Bahir Dar University
BIT Faculty Of Computing
Department Of Software Engineering

Course Title: Operating Systems and System Programming

Individual Assignment

# OPERATING SYSTEM INSTALLATION AND VIRTUALIZATION

## UBUNTU 25.04 SERVER OS

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**Submittion date: 04/09/2017**

# Table of Contents

# 1. General Overview of Operating Systems

The operating system (OS) is one of the most crucial components of any computer system. It acts as a link between the user and the hardware of the computer. By managing the system's resources, such as the CPU, memory, disk storage, and input/output devices, the operating system (OS) ensures that users and applications can interact with the hardware in a safe and efficient manner.

The OS is in charge of a number of important tasks. In order to safeguard data and system integrity, it controls process execution, makes sure memory is allocated appropriately, manages input and output operations, keeps file systems up to date, and enforces security policies. Users would have to manually control and communicate with hardware components in the absence of an operating system, which would be difficult and unfeasible.

Numerous operating system varieties have been created over time, each suited to particular computer requirements. Distributed operating systems oversee systems dispersed across numerous nodes, embedded operating systems are made for use in specialized devices like routers, sensors, or smart appliances, batch operating systems automate job processing, time-sharing operating systems accommodate multiple users concurrently, and real-time operating systems are employed in mission-critical applications needing precise timing.

Widely used operating systems include, for example, Unix, a foundational OS that has influenced many others, including Linux and BSD variants; Linux, an open-source OS preferred for its flexibility and security; macOS, the default OS for Apple computers, praised for its stability and design; and Microsoft Windows, renowned for its user-friendly interface and application ecosystem.

The operating system is essentially the foundation of any contemporary computer system. It offers the platform required to run applications, makes user interaction easier, and guarantees the efficient and safe use of system resources.

Windows, Linux, macOS, and Unix-based systems are among the well-known operating systems.
In order to meet the demands of various computing environments, ranging from personal desktops to servers and mobile devices, each has developed with distinct objectives and architecture.

## 1.1 What is Ubuntu server OS

**Ubuntu Server** is a robust and adaptable operating system made especially for server settings. It belongs to the Ubuntu family, which is renowned for its robust community support and ease of use. Ubuntu Server is a well-liked option for both developers and enterprises due to its extensive usage in a variety of applications, including cloud computing and web hosting.

Important Distinctions Between the User Interfaces of Ubuntu Desktop and Ubuntu Server:

**1. User Interface:**

- **Ubuntu Server:** is controlled via the command line and lacks a graphical user interface (GUI).
- **Ubuntu Desktop**: Offers a comprehensive graphical user interface for easy interaction.

**2. Purpose**

- **Ubuntu Server:** Made to host services and apps in server environments.
- **Ubuntu Desktop:** Designed for daily computing tasks in the office and on personal computers.
  By default, the software

**3.Default Software**

- **Ubuntu Server:** Web servers, databases, and other server-related apps are included with Ubuntu Server.
- **Ubuntu Desktop**: Contains desktop programs, such as office suites and browsers. Utilization of Resources:

## 1.2 Introduction and Motivation to Ubuntu 25.04 Server OS

### Introduction to Ubuntu 25.04 Server OS

Ubuntu 25.04 Server, released on **April 17, 2024**, is the latest version of Canonical's renowned open-source operating system designed specifically for server environments. This release continues Ubuntu's tradition of providing a robust, secure, and efficient platform, making it a preferred choice for businesses and developers alike.

### Motivation for Ubuntu 25.04 Server OS

In an atmosphere when digital transformation is speeding up, establishments need server operating systems that are secure, reliable, and flexible enough to handle today's workloads. Ubuntu Server 25.04 is a potent solution made to satisfy the changing needs of businesses, IT departments, and developers. It provides the fundamental tools and technologies required to support today's dynamic computing environments, with an emphasis on performance, security, and long-term sustainability.

Here are key motivations for developing Ubuntu 25.04 server OS.

**1. Growing Demand for Reliable Server Solutions**

Reliable and scalable server solutions are urgently needed due to the growing dependence on web apps, cloud services, and data management. In order to meet this need, Ubuntu 25.04 Server provides improved performance and stability, enabling companies to efficiently handle their workloads.

**2. Focus on Security**

Security is crucial in today's digital environment. To safeguard apps and networks, Ubuntu 25.04 Server integrates cutting-edge security features like AppArmor and UFW. This emphasis on security aids businesses in reducing risks and protecting private information.

**3. Support for Modern Technologies**

As technology evolves, so do the needs of developers and IT professionals. Ubuntu 25.04 Server provides built-in support for cloud services and containerization technologies like Docker and Kubernetes, enabling users to deploy and scale applications efficiently in cloud environments.

**4. Long-Term Viability**

Ubuntu 25.04 Server's Long-Term Support (LTS) model gives businesses a stable and dependable platform for their operations by offering five years of security updates and maintenance. For companies that need steady support without frequent upgrades, this long-term viability is essential.

**5. Community and Ecosystem**

A sizable and vibrant community supports and advances Ubuntu. This ecosystem makes it simpler for users to troubleshoot problems and optimize their server environments by offering a wealth of resources, forums, and documentation.

## 1.3 Users of Ubuntu 25.04 Server OS

Ubuntu 25.04 Server OS caters to a diverse range of users, including:

**1. System Administrators**

- Responsible for managing and maintaining server environments.
- Use Ubuntu for its stability, security, and extensive documentation.

**2. Developers**

- Build and test applications in a reliable environment.
- Favor Ubuntu for its compatibility with various programming languages and frameworks.

**3. Businesses and Enterprises**

- Utilize Ubuntu for web hosting, database management, and enterprise applications.
- Benefit from long-term support and regular security updates.

**4. Cloud Service Providers**

- Deploy Ubuntu in cloud environments due to its optimized performance and scalability.
- Use it for hosting virtual machines and containerized applications.

**5. Educational Institutions**

- Implement Ubuntu in labs and classrooms for teaching and research purposes.
- Leverage its cost-effectiveness and open-source nature.

**6. DevOps Professionals**

- Use Ubuntu for continuous integration/continuous deployment (CI/CD) pipelines.
- Integrate with tools like Docker and Kubernetes for container orchestration.

**7. Non-Profit Organizations**

- Choose Ubuntu for its free and open-source licensing, minimizing costs.
- Utilize it for various applications, from web services to internal tools.

## 1.4 Objective

Ubuntu Server 25.04 is an alternative operating system designed to be versatile, secure, and powerful in both on-premise and cloud-hosting scenarios. Our high-level goals fall into these categories:

- ✓ **Performance:** We want to ensure that a user can expect high performance from Ubuntu Server 25.04 so that workloads are deployed as efficiently as possible.
- ✓ **Scalability:** As more work is added to an application or service, the easy-to-use features should as well remove barriers to scale.
- ✓ **Security:** We want to provide security, and identity and access management that can be trusted to protect data and the applications that manage, provide and process them.
- ✓ **Usability:** Ubuntu Server 25.04 can make the complex demands of using an enterprise technology stack platforms easy to manage from deployment to scaling.
- ✓ **Cloud:** Every growing service offers a way to deploy and consume workload in a hybrid or fully cloud-based infrastructure.

- ✓ **Community:** Community around Ubuntu Server 25.04 is unprecedented, with depth of documentation that directly assists anyone with troubleshooting and making good decisions.

Ultimately, Ubuntu Server and the Ubuntu Server ecosystem hopes to offer a reliable platform around which to run a workload, host a website, and command an enterprise service.

## 1.5 Requirements

### 1.5.1 Hardware requirements

Ubuntu 25.04 Server OS can run on minimal hardware, but for production environments, it is advisable to meet or exceed the recommended specifications to ensure optimal performance and reliability.

To run Ubuntu 25.04 Server OS in a virtual environment, the following hardware requirements are recommended:

- **Processor:** 2 GHz dual-core processor or better
- **RAM:** Minimum 4 GB RAM
- **Storage:** 25 GB of free hard drive space
- **Network:** Ethernet or compatible network interface for connectivity

### 1.5.2 Software requirements

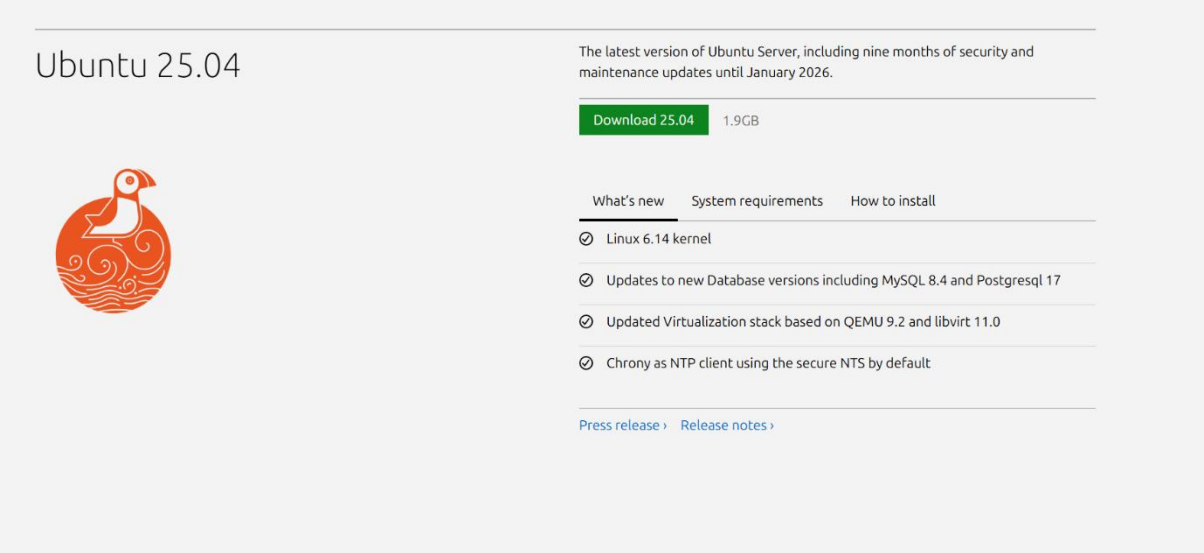
- **Virtualization Software** (VMware workstation, Oracle VM VirtualBox, and etc…)
- **Operating System (ISO):** Ubuntu 25.04 server OS ISO file, which can be downloaded from the official website.
- **Host OS:** supported operating system to run the virtualization software (e.g., Windows, macOS, Linux).
- **Filesystem:** Ubuntu Server 25.04 supports ext4, XFS, Btrfs, and ZFS filesystems for installation on VirtualBox.

## 1.6 Installation steps

- ➢ Go to the official Ubuntu website (https://ubuntu.com/)and download the latest ISO image file.
- ➢ If VMware is not installed before, Download and Install VMware.
- ➢ Launch the VMware application and create a new virtual machine.

- Naming the new virtual machine with My full name.
- Assign hardware resources.
- Power on the new Virtual Machine.
- Follow Installation steps.
- Verify Installation.
- Once the setup is complete, reboot the virtual machine.

