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DEPARTMENT OF SOFTWARE ENGINEERING

OPERATING SYSTEM AND SYSTEM

PROGRAMING

INDIVIDUAL ASSIGNMENT

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1.1. Introduction (Background, Motivation)

Debian is a free and open-source operating system (OS) based on the Linux kernel. It's one of the oldest and most respected Linux distributions, known for its stability, adherence to open-source principles, and extensive package repository.

1.1.1.Background

Debian was founded in 1993 by Ian Murdock, who initially called it "Debian Linux Release." The name "Debian" is a portmanteau of Ian's name and that of his then-girlfriend, Debra Lynn. It was envisioned as a community-driven distribution committed to the principles outlined in the Debian Social Contract.

1.1.2 Motivation

The primary motivation behind Debian was to create a completely free operating system built upon the principles of open-source software. This involved:

- **Freedom:** Ensuring users have the freedom to use, study, modify, and distribute the OS.
- **Community**: Building a community-driven project where decisions are made collaboratively.
- **Stability:** Providing a reliable and stable base for various applications and servers.
- **Universal** Operating System: Supporting a wide range of hardware architectures.

1.2. Objectives

The objectives of Debian are multifaceted:

- **Universality:** Support as many computer architectures as possible. Debian runs on a vast array of hardware, from embedded systems to mainframes.
- **Stability:** Provide a reliable platform for servers, desktops, and development environments. Debian's stable releases undergo extensive testing to ensure robustness.
- **Freedom:** Adhere strictly to the Debian Free Software Guidelines (DFSG), ensuring that the OS is entirely free software.
- **Ease of Use:** While traditionally appealing to advanced users, Debian strives to improve its usability for beginners through graphical installers and desktop environments.
- **Security:** Maintain a strong security posture through timely security updates and vulnerabilities patching.

• **Customization:** Offer a highly customizable environment through its package management system (APT) and various desktop environment options.

1.3.Requirements

1.3.1. Hardware

The minimum and recommended hardware requirements depend on the Debian version (e.g., Debian 11, 12) and the intended usage (desktop, server, etc.). Here are general guidelines:

- Minimum (Debian with a lightweight desktop like Xfce or LXQt):
- Processor: 1 GHz or better
- RAM: 512 MB
- Hard Disk Space: 10 GB
- Recommended (Debian with GNOME or KDE Plasma):
- Processor: 2 GHz or better
- RAM: 2 GB or more
- Hard Disk Space: 20 GB or more
- Server (Minimum):
- Processor: 1 GHz
- RAM: 256 MB
- Hard Disk Space: 5 GB (minimum, depending on services)

1.3.2. Software

• **Installation Media:** You'll need a bootable USB drive or DVD containing the Debian installation image. Download the appropriate ISO image from the official Debian website (www.debian.org).

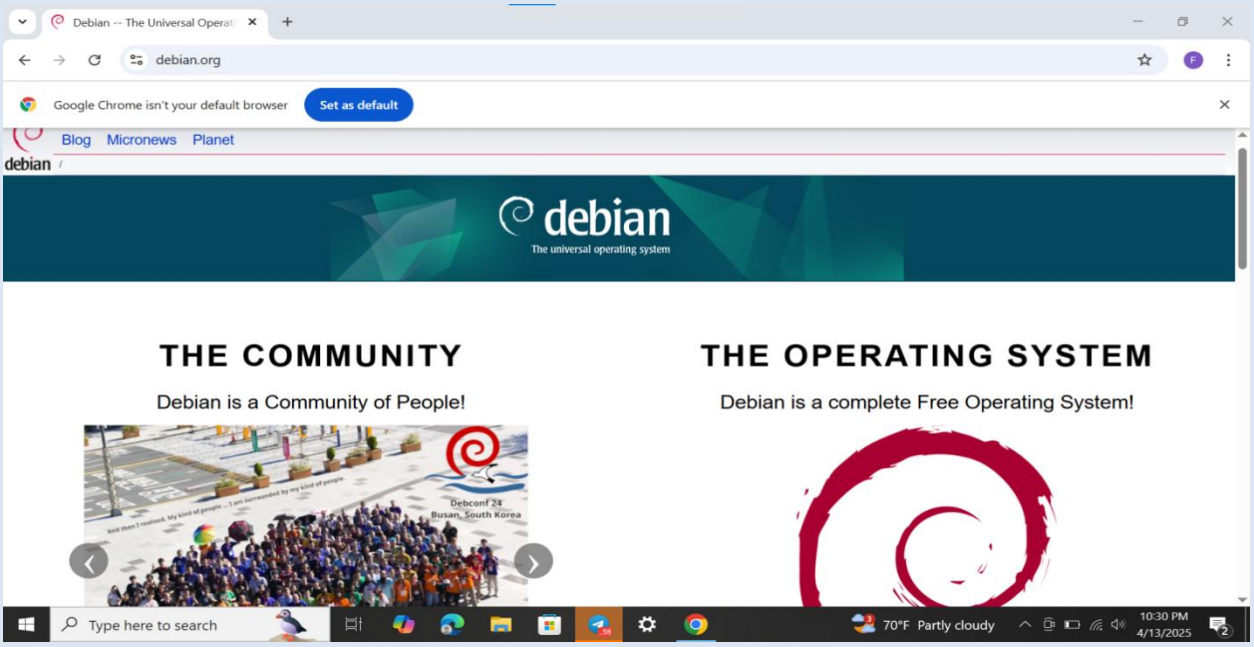
• **Burning Software:** Software to burn the ISO image to a USB drive (e.g., Rufus, Etcher, Ventoy).

