



BAHIR DAR UNIVERSITY

BAHIR DAR INSTITUTION OF TECHNOLOGY

Faculty of computing

Department of software engineering

Course title : operating system and system programming

Individual Assignment

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Section : A

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❖ Introduction

Operating systems are one of the most essential components in the world of computing. They manage both hardware and software resources and provide the environment that allows applications to run. Without an operating system, a computer wouldn't be able to function. As software engineering students, it's important that we understand not only how to use an OS, but also how it works, how it's installed, and how it interacts with hardware and application.

Nowadays, people use virtual machines a lot- in school, work, even big companies. A virtual machine lets us install and use another operating system inside our main computer, without affecting anything. For this project, I used VirtualBox, which is free and easy to use. With it, I installed NetBSD, a UNIX-based operating system. It's simple, fast, good for learning.

I work NetBSD, it's known for being secure and flexible. Even though it's not as popular as Linux or Windows, it's used in a lot of tech fields—like research, servers, and embedded systems. This makes it interesting for students like me who want to learn something new and useful.

Background

NetBSD is a free and open-source operating system that is based on UNIX. It was first released in 1993 and is known for being very portable—meaning it can run on almost any kind of computer or device. NetBSD is used in many fields like education, research, servers, and even in some space technologies. It follows UNIX standards and offers a clean and lightweight system that is useful for learning how an operating system works.

In our Operating Systems course, we are learning about different types of systems and how they are installed and used. Installing NetBSD in a virtual machine helps us understand how UNIX-like systems work and how they can be managed. It also

teaches us about file systems, partitioning, and root access in a real OS environment.

Motivation

- ❖ I am doing this project mainly because it is part of my assignment. But through this task, I also get a chance to practice how to install an operating system using VirtualBox and understand more about UNIX-based systems like NetBSD. This experience helps me gain practical skills that are useful for my future career in software engineering, especially if I work with servers or system programming. Even though I started this because it's required, it's helping me build confidence in using virtual machines and exploring new operating systems.
- ❖ Objectives

The goals of this project are :

- To install the NetBSD operating system using virtualbox.
- To learn how virtualization works and how to setup an operating system virtually
- To understand the tools and steps needed for installation.
- To face and fix any problems during the process.
- To explore what kind of file system NetBSD uses.
- To explain what I learned and give my thoughts on the process at the end.

❖ Requirements

I. Hardware Requirements

To install and run NetBSD in a virtual environment , the following hardware is needed:

- A computer (laptop or desktop) with at least:
 - Processor: Dual-core or higher(intel or AMD)

- RAM: minimum 2 GB (4 GB or more recommended for smooth performance)
- Storage: At least 10 GB of free disk space
- Virtualization support: Enabled in BIOS/UEFI (most modern computers support this)

II. Software requirements

- Oracle VM VirtualBox: A virtualization software used to create and run virtual machine.
- NetBSD ISO file: The operating system image used for installation.
- Operating system(Host): windows, Linux, or macos-the main system where virtualbox is installed.

❖ Installation steps

Installing NetBSD ON VirtualBox was a new experience for me, and I tried to follow each step carefully. Here's how I did it, step by step:

Step 1: Download and install virtualbox

I started by downloading Oracle VirtualBox from its official website. After the file finished downloading, I opened it and followed the setup instructions. It was mostly just clicking "Next" and "install".

Downloads - Oracle VirtualBox

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Powerful open source virtualization

For personal and enterprise use

VirtualBox is a general-purpose full virtualization software for x86_64 hardware (with version 7.1 additionally for macOS/Arm), targeted at laptop, desktop, server and embedded use.


Get Started

Download

Download VirtualBox binaries and platform packages


Community

Become a part of the VirtualBox community. Discuss and solve problems in the forums, access test builds, and more.




Documentation

Learn from a variety of resources including user manuals, end-user and technical documentation, the source code repository timeline, or the changelog.



Training

Access labs, tutorials, and videos to learn how to use VirtualBox. Quizzes are available to test your learning.