## Installation steps with screenshots.



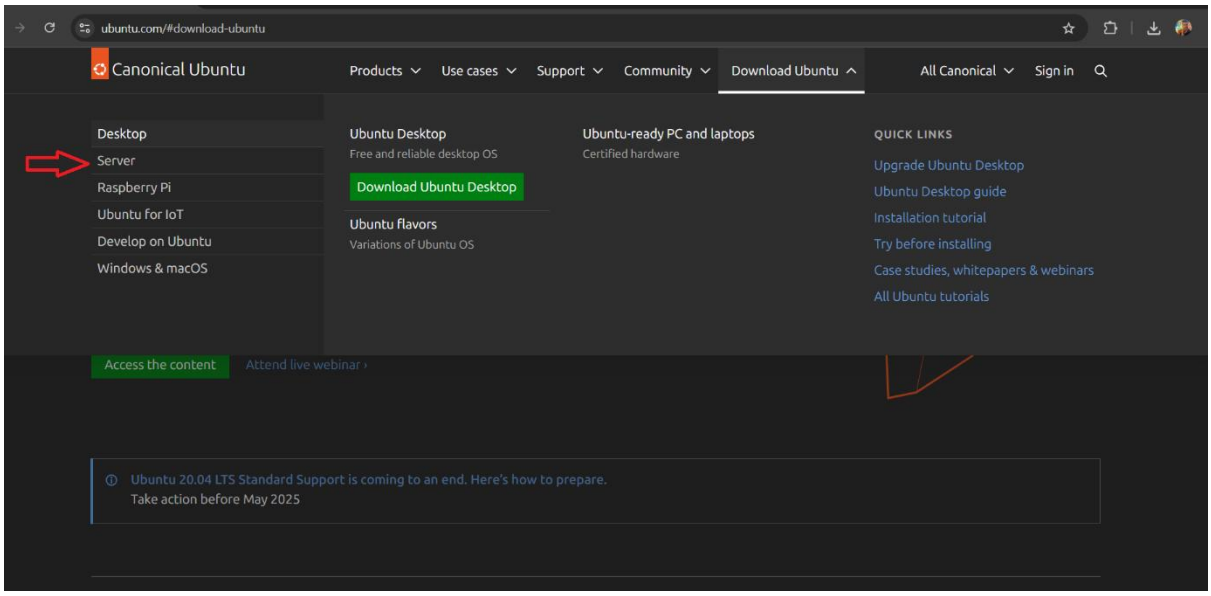




Image 1. Downloading Ubuntu server 25.04 from their official website.

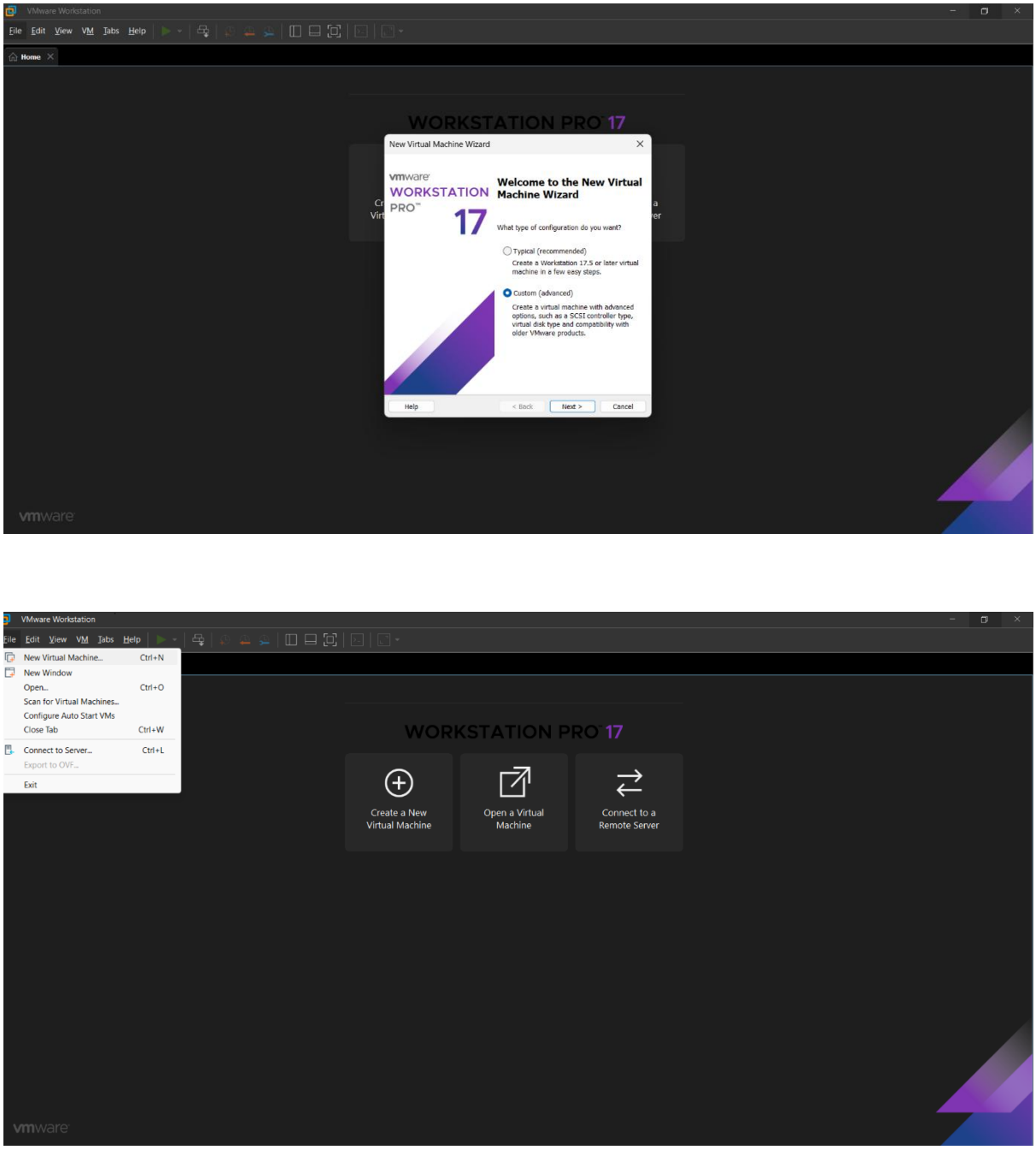
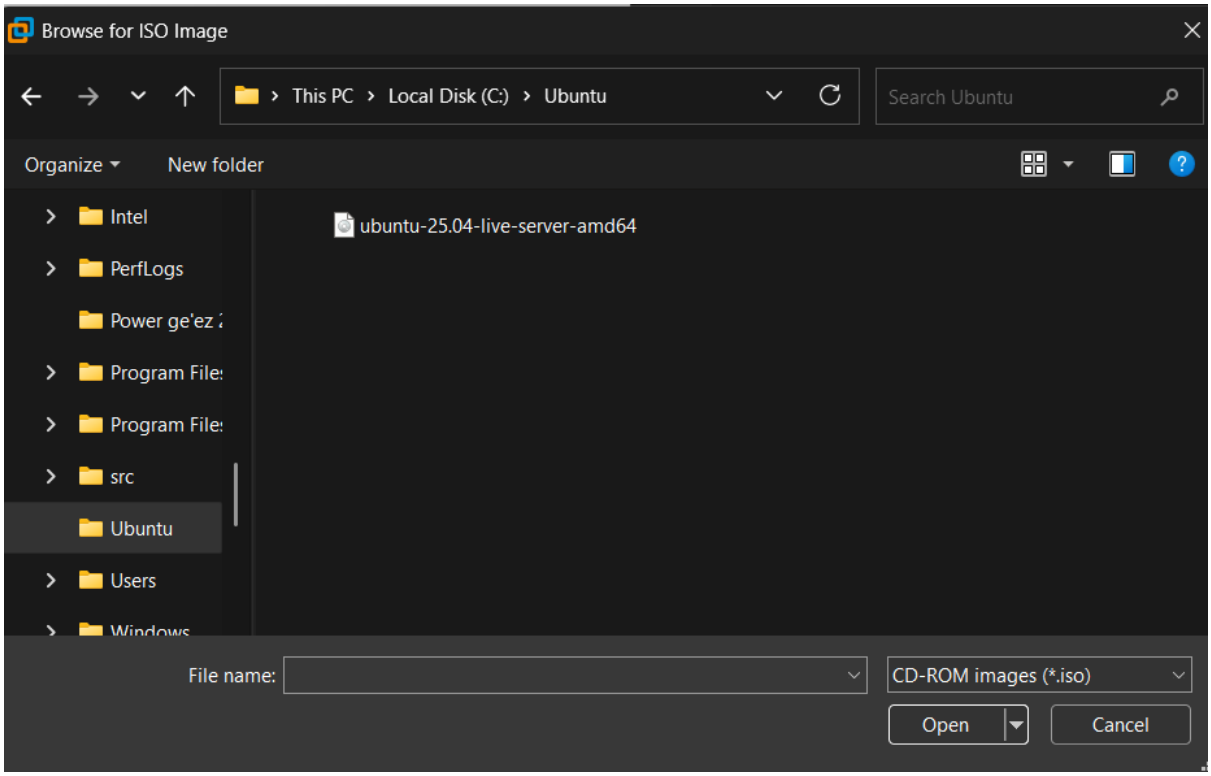



