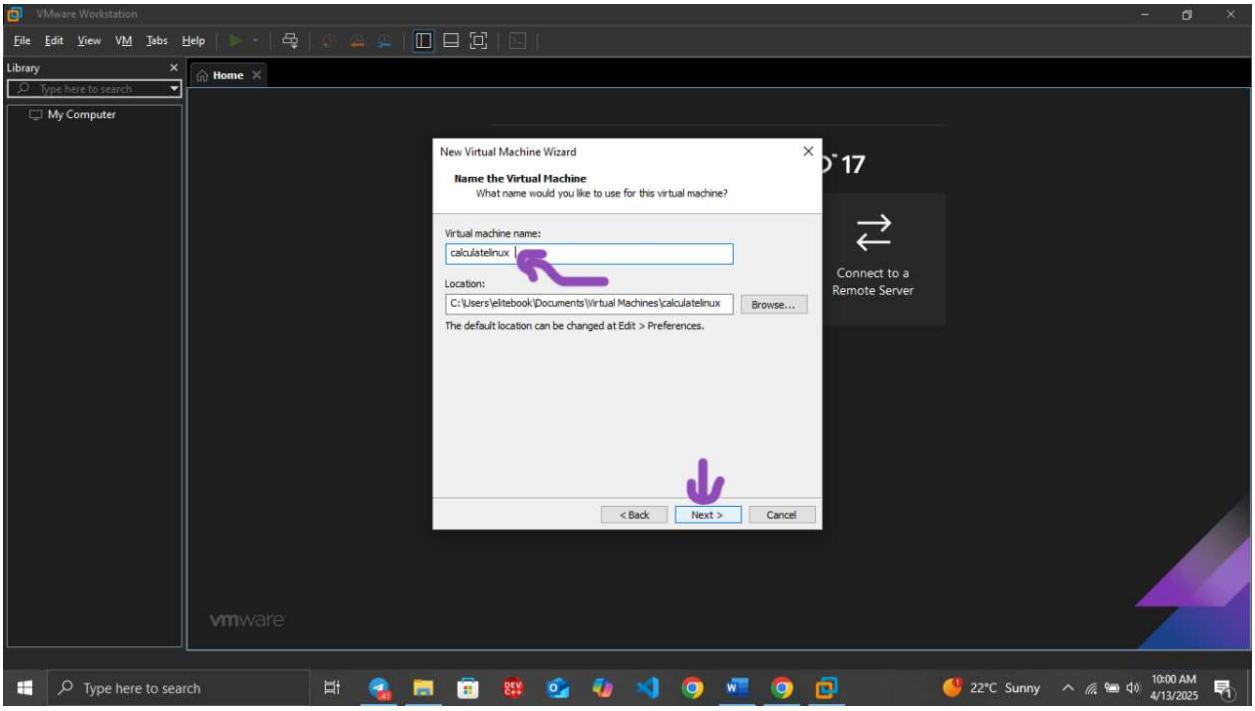


4. Click on Linux and the version to other Linux 3.x kernel 64-bit and next

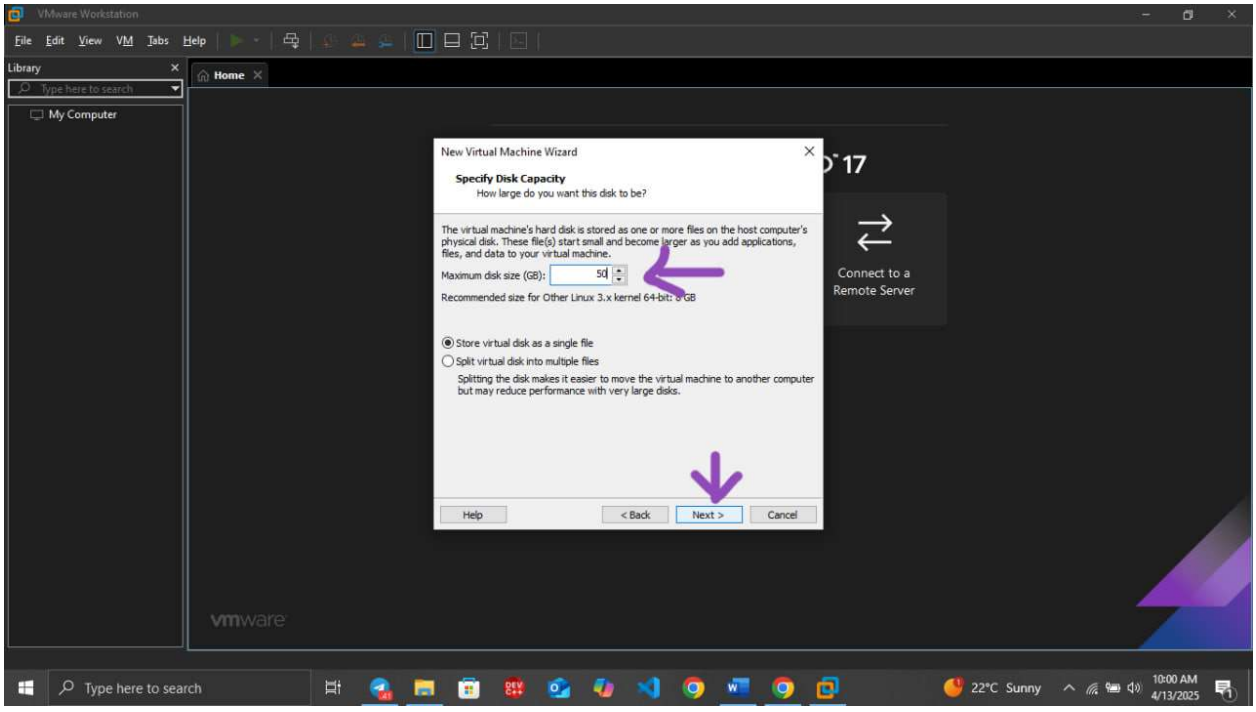


5. Select the Installation Method

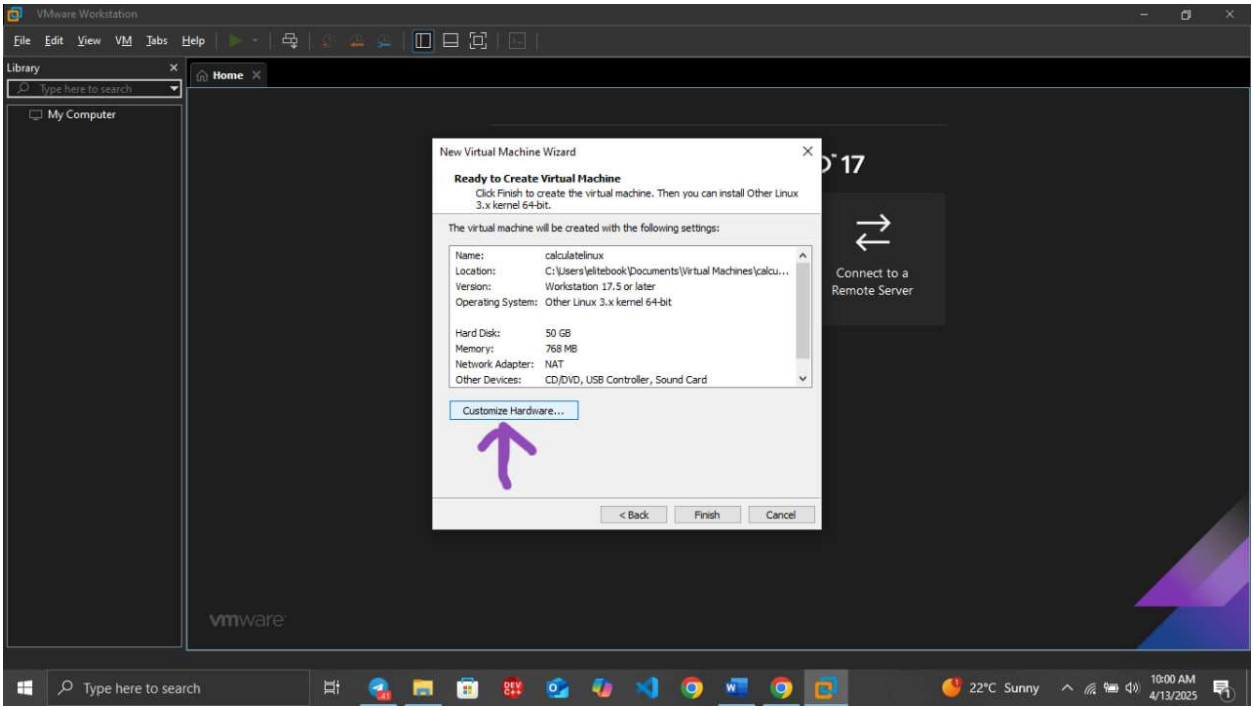
   Set the virtual machine name to : calculatelinux



