



BAHIR DAR UNIVERSITY

Software engineering

OSSP Individual assignment

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a. Introduction

Background:

Guix OS is a run-time GNU/Linux distribution with a focus on reproducible and declarative system configuration. It is based on the GNU Guix package manager and is appropriate for advanced users who value software freedom and total control over their system environment.

Motivation:

As computing platforms become increasingly dynamic and sophisticated, there's an increasing need for reproducible, adaptable, and trustworthy systems. Guix OS provides exactly this due to functional package management that aligns itself with modern DevOps and infrastructure-as-code principles.

b. Objectives

Install and configure Guix OS in a virtual machine.

Configure user account "Abyu Zewdu".

Record any installation problems encountered and how they were resolved.

Experiment with filesystem support in Guix OS.

Use a simple example with the clone() system call.

c. Requirements

i. Hardware:

CPU: x86_64 compatible processor

RAM: At least 2 GB (4 GB recommended)

Disk Space: At least 15 GB

Virtualization support enabled in BIOS

ii. Software:

Virtual Machine Software: Oracle VM VirtualBox (or VMware Workstation)

Guix OS ISO Image

Host OS (e.g., Windows/Linux for virtual environment)

D. Installation Steps

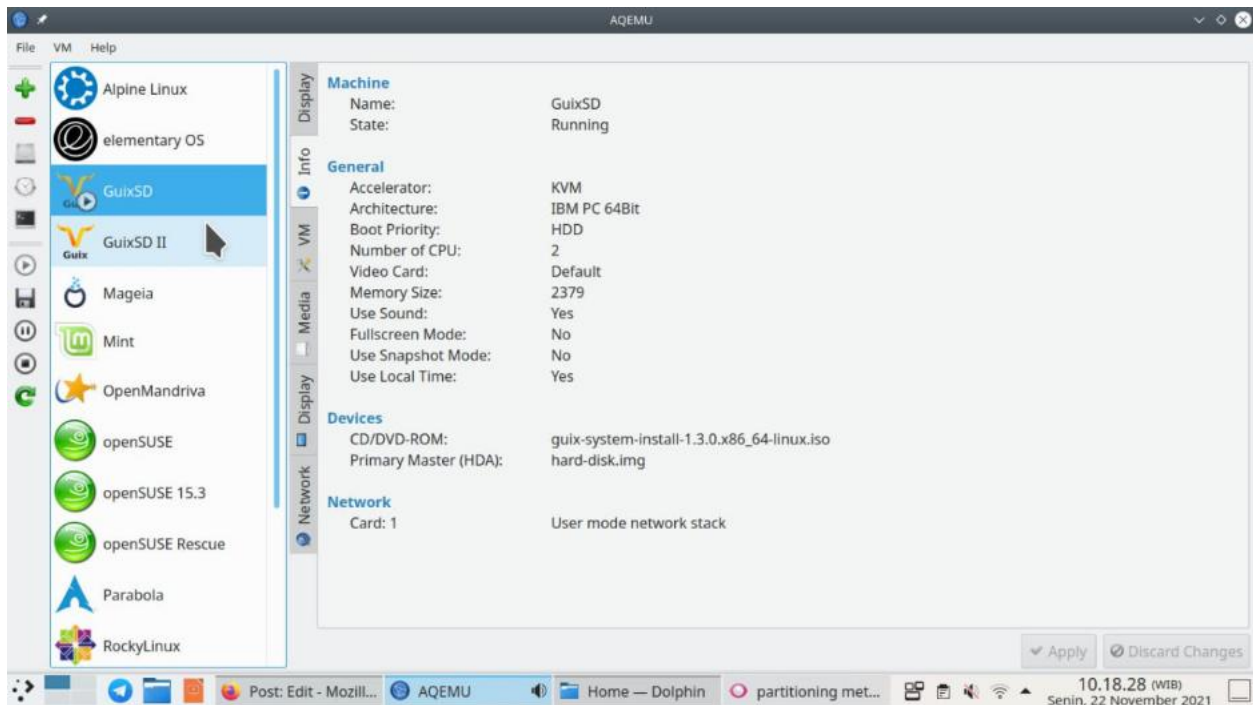
1, first, we get the guix OS on the official website

<https://guix.gnu.org/en/download>

2, Create a New Virtual Machine

To install Guix GNOME on a virtual machine, we create one with these parameters. We use AQEMU Virtual Machine.