Image 2. Start working with VMware workstation



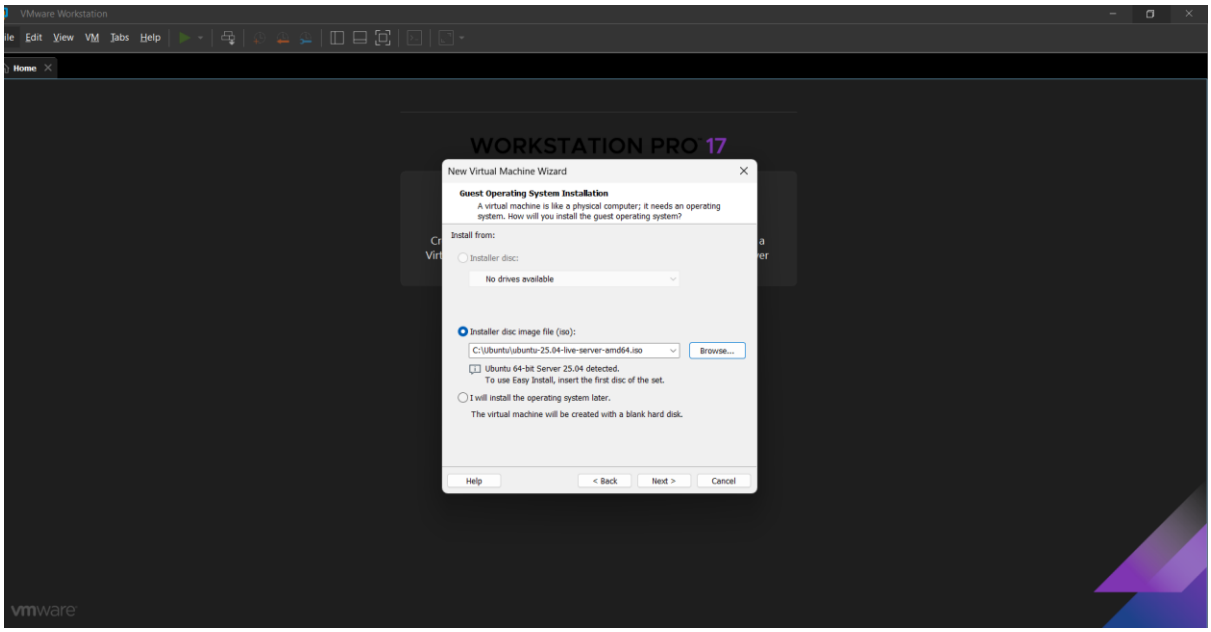




Image 3. Loading the Ubuntu server 25.04 ISO file in to the new virtual Machine

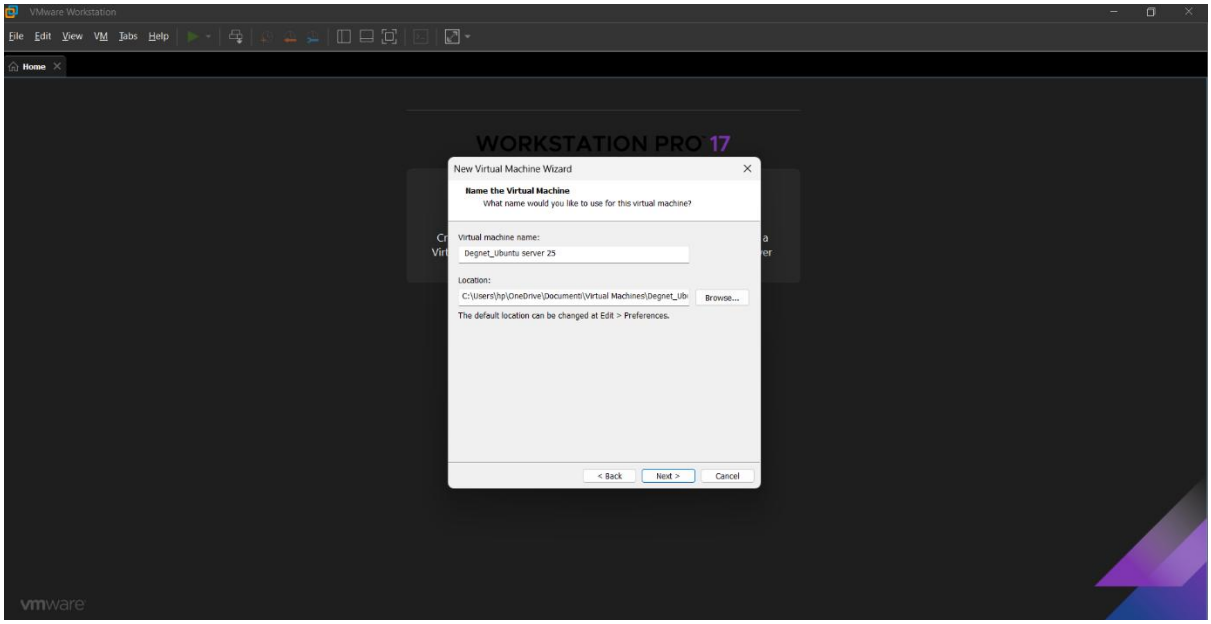
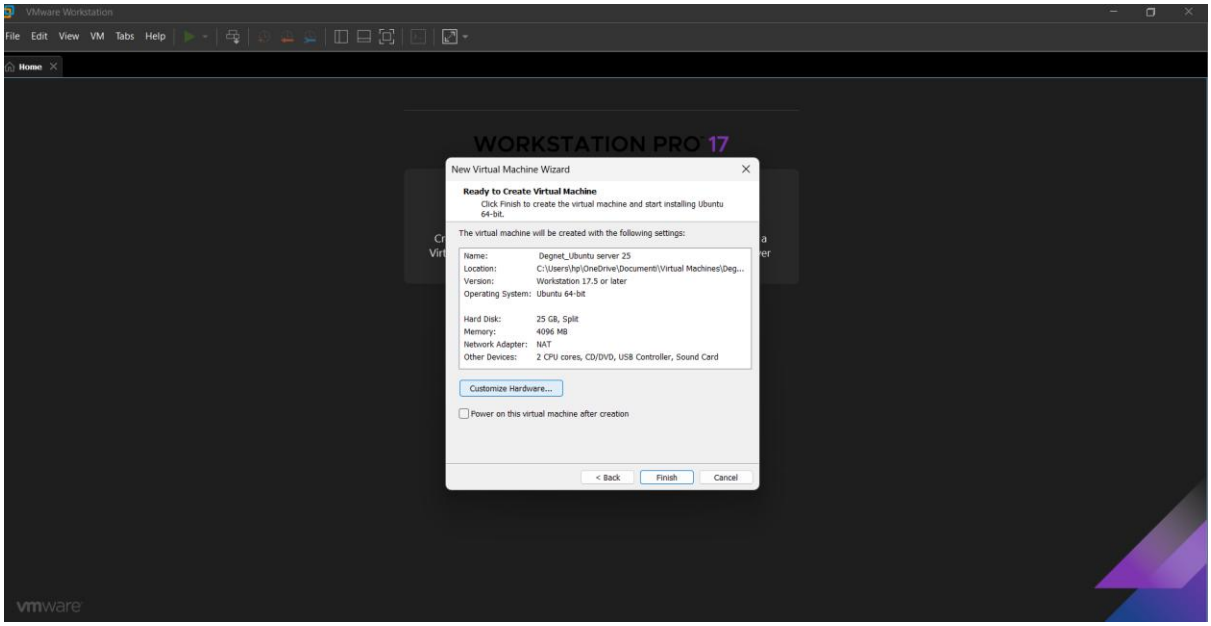



Image 4. Naming the virtual machine



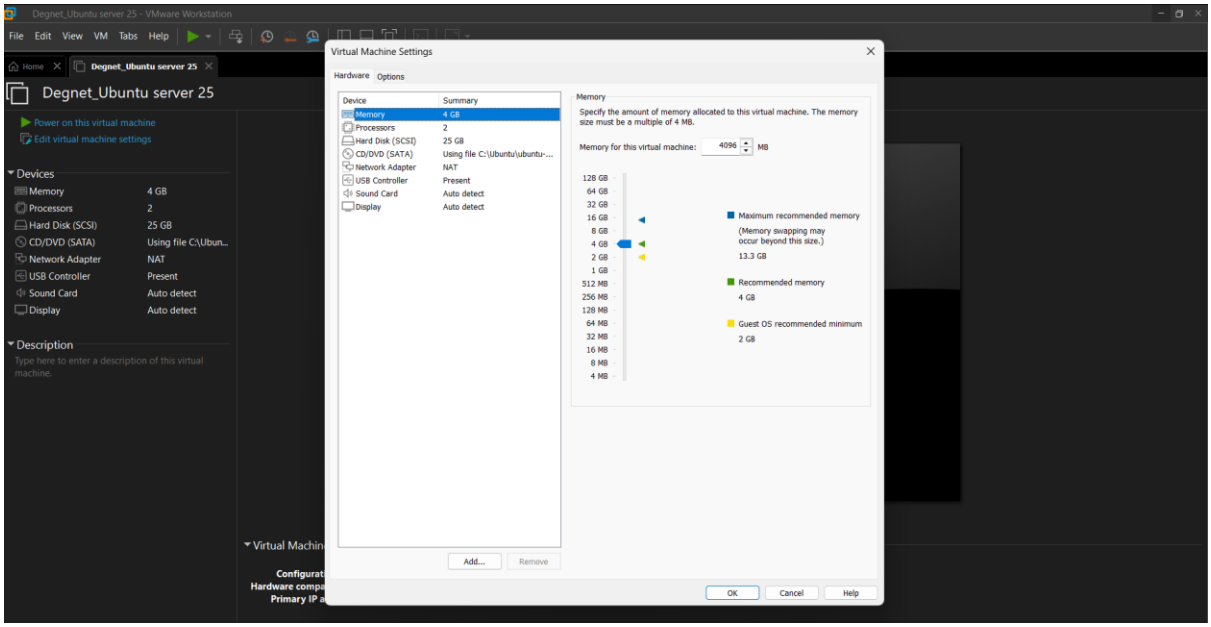
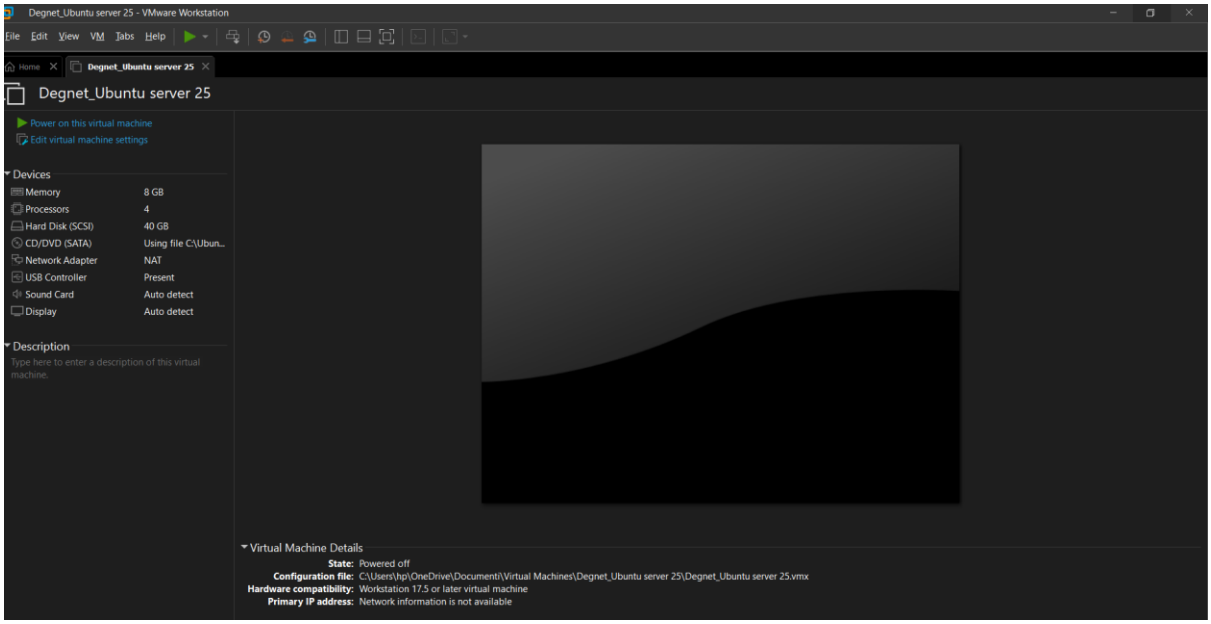