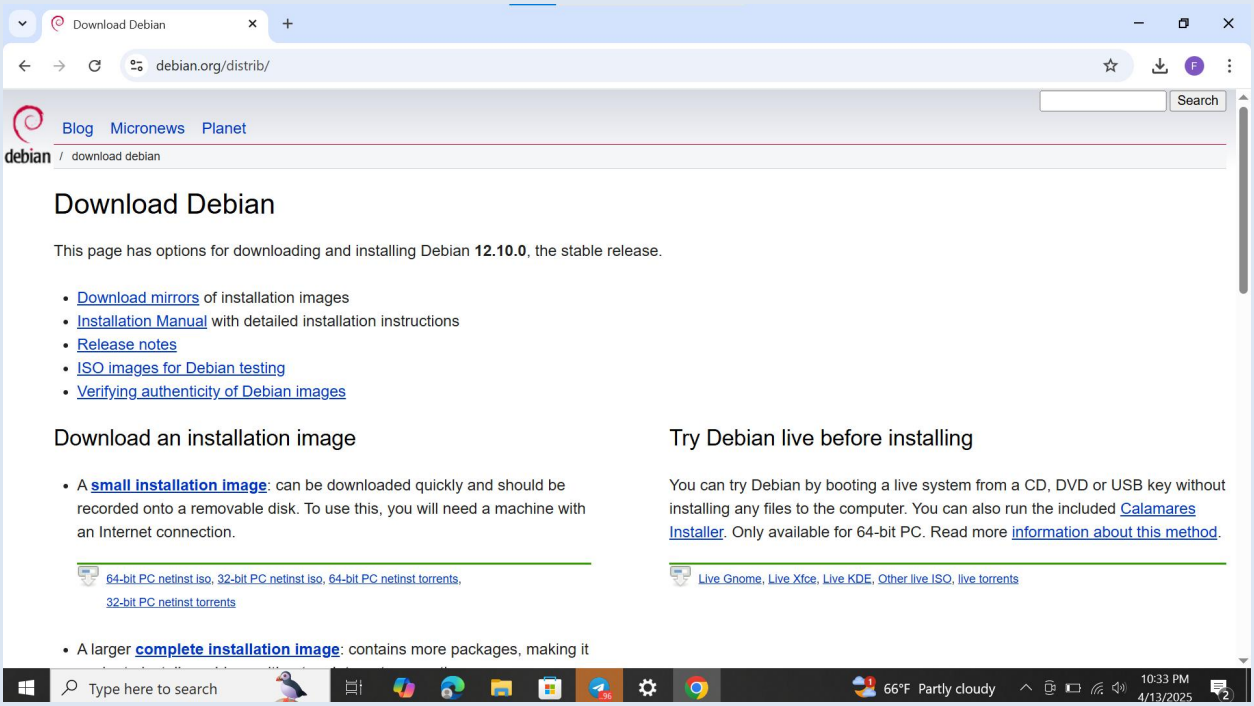
• **BIOS/UEFI Access:** Ability to access your computer's BIOS/UEFI settings to boot from the USB drive or DVD.

