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COURSES NAME:*operating system assignment one*

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Gentoo Linux Installation Documentation

Introduction: The Gentoo Philosophy

Gentoo Linux is a unique, meta-distribution built on the "Portage" package management system. Unlike binary-based distributions (such as Ubuntu or Fedora) that provide pre-compiled software, Gentoo is built from source.

Why choose Gentoo?

- **Extreme Optimization:** Every piece of software is compiled specifically for your computer's CPU, ensuring maximum performance.
- **Granular Control:** Through "USE flags," you decide exactly which features are included in your software, keeping your system lean and free of "bloat."
- **Educational Value:** The installation process is a deep dive into the inner workings of the Linux kernel, filesystems, and the toolchain.

1. Prerequisites & VM Setup

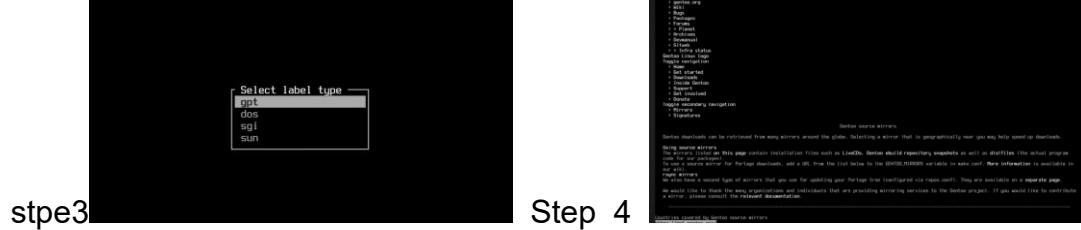
First, download the **Gentoo Minimal Installation CD** (ISO) from the [Gentoo Downloads Page](#).

VirtualBox Configuration

Create a new Virtual Machine with these specific settings for a smooth experience:

- **Memory:** 4GB to 8GB (Compiling requires RAM).
- **Processor:** Allocate at least 2–4 CPUs. **Enable PAE/NX**.
- **System > Motherboard:** Check **Enable EFI (special OSes only)**.
- **Storage:** Create a Virtual Hard Disk (VDI) of at least **40GB**.
- **Network:** Set to **Bridged Adapter** (simplest for internet access) or **NAT**.
 - **Preparing the Disk**
- Boot the VM from the ISO. Once you reach the prompt, verify your internet connection with `ping -c 3 google.com`.
- **Partitioning (GPT/UEFI)**
 - We will use `parted` or `cfdisk` to create the structure.
 - Type `cfdisk /dev/sda` and select `gpt`.

- **New Partition 1:** 512MB, Type: **EFI System** (This is /dev/sda1).
- **New Partition 2:** 4GB, Type: **Linux swap** (This is /dev/sda2).
- **New Partition 3:** Remaining space, Type: **Linux root** (This is /dev/sda3).



Formatting & Mounting

Bash

```
# 1. Format EFI
mkfs.vfat -F 32 /dev/sda1
# 2. Setup Swap
mkswap /dev/sda2
swapon /dev/sda2
# 3. Format Root
mkfs.ext4 /dev/sda3
# 4. Mount Root
mount /dev/sda3 /mnt/gentoo
```

3. Installing the Gentoo Base (Stage 3)

The Stage 3 Tarball contains the core binaries needed to begin.

1. **Download:** cd /mint/gentoo and use links
<https://www.gentoo.org/downloads/mirrors/>. Navigate to releases/amd64/auto builds/ and pick the stage3-amd64-openrc file.
2. **Unpack:** bash tar xpvf stage3-.tar.xz --attars--include='.*' --numeric-owner

4. Entering the Chroot

We now move from the Live CD environment into your new virtual drive.

Bash

```
# Copy DNS settings
cp --dereference /etc/resolv.conf /mnt/gentoo/etc/

# Mount temporary filesystems
mount --types proc /proc /mnt/gentoo/proc
mount --rbind /sys /mnt/gentoo/sys
mount --make-rslave /mnt/gentoo/sys
mount --rbind /dev /mnt/gentoo/dev
mount --make-rslave /mnt/gentoo/dev
```



```
# Enter the system
chroot /mnt/gentoo /bin/bash
source /etc/profileexport PS1="(chroot) $P1"
```

5. System Configuration & Kernel

Configure Portage

Edit `/etc/portage/make.conf`. This is vital for VirtualBox performance.