Image 5. Customizing the Hard ware



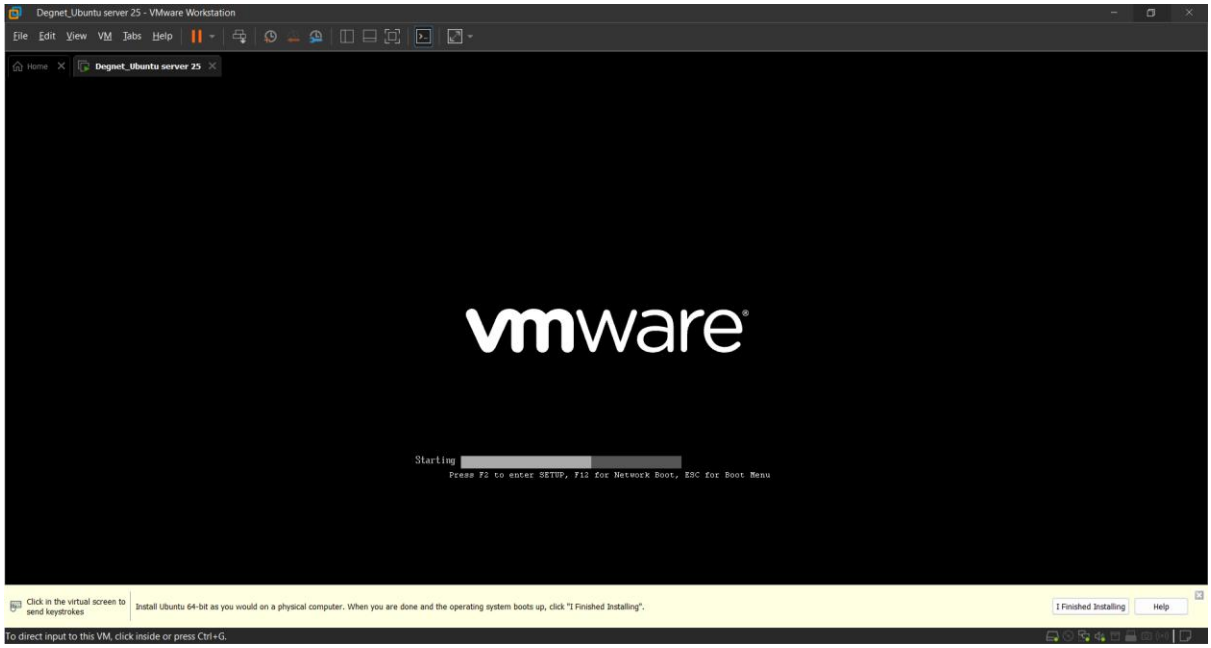
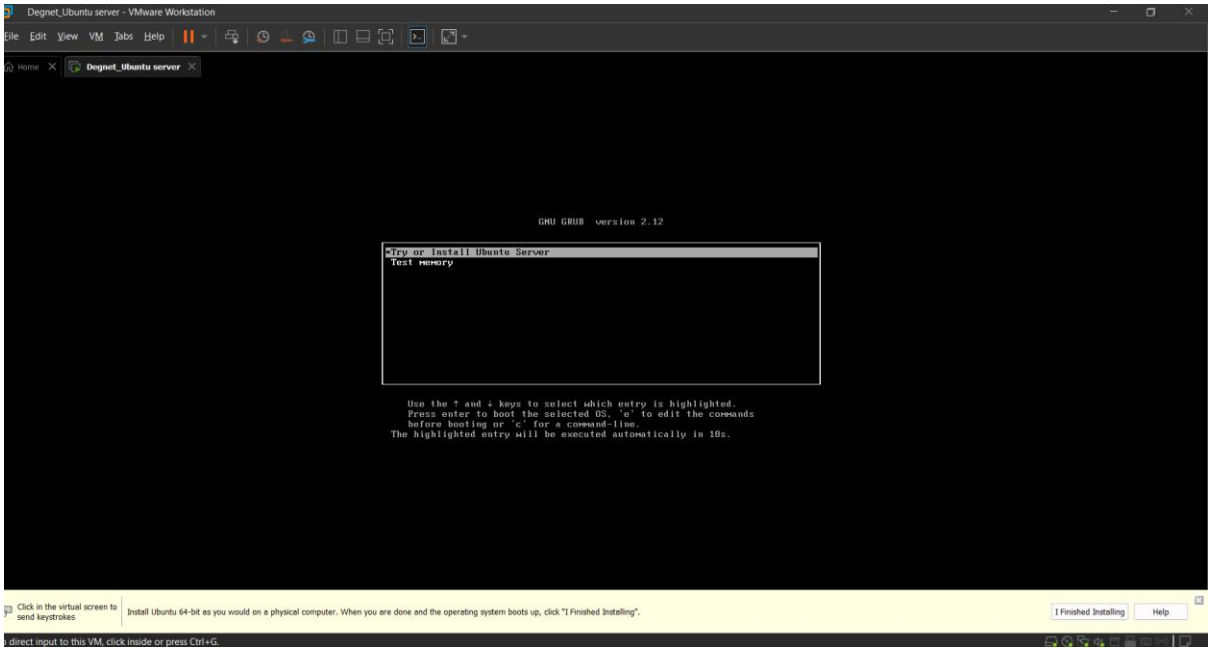



Image 6. Power on the new virtual machine



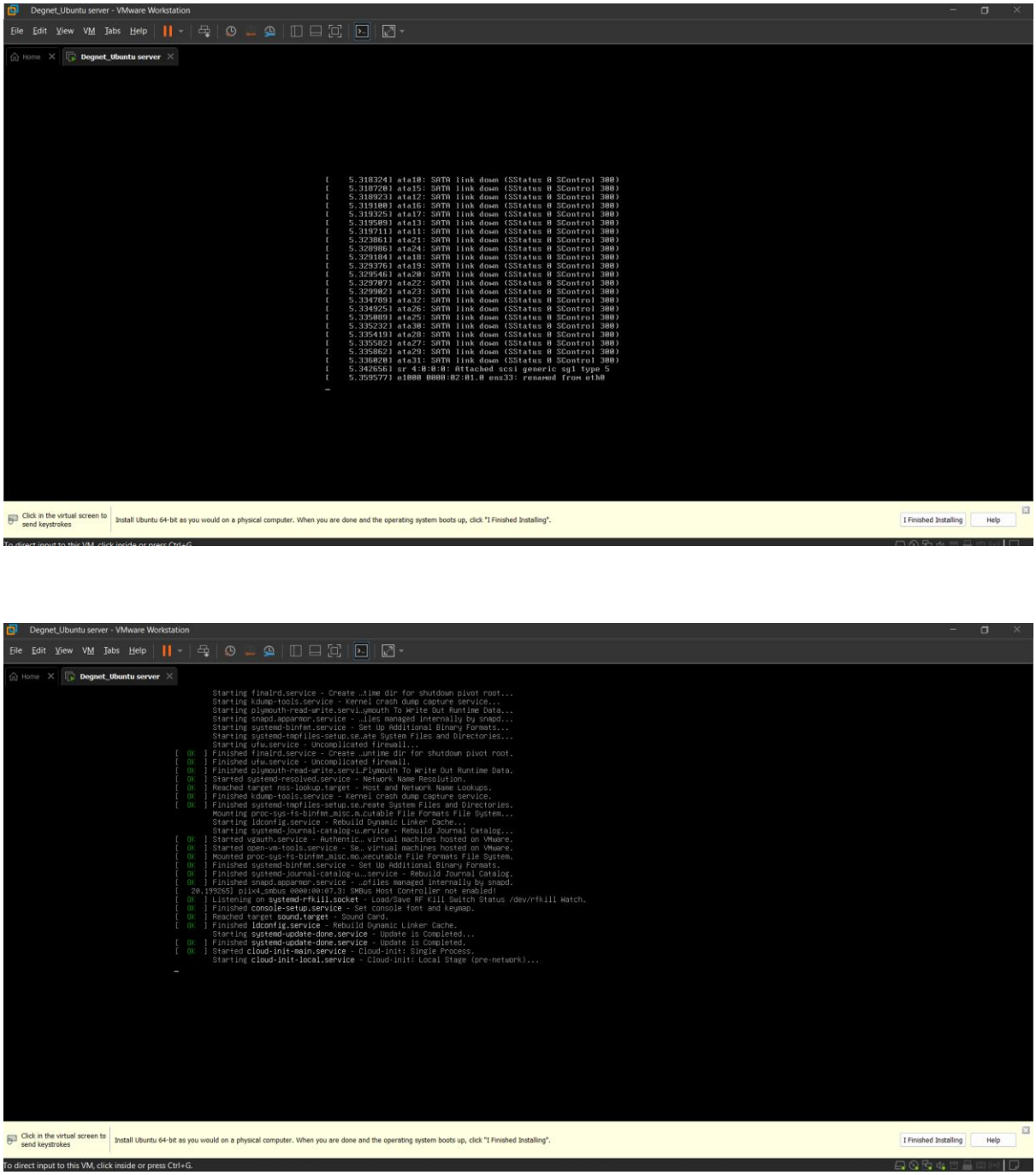
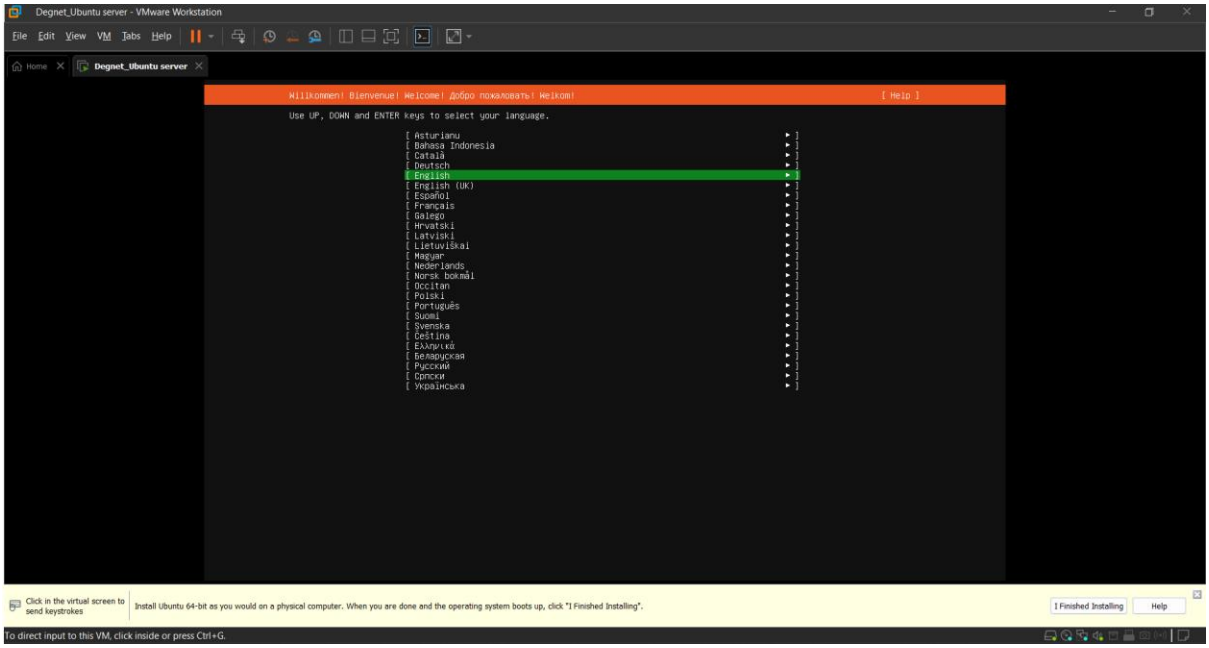






