Faculty of computing

Department information of system

Operating system individual assignment

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Operating System Installation

Kali Linux Operating System

a. Introduction (Background & Motivation)

Kali Linux is a Debian-based Linux distribution developed and maintained by Offensive Security. It is specifically designed for penetration testing, ethical hacking, digital forensics, and cybersecurity research. Kali Linux comes with hundreds of pre-installed security tools used by security professionals worldwide.

The motivation for choosing Kali Linux is its importance in modern cybersecurity education. As cyber threats increase, understanding security testing tools and environments becomes essential for Information System and IT students. Installing Kali Linux in a virtual environment allows safe experimentation without affecting the host operating system.

Objectives

The objectives of this project are designed to help students gain theoretical understanding, practical skills, and confidence in operating systems and virtualization, with special focus on Kali Linux.

General Objective

The main objective of this project is to install, configure, and study the Kali Linux operating system in a virtualized environment, and to understand its role, features, and importance in modern operating systems and cybersecurity.

Specific Objectives

1. **To Understand the Concept of Operating Systems**

   This objective focuses on helping the student understand: When an operating system is and How an operating system manages hardware , The role of the operating system as an interface between users and hardware , By using Kali Linux, the student gains practical exposure to a real-world operating system rather than only theoretical knowledge.

2. **To Learn Virtualization Technology**

   This objective aims to: Understand the meaning of virtualization, Learn how virtual machines work ,Identify the benefits of using virtualization in modern computing , Through tools like VirtualBox or VMware, the student learns how

multiple operating systems , can run on one physical computer efficiently and safely.

3. To Install Kali Linux in a Virtual Environment

This objective ensures that the student: Download the correct Kali Linux ISO file ,Creates a virtual machine correctly ,Allocate system resources such as RAM, CPU, and storage, complete the installation process step by step.

ThiS improves hands-on skills and builds confidence in OS installation procedures.

4. To Gain Practical Experience with Linux-Based Systems

Kali Linux is a Linux-based operating system. This objective helps the student to: Become familiar with Linux desktop environments, Use terminal commands

Understand Linux file structure, Manage users and permissions.

These skills are essential for system administration and cybersecurity careers.

5. To Understand File system Types and Their Uses

This objective focuses on: Learning different file system types (ext4, NTFS, FAT32, etc.)

Understanding why ext4 is used as the default file system in Kali Linux

Comparing Linux file systems with Windows and macOS file systems

This helps the student make correct technical decisions, such as choosing the right file system for a specific operating system.

6. To Identify and Solve Installation Problems

During installation, problems may occur. This objective enables the student to: Identify common installation errors, Analyse the causes of these problems, Apply appropriate solutions

This improves problem-solving skills and technical confidence.

7. To Study Security and Ethical Hacking Tools

Kali Linux includes many security tools. This objective aims to: Understand the purpose of these tools, Learn how they are used in ethical hacking, Distinguish between ethical and illegal use of hacking tools.

This encourages responsible and professional use of technology.

8. To Develop Documentation and Technical Writing Skills

This objective helps the student to: Prepare a structured technical report, Documents installation steps clearly

Include screenshots and explanations, Follows academic project guidelines.

Good documentation is a key skill for IT professionals.

9. To Build Confidence in Technical Skills

By completing this project, the student will:

Gain confidence in OS installation

Improve system configuration skills

Demonstrate practical knowledge during evaluation

This directly supports the evaluation criteria related to technical confidence.

10. To Prepare for Future Careers in IT and Cybersecurity

This objective focuses on long-term benefits:

Preparing for cybersecurity roles

Building a strong foundation in Linux and operating systems

Encouraging further learning in penetration testing and system security

C. Requirements

i. Hardware Requirements

Minimum hardware requirements for Kali Linux (Virtual Machine):

Processor: Intel or AMD (64-bit) with virtualization

Support.

- RAM: Minimum 2 GB (Recommended: 4 GB)
- Storage: Minimum 20 GB free disk space
- Internet connection (for updates and tools)
- Laptop/Desktop computer

ii. Software Requirements

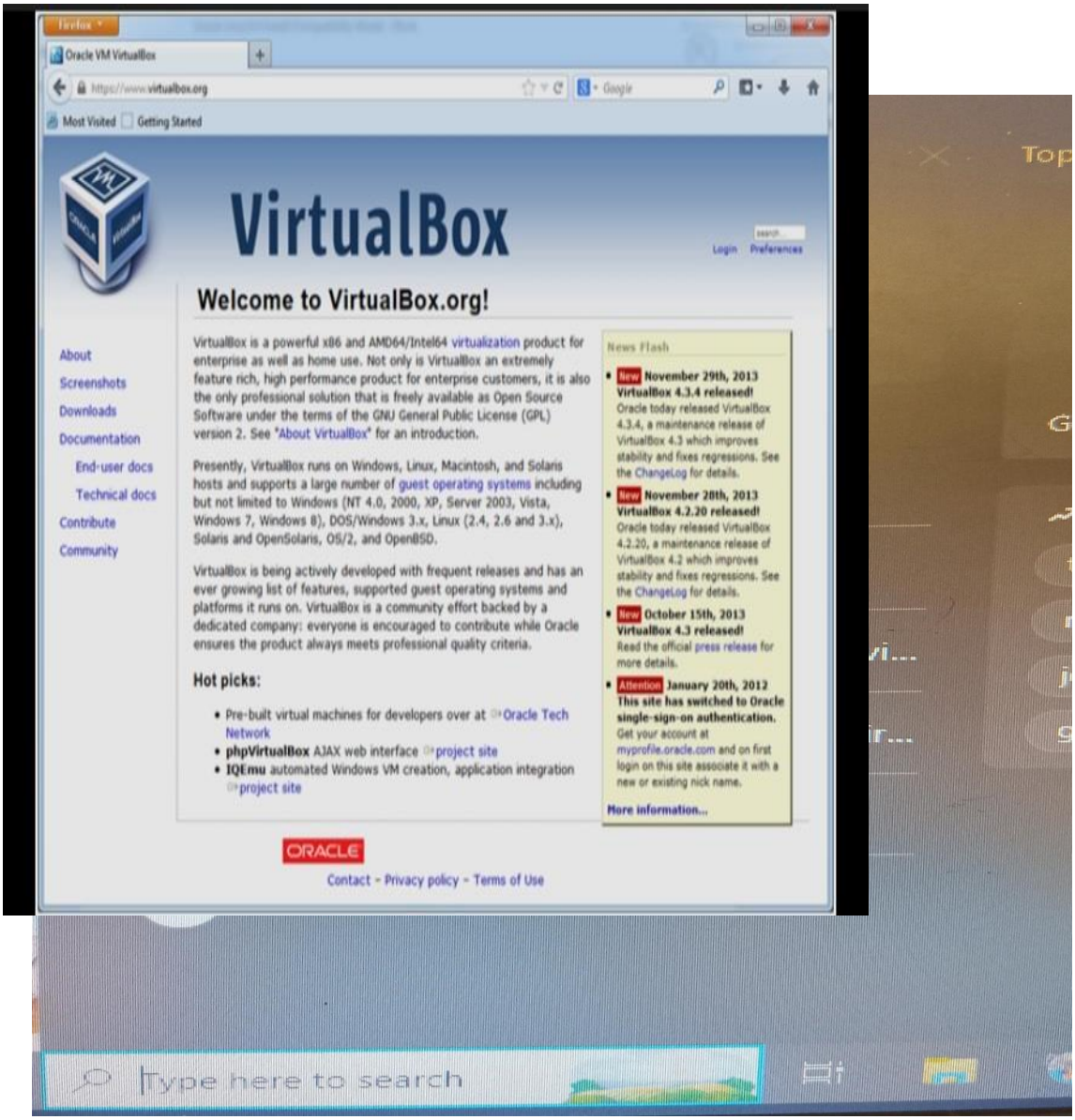
Host Operating System: Windows / Linux / macOS

- Virtualization Tool:

- ✓ VMware Workstation OR
- Oracle VM VirtualBox
- Kali Linux ISO file (Installer or Live)
- Web browser (for downloading files)