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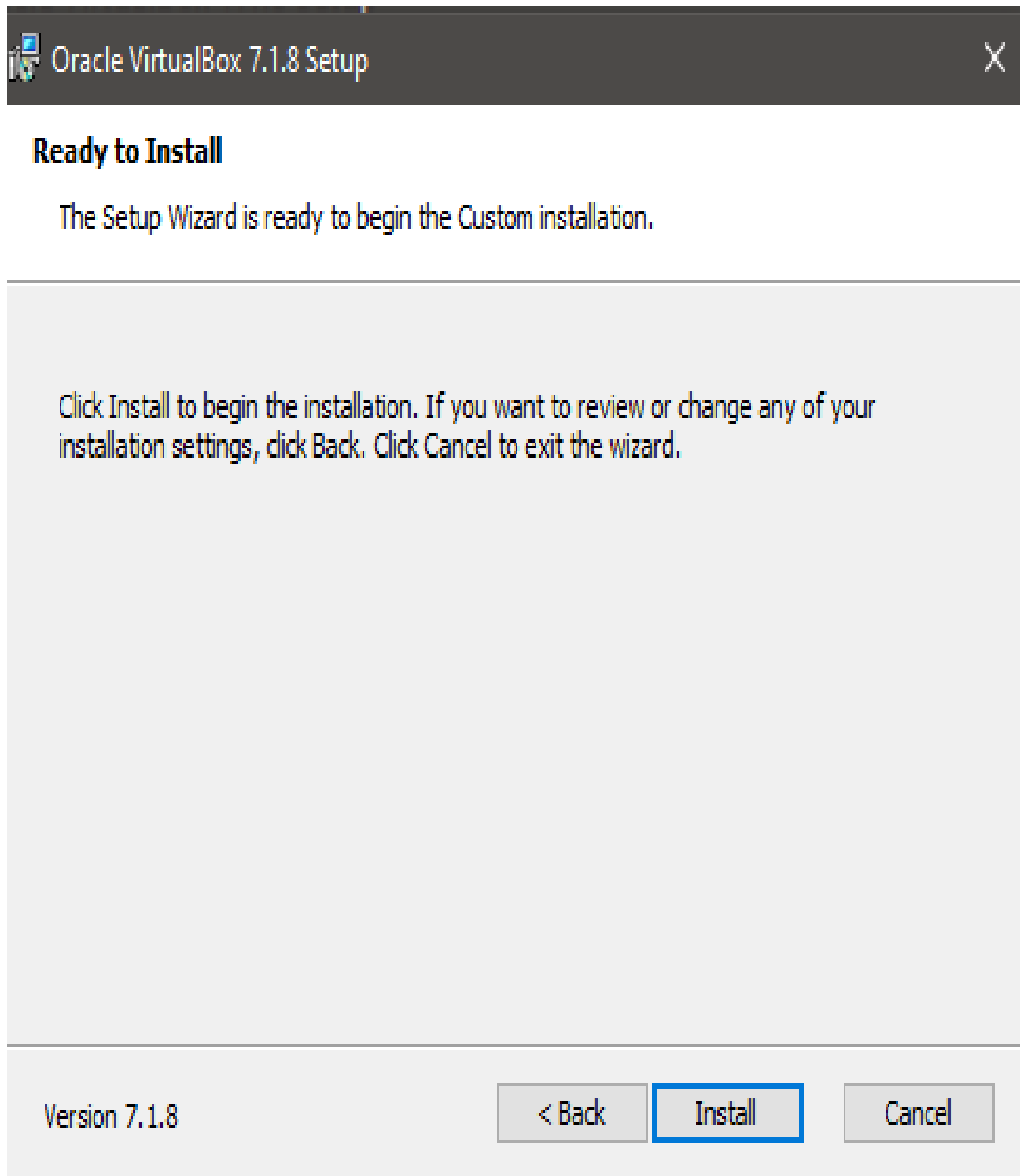
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- VirtualBox-7.1.8-168469-Win.exe
1.9/119 MB • 19 minutes left
- Oracle_VirtualBox_Extension_Pack-7.1.8 (11).vbox-extpack
21.9 MB • 2 minutes ago
- Oracle_VirtualBox_Extension_Pack-7.1.8 (10).vbox-extpack
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VirtualBox Platform Packages