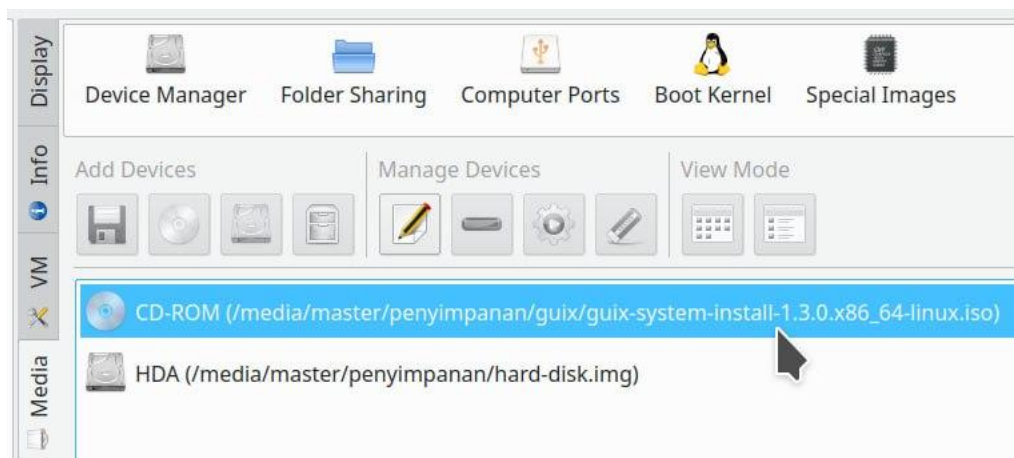
- 64-bit PC
- 2 GigaByte memory
- 20 GigaByte hard disk
- Networking enabled
- Default graphics option
- BIOS Legacy booting mmode



(AQEMU displaying the virtual machine configuration for Guix System)

3. Insert guix os file

Then, after we have created the virtual machine, next we insert the operating system file into it. To do so, on unstarted Guix vm, select Media, click Add CD/DVD ROM, insert the guix-system-*.iso file, image file inserted. Proceed to next section.



(ISO image preparation on the virtual machine)

4, Boot up guix OS:

Once we put the image file in place, we then boot the virtual computer to install Guix System installer. To do this, we double click on the Guix vm, click menubar VM, click Start, a display port will be opened as a monitor, Guix System installer will be shown, you are now ready to install Guix System. Proceed to next.



(Guix System when booting into its installer)

How To Play

Guix installer does not allow mouse click interactions. Thus, to navigate the system installer, press TAB and Shift+TAB to jump from one choice to another one and back, press SPACE to give check mark, and press ENTER to select an option.

5, user identity

- We Select language
- We Select territory
- We Select installation type
- We Select a timezone

- We Select a keyboard layout
- Name your computer

1 . Locale language: We choose English and continue.



2. Locale location: select United States and continue.
3. GNU Guix install: select Graphical install. option and continue.
4. Timezone: select a timezone e.g. Asia/Jakarta.
5. Keyboard layout: select English (US).
6. Hostname: select a name for your Guix computer e.g. we use 'master'. Continue to next step.

6. System set up

- Substitute server discovery
- Create administrator account
- Create user account
- Select a desktop environment
- Enable network