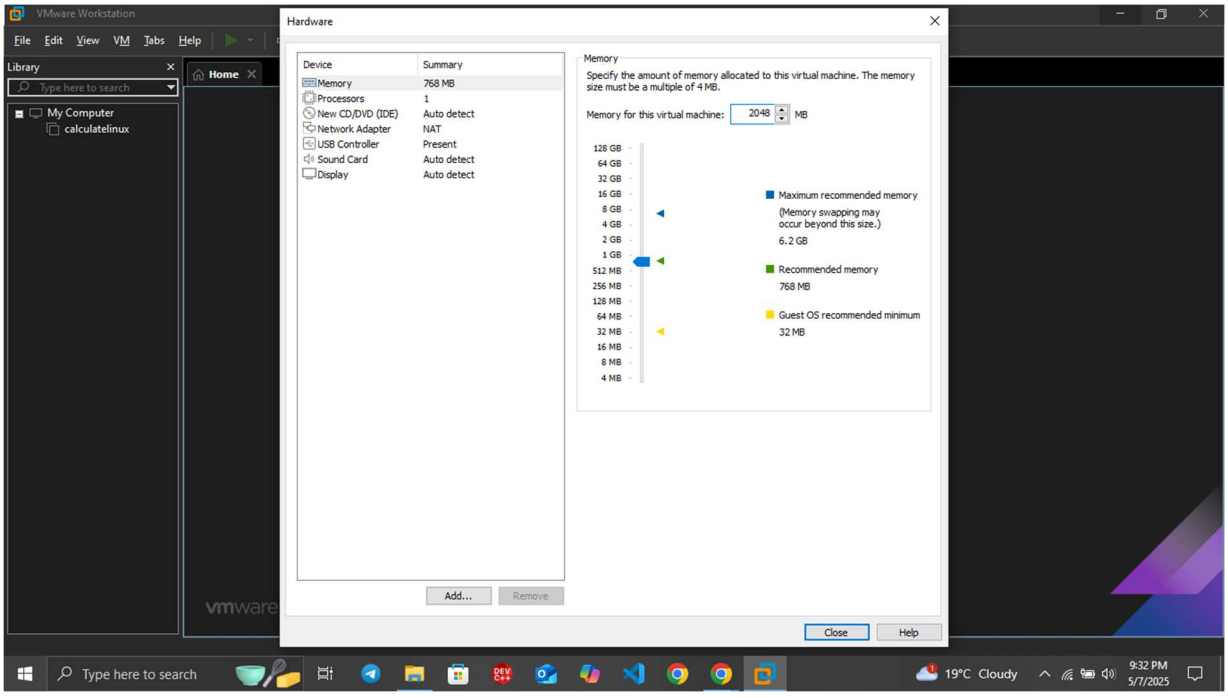
6. Specify the size and where to store



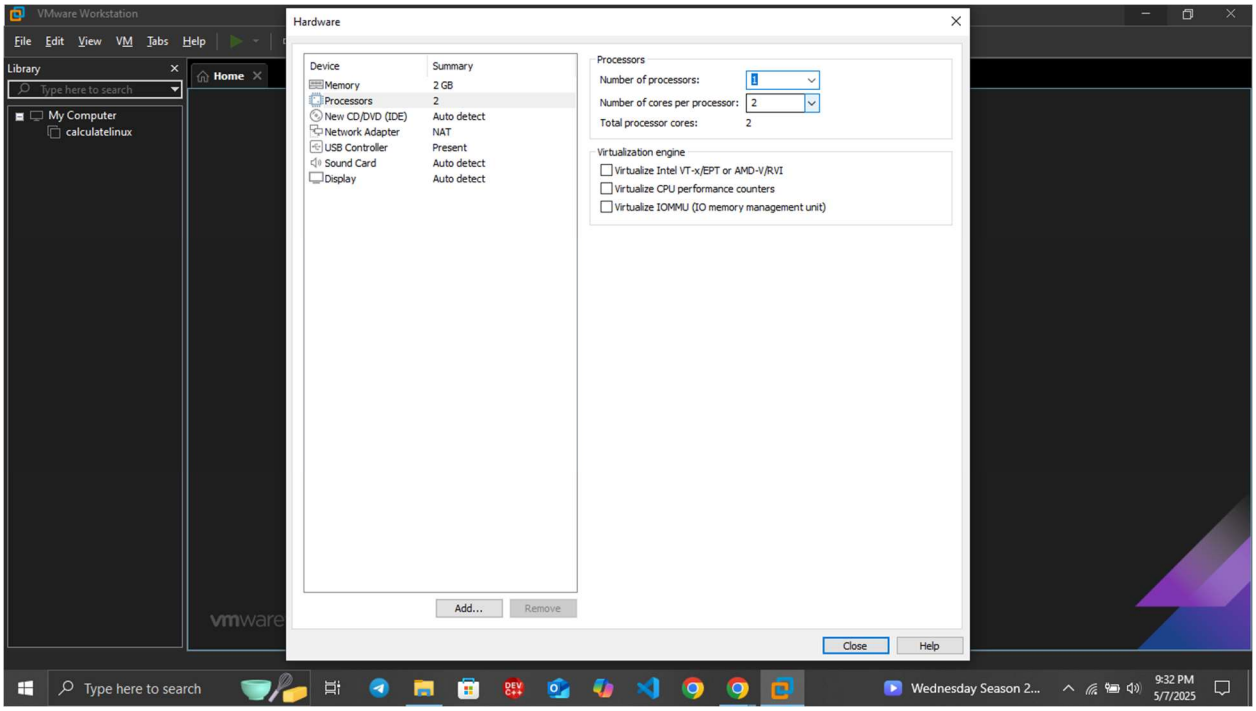
7. Customize the Hardware



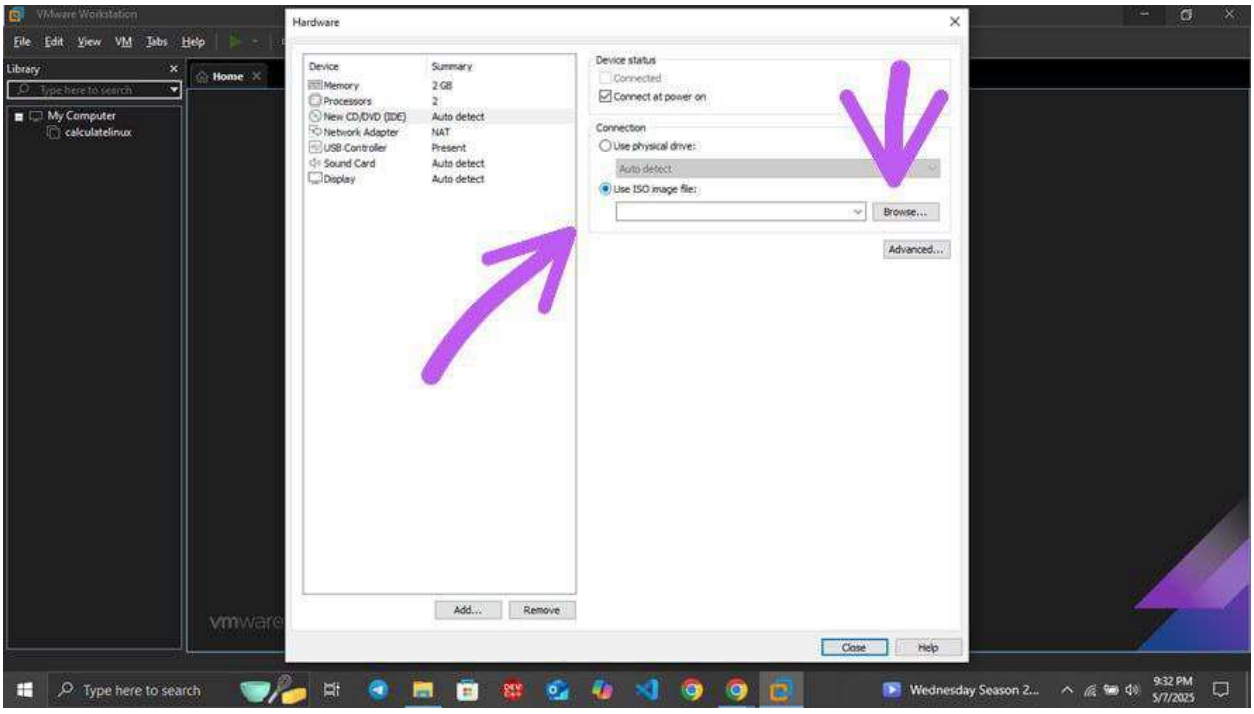
- Memory



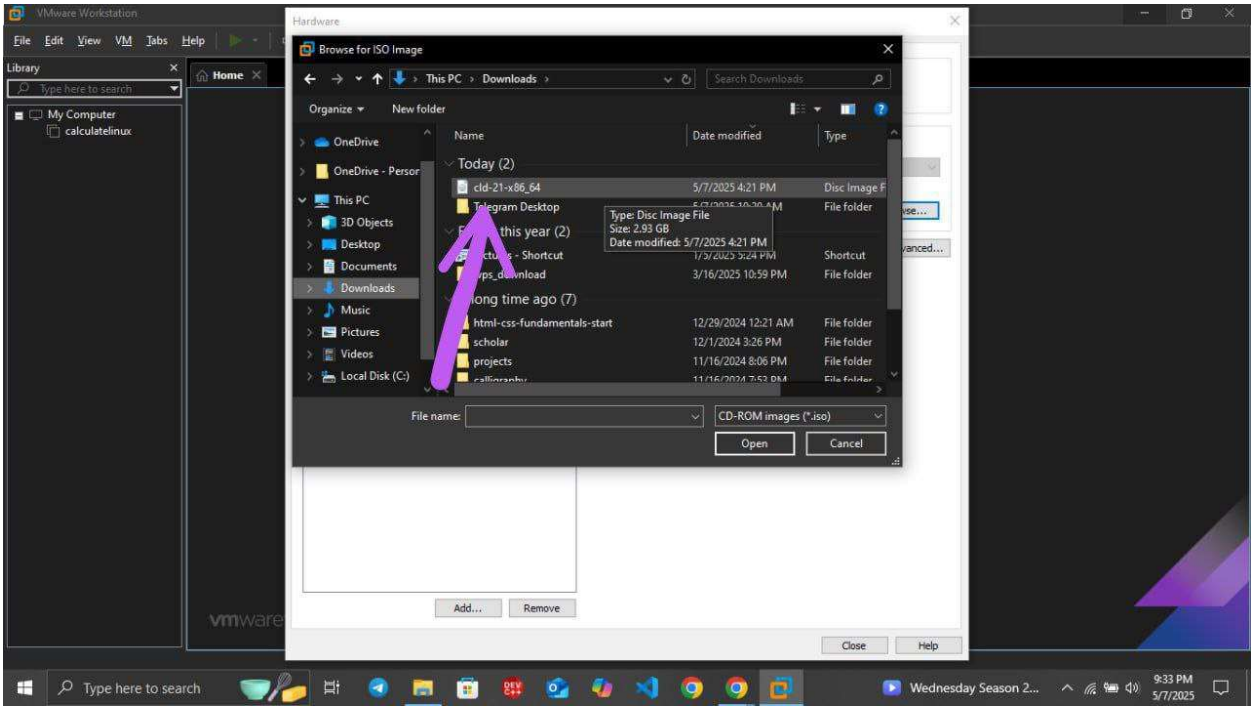
- Processor

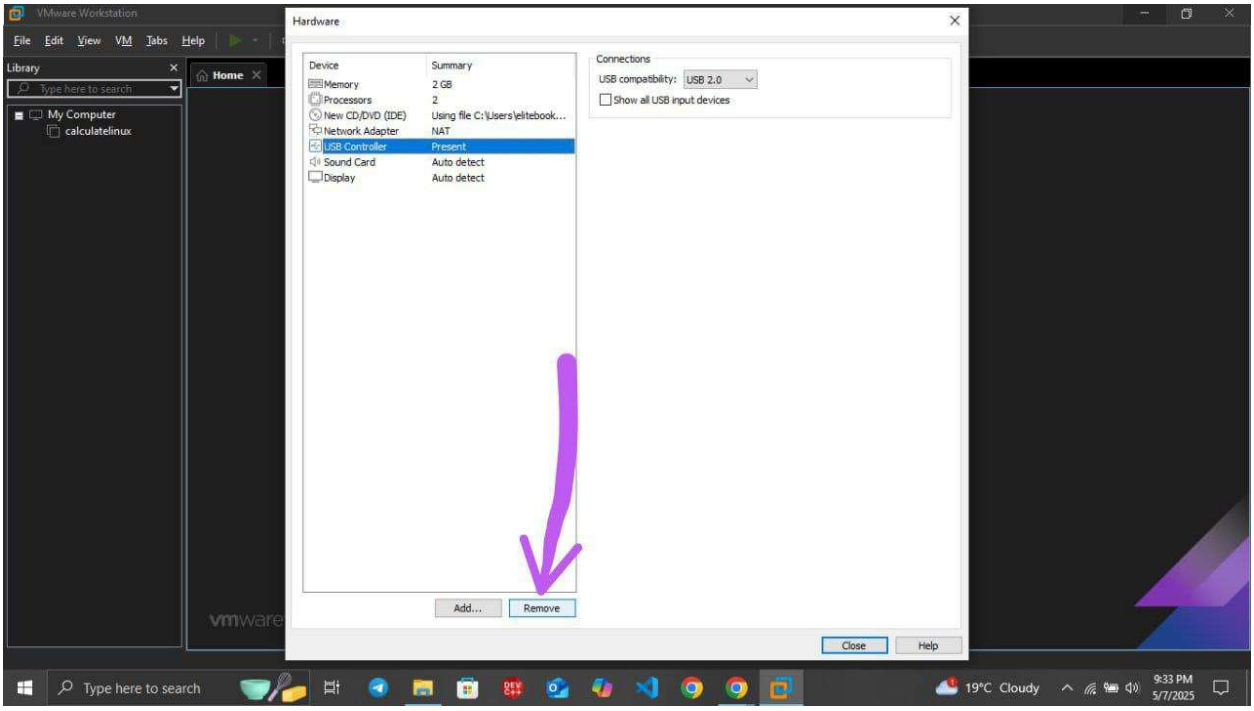


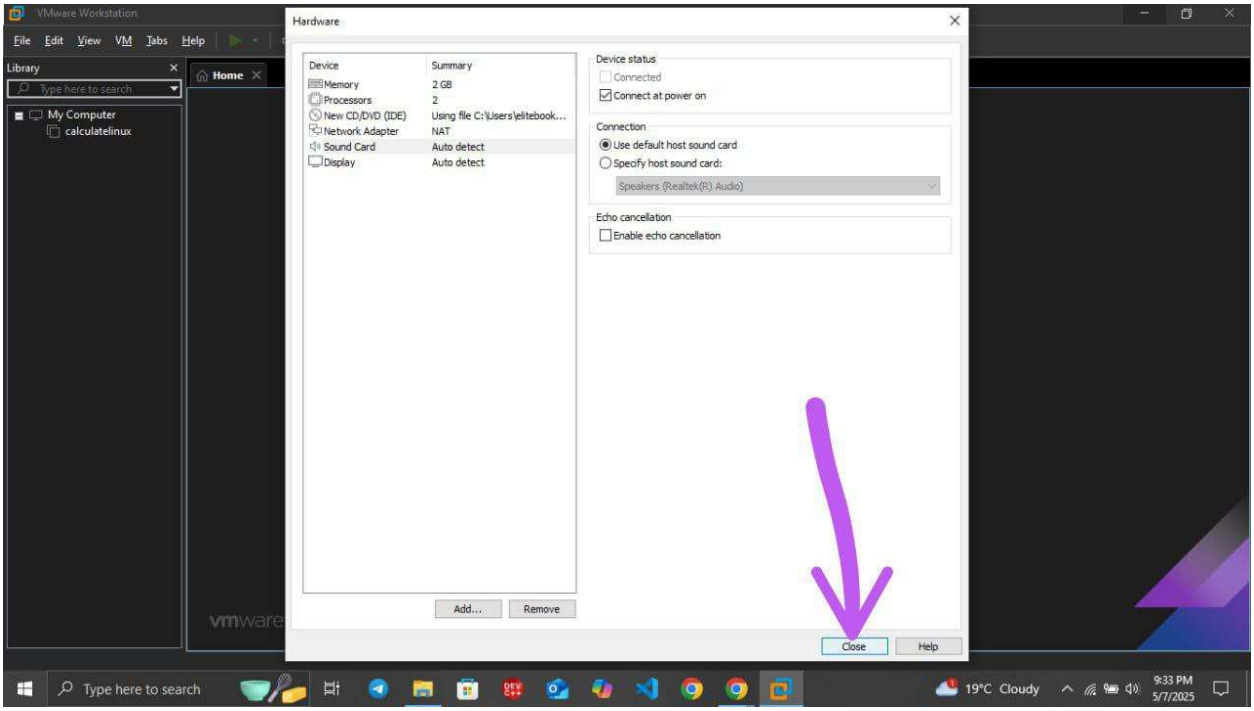
- Choose "Installer disc image file (iso)", then click Browse and select the Calculate Linux ISO file.
  Attach the ISO file of the operating system you want to install (e.g., Calculate Linux). The virtual machine will boot from the attached ISO file, allowing you to proceed with the installation of Calculate Linux.