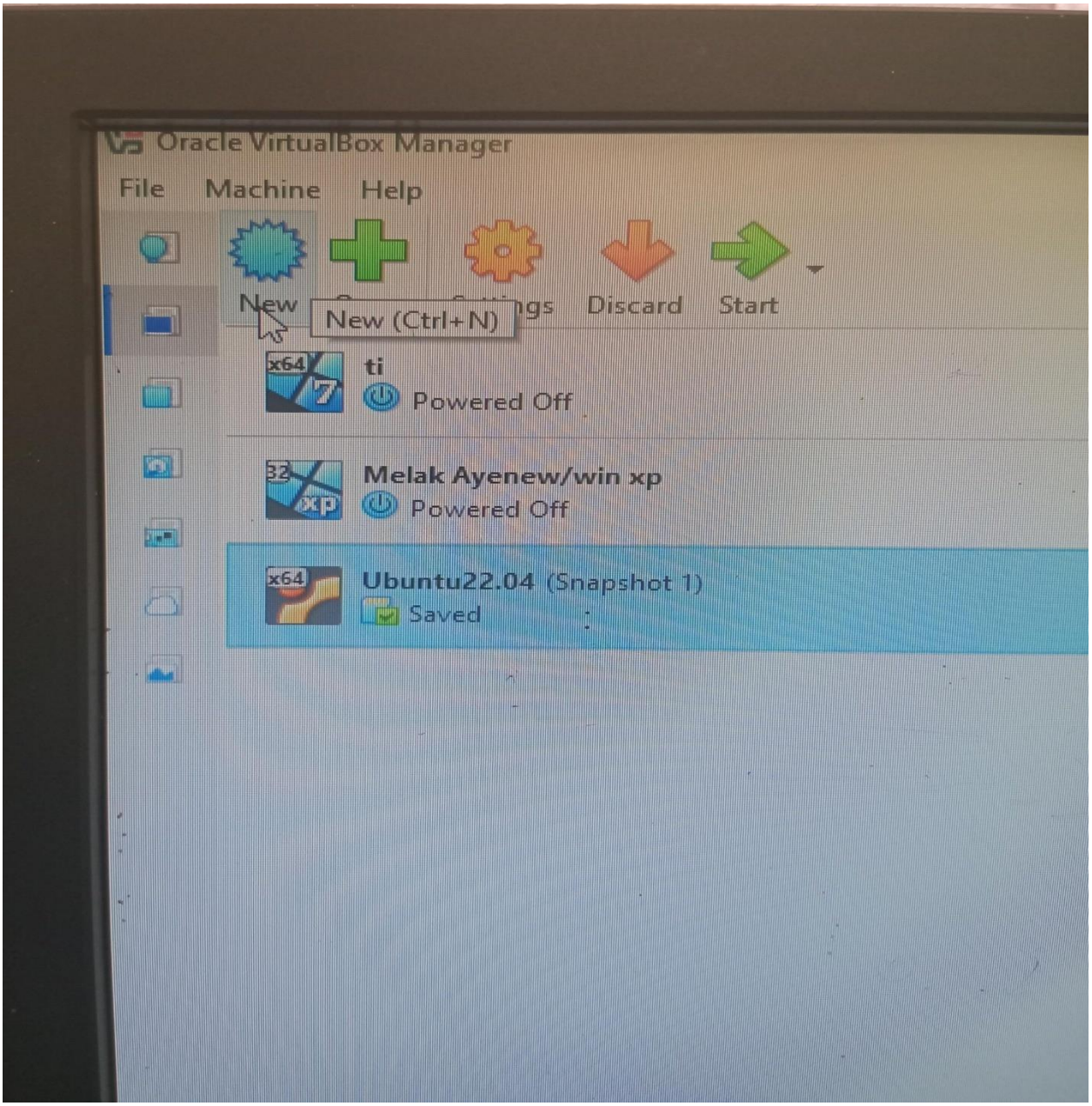
D. Installation Steps (Kali Linux on VirtualBox)