1. Substitute server discovery: select Enable and continue

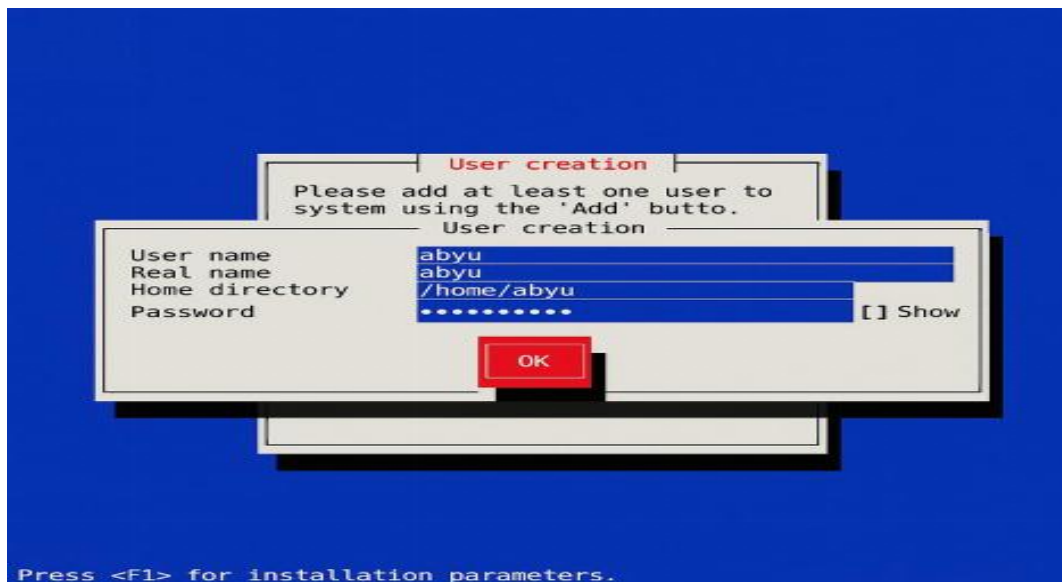


2. System administrator password: create a root user password.

3. Building a user: assign ourself a username and a password.

4. Desktop environment: check box beside GNOME from the list.

5. Network service: select Mozilla NSS Certification and go to next step.





(System administrator password)



(Network service)

7, partitioning, processing and finishing

- Start Guided partitioning
- Select disk
- Select partitioning scheme
- Make partitions required
- Verify the summary in code form
- Start the real installation
- Wait patiently for the process to finish

1, Partitioning option: select Guided - using entire disk.

2. Disk: select the virtual machine's hard disk. In this scenario, we select ATA QEMU HARD DISK (20GB).

3. Partition scheme: select Everything is one partition.

4. Guided partitioning: the installer will display a proposal of disk partitions that will be formatted. Accept it by selecting OK. Continue.

5. Format disk?: accept this by selecting OK.

6. Preparing partitions: please wait for the disk formatting process is taking place.

7. Configuration file: the installation plan will be displayed in form of code written in a language called Scheme. Accept this by selecting OK.

8. Waiting: the installation process will take place. If this process takes place, don't close your internet connection and don't shut down the virtual machine. Wait for a few minutes until you are faced with a final message saying "Please ENTER to continue".



(Partitioning method)



(Guided partitioning)