8. Follow the on-screen instructions to complete the installation process.






VMware Workstation
File Edit View VM Tabs Help
Library
Type here to search
My Computer
calculatelinux
Home
Hardware
Device
Summary
Memory
2 GB
Processors
2
New CD/DVD (IDE)
Using file C:\Users\elitebook...
Network Adapter
NAT
Sound Card
Auto detect
Display
Auto detect
Device status
Connected
Connect at power on
Connection
Use default host sound card
Specify host sound card:
Speakers (Realtek(R) Audio)
Echo cancellation
Enable echo cancellation
Add...
Remove
Close
Help
vmware
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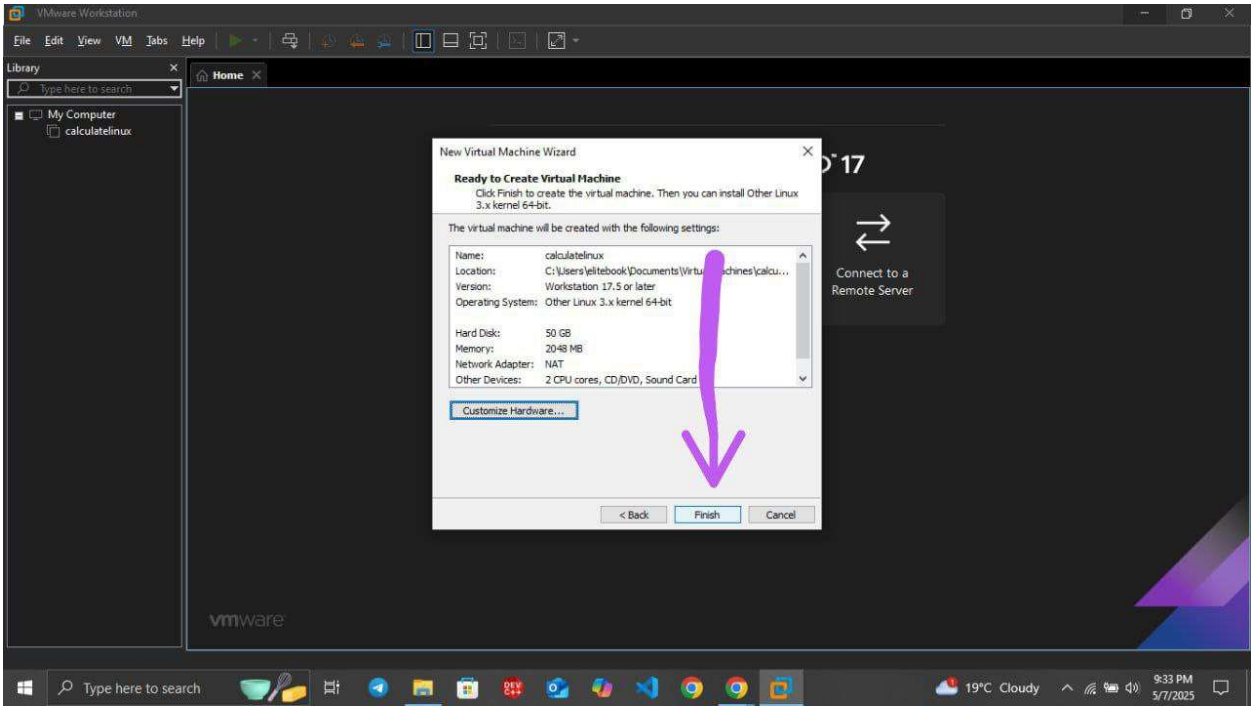
VMware Workstation
File Edit View VM Tabs Help
Library
Type here to search
My Computer
calculatelinux
Home
New Virtual Machine Wizard
Ready to Create Virtual Machine
Click Finish to create the virtual machine. Then you can install Other Linux 3.x kernel 64-bit.
The virtual machine will be created with the following settings:
Name: calculatelinux
Location: C:\Users\elitebook\Documents\Virtu...chines\calcu...
Version: Workstation 17.5 or later
Operating System: Other Linux 3.x kernel 64-bit
Hard Disk: 50 GB
Memory: 2048 MB
Network Adapter: NAT
Other Devices: 2 CPU cores, CD/DVD, Sound Card
Customize Hardware...
< Back
Finish
Cancel
17
Connect to a Remote Server
vmware
Type here to search
19°C Cloudy
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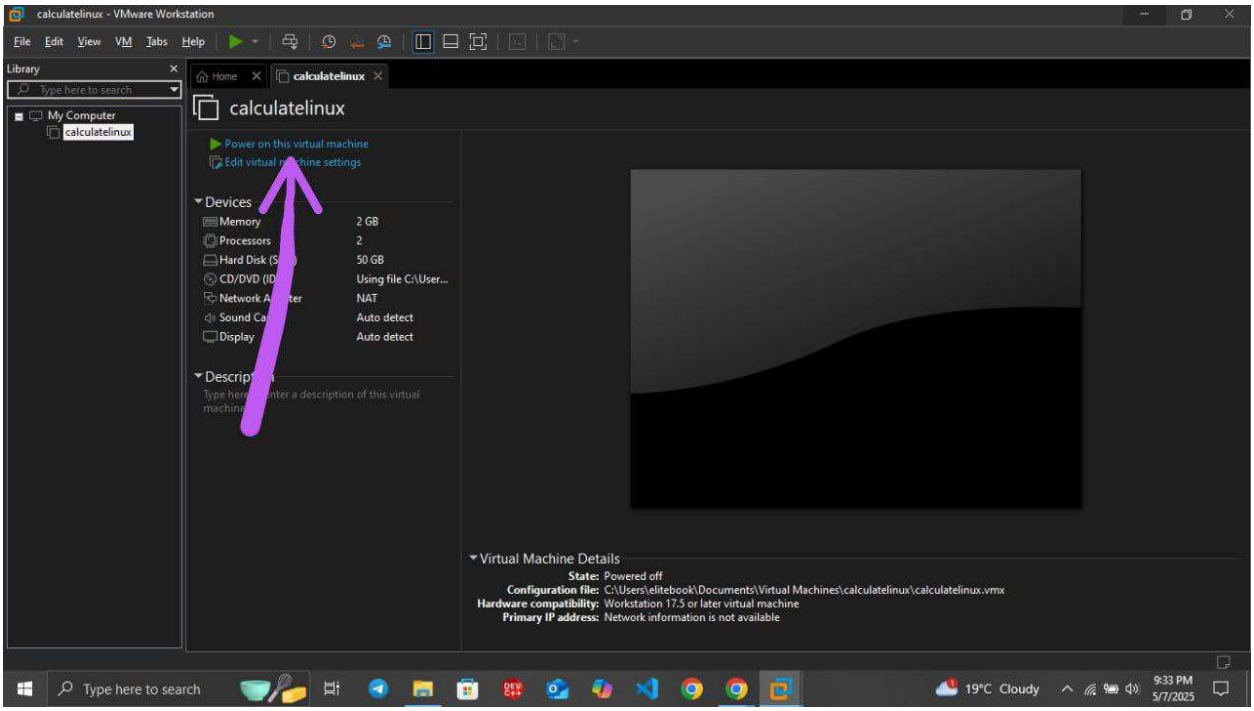
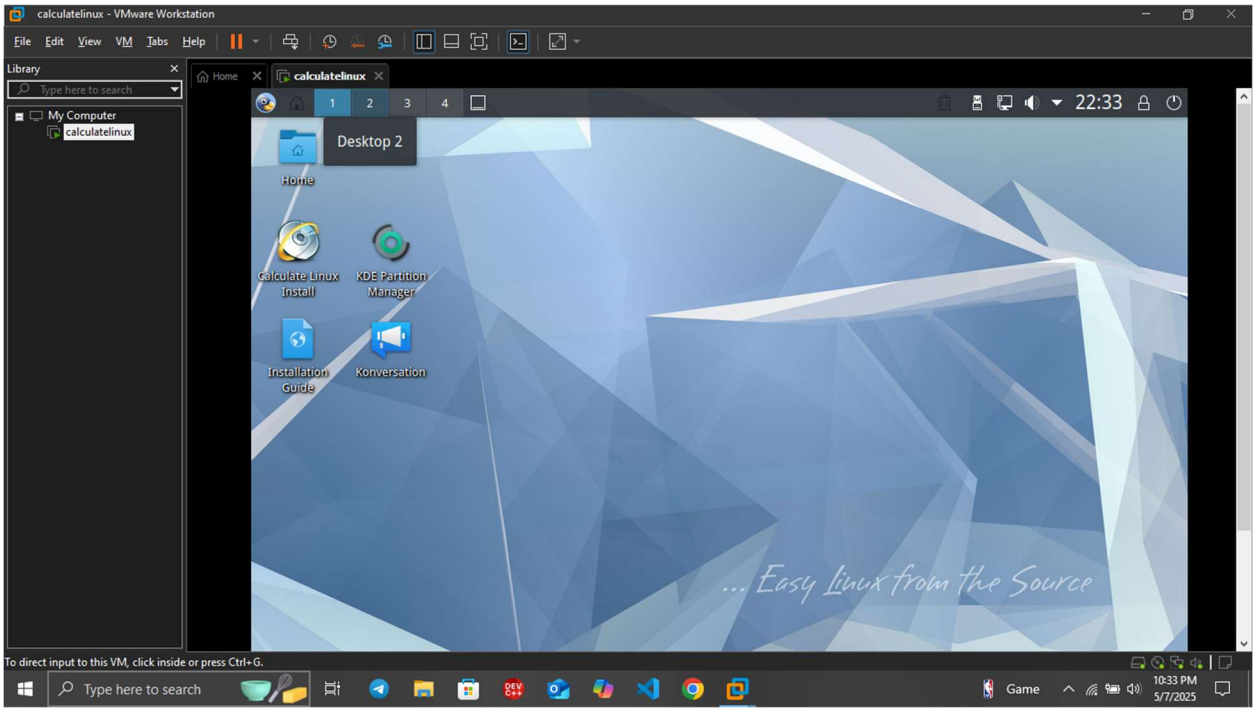
9. Installing Calculate Linux OS
    1. Boot Menu: power on the virtual machine in VMware.
        - The Calculate Linux ISO file will boot, and you'll see the boot menu.
        - Select "Start Calculate Linux" from the boot menu.