Bash

```
# Adjust -jX to your VM cores + 1
MAKEOPTS="-j3"
VIDEO_CARDS="virtualbox"
INPUT_DEVICES="libinput"
```

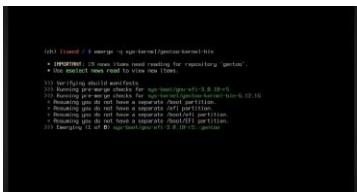
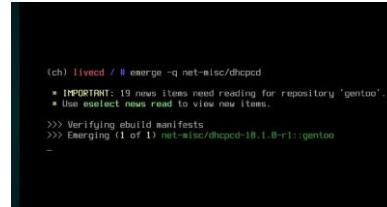
Install the Kernel

In a VM, the simplest path is the binary distribution kernel:

Bash

emerge-webrsync

```
emerge sys-kernel/gentoo-kernel-bin
```



6. Bootloader (GRUB)

This allows the VM to find the operating system upon restart.

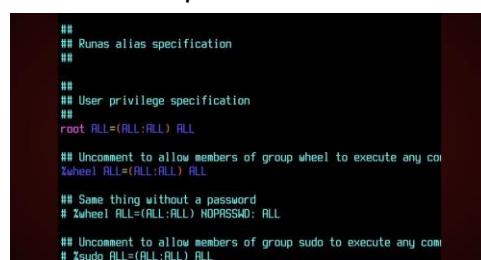
Bash

```
echo "sys-boot/grub:2" >> /etc/portage/package.accept_keywords  
emerge --ask sys-boot/grub
```

```
# Mount EFI and Install
mkdir -p /boot/efi
mount /dev/sda1 /boot/efi
grub-install --target=x86_64-efi --efi-directory=/boot/efi
grub-mkconfig -o /boot/grub/grub.cfg
```

7. Final Steps

1. Set Password: Type `passwd` and enter a root password.



❖ The final step interface of gntoolinux this sniped image



- While Gentoo is incredibly rewarding, it comes with a steep learning curve. In a VirtualBox environment, some of these challenges are amplified because you are working within "virtualized" hardware.

1 The "Compilation Time" Wall

The Challenge: Because Gentoo builds software from source code, installing a large package (like a Web Browser or a Desktop Environment) can take hours, even on a fast computer. **The Solution:**

- **Use Binary Packages:** For massive software, use the "bin" versions (e.g., emerge gui-libs/gtk:3 vs emerge-bin).
- **Optimize MAKEOPTS:** In /etc/portage/make.conf, ensure MAKEOPTS="-jX" is set to the number of CPU cores you gave the VM + 1.
- **Allocate more RAM:** Compiling needs memory. If the VM runs out of RAM, it will use "Swap," which is extremely slow.

2. Dependency Conflicts (Slot Conflicts)

The Challenge: When updating or installing new software, Portage may report that two packages "conflict" because they require different versions of the same library. **The Solution:**

- **Read the Output:** Gentoo's package manager (Portage) actually tells you how to fix it. Look for the "suggested" changes.
- **Use --autounmask-write:** Run your command with this flag: emerge --ask --autounmask-write <package>. Then run etc-update to automatically apply the configuration changes needed to fix the conflict.

3. Kernel Configuration Errors

The Challenge: If you try to build a "Manual" kernel instead of using the "Distribution Kernel," the system might not boot (showing a "Kernel Panic"), or the internet/mouse might not work. **The Solution:**

- **Start with gentoo-kernel-bin:** Use the pre-built version first to ensure your system works.
- **Use genkernel:** It automates the kernel building process while still allowing some customization.
- **VirtualBox Drivers:** Ensure CONFIG_VBOXGUEST and related drivers are enabled in the kernel configuration if you are doing it manually.

4. Circular Dependencies

The Challenge: Package A needs Package B to install, but Package B needs Package A to install. **The Solution:**

- **Temporary USE flags:** Temporarily disable a feature (USE flag) in one of the packages to break the loop.
- **Example:** USE="-python" emerge package-a. Once it's installed, you can re-enable the flag and re-compile.

5. Screen Resolution & Mouse Issues (VirtualBox Specific)

The Challenge: After booting, the VM window is tiny, and the mouse might feel "stuck" or laggy. **The Solution:**

- **Guest Additions:** This is mandatory. Install app-emulation/virtualbox-guest-additions.
- **Video Driver:** Ensure your make.conf contains VIDEO_CARDS="virtualbox" and that you have compiled your Xorg or Wayland server with that driver.

Problem	Quick Fix / Solution
Slow Installation	Use MAKEOPTS and binary packages (-bin).
Kernel Panic	Use gentoo-kernel-bin until you are an expert.
Missing Internet	Check if dhcpcd is running (rc-service dhcpcd status).

"Blocked" Packages	Read the Portage output and use etc-update.
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In summary

- installing Gentoo Linux is more than just setting up an operating system—it is a comprehensive masterclass in Linux architecture. By navigating the challenges of source compilation and manual configuration, you gain a system that is perfectly tailored to your hardware and free of unnecessary overhead.
- While the learning curve is steep, the result is a high-performance, ultra-stable environment that provides total transparency and control over your computing experience. Welcome to the world of Gentoo!