1. Download and install Oracle VM VirtualBox



2. Download Kali Linux ISO from the official website

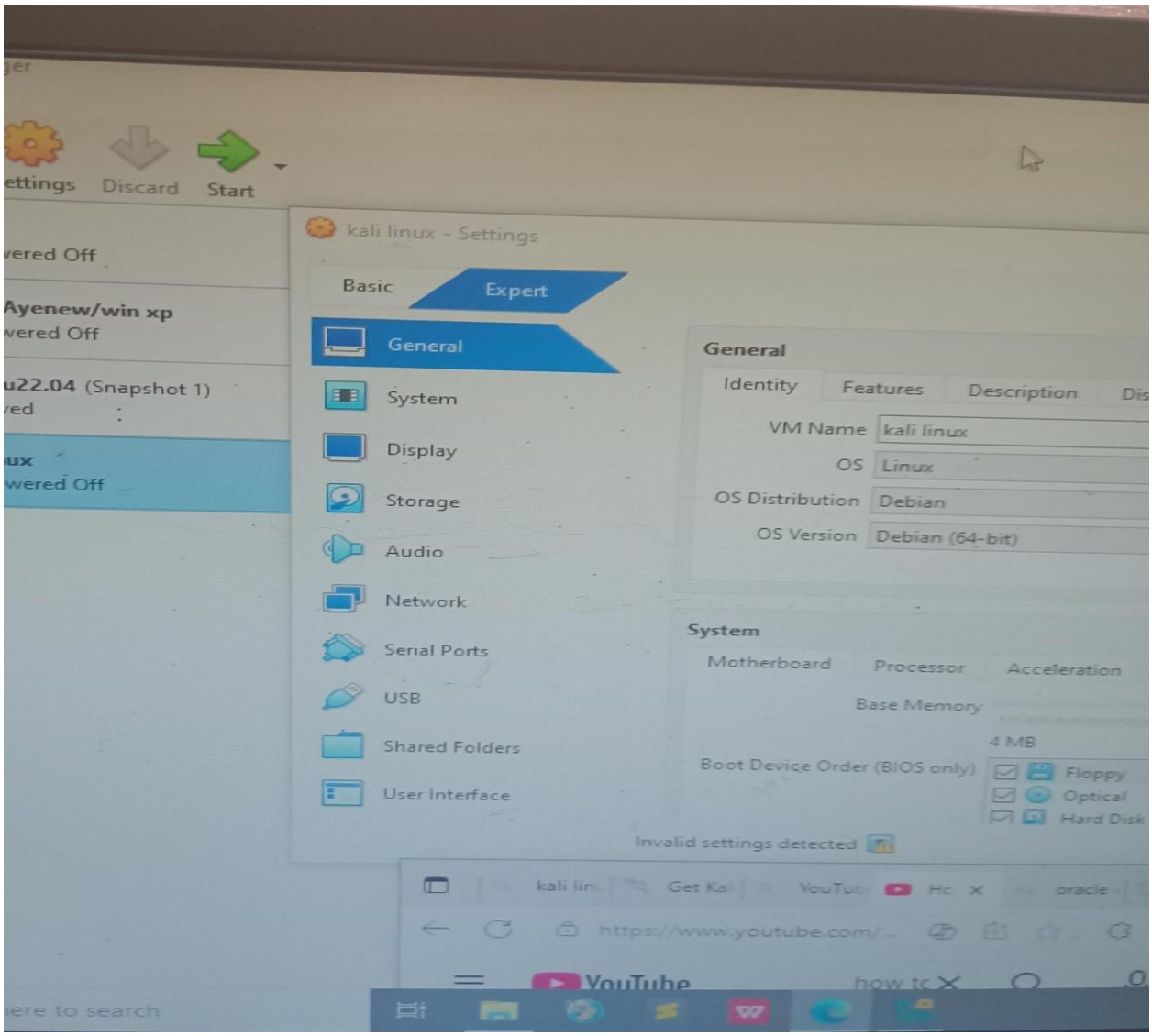
3. Open VirtualBox and click New



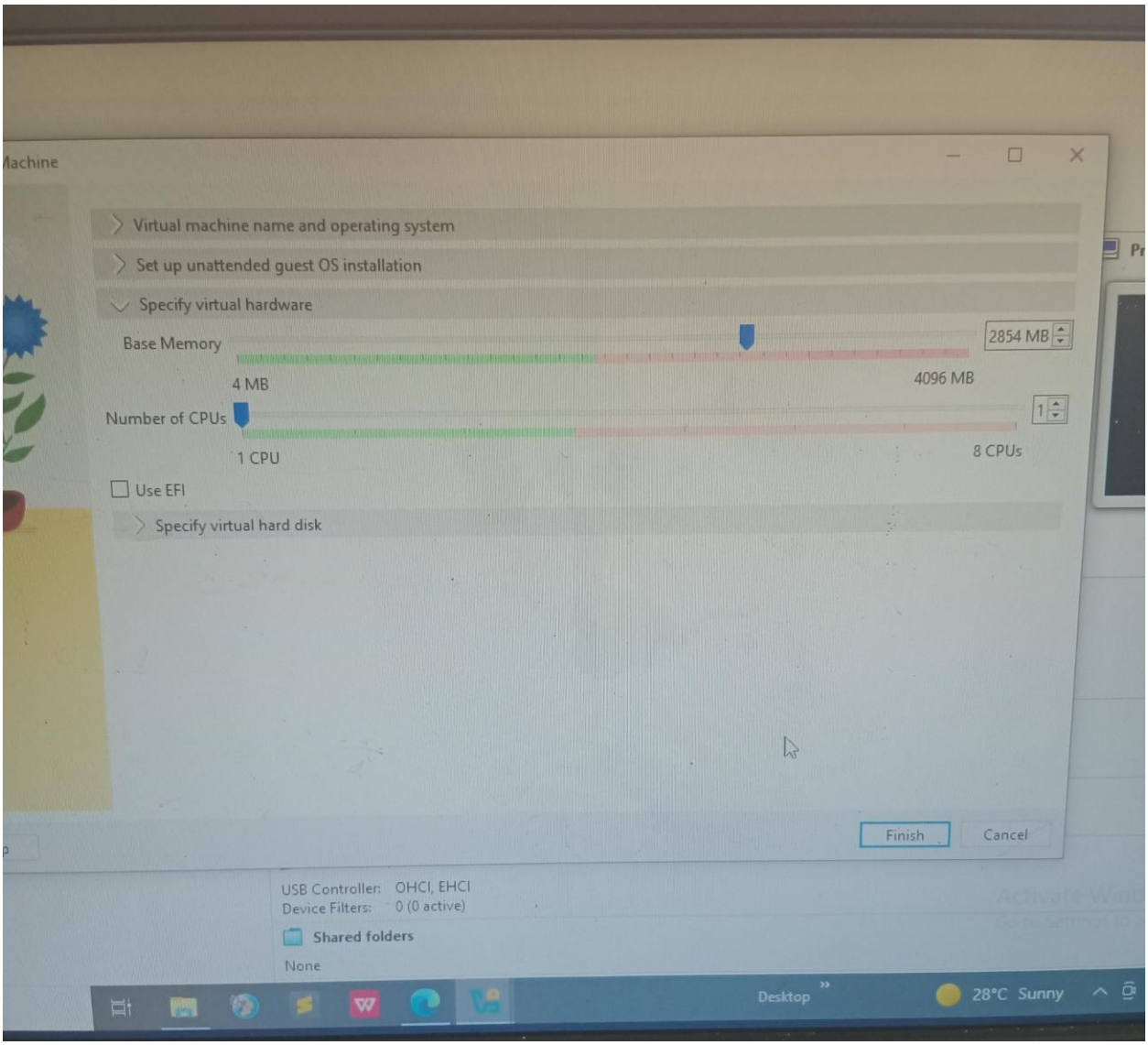
4. Name the virtual machine using your full name

5. Select:

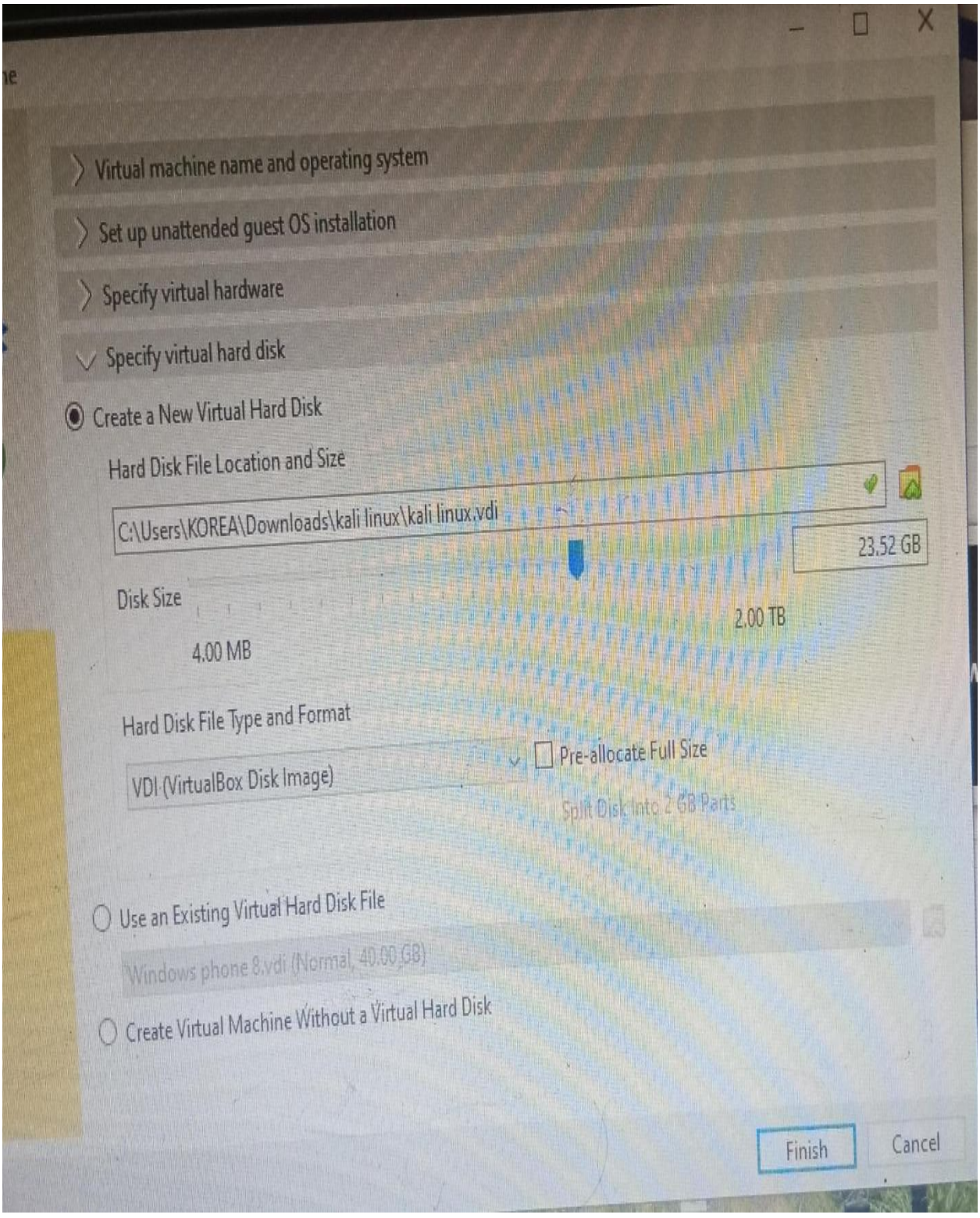
- ✓ Type: Linux
- ✓ Version: Debian (64-bit)