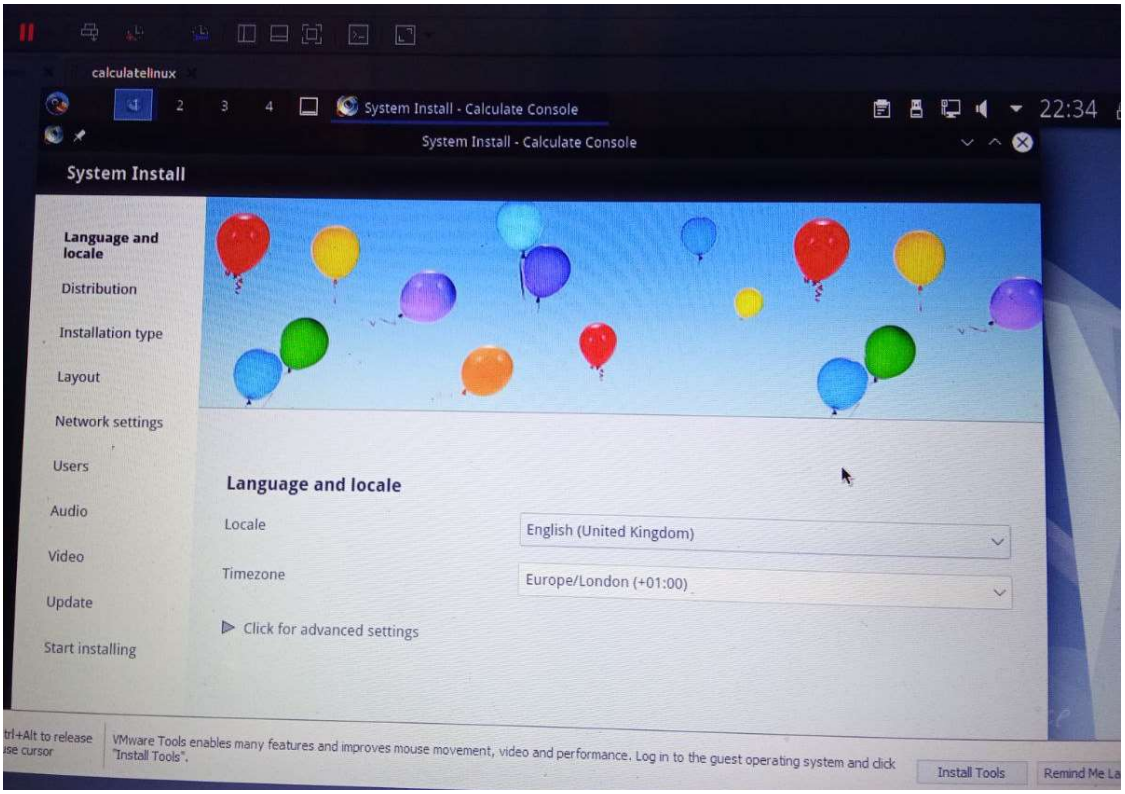




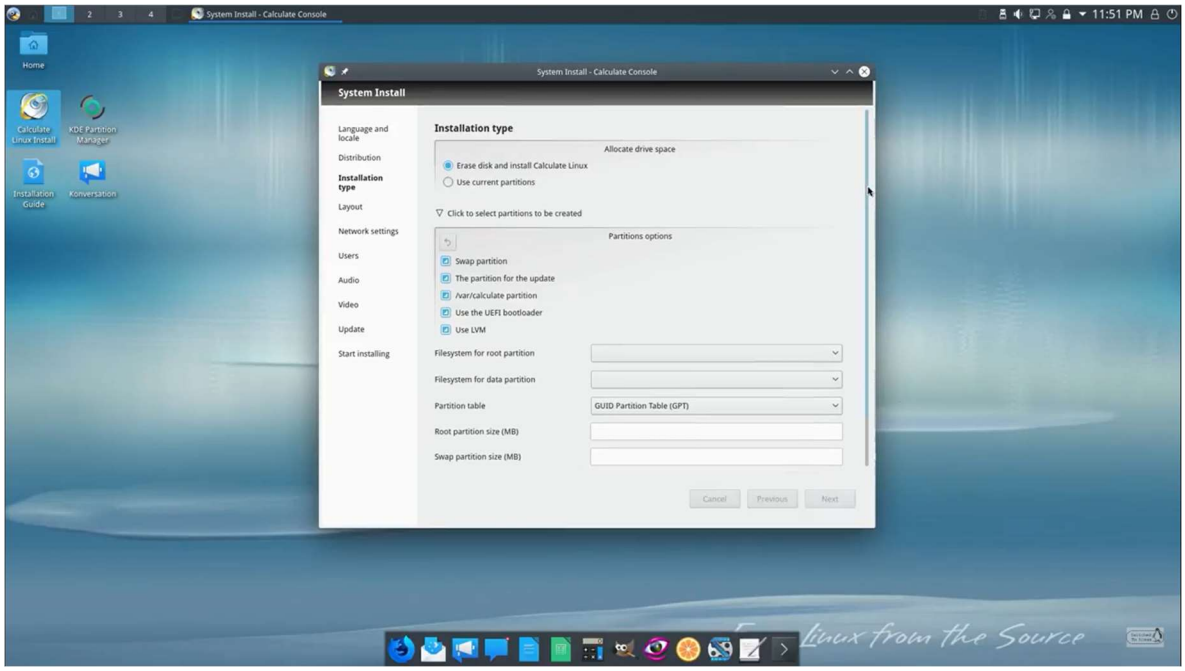
AFTER YOU CLICK CALCULATE LINUX INSTALL YOU WILL BE DIRECTED TO

2. Language and locale

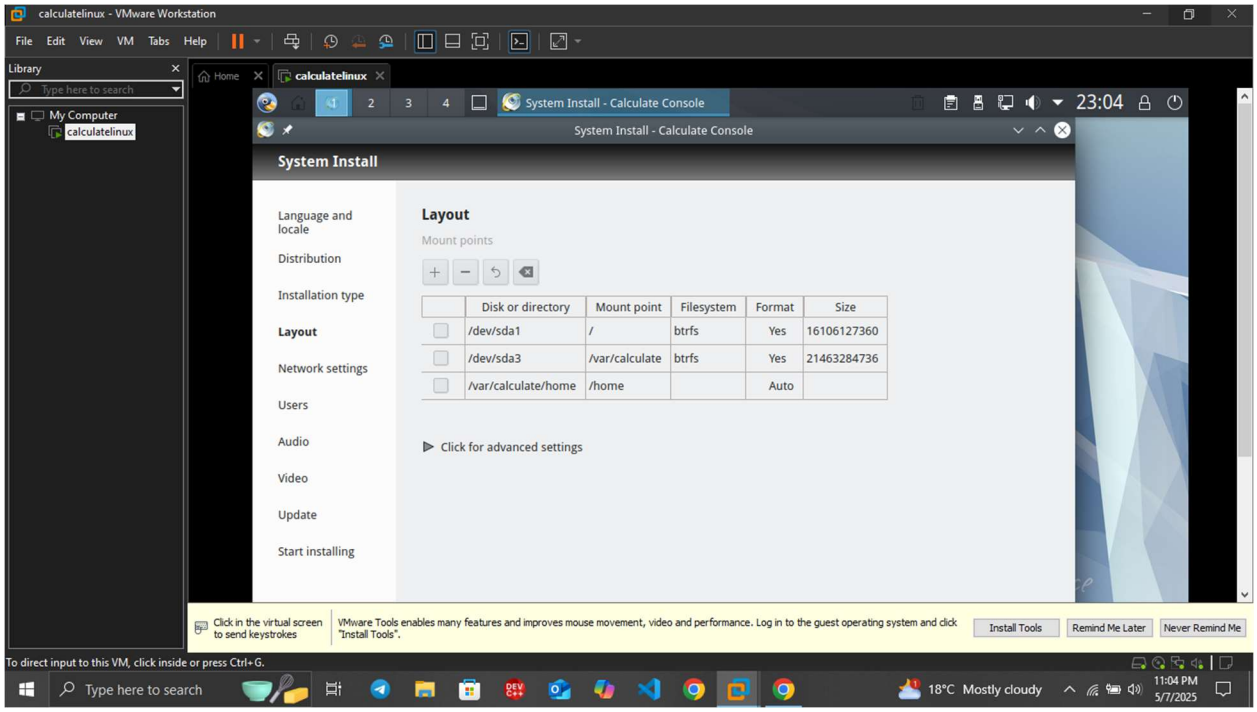
   Language Selection: Once the live environment loads, you'll be prompted to select your preferred language.