• **Network Connection (Optional):** A network connection is recommended during installation for downloading updates and additional packages, but it's not strictly required.

1.4. installation steps

1. Downloading the Debian ISO: Downloading the correct ISO.





2. Creating a New VM in VirtualBox: giving the VM a name, specifying the OS type (Linux, Debian), and allocating memory.

3. Creating a Virtual Hard Disk: Choosing dynamically allocated disk space and setting the size.

4. Configuring VM Settings: Adjusting settings like memory, processors, and network.

5. Attaching the ISO Image: Selecting the Debian ISO as the virtual CD/DVD drive.

6. Starting the VM and Installation: Booting from the ISO and going through the Debian installer steps.

- Choosing the language, location, and keyboard layout.

- Choosing your location.

- Choosing keyboard layout.

- Setting the host name.

- Setting the domain name.

- Creating user accounts (including the root password).

- Partitioning the disk use the "Guided – use entire disk" option.

- Configuring the package manager.

- Selecting software (desktop environment).

- Installing the GRUB bootloader.

1.5. issues or problem faced

- Slow Performance: Insufficient RAM or CPU cores allocated to the VM.
- Network Connectivity Issues: Incorrect network adapter configuration (Bridged vs. NAT).
- Graphical Issues: Poor graphics performance or display problems.
- Installation Errors: Corrupted ISO image, partitioning errors, or package installation failures.
- Guest Additions/VMware Tools Installation Problems: Compatibility issues with the Debian kernel.
- Disk Space Full: Not allocating enough disk space for the VM.

1.6. Solution

- Slow Performance:
  * Allocate more RAM and CPU cores to the VM.
  * Ensure hardware virtualization is enabled in your BIOS/UEFI settings.
  * Install Guest Additions/VMware Tools.
- Network Connectivity Issues:
  * Verify the network adapter settings in the VM configuration (Bridged or NAT).
  * If using Bridged networking, ensure the VM obtains an IP address from your DHCP server.

    * Check firewall settings on the host OS.

- Graphical Issues:
    * Install Guest Additions/VMware Tools.
    * Increase the video memory allocated to the VM.
    * Try a different desktop environment (Xfce is lightweight).
- Installation Errors:
    * Verify the integrity of the downloaded ISO image.
    * Try a different mirror site for downloading packages.
    * Review the installation logs for error messages.
- Guest Additions/VMware Tools Installation Problems:
    * Ensure that build-essential, dkms, and the kernel headers are installed.
    * Try a different version of the Guest Additions/VMware Tools.
- Disk Space Full:
    * Increase the virtual disk size of the VM (requires shutting down the VM).
    * Clean up unnecessary files within the VM.

1.7. File system Support

Debian supports a wide range of filesystems:

- ext4: The default and recommended filesystem for Debian installations. It's a robust and reliable journaling filesystem. Chosen for its balance of performance, reliability, and features.
- Btrfs: A modern copy-on-write filesystem with advanced features like snapshots, subvolumes, and built-in RAID. Potentially suitable for advanced users but less mature than ext4.
- XFS: A high-performance journaling filesystem, often used for large storage arrays and servers.
- ext3: An older journaling filesystem, still supported but generally superseded by ext4.
- ext2: A non-journaling filesystem. Not recommended for the root partition due to the risk of data loss in case of a crash.
- FAT32: Commonly used on USB drives and older systems. Limited file size support.

• NTFS: Used by Windows. Debian can read and write to NTFS partitions, but performance might be lower compared to native Linux filesystems. Requires the ntfs-3g package. Useful for interacting with Windows systems.

• exFAT: Used by newer USB drives and external hard drives. Debian can read and write to exFAT partitions, but requires the exfat-fuse and exfat-utils packages.

• ZFS: An advanced filesystem known for its data integrity features and snapshots.

Which filesystem support(NTFS, FAT32, exFAT, ext4, Btrfs, ZFS, HFS+, APFS) and why

• Ext4: Is typically chosen by default because it provides a good combination of robustness, speed, and features for a system and data drive.

1.8. Advantages and Disadvantages

1.8.1 Advantages:

• Isolation: Provides a sandboxed environment, preventing conflicts with the host OS.

• Flexibility: Easy to create, clone, and move