6. Allocate RAM (at least 2 GB)

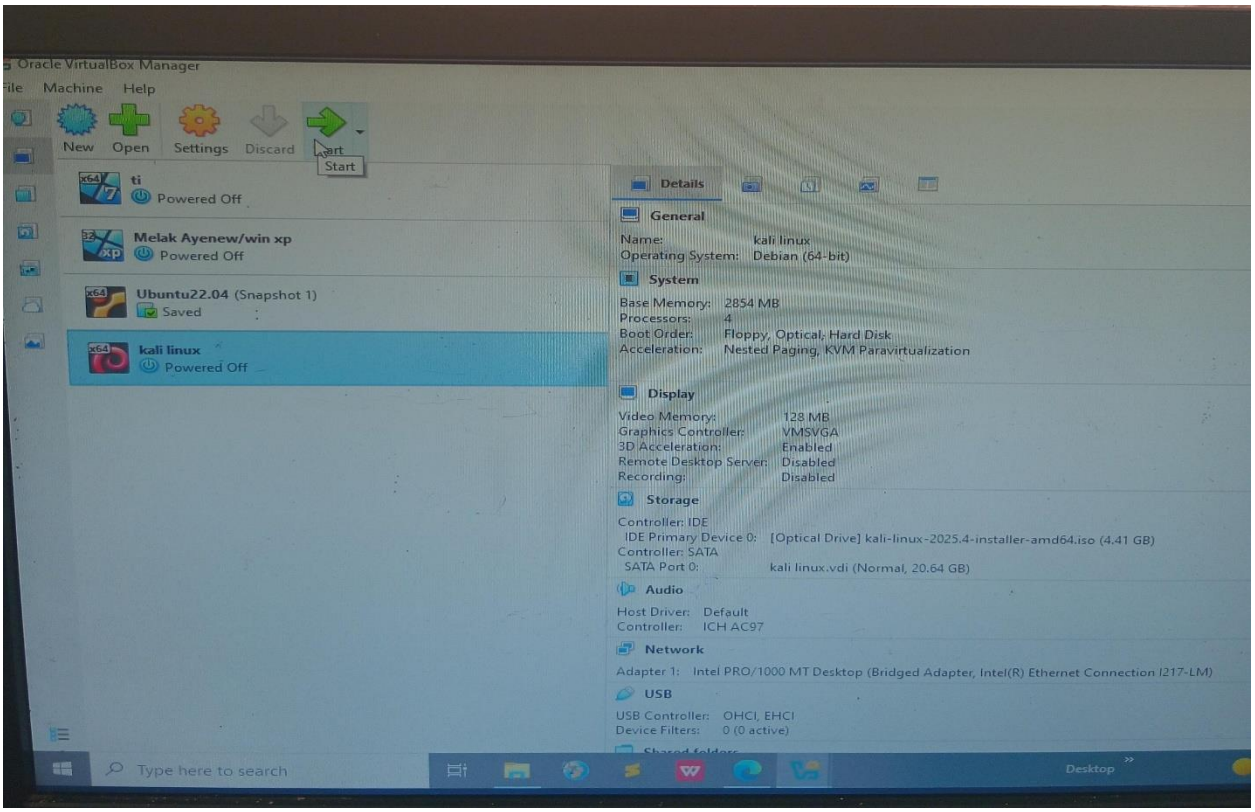


7. Create a virtual hard disk (VDI → Dynamically allocated → 20 GB)

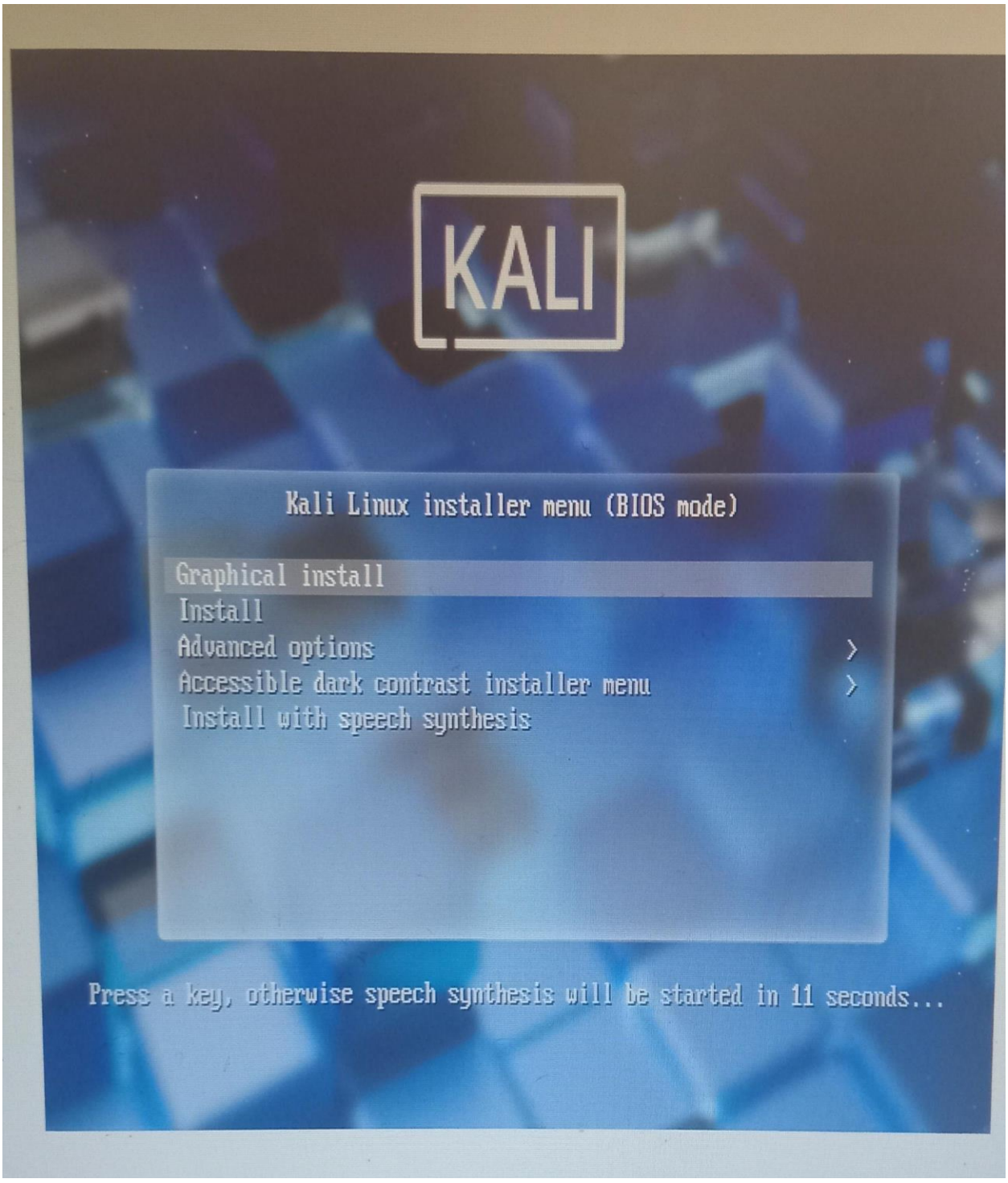

Virtual machine name and operating system
Set up unattended guest OS installation
Specify virtual hardware
Specify virtual hard disk
Create a New Virtual Hard Disk
Hard Disk File Location and Size
C:\Users\KOREA\Downloads\kali linux\kali linux.vdi
23.52 GB
Disk Size
4.00 MB
2.00 TB
Hard Disk File Type and Format
VDI (VirtualBox Disk Image)
Pre-allocate Full Size
Split Disk Into 2 GB Parts
Use an Existing Virtual Hard Disk File
Windows phone 8.vdi (Normal, 40.00 GB)
Create Virtual Machine Without a Virtual Hard Disk
Finish
Cancel