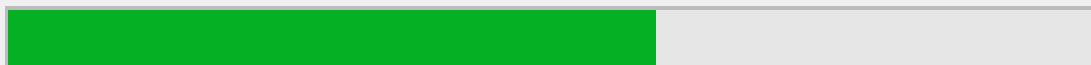


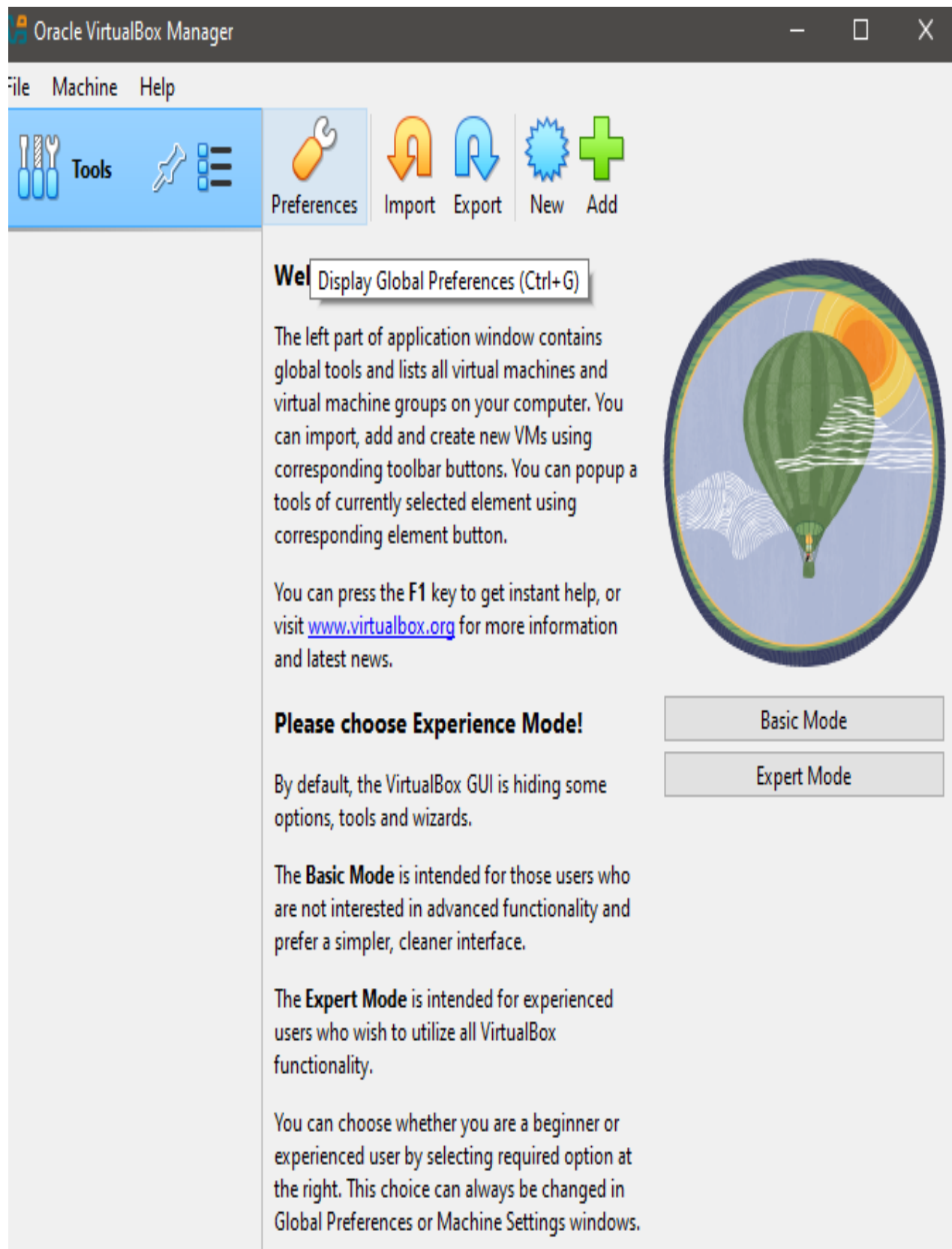


Oracle VirtualBox 7.1.8

Please wait while the Setup Wizard installs Oracle VirtualBox 7.1.8. This may take several minutes.