(Configuration file)

```

building /gnu/store/4sjs9aafchvx4g9g7a7hslqcs7rarg6x-X-wrapper.drv...
applying 11 grafts for /gnu/store/7kns1bjzwk8cni792hvwlyh3xfsh7ybhv-zenity-3.32.0.drv ...
building /gnu/store/d9978lqs8c88w49zrb6ip4rmbdxq155-shepherd-xorg-server.scm.drv...
building CA certificate bundle...
building fonts directory...
generating Glib schema cache...
creating GTK+ icon theme cache...
building cache files for GTK+ input methods...
building directory of info manuals...
building database for manual pages...
building /gnu/store/6prxrcwgv46zdc90zq6x8az3yxhxl98-shepherd-xorg-server.go.drv...
building XDG desktop file cache...
building /gnu/store/jxxbflg3095fahsjr6w934gwdgxqsbbl-shepherd.conf.drv...
building XDG MIME database...
building /gnu/store/4d8qcxsdgxv7baf1rlnj59v1wh4jrdj-boot.drv...
building profile with 37 packages...
building /gnu/store/8czaqx8icp8y28ng9rvkkp3gr6h4sm-system.drv...
building /gnu/store/5w5w6l2f1galhguxh3vn5aqcj625x8q4g-grub.cfg.drv...
/gnu/store/4ni0ahh0phvavilvzma8jxsnqkaiwv-system
/gnu/store/2hdn8sx5w5zab4y124yya8dw0kvcsz8-grub.cfg

initializing operating system under '/mnt'...
copying to '/mnt'...
populating '/mnt'...
substitute: updating substitutes from 'https://ci.guix.gnu.org'... 100.0%
The following derivations will be built:
  /gnu/store/5l67d1pv0az9kk3pa046l9yj3sr7fqw9-install-bootloader.scm.drv
  /gnu/store/ahdppfv8bfyx3qzkh2hzphlvp7ncq9r-module-import.drv
  /gnu/store/bnj198z303ax2qx8iwa13dhgzsfngsm-module-import.drv

1.4 MB will be downloaded
  module-import-compiled 609KiB 470KiB/s 00:01 [#####] 100.
  module-import-compiled 609KiB 592KiB/s 00:01 [#####] 100.
building /gnu/store/ahdppfv8bfyx3qzkh2hzphlvp7ncq9r-module-import.drv...
building /gnu/store/bnj198z303ax2qx8iwa13dhgzsfngsm-module-import.drv...
building /gnu/store/5l67d1pv0az9kk3pa046l9yj3sr7fqw9-install-bootloader.scm.drv...
guix system: bootloader successfully installed on '/dev/sda'

Press Enter to continue.

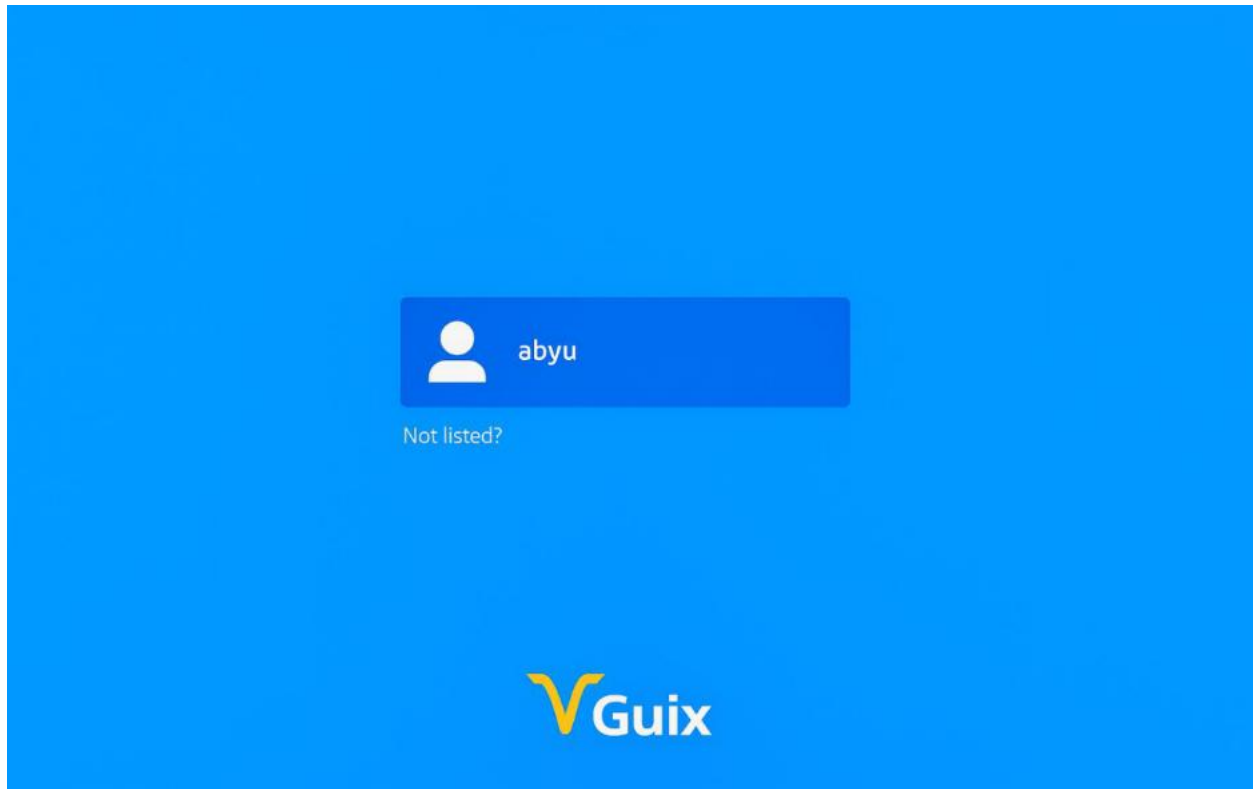
```