8. Attach Kali Linux ISO to the virtual optical driver

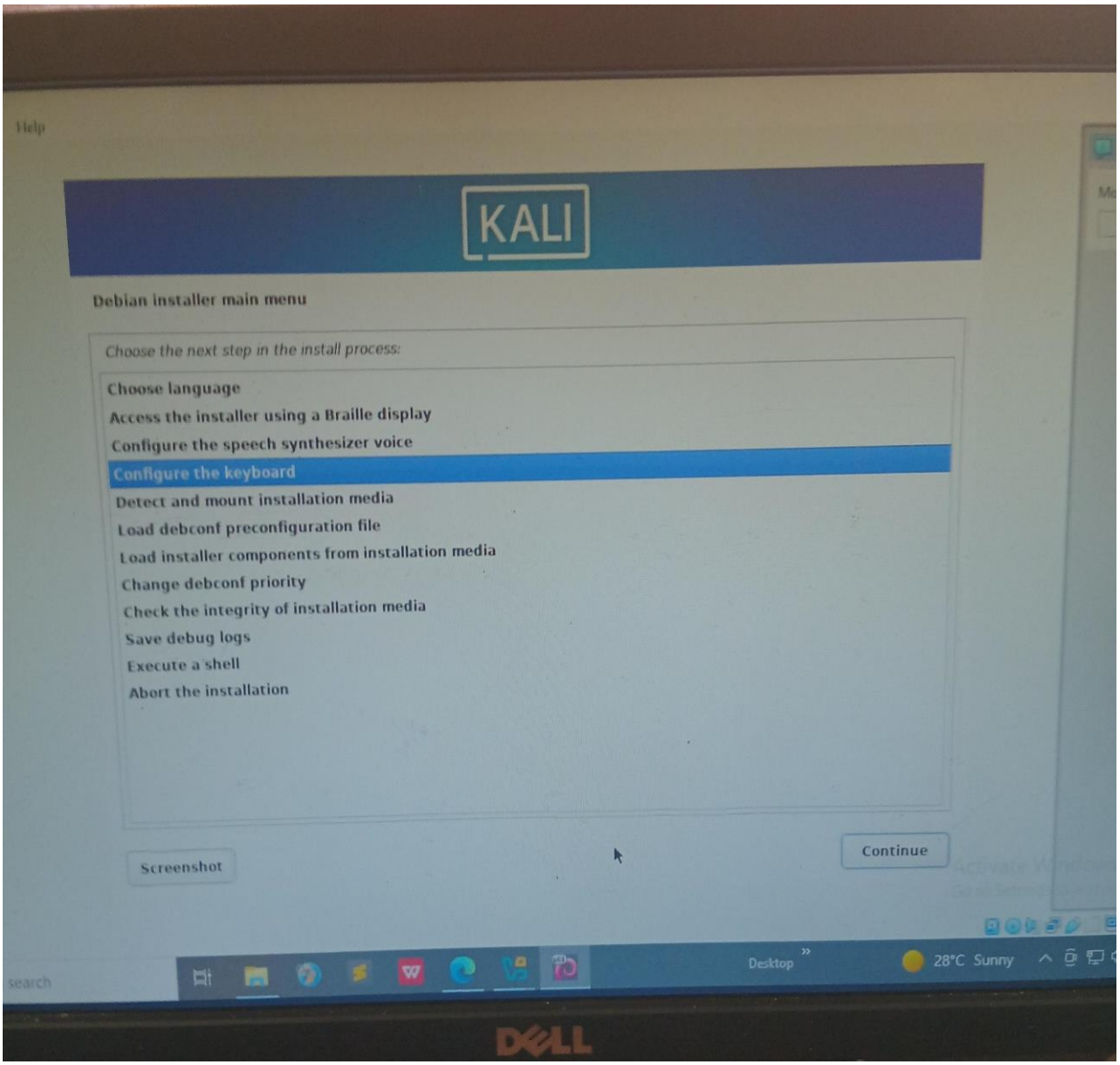
9. Start the virtual machine



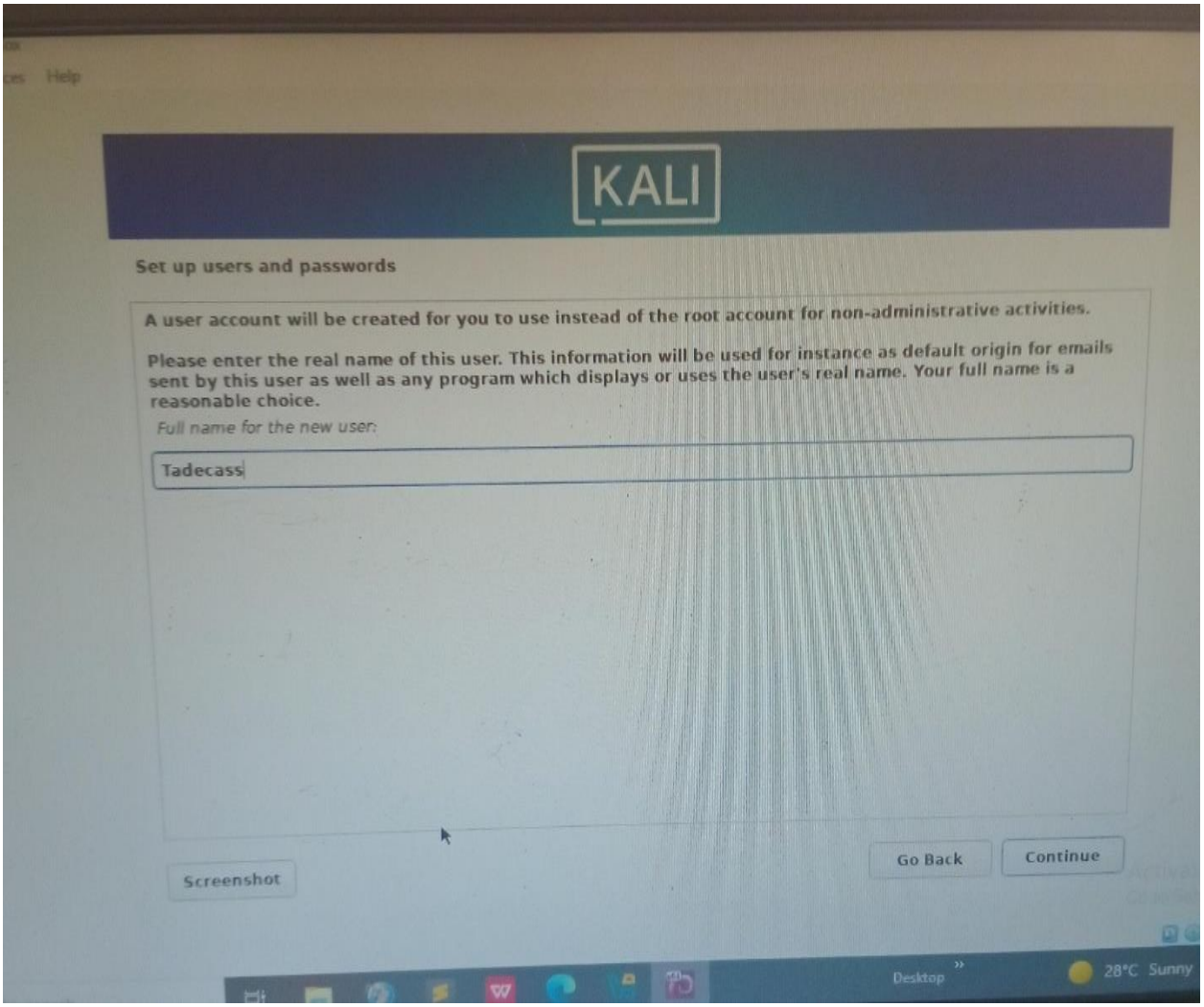
10. Select Graphical Install



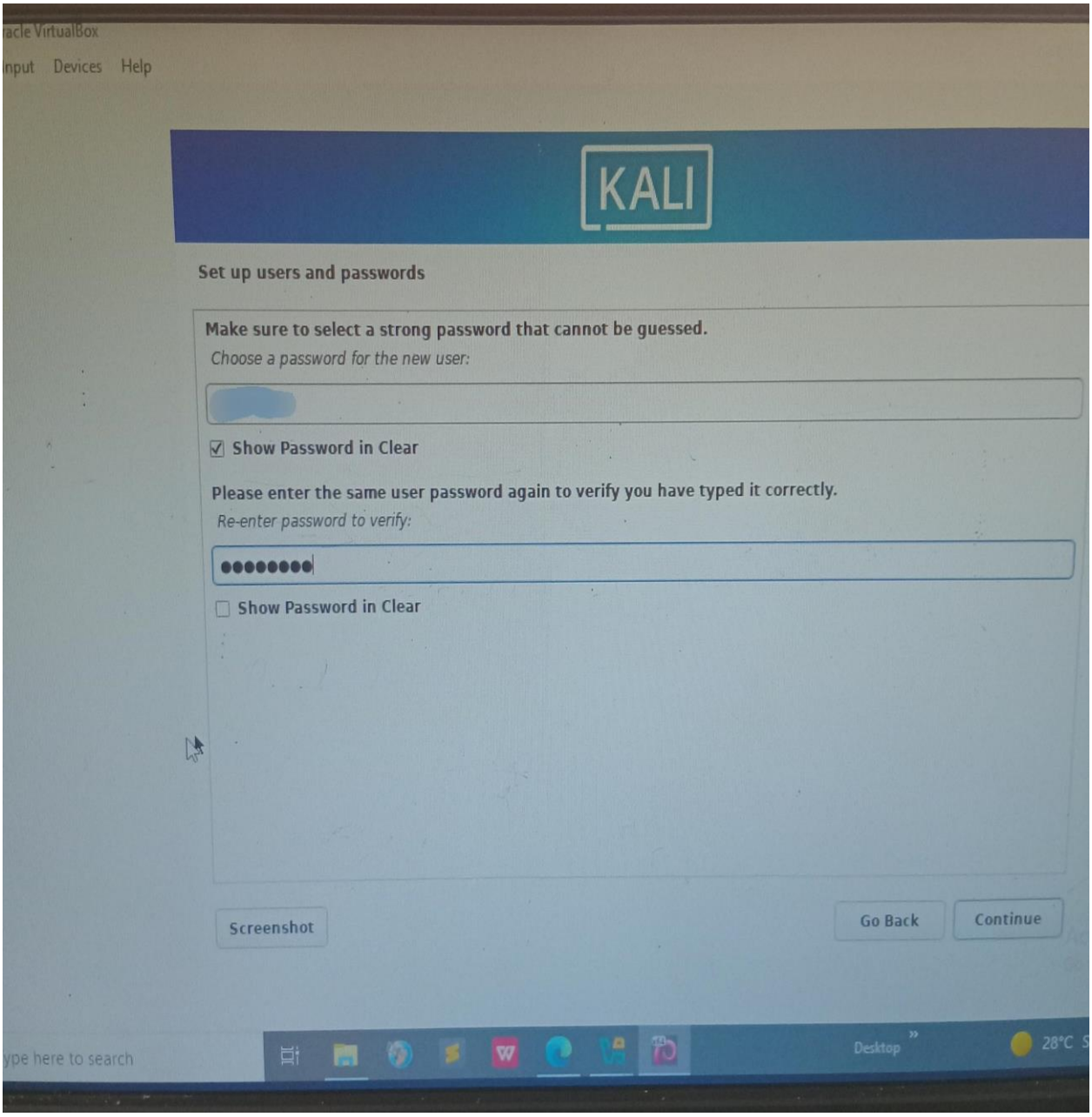
11. Choose language, location, and keyboard layout