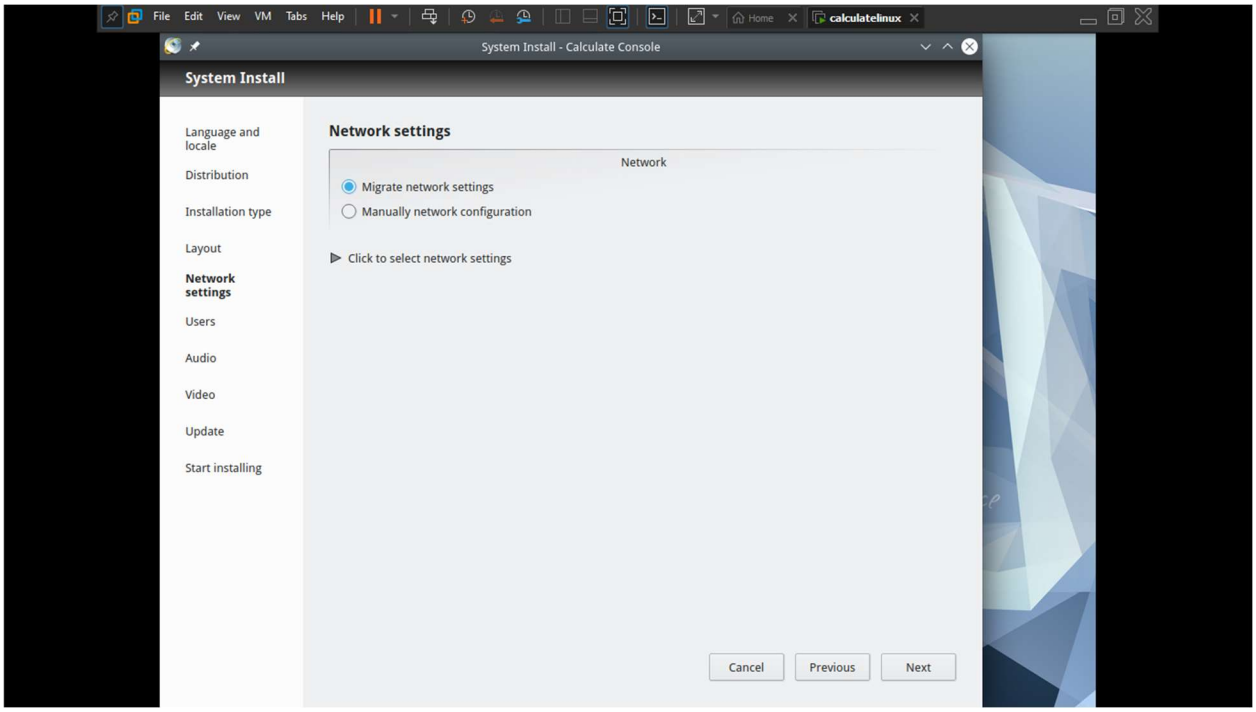
3. Installation type



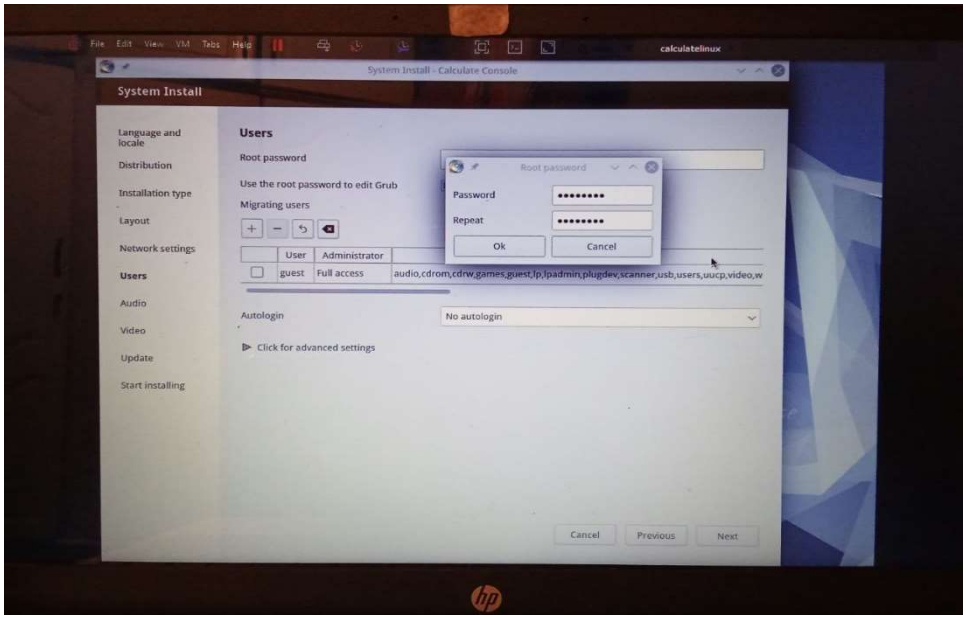
4. Layout



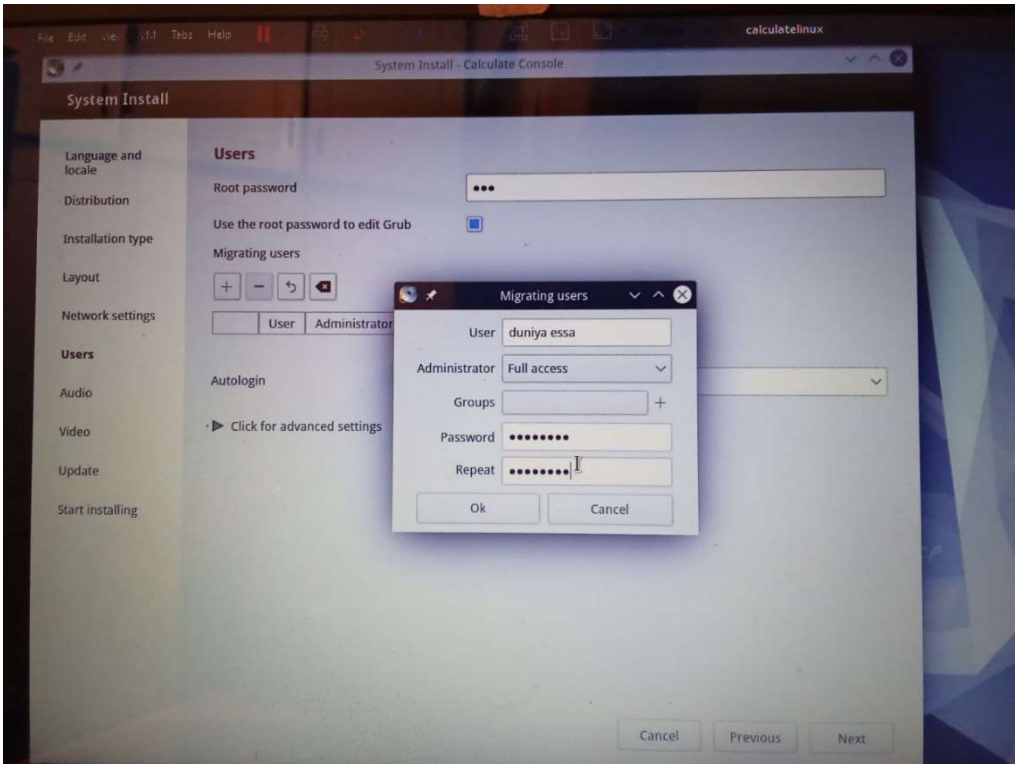
5. Network setting



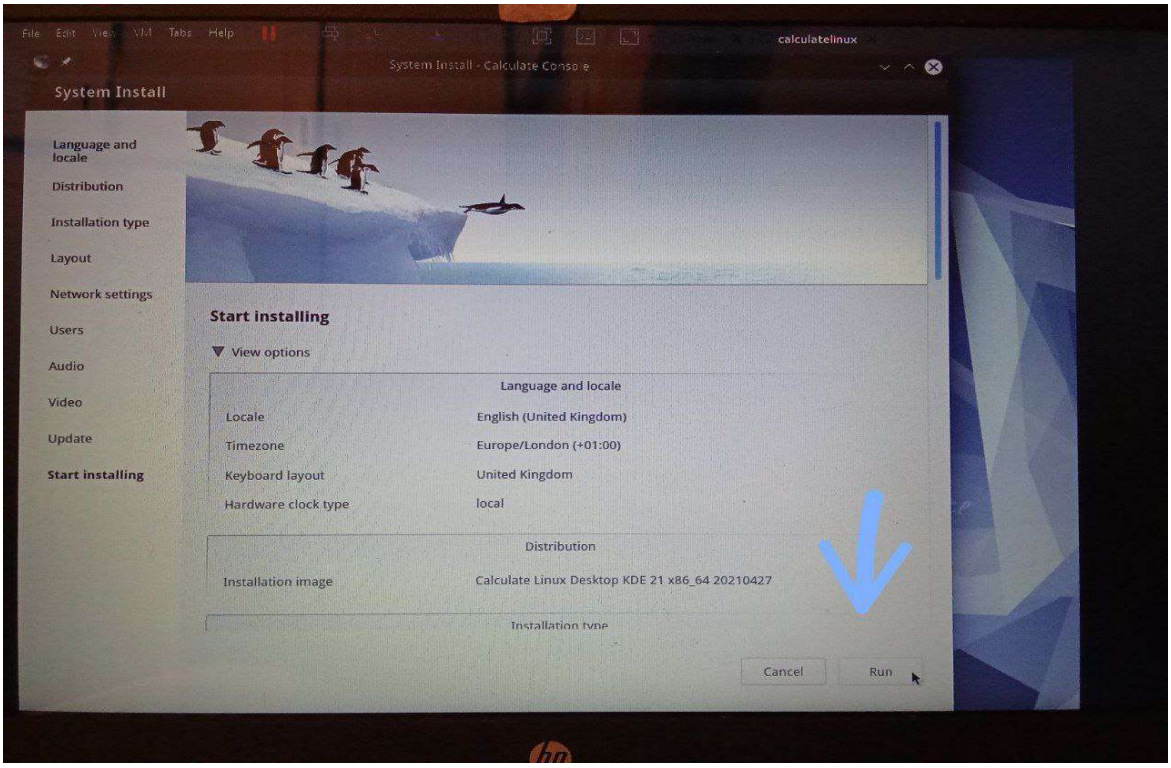
6. User Account Creation
    1. Root Account :Set a password for the root (administrator) account. This is essential for performing system-level tasks

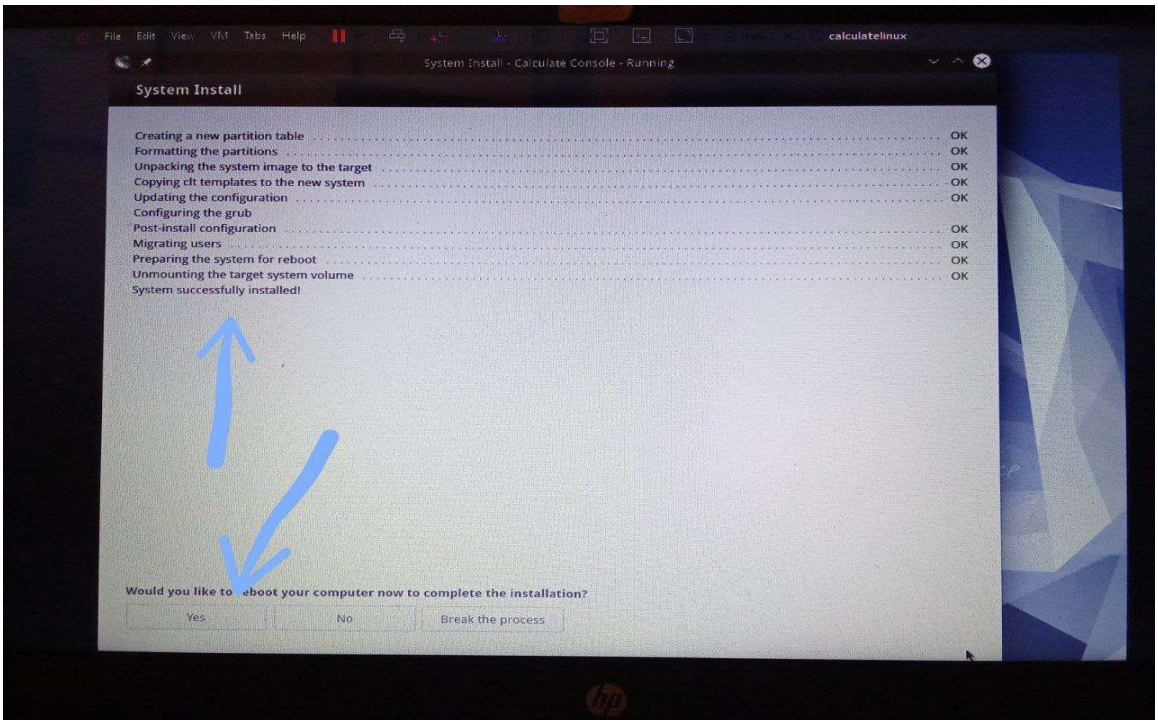


2. Set Up User Account:
    - Enter your full name as the username.
    - Create a strong password for your user account.