(The actual installation process)

8, Restart and login

Once finished, the installer will ask you to Reboot then press Enter and you should be able to see

Guix login screen like below.



E. Problems Faced

i.

Default network adapter not working.

GRUB bootloader unable to detect boot partition.

f. Solution

i.

Changed network settings to "Bridged Adapter" in VirtualBox.

Set GRUB installation location manually in final steps of installation.

g. Filesystem Support

Guix OS has native support for ext4, Btrfs, and XFS. The default and recommended is ext4 because it is stable, widely supported, and supports journaling data integrity. Other filesystems like Btrfs are feature-rich but less stable with minimal setups.

h. Advantages and Disadvantages

Advantages:

Extremely high customizability through functional configuration.

High free software emphasis.

Reproducible builds with Guix package manager.

Disadvantages:

Mildly steeper learning curve.

Less hardware support compared to mainstream distributions.

Smaller support resources and community.

.i. Conclusion

Installing and utilizing Guix OS provides more insight into modern-day operating systems and usable package management. Even though it is challenging, learning from it is worthwhile for the sake of appreciating reproducibility and declarative configuration in Linux.

j. Future Outlook / Recommendation

Guix OS is most appropriate for advanced users and researchers. It's appropriate for reproducible science, DevOps, or system administration experts. Its functional style is a vision of the future of system configuration and software management.

Virtualization in Modern Operating Systems

1. What is Virtualization?

Virtualization is a technology allowing you to create several simulated environments or committed resources from one physical hardware configuration. This includes virtual machines (VMs), virtual storage, virtual networks, etc.

For operating systems, virtualization means running several copies of an OS—such as Linux, Windows, or macOS—on one physical machine simultaneously.

Every virtual machine runs independently with its own virtual CPU, memory, storage, and network interface, though they all share the physical resources of the host machine.

2. Why Use Virtualization?

Virtualization has become a necessity in today's computing for several critical reasons:

Resource Efficiency: Allows more effective use of hardware by running multiple OSes on a single machine.

Isolation: Every virtual machine is isolated from each other, improving security and stability.

Testing and Development: Applications can be tested on many different operating systems without needing several physical machines.

Disaster Recovery: VMs are easily recoverable and backed up in seconds.

Cost Savings: Less hardware and energy cost when there are fewer physical machines.

Scalability and Flexibility: Virtual machines are easy to deploy and manage in cloud and enterprise setups.

3. How Does Virtualization Work?

Virtualization is facilitated by a layer of software called a hypervisor. It sits between the hardware and the operating system(s) and manages the hardware resource allocation.

There are two main types of hypervisors:

Type 1 (Bare Metal):

Runs on bare hardware. Examples: VMware ESXi, Microsoft Hyper-V, Xen.

Type 2 (Hosted):

Runs on top of a host OS. Examples: Oracle VM VirtualBox, VMware Workstation.

Basic Workflow:

Hypervisor Installation:

The hypervisor is loaded onto a host computer (either on bare metal or on top of an OS).

Resource Allocation:

You define how much CPU, RAM, storage, etc., each virtual machine gets.

VM Creation:

You define virtual machines and install guest operating systems inside them.

Execution:

The hypervisor manages all interaction between the VM and the underlying hardware.

Example: Using VirtualBox to Run Guix OS

Host OS: Windows/Linux/macOS

Hypervisor: VirtualBox

Guest OS: Guix OS

Outcome: Guix runs as if it were installed on a real computer, although it is being run in a controlled virtual environment.

Reference

<https://guix.gnu.org> guix.gnu.org

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