Status: Installing support driver ...





Step 2: Download NetBSD

Then I went to the NetBSD official website and downloaded the ISO image of NetBSD 10.1 . This file is what I would later use to install the operating system on the virtual machine.



\$6,420 raised of \$50,000 goal

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The NetBSD Project

NetBSD is a free, fast, secure, and highly portable Unix-like Open Source operating system. It is available for a wide range of platforms, from large-scale servers and powerful desktop systems to handheld and embedded devices.

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10.1 available!

The NetBSD project is pleased to announce the first update to the NetBSD 10 release branch [» NetBSD 10.1 «](#)

Get NetBSD

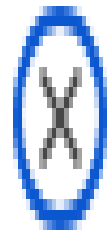
NetBSD 10.1, released on December 16, 2024. [» Release Notes](#)

CPU	Machines	Install media
amd64	64-bit x86-family machines with AMD or Intel CPUs	USB image, CD
arm	ARM systems like Raspberry Pi, PINE64, ODROID, "ServerReady" machines more	Various boards, original RPi
i386	32-bit x86-family generic machines	USB image, CD
mips	MIPS systems like EdgeRouter, Loongson, Malta	octeon, mips64el, mipsel
powerpc	PowerPC systems like Nintendo Wii, DHT Walnut, RouterBOARD	wii, others
sparc64	Sun UltraSPARC	CD
others	Amiga, Alpha, Apple PowerPC/68K, Dreamcast, SPARC32, VAX, more architectures	various

Activate Windows

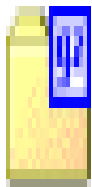
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NetBSD-10.1-amd64.iso