Help
KALI
Debian installer main menu
Choose the next step in the install process:
Choose language
Access the installer using a Braille display
Configure the speech synthesizer voice
Configure the keyboard
Detect and mount installation media
Load debconf preconfiguration file
Load installer components from installation media
Change debconf priority
Check the integrity of installation media
Save debug logs
Execute a shell
Abort the installation
Screenshot
Continue
Desktop
28°C Sunny
search
DELL

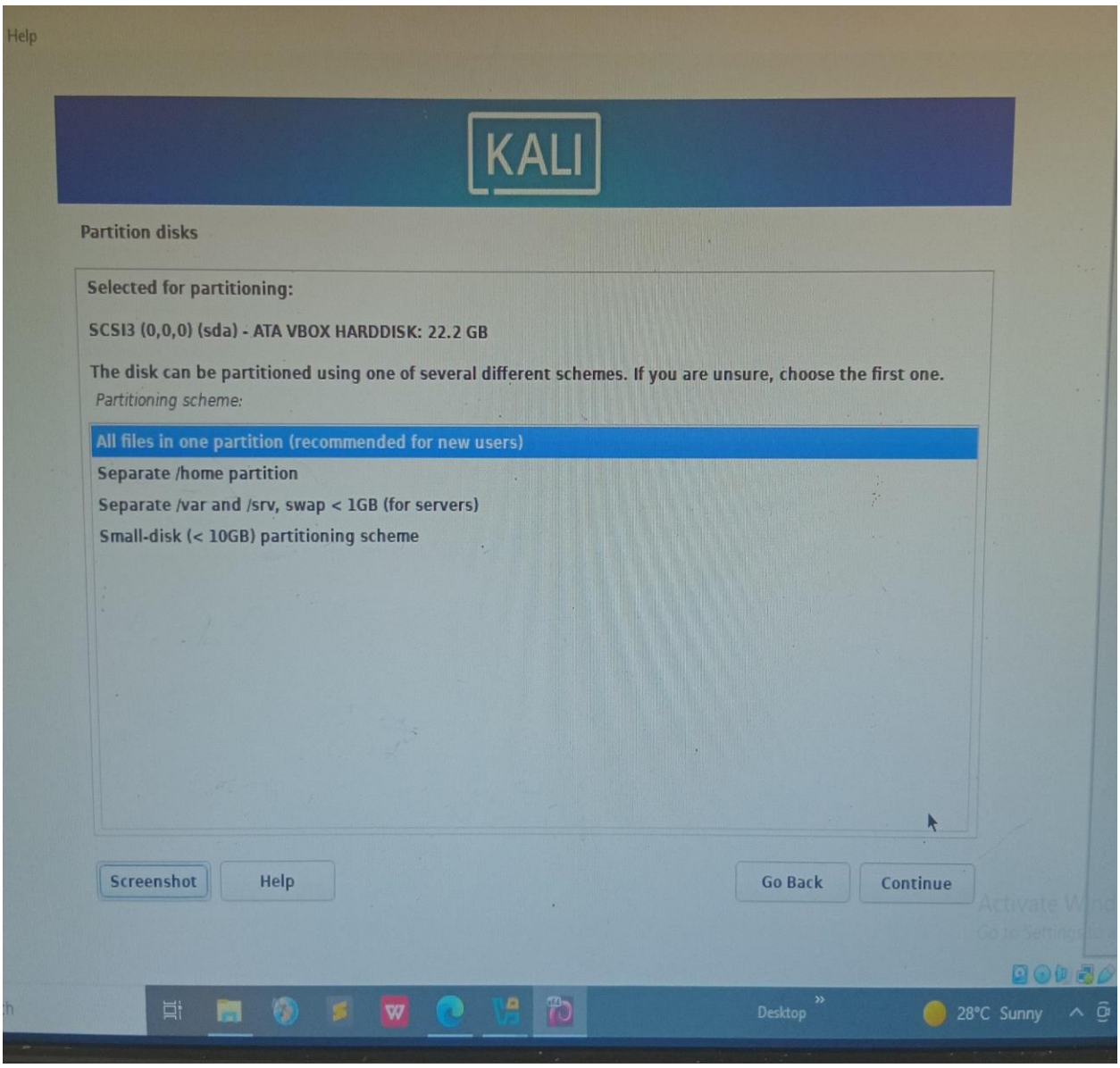
12. Configure network automatically
13. Create a user account (use your full name)