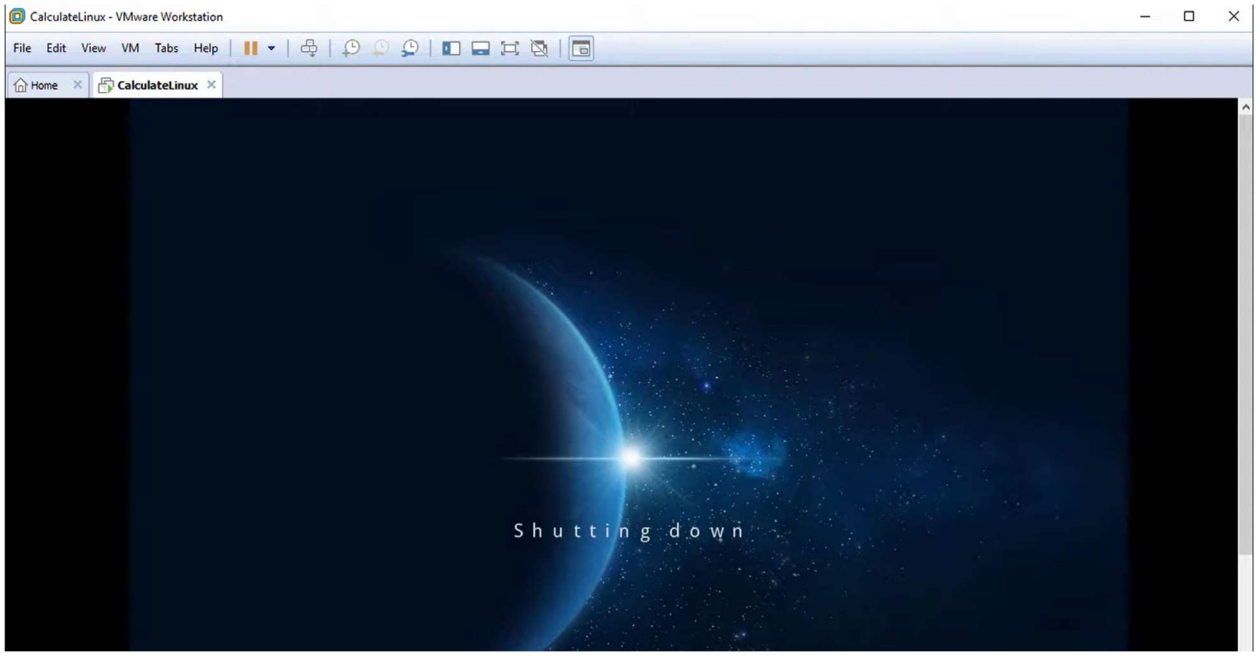


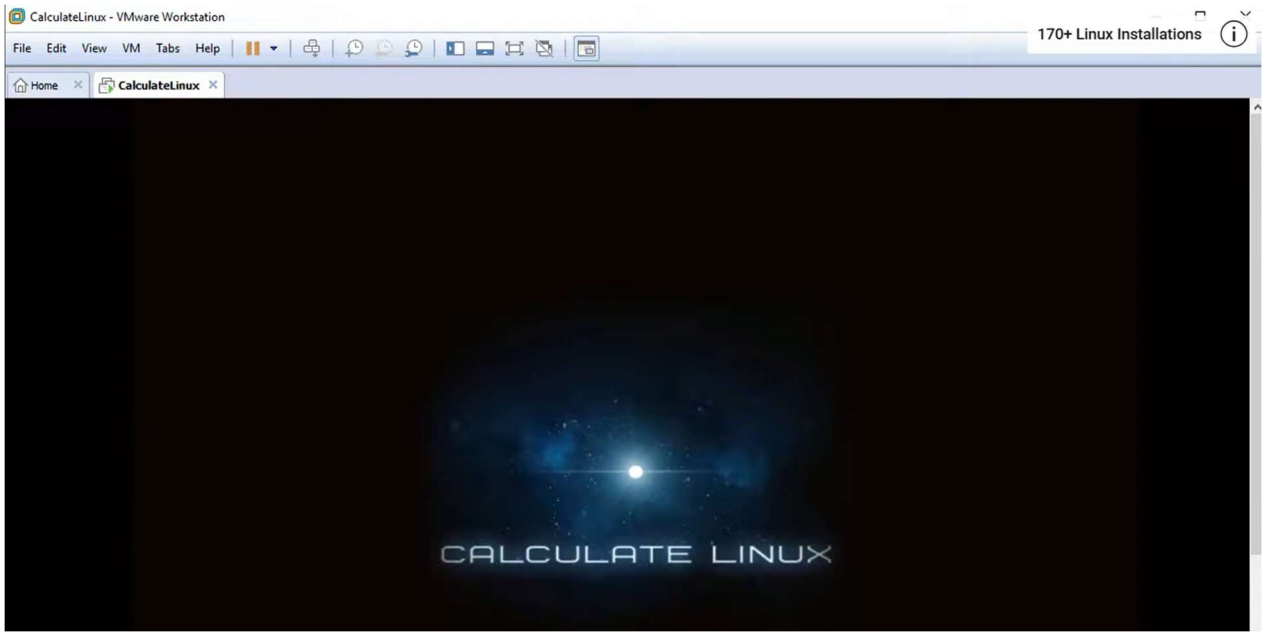
7. **Start Installation**:
    - Confirm and begin the installation process.
    - The installer will copy files, configure the system, and set up the bootloader.
    - The installation process may take some time, depending on your system's performance.
    - Once completed, you'll see a success message.



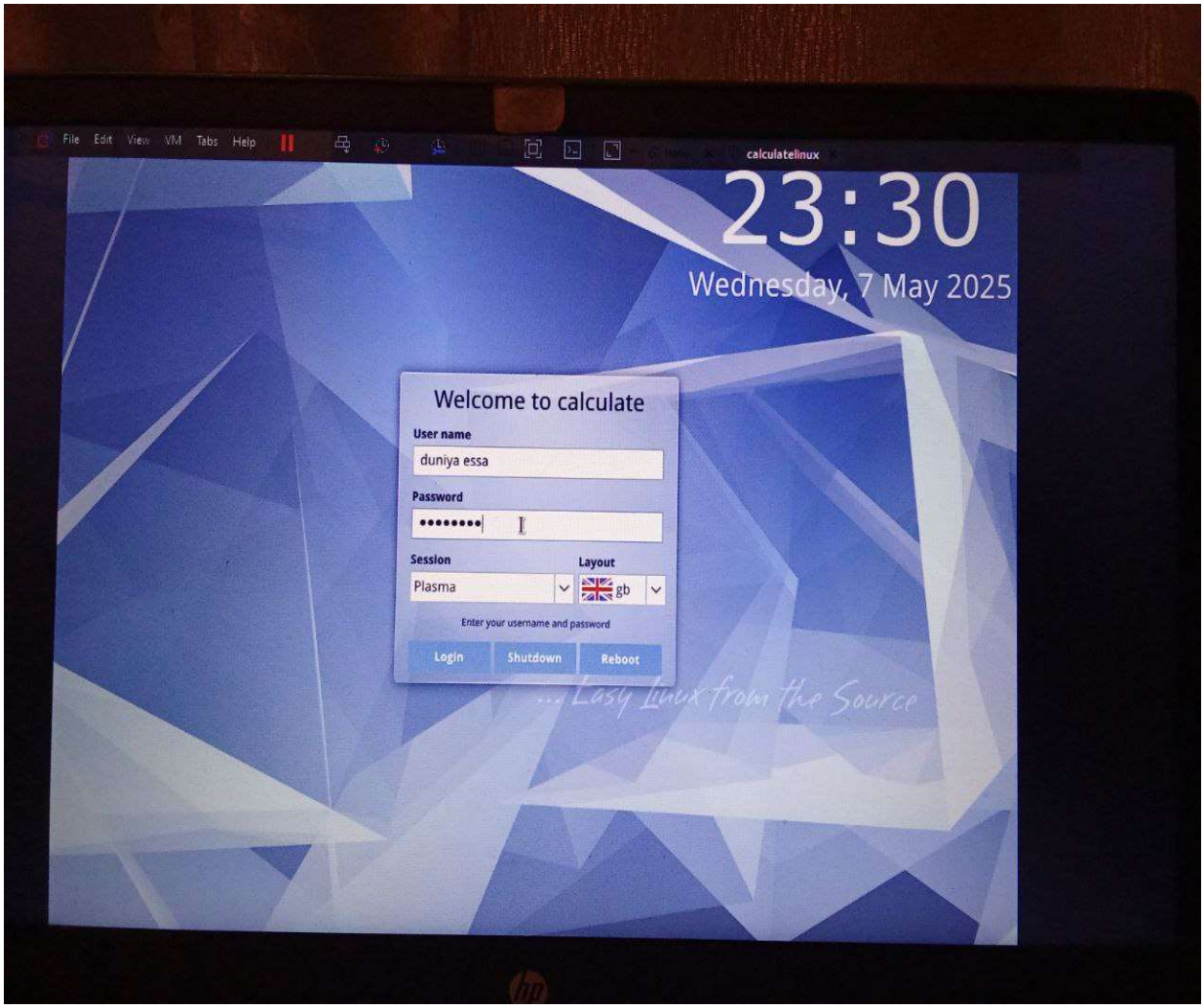


8. **Reboot the System:**
    - Remove the ISO file from the virtual machine's CD/DVD drive.
    - Restart the virtual machine to boot into the newly installed Calculate Linux.

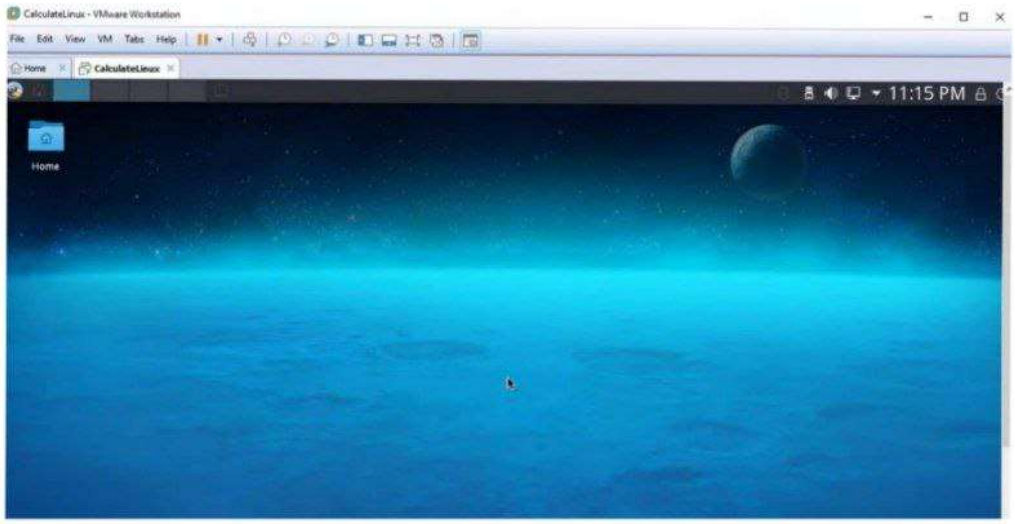


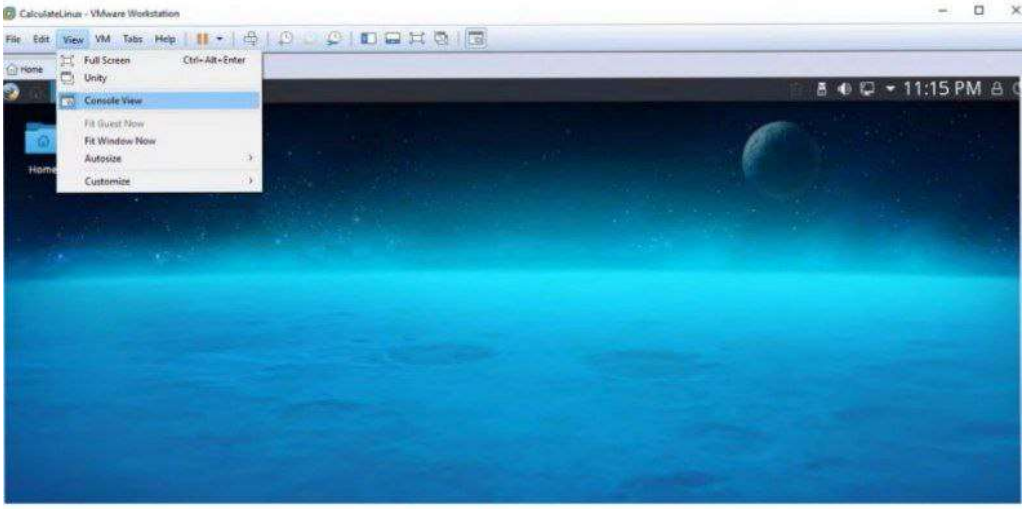


9. **Log In** : Use the username and password you created during installation to log in.