↓ 1.4/624 MB • 1 hour left

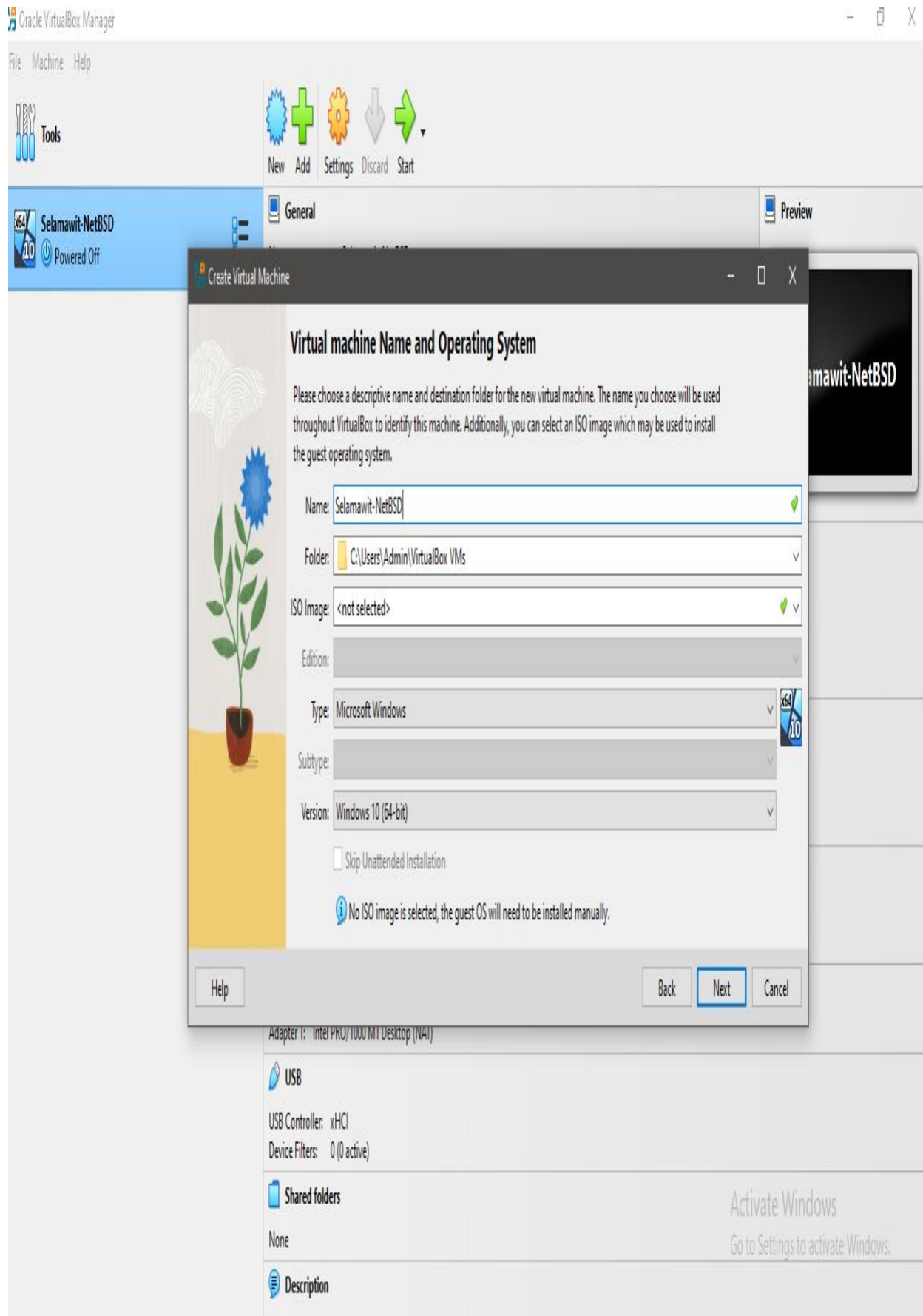


NetBSD-10.1-amd64-install.img.gz

↓ 3.1/844 MB • 1 hour left

Step 3 :create a new virtual machine

I opened VirtualBox and clicked “New” to create a new virtual machine. I named it something like selamawit-netbsd , selected BSD as the type and NetBSD (64-bit) as the version. Then I followed the wizard to set the memory(RAM) and create a virtual hard disk.



Summary

The following table summarizes the configuration you have chosen for the new virtual machine. When you are happy with the configuration press Finish to create the virtual machine. Alternatively you can go back and modify the configuration.

Machine Name and OS Type

Machine Name	Selamawit-NetBSD
Machine Folder	C:/Users/Admin/VirtualBox VMs/Selamawit-NetBSD
ISO Image	
Guest OS Type	Windows 10 (64-bit)

Hardware

Base Memory	1742
Processor(s)	1
EFI Enable	true

Disk

Disk Size	50.00 GB
Pre-allocate Full Size	false

Oracle VM VirtualBox Manager

File Machine Help

Tools

New Add Settings Discard Start

Selamawit-NetBSD Powered Off

Selamawit-NetBSD Powered Off

General

Name: Selamawit-NetBSD
Operating System: Windows 10 (64-bit)

System

Base Memory: 1742 MB
Boot Order: Floppy, Optical, Hard Disk
EFI: Enabled
Acceleration: Nested Paging, Hyper-V Paravirtualization

Preview

Selamawit-NetBSD

Display

Video Memory: 128 MB
Graphics Controller: VBoxSVGA
Remote Desktop Server: Disabled
Recording: Disabled

Storage

Controller: SATA
SATA Port 0: Selamawit-NetBSD.vdi (Normal, 50.00 GB)
SATA Port 1: [Optical Drive] Empty

Audio

Host Driver: Default
Controller: Intel HD Audio

Network

Adapter 1: Intel PRO/1000 MT Desktop (NAT)