Image 7. Initialization of Installation



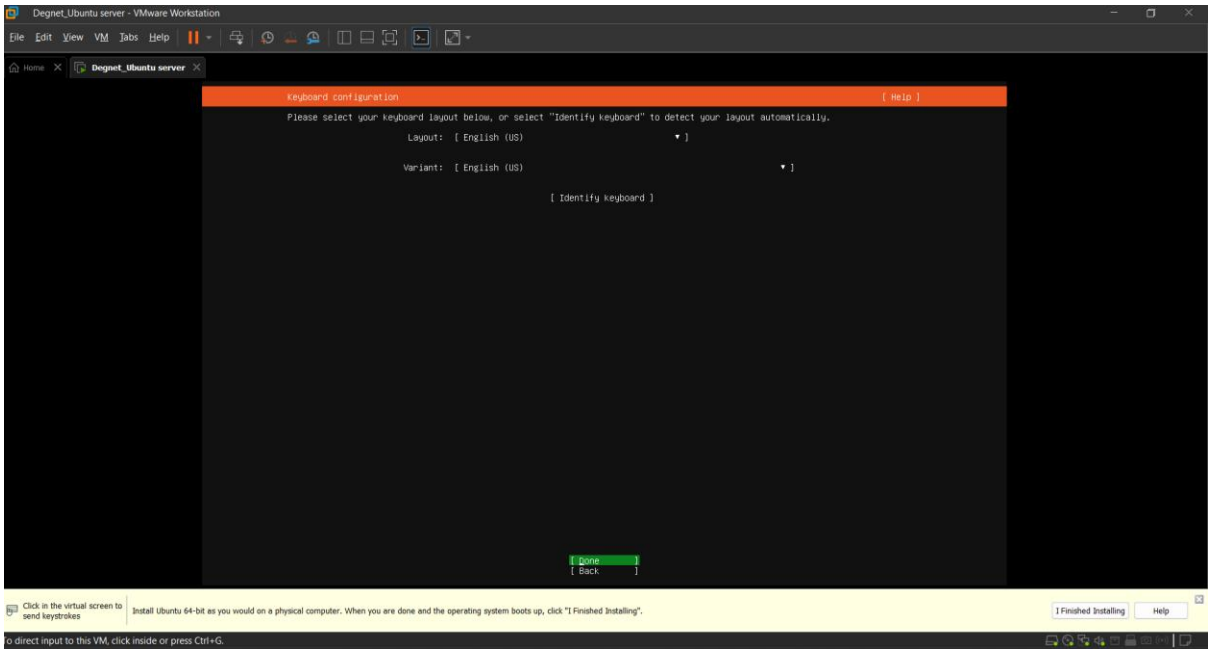




Image 8. Keyboard configuration

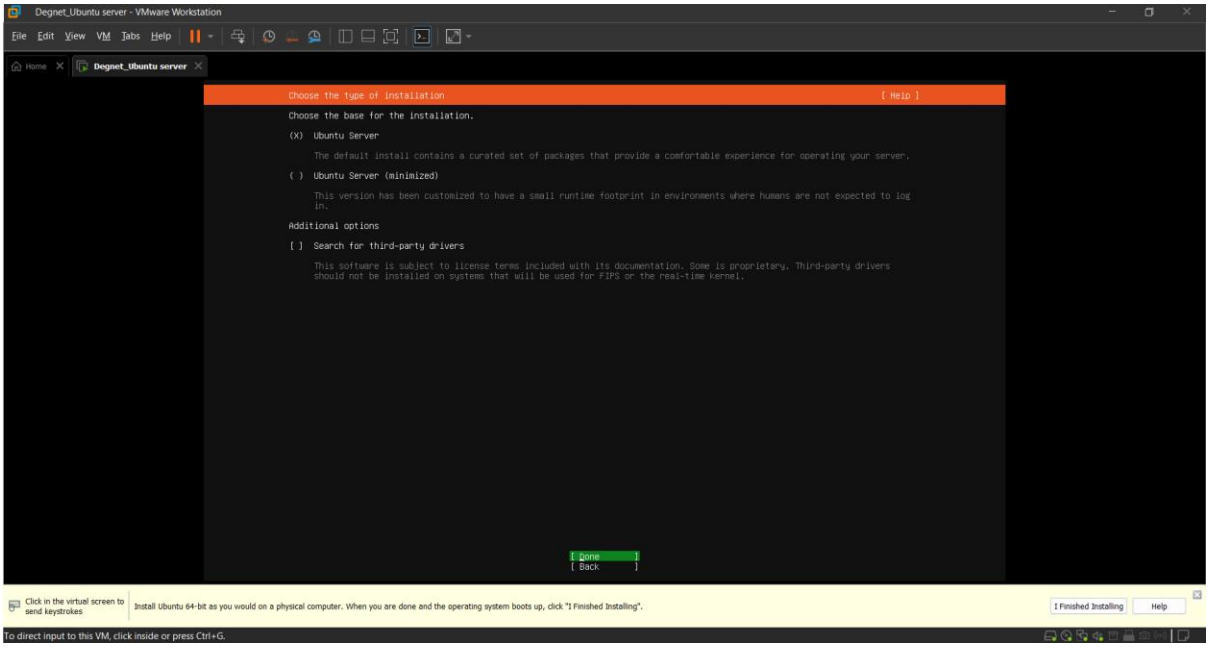



Image 9. Choosing the type of installation

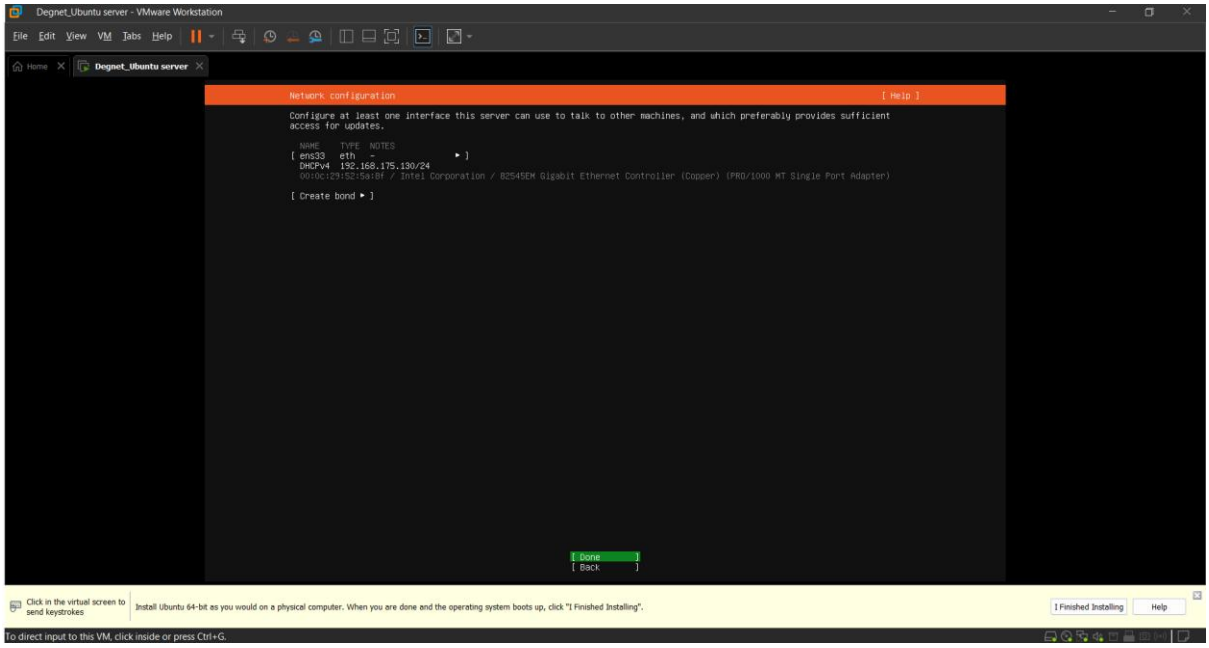



Image 10. Network configuration