❖ **It should be structured in this manner**.





4. ISSUES(PROBLEMS) FACED AND THEIR SOLUTION

Not being able to find VMware Software to load

Issue:A few people seems to have a hard time getting to the official VMware Workstation / VMware Player software to download from VMware's website – and end up at 3rd party or out of date sites.

Solution:Download VMware products only from VMware official website (https://www.vmware.com/) Login to vmware and then try to get it out. Check that it's compatible with your OS and what version (like VMware Workstation for Windows/Linux and VMware Fusion for macOS).

Steps in Detail Are Not Provided for Some Steps

Issue: The above won't work if an installation guide omits steps or assumes you know what you are doing and, especially in the heat of partitioning or configuring GRUB, words have failed me in an installation rundown.

Solution: Use the official documentation of the Linux distribution and VMware. Supplement with trusted community forum/group (e.g. Stack Overflow, Ubuntu Forums). You should now document how you installed (for your own reference, for writing your own guide in the future, etc…). You can also search for detailed tutorials on youtube or going to sites like linuxize, TecMint

System Fails to Boot to Installer

Issues: Installation issues are fairly common, but one of the most frequent is when the system fails to recognize the installation media. This may occur for a number of reasons, including a failure to properly configure the boot order, an inability to access the media due to an error in the specified boot mode, or Secure Boot preventing the execution of unrecognized code.

Solutions: To correct any errors involving the boot order, access the BIOS/UEFI settings and make certain that the media you are using has the best possible chance to work.

Installer Fail During Partitioning:

Issues & Solution: On occasion, the installer fails to properly recognize partitions, thus blocking installation. This malady frequently stems from either preexisting partitions that the installer cannot reconcile with its own partitioning logic or from partitions formatted in a way that the installer deems incompatible. A swell workaround is to boot into a live session and to use the GParted tool (or any other partitioning tool you feel comfortable with) to manually create, as the installer ought to have done, and to format partitions in a way that will allow installation to proceed. A good tip for succeeding at this; make sure that the partition you're installing to is formatted in ext4, a Linux-friendly filesystem.

Installation Completes but Won't Boot:

After successful installation, Calculate Linux OS might not be able to be booted into by some of the users. A bootloader installed in an improper way can cause this kind of issue. It may result from partition settings that are incorrect. For fixing this, boot into a live session and then reinstall the GRUB bootloader. You should be sure to set the partition that is correct as bootable through the use of tools such as GParted. For any UEFI system, make sure that the EFI System Partition (ESP) is configured in a proper way because UEFI systems do have a need for particular boot settings.

Users also face another challenge:

A lack of connectivity to the internet during the installation, especially in the event they install packages that are additional. Missing drivers might cause this issue in addition to improper network configurations or reliance on Wi-Fi instead of wired connections perhaps also causing it. For troubleshooting, connect using a wired Ethernet connection whenever possible. It tends to be a more reliable connection than Wi-Fi. Do confirm network adapter recognition through using commands just like ip a or ifconfig. If missing, drivers may need downloading on another system or a manual install from storage.

5. Filesystem Support

Calculate Linux supports filesystems like **ext4**, **Btrfs**, and **XFS**. Ext4 is recommended for its balance between performance and reliability, while Btrfs offers advanced features like snapshots and compression.

In Detail

ext4: Default and most stable, why because: Best balance of speed, stability, and compatibility

Btrfs: Advanced features like snapshots, compression , why because : Used for features like snapshots (ideal for backup/recovery).

XFS: High performance for large files.

ZFS: Can be added manually.

HFS+ and APFS: Limited support, mostly read-only.

FAT32/exFAT/NTFS: Read/write supported for external drives , why because: For Windows interoperability.

6. Advantages and Disadvantages

Advantages

- Gentoo-Based, Binary + Source Hybrid ,Combines Gentoo's flexibility with binary packages for faster installs .You can compile from source if you want to customize deeply.
- Preconfigured Desktop Environments which Comes with KDE, XFCE, MATE, and others—ready to use out of the box.No need to build everything from scratch like vanilla Gentoo.
- Powerful Tools for System Management: Good for admins managing multiple machines.
- Rolling-release model ensures up-to-date software.
- Excellent for Networks / Enterprise Use:Designed for corporate environments with LDAP, roaming profiles, etc.
- Highly customizable and efficient.
- Lightweight and Fast
- Strong community support.

Disadvantages

- Gentoo Learning Curve: Steeper learning curve for beginners.
- Limited documentation compared to other distributions: Most support forums are in Russian, though some English documentation exists.
- Smaller Community (Compared to Ubuntu, Fedora, etc.):Less mainstream, so less third-party support or tutorials.
- VMware / VirtualBox Compatibility
- May require extra steps to set up VMware tools or proper graphics in virtual environments.
- Update Process Can Be Tricky

7. Conclusion

Calculate Linux is an example of a sophisticated and flexible OS for advanced users and developers that need one for enterprise environments, being built on top of Gentoo. It merges the performance and customization advantages of source-based distributions with the ease-of-use associated with binary packages, enabling users to install software quickly while having the option to compile from source when greater control is required. With specific editions like Desktop, Server, and Scratch, Calculate Linux provides distinct solutions for diverse scenarios ranging from personal workstations to large scale network deployments and everything in between. The Calculate Utilities stand out for improving system installation, maintenance, and configuration, going beyond what Gentoo offers and increasing approachability. Best performance is achieved with its enterprise features, integrating into centralized authentication systems with roaming profiles and simplified network setups. It also offers a rolling release model to keep software up to date, and its design is lightweight and efficient, maintaining strong performance on a wide range of hardware. Although there is some difficulty for new users due to limited English documentation viciously fighting against virtualization, the additional challenges face in using Gentoo is undoubtedly offset by the ease provided by Calculate Linux.

8. Future Outlook / Recommendations

Calculates Linux is particularly poised to increase its user base among power and enterprise users. This is if the developers put more focus on community-based support and improving accessibility. Moreover, while it combines the flexibility of gentoo with the power of binary packaged gentoo, it remains best suited for users who are versed with linux because of the proprietary information's relative difficulty in mastering. To gain new users, especially those migrating from user friendly distributions, the developers must focus on system management through graphical interfaces like configuration wizards, step-by-step installers for GUI-based applications, and automatic software update managers. Such components would improve the chances non-technical users will be comfortable with the system.

The most glaring gap, however, seems to be in the English documentation. Having most of the support in the Russian language isn't bad, but for a non-regional global audience, it creates a major barrier. Calculate linux stands to gain a lot out of it through english documents, guides, and troubleshooting tutorials as well as actively involving users through english community forums, wikis including other social interaction platforms.

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II

- **What is Virtualization?**

Virtualization is a technology that allows a single physical machine to run multiple virtual machines (VMs), each with its own operating system and applications. These VMs behave like independent systems, even though they share the underlying hardware.

- **Why Use Virtualization**?

Virtualization provides several benefits in modern computing:

Efficient Resource Utilization: It allows better usage of hardware resources by running multiple systems on one physical machine.

Cost Saving: Reduces the need for multiple physical servers, saving energy, maintenance, and hardware costs.

Testing and Development: Developers can test software on different operating systems without needing separate devices.

Isolation and Security: Each VM is isolated, so issues in one VM don't affect other's.

- **How Does It Work?**

Virtualization is made possible through software called a hypervisor, which sits between the hardware and the virtual machines. There are two main types of hypervisors:

Type 1 (bare-metal) runs directly on hardware (e.g., VMware ESXi)

Type 2 (hosted) runs on top of a host OS (e.g., VirtualBox).

Modern operating systems often include built-in virtualization support (like KVM in Linux or Hyper-V in Windows) to manage and run VMs efficiently**.**

III

Implement System Calls

In Calculate Linux (which is Gentoo-based), like other Linux distributions, system calls such as setgid() are implemented at the kernel level and can be accessed in user-space programs written in C or similar low-level languages.

What is setgid()? AND How setgid() Works in Calculate Linux?

setgid() is a system call in Linux used to set the group ID (GID) of the current process. The GID determines the group permissions the process has when accessing files and resources.

Since Calculate Linux uses the standard Linux kernel, setgid() behaves the same as in any Linux-based system:

```
#include <iostream>
#include <unistd.h>
#include <sys/types.h>
#include <errno.h>
#include <cstring>
int main() {
   gid_t new_gid = 1001;  // Replace with a valid group ID on your system
   // Attempt to change the group ID
   if (setgid(new_gid) == 0) {
      std::cout << "Group ID successfully changed to " << new_gid << std::endl;
   } else {
      std::cerr << "Failed to change Group ID: " << std::strerror(errno) << std::endl;
   }
```

```
    return 0;
}
```