USB

USB Controller: xHCI
Device Filters: 0 (0 active)

Shared folders

None

Description

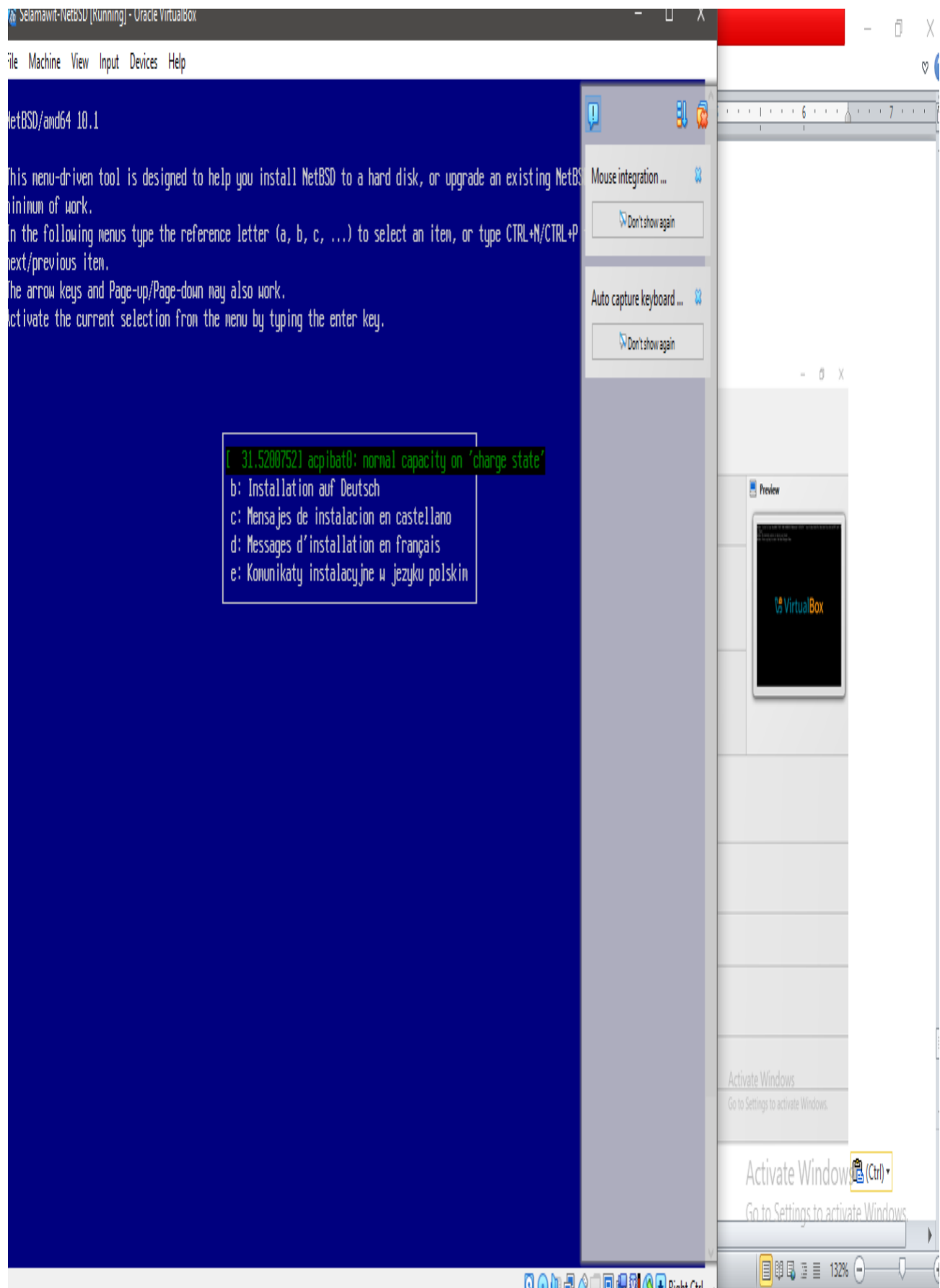
Activate Windows
Go to Settings to activate Windows.