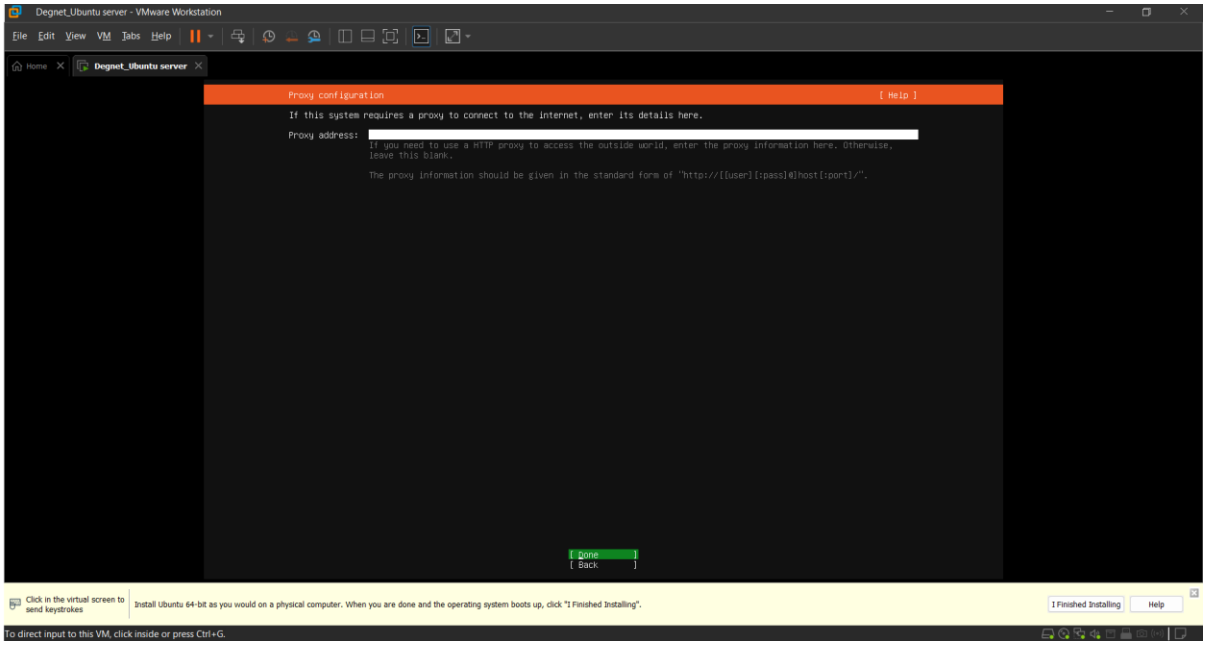



Image 11. Proxy configuration

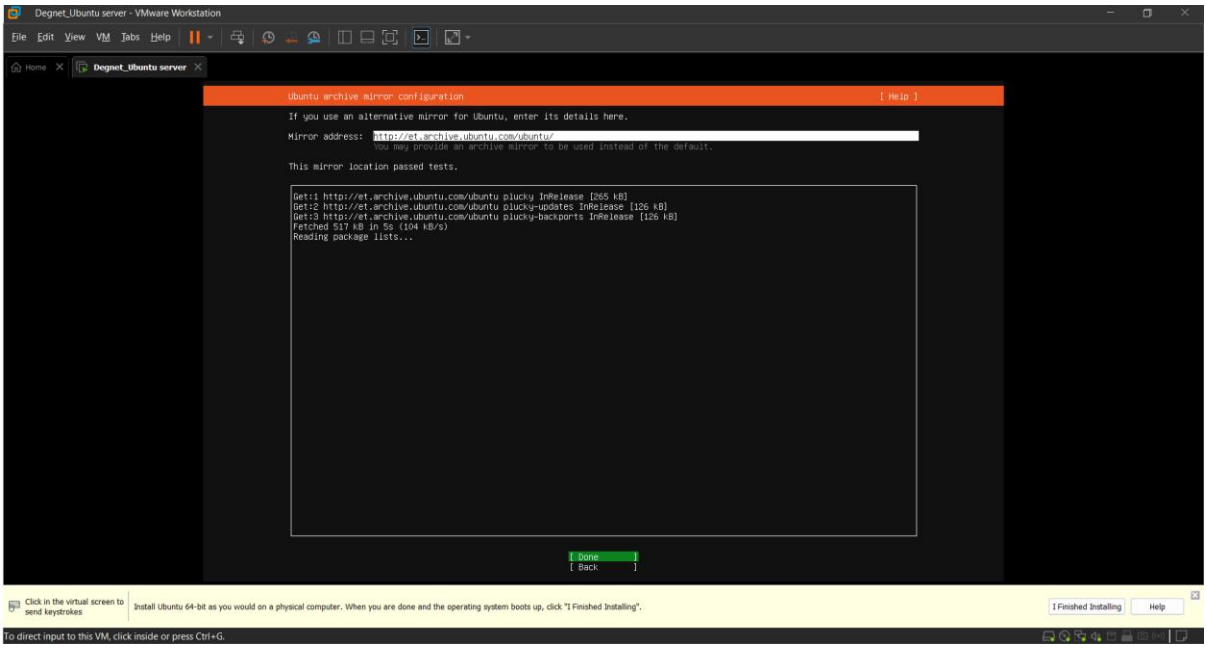



Image 12. Ubuntu archive mirror configuration

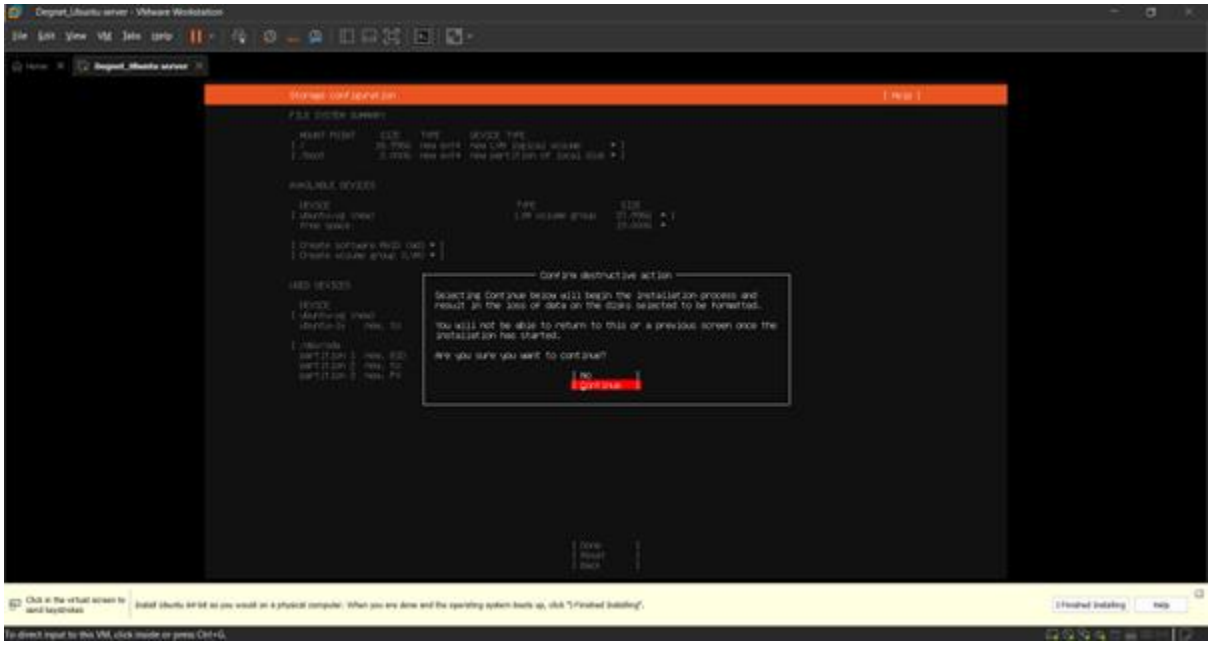


Image 13. Storage Configuration

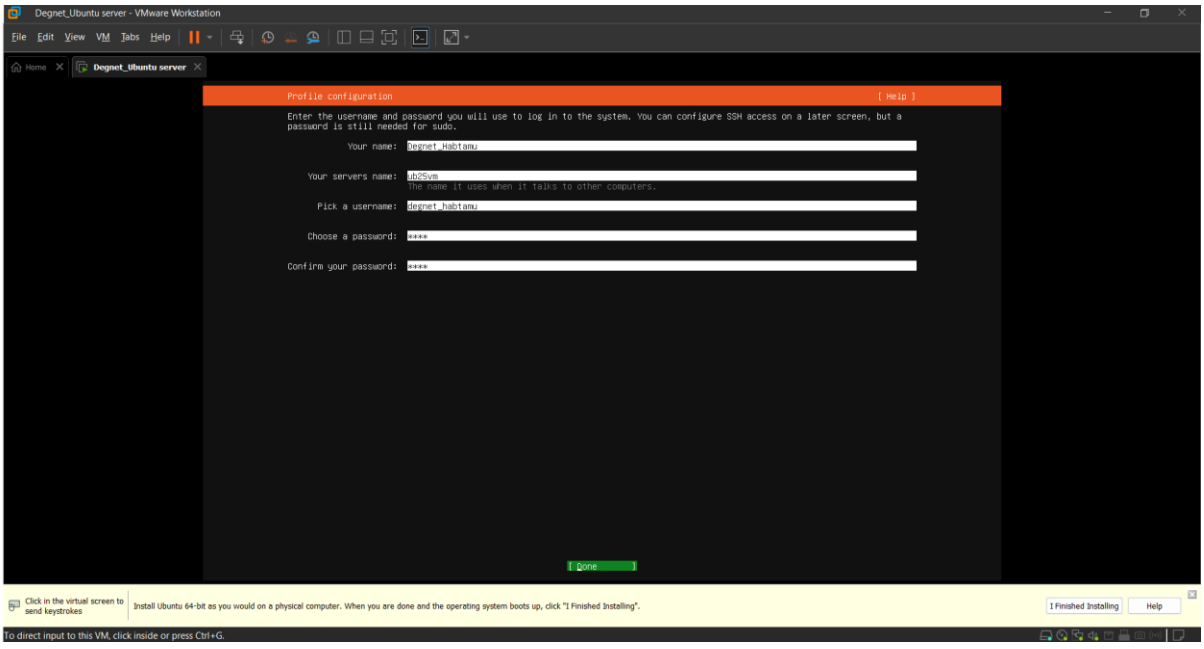