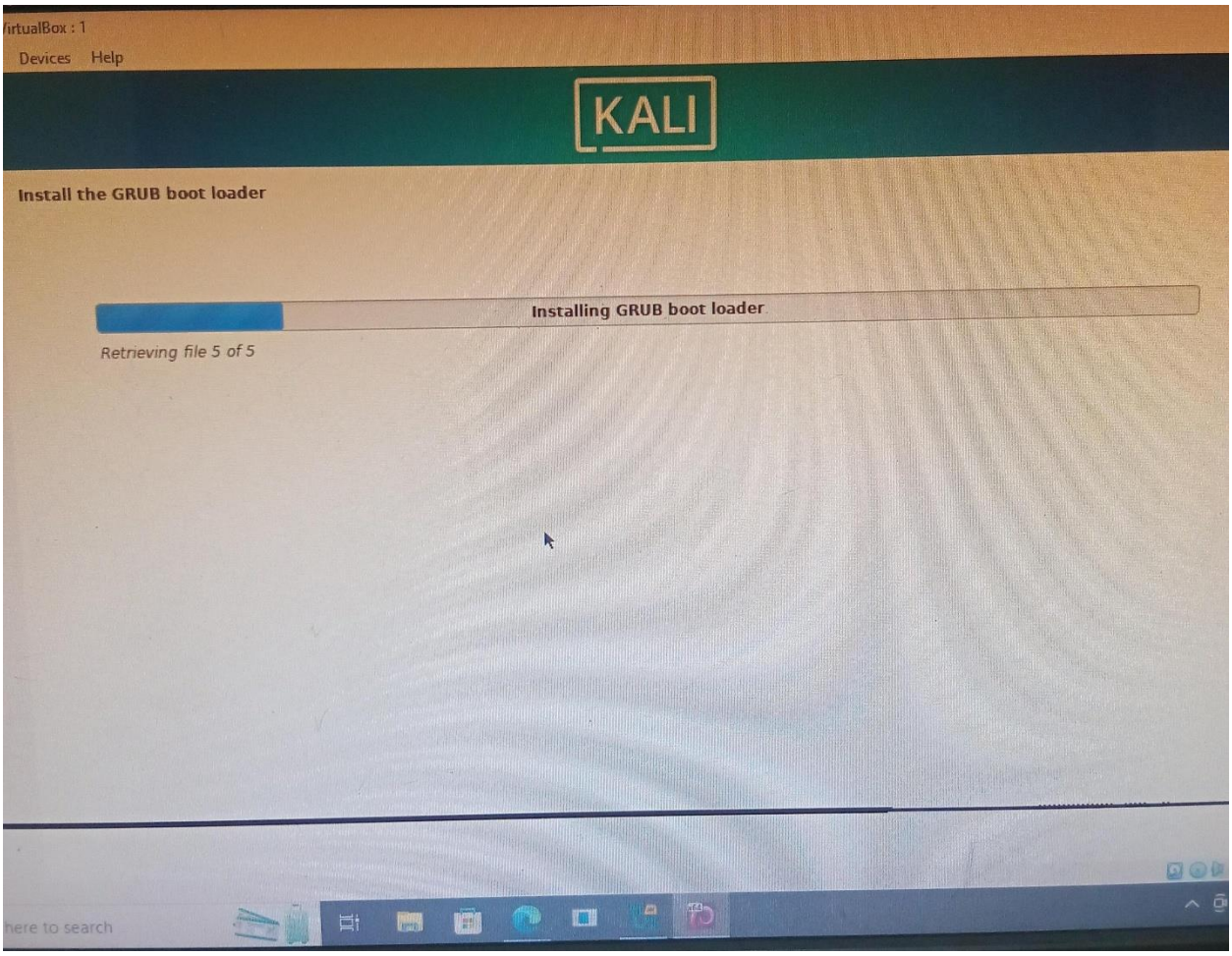
14. Set password



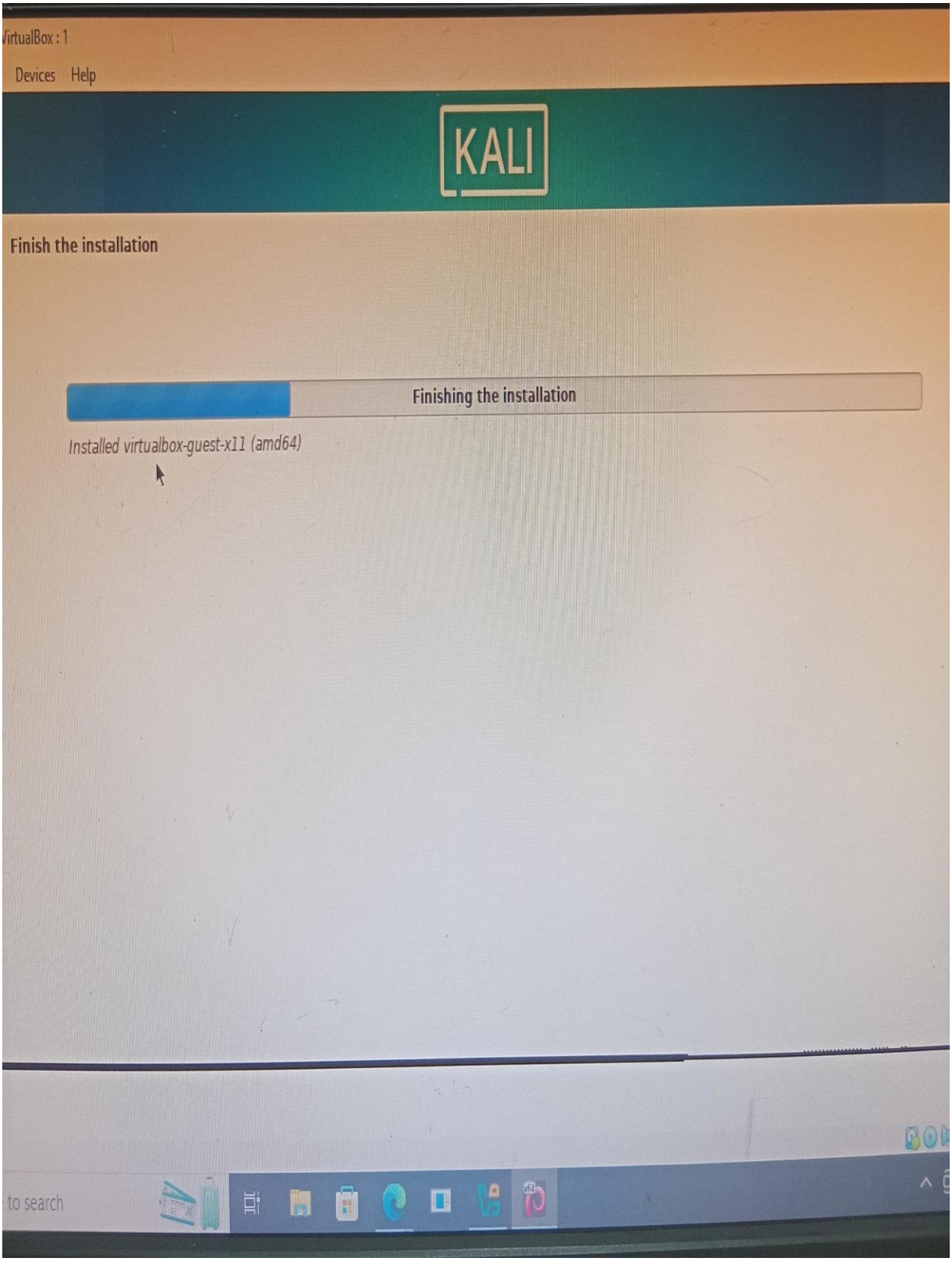
15. Choose disk partition (Guided – use entire disk)



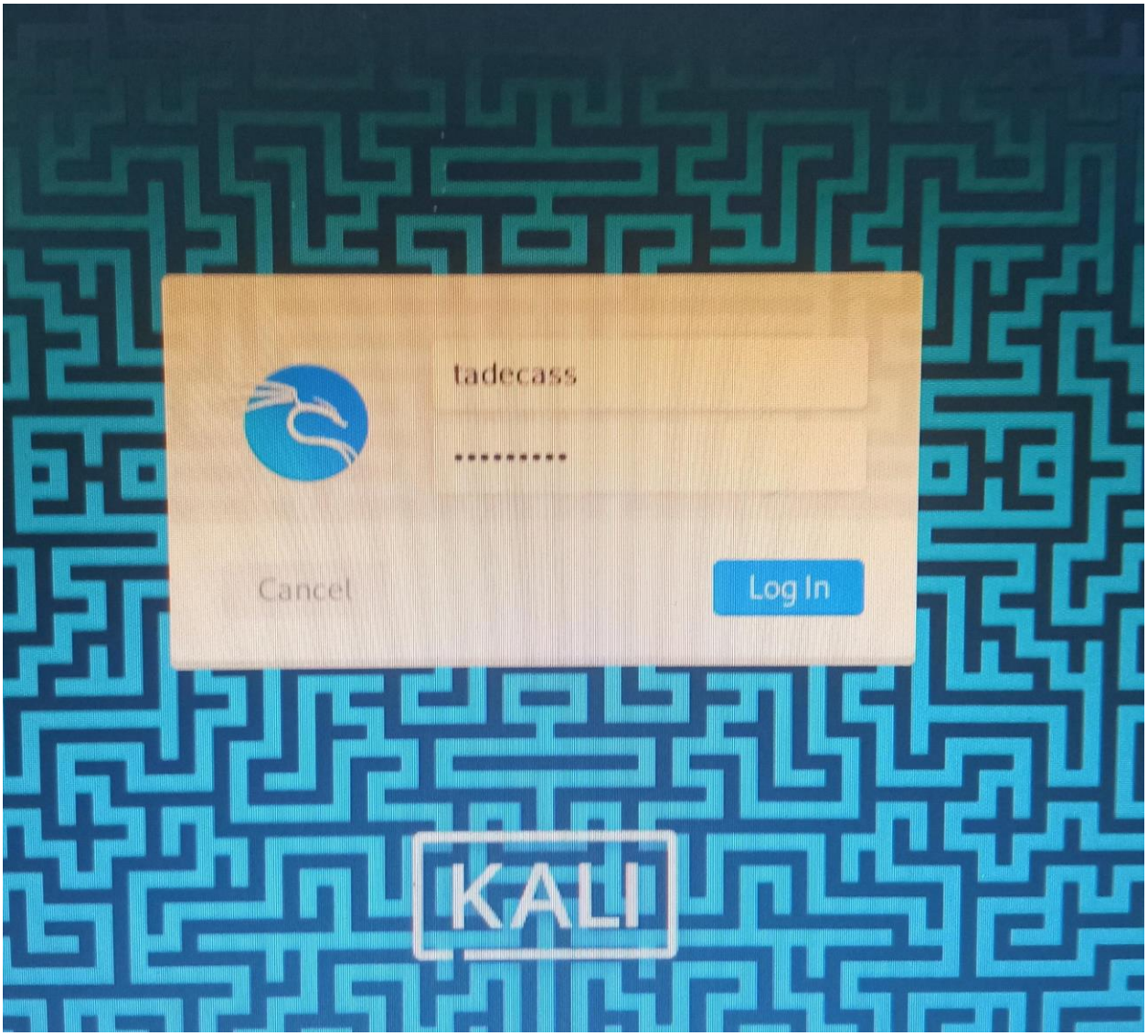
16. Install GRUB bootloader



17. Finish installation and reboot


VirtualBox : 1
Devices Help
KALI
Finish the installation
Finishing the installation
Installed virtualbox-guest-x11 (amd64)
to search