Step 4 : configure the virtual machine

After creating it , I clicked settings, went to the storage section , and added the downloaded ISO file under the “optical Drive”. This lets the VM boot from the NetBSD installer.

Step 5: start the virtual machine

I clicked start, and the virtual machine booted up from the ISO . A blue screen appeared , and I followed the prompts to start the NetBSD installation process.



Step 6: partition the disk

I got a message asking how I wanted to partition the disk. I chose “Master Boot Recored(MBR)” as my partitioning scheme since it’s more common.

Step 7 : Follow the installation process

Then I followed the installation instructions : selected a keyboard layout, language , confirmed the disk to use, and chose default settings when possible. NetBSD was then installed to the virtual hard drive I created earlier.

Step 8: final steps after installation

After the install completed , it asked me to reboot. When it restarted , NetBSD booted directly from the virtual hard disk. At the end, it mentioned editing the /etc/rc.conf file, but since this was just a class project, I left that part for now.

Issues & solutions I took

1. After installing , I only saw the root user and didn’t know how to log in or create another user.
2. It showed a message about disk size and asked if I want to set partitions. I didn’t understand well, so I chose the default.
3. It asked me to chose between gpt and mbr partition schemes. I was not sure, so I picked MBR .
4. After installation , I told me to edit /etc/rc/conf. I didn’t know what to do with it , so I skipped it .
5. I was not sure if the key board layout I selected was correct, so I just chose the default one.

❖ File system support

During my NetBSD installation , I used the default file system, which is usually FFS(fast file system) . I chose this option because it was already recommended by the system and it’s the most commonly used file system for NetBSD. FFS is stable , reliable ,and works well with UNIX –like systems.

Advantage of NetBSD

1. lightweight – it uses less memory and works well even on old computers.
2. secure and stable- it's known for being safe and not crashing easily.
3. highly portable- can run on many types of hardware, not just normal PCs.
4. open source-it's free to use , and anyone can look at or improve the code.
5. Good for learning UNIX-it's a great OS to understand how UNIX systems work.

Disadvantage of NetBSD

1. Not user-friendly-it doesn't have a fancy interface , so it's hard for beginners.
2. Limited software-it doesn't support as many apps or tools as Linux or windows.
3. Less popular-fewer people use it, so it's harder to find help online.
4. Manual setup- many things have to be done by command , not clicks.

❖ Conclusion

Doing this assignment helped me understand how an operating system works, especially NetBSD. Even though it was a bit challenging at first, installing it on virtualbox and going through each step gave me hands-on experience that I wouldn't get from just reading . I also learned more about virtualization , UNIX systems, and how system limits and standards work. NetBSD might not be very popular, but I now see why it's respected for its simplicity , security, and performance

This project gave me a deeper appreciation for operating systems and made me feel more confident in using and managing them as software engineering student.

➤ **Virtualization**

- ✓ What is virtualization

Virtualization refers to the technique of creating virtual versions of physical resources, such as operating systems , servers, storage, or networks. It enables a single physical machine(host) to run several virtual machines, each with its own operating system.

✓ Why is virtualization important ?

Virtualization helps use computer resources better by allowing multiple operating systems to run on the same physical machine . this makes the system more efficient .

It also keeps each virtual machine separate , so if one has a problem, the others won't be affected . this is good for security and testing different software .

Virtualization reduces the need for extra hardware, saving money and energy.

It also makes it easy to add or move virtual machines when more resources are needed, making it simple to scale as needed.

✓ How virtualization works

A hypervisor manages the virtual machines(VMs) . it sits between the hardware and the VMs. There are two types hypervisors.

- Type 1 runs directly on the physical hardware.
- Type 2 runs on top of an existing operating system.

Each virtual machine acts like a separate computer with its own operating system and apps, but they all share the same physical resources like cpu, memory, and storage.

The hypervisor makes sure each VM gets the resources it needs while keeping them separated from each other.