Image 14. Profile Configuration

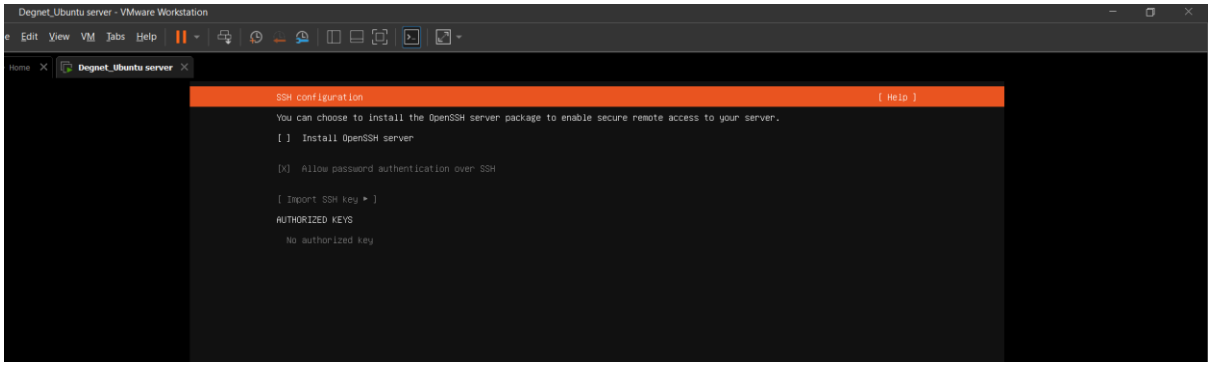



Image 15. SSH Configuration

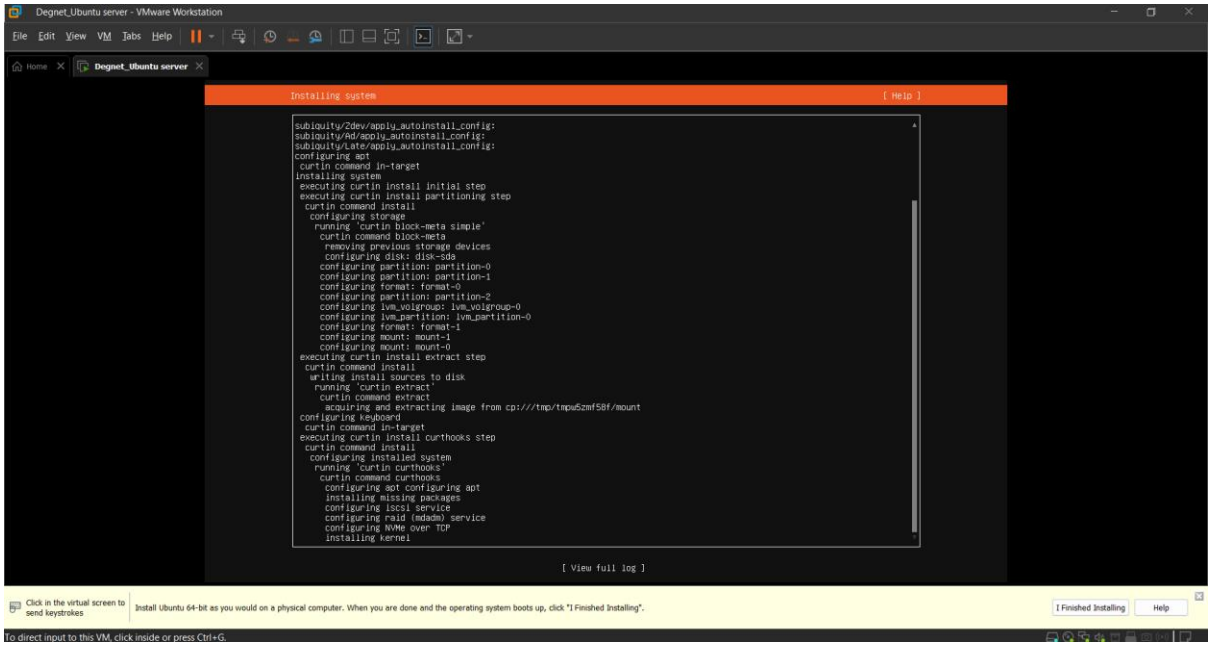



Image 16. Installing System

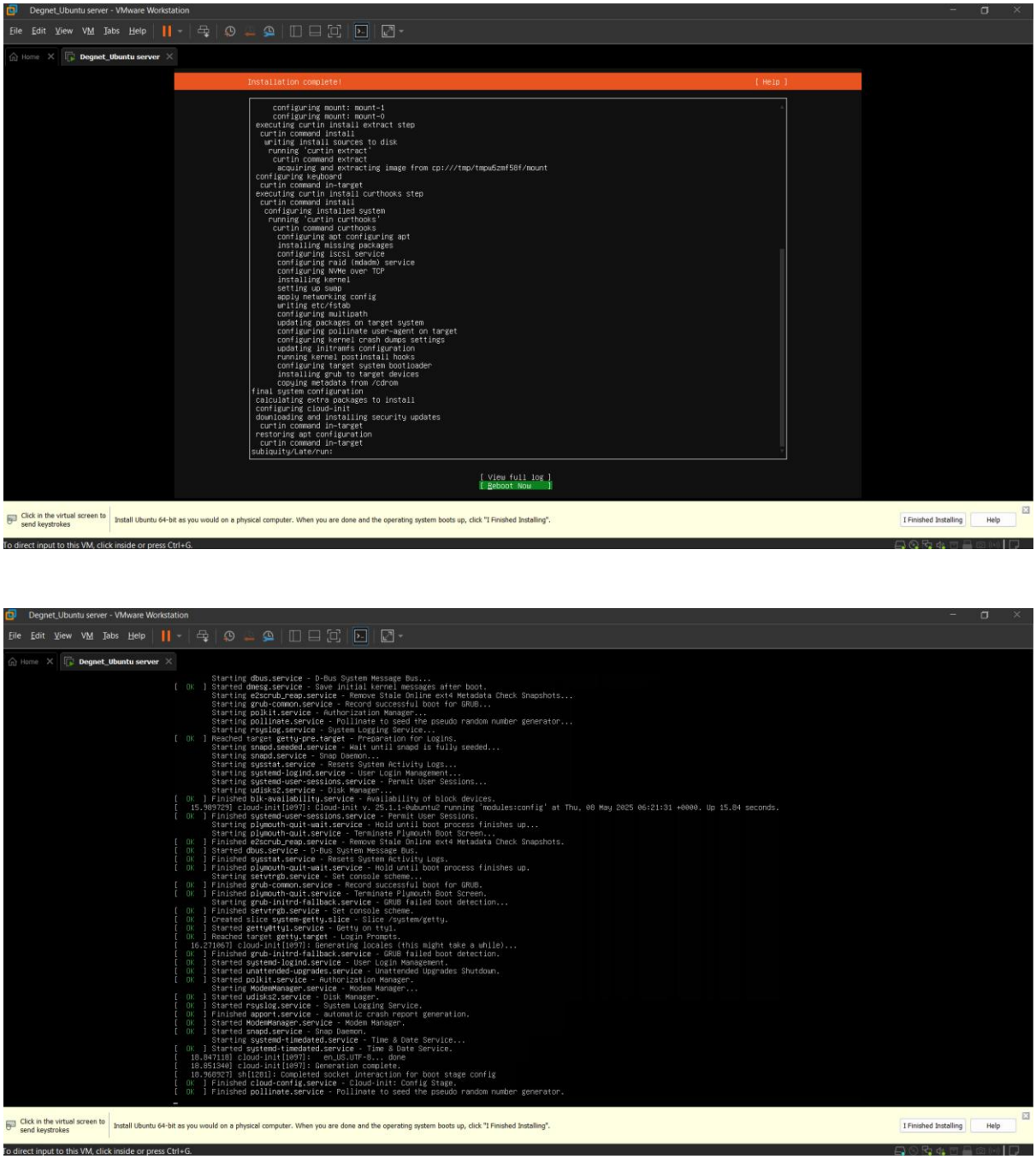
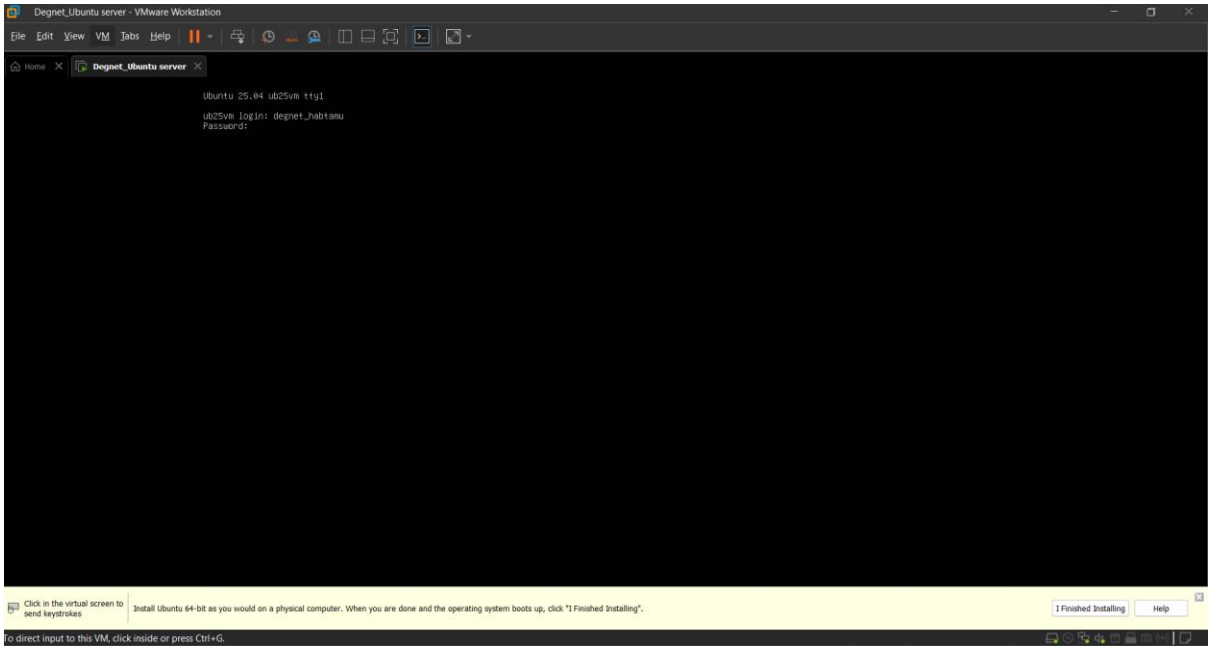