18. Login to Kali Linux desktop



E. Issues (Problems Faced)

Some common problems faced during installation

1. Black screen after installation
2. Slow performance
3. Network not working

F. Solutions

- Install VirtualBox Extension Pac
- Increase RAM and CPU core
- Change display graphics controller to VMSVGA
- Use NAT network adapter

G. File system Support

Kali Linux supports several file systems:

- ext4 – Default and recommended file system
- Bars – Advanced Linux file system
- FAT32 / exFAT – Used for USB drives
- NTFS – Supported for Windows file access

Why ext4 is preferred ?

- Fast and stable
- Journaling support
- Large file and disk support
- Well supported by Linux kernels

H. Advantage and Disadvantages of kali linux

Advantages of Kali Linux

1. Free and Open Source

Kali Linux is completely free to use, and its source code

is open to everyone.

This allows:

Students to learn without financial cost , Developers to modify and improve the system

Security experts to verify tools for transparency and trust Being open source also means Kali Linux benefits from continuous global community contributions.

2. Pre-installed Security and Penetration Testing Tools

Kali Linux comes with hundreds of built-in tools for:

- Penetration testing, Network security analysis, Web application testing Digital forensics
- Wireless security testing
- Examples include:
  - Nmap (network scanning)
  - Metasploit (exploitation framework)
  - Wireshark (packet analysis)

This saves time because users do not need to install tools manually.

3. Strong Community and Professional Support

Kali Linux has: A large global user community , Detailed documentation Active forums and tutorials Because Kali Linux is maintained by Offensive Security, it is widely used by professionals, which ensures reliability and regular updates.

4. Regular Updates and Security Patches

Kali Linux is frequently updated to: Add new tools, Fix bugs ,Improve performance Patch security vulnerabilities , This makes Kali Linux reliable for modern security challenges.

5. Supports Virtualization Very Well

Kali Linux is optimized for:

- VirtualBox, VMware ,Cloud environment Pre-built virtual
- machine images are available, making installation faster and easier. This is ideal for
- student and beginners.

6. Highly Customizable

Users can:

- Change desktop environments (GNOME, KDE, XFCE)
- Install or remove tools, Customize system settings.
- This flexibility helps users tailor the system to their needs.

7. Cross-Platform Compatibility

Kali Linux can run on:

- Desktops and laptops, Virtual machines Mobile devices ARM devices
- . This makes it suitable for different learning and professional environments.

8. Real-World Industry Relevance

Kali Linux is used by: Cybersecurity

- professionals, Ethical hackers, Law enforcement agency
- Security researchers, Learning Kali Linux gives students real-world, job-ready skills.

Disadvantages of Kali Linux

1. Not Beginner-Friendly

Kali Linux is not designed for beginners because:

- It assumes knowledge of Linux commands
- Many tools require technical understanding, Mistakes can cause system damage New
- users may find it difficult without proper guidance.

2. Risk of Misuse

Kali Linux contains powerful hacking tools. If misused:

- It can cause legal problems It may
- violate laws and ethical guidelines. Therefore, Kali Linux must be used only for
- educational and authorized purposes.

3. High System Resource Usage

Running Kali Linux, especially in a virtual machine, requires:

- High RAM, Good CPU performance
- Low-end systems may experience slow performance.

4. Not Suitable as a Daily-Use Operating System

Kali Linux is not intended for:

- Office work, Gaming ,Multimedia tasks Other operating systems
- like Ubuntu or Windows are better for daily use.

5. Limited Hardware Driver Support

Some hardware components may not work properly:

- Wi-Fi adapters, Graphics drivers Additional
- configuration may be required to enable full functionality.

6. Short-Term System Stability

Frequent updates can sometimes:

- Introduce bugs, Break system compatibility This
  makes Kali Linux less stable than long-term support (LTS) operating systems.

7. Ethical and Legal Responsibility Required

Users must have:

- Permission to test systems, Clear understanding of laws With out responsibility, using Kali Linux tools can lead to serious consequences.

i. Conclusion

Kali Linux is a powerful operating system designed for cybersecurity professionals and students. Installing it in a virtual environment is safe and effective for learning ethical hacking and penetration testing. Through this project, practical skills in operating system installation, virtualization, and file system understanding were gained.

j. Future Outlook / Recommendation

Use Kali Linux only for ethical and legal purposes Practice cybersecurity labs and simulations Combine Kali Linux with networking and Linux administration studies Recommended for students interested in cybersecurity careers

2. Virtualization in Modern Operating Systems

2.1 What is Virtualization?

Virtualization is a technology that allows one physical computer to run multiple operating systems at the same time. Each operating system runs inside its own virtual machine (VM) and behaves like a real computer with its own CPU, memory, storage, and network interface.

In simple words, virtualization creates virtual computers inside a real computer.

For example:

One laptop can run Windows (host OS).

Inside it, we can run Kali Linux, Ubuntu, or Windows Server as virtual machines.

Each virtual machine works independently and does not affect the others.

2.2 Why Virtualization is Needed (Importance of Virtualization)

Virtualization is very important in modern operating systems for many reasons:

1. Efficient Use of Hardware

Normally, one operating system does not fully use all CPU, RAM, and storage. Virtualization allows multiple OSs to share the same hardware, reducing waste.

2. Safe Testing Environment

Virtual machines are isolated from the host system. This means:

If a VM crashes, the host OS is safe.Viruses or hacking tools used in Kali Linux do not harm the real system. This is why Kali Linux is strongly recommended to be used in a virtual environment.

3. Cost Reduction

Instead of buying many physical computers, virtualization allows:

One computer → many virtual machines

Saves money on hardware, electricity, and maintenance

4. Learning and Education

Students can: Practice Linux commands, Learn ethical hacking, Test server setups without risk

5. Easy Backup and Recovery

Virtual machines are stored as files:

Easy to copy

Easy to back up

Easy to restore if something goes wrong

2.3 How Virtualization Works

Virtualization works using a special software called a Hypervisor.

What is a Hypervisor?

A hypervisor is software that: Creates virtual machines, Allocates CPU,RAM, disk, and Network , Controls communication between hardware and virtual OS

Types of Hypervisors

Type 1 (Bare-Metal Hypervisor)

- ✓ Installed directly on hardware
  - Used in data centres

Examples:

- ✓ VMware ESXi
- ✓ Microsoft Hyper-V Server
- ✓ Xen

Advantages:

- High performance
- More secure

Type 2

- Installed on top of an existing OS
- Easier to use
- Best for students and learning

Examples:

- ➢ Oracle VM VirtualBox
- ➢ VMware Workstation

2.4 Role of Virtualization in Kali Linux

Virtualization is especially important for Kali Linux because: Kali Linux contains penetration testing and hacking tools Using these tools on a real network can be risky Virtual machines provide isolation and safety

Example Scenario

- Host OS: Windows
- Hypervisor: VirtualBox
- Guest OS: Kali Linux

2.7 Advantages of Virtualization in Modern OS

- ✓ Run multiple operating systems simultaneously
- ✓ Strong isolation and security
- ✓ Easy testing and experimentation
- ✓ Better hardware utilization
- ✓ Supports cloud computing and servers

2.8 Disadvantages of Virtualization

- ✓ Requires powerful hardware
- ✓ Performance slightly lower than physical OS
- ✓ Needs technical knowledge
- ✓ Misconfiguration can cause slow performance