Image 17. Rebooting



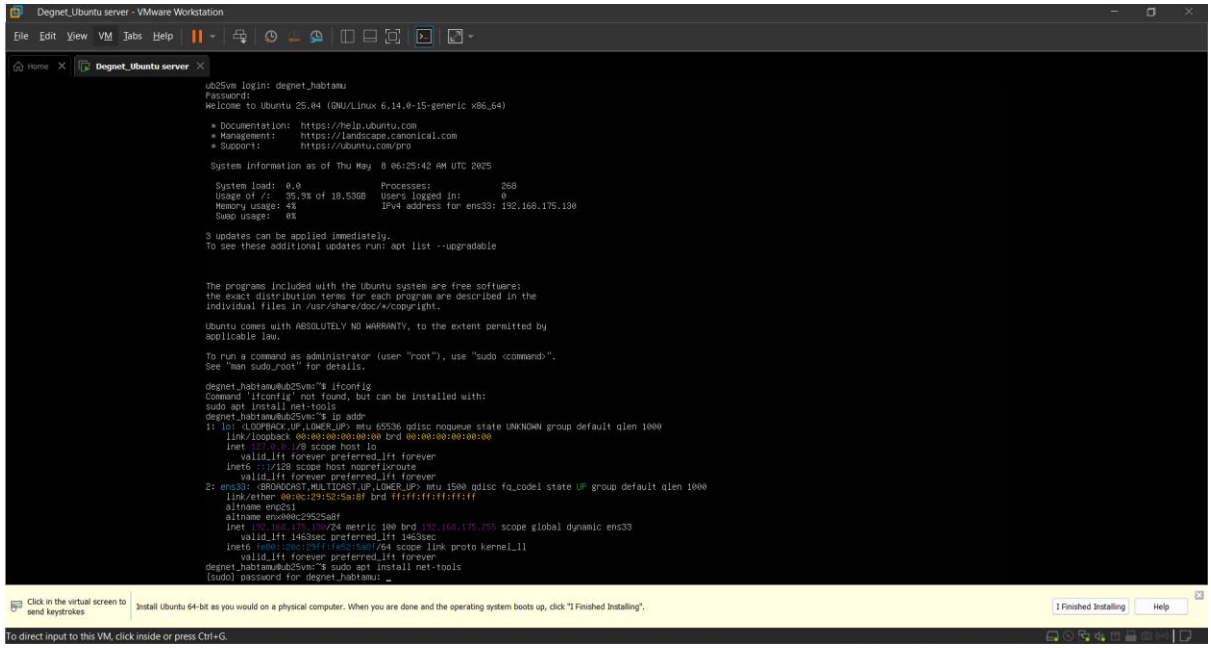




Image 18. Login to user Account and Installing net-tools

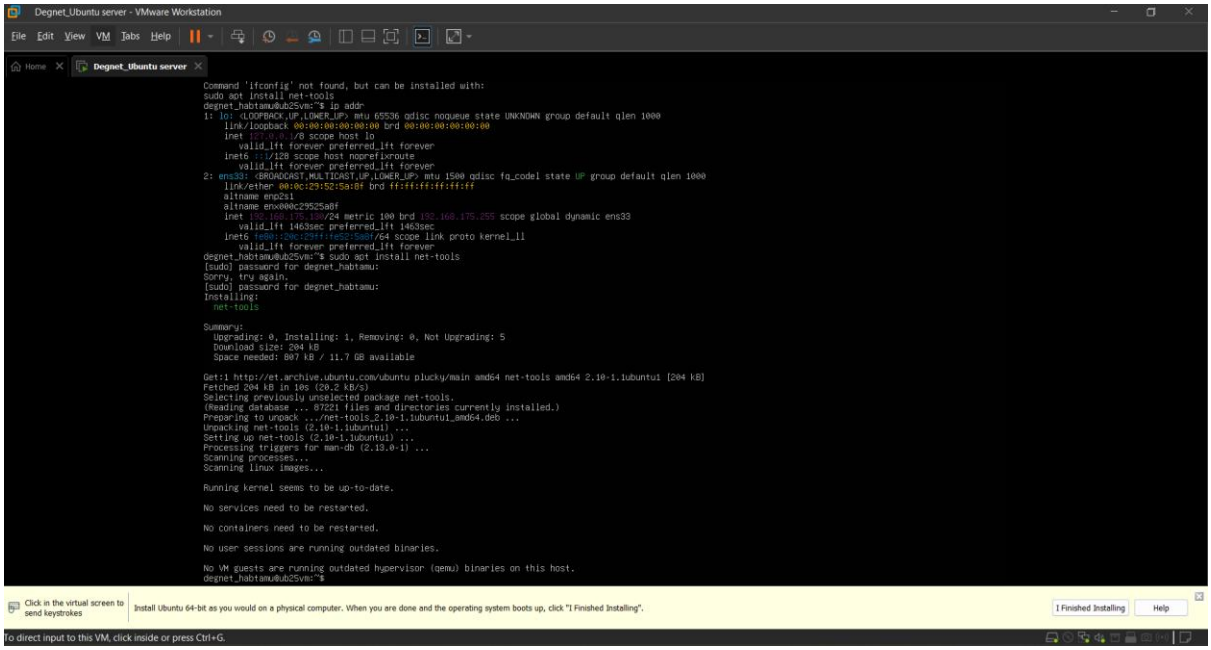



Image 19. Now Ubuntu server 25.04 is successfully installed and it is up-to- date.

## 1.7 Issues (problem faced)

When I was installing and after installation of Ubuntu Server, I encountered the following problems:

**Problem 1:** Since Ubuntu Server operates without a graphical user interface (GUI), I found it challenging to manage the system, especially as I wasn't very familiar with command-line environments.

**Problem 2:** Some services failed to start correctly after installation, hindering server functionality.

**Problem 3:** I experienced slow updates and trouble downloading packages due to a poor internet connection.

## 1.8 Solutions

- For problem 1 I spent time using online tutorials to learn the fundamental Linux commands, which improved my ability to use the system.
- For the second problem I performed sudo apt update and then sudo apt upgrade to make sure all packages were current. This fixed compatibility problems and enabled the services to launch properly.
- For the last problem I made use of wired connections whenever possible for more stability.

## 1.9 Filesystem support

To meet a range of storage requirements, Ubuntu Server 25.04 provides broad support for multiple filesystems. The list of supported and unsupported filesystems is as follows:

**Supported Filesystems**

1. **Ext4**
   - ✓ Known for reliability and performance.
   - ✓ Default filesystem for Ubuntu.
2. **XFS**
   - ✓ High-performance filesystem suitable for large files and enterprise environments.
3. **Btrfs**
   - ✓ Supports advanced features like snapshots, compression, and dynamic resizing.
4. **ZFS**
   - ✓ Offers data integrity features, snapshots, and built-in compression.
   - ✓ Ideal for high-data protection needs.
5. **NTFS**
   - ✓ Read and write support via ntfs-3g.
   - ✓ Allows access to Windows-compatible drives.
6. **exFAT**
   - ✓ Support for external drives used in Windows environments (e.g., USB drives, SD cards).
   - ✓ Installed via exfat-fuse and exfat-utils.
7. **FAT32**
   - ✓ Compatible with a wide range of devices, including older systems.

**Unsupported Filesystems**

1. **APFS**
   - ✓ Apple's filesystem is not natively supported on Ubuntu.
2. **HFS+**
   - ✓ While it may be possible to read HFS+, write support is limited and not reliable.
3. **ReiserFS**
   - ✓ Not included by default and not actively maintained.
4. **JFS**
   - ✓ Less widely used and not included by default, though it can be installed manually.

The following tables summarizes the above.

| Filesystem | Support Status | Notes | Reason |
|---|---|---|---|
| Ext4 | Supported | Default filesystem; reliable and performant. | Widely used and well-supported in Linux. |
| XFS | Supported | High-performance for large files; ideal for enterprise use. | Optimized for scalability and large data sets. |
| Btrfs | Supported | Supports snapshots, compression, and dynamic resizing. | Active development and advanced features. |
| ZFS | Supported | Offers data integrity, snapshots, and compression features. | Popular for data protection and enterprise solutions. |
| NTFS | Supported | Read/write support via ntfs-3g; for Windows drives. | Needed for interoperability with Windows systems. |
| exFAT | Supported | Used for USB drives and SD cards; requires additional packages. | Common for external storage devices. |
| FAT32 | Supported | Compatible with many devices; widely used in external storage. | Legacy support for compatibility across platforms. |
| APFS | Not Supported | Apple filesystem; no native support. | Primarily designed for macOS, not for Linux. |
| HFS+ | Not Supported | Limited write support; primarily read-only. | Obsolete for most modern Linux systems. |
| ReiserFS | Not Supported | Not actively maintained; not included by default. | Development has stagnated, less community support. |
| JFS | Not Supported | Less commonly used; not included by default. | Limited adoption in modern Linux distributions. |

## 1.10 Advantage and Disadvantage

Ubuntu Server 25.04 is a robust operating system made for server environments. Like any technology, it has benefits and drawbacks that users should weigh when choosing which one is best for their infrastructure.

### Advantage

**Stability and Reliability**

- **Long-Term Support (LTS)**: Ensures regular updates and support for security and maintenance.
- **Robust Performance**: Optimized for server workloads, providing consistent uptime.

**Scalability**

- **Dynamic Resource Management**: Easily scale resources up or down based on demand.
- **Support for Virtualization**: Compatible with technologies like KVM and LXD for efficient resource allocation.

**Security Features**

- **Regular Security Updates**: Timely patches and updates to keep systems secure.
- **Built-in Firewall**: UFW (Uncomplicated Firewall) simplifies firewall configuration.

**Wide Software Repository**

- **Extensive Package Management**: Access to thousands of software packages through APT.
- **Support for Containerization**: Compatible with Docker and Kubernetes for microservices deployment.

**Community and Documentation**

- **Strong Community Support**: Large user community provides forums, guides, and troubleshooting assistance.
- **Comprehensive Documentation**: Official documentation is thorough, making it easier for users to find solutions.

**Flexible Deployment Options**

- **Cloud Integration**: Easily deploy on public, private, or hybrid cloud environments.

**Advanced Filesystem Support**

- **Support for Modern Filesystems**: Includes Btrfs and ZFS for advanced data management options.
- **Efficient Storage Management**: Features like snapshots and compression for better data handling.

**Support for Latest Technologies**

- **Container and Microservices Support**: Native tools for deploying modern applications.
- **Integration with DevOps Tools**: Compatible with CI/CD pipelines and automation tools.

## Disadvantage

**Learning Curve**

- **Complexity**: New users, especially those coming from Windows or other operating systems, may find the command-line interface challenging.
- **Limited GUI Options**: Primarily designed for headless operation, which may deter users preferring graphical interfaces.

**Compatibility Issues**

- **Software Limitations**: Some proprietary software applications may not be available or fully supported on Linux.
- **Hardware Compatibility**: Certain hardware components may lack drivers or support, leading to functionality issues.

**Resource Requirements**

- **Performance Overhead**: Running additional features, such as containers or virtualization, may require significant system resources.
- **Initial Setup**: Configuration can be time-consuming, especially for complex setups.

**Community Dependency**

- **Support Variability**: While the community is active, support responses can vary in quality and speed.
- **Documentation Gaps**: Some advanced features may lack thorough documentation, making troubleshooting difficult.

**Frequent Updates**

- **Update Management**: Regular updates can introduce changes that may affect compatibility with existing applications.

- **Downtime Risks**: Updates may require reboots or downtime, impacting availability if not manage properly.

## 1.11 Conclusion

When I installed Ubuntu Server 25.04, I found it to be a robust solution tailored for server environments, emphasizing performance, security, and flexibility. The installation process was straightforward: I downloaded the ISO from the official website, set up a virtual machine, and followed the guided steps.

Using online resources and community support, I was able to mitigate the challenges I faced, especially with regard to managing the command-line interface and guaranteeing service functionality.

Overall, Ubuntu Server 25.04 satisfies the requirements of contemporary computing and offers a reliable platform for a range of applications. Even though there was some initial learning involved in the installation and configuration, the end result was a strong and effective server setup.

## 1.12 Future outlook/Recommendations

### Outlook:

With continued security improvements, better support for cloud and container technologies, and a dedication to long-term stability, Ubuntu Server 25.04 is poised for success. Innovation and user support will be sustained by its vibrant community.

### Recommendations:

**Adopt Security Features:** To protect your infrastructure, update and use built-in security tools on a regular basis.
**Leverage Cloud Capabilities:** Use Kubernetes to investigate container orchestration and optimize deployments in cloud environments.
**Participate in the Community: For** best practices and troubleshooting, make use of forums and documentation.
**Make a plan for upcoming upgrades:** Keep up with updates and new features to keep your server safe and effective.

## 2. Virtualization in modern operating systems

what, why, and how virtualization in modern operating system.

**What?**

In contemporary operating systems, virtualization is the process of building a virtualized computer environment that behaves like real hardware, usually with virtual machines (VMs). A single physical machine can run several operating systems concurrently, each in a separate, isolated environment, thanks to virtualization.

**Why?**

Virtualization has a number of important advantages that appeal to both individuals and businesses. these includes:

- ✓ **Resource Efficiency:** By pooling resources, hardware utilization is maximized.
- ✓ **Savings:** Minimizes the need for actual servers.
- ✓ **Flexibility**: Scale resources as needed with ease.
- ✓ **Isolation:** Maintains virtual machines' independence, improving security.
- ✓ **Testing and Development:** Offers secure testing environments.
- ✓ **Legacy Support:** Enables more recent systems to run older apps.

**How?**

A unique software layer called a hypervisor, which is positioned in between the virtual machines and the actual hardware, is used to accomplish this. The underlying physical resources—CPU, memory, storage, and network interfaces—are distributed among the virtual machines by the hypervisor, which also controls their allocation. With its own operating system and apps, every virtual machine functions as a completely separate system.

**Key Points**

- **Hypervisor**: Manages VMs, can be Type 1 (bare-metal) or Type 2 (hosted).
- **Virtual Machines (VMs)**: Isolated environments with their own virtual hardware.
- **Resource Management**: Allocates CPU, memory, and I/O efficiently.
- **Isolation**: Each VM operates independently, enhancing security.

# References

https://help.ubuntu.com/

https://ubuntu.com/server/docs

https://ubuntu.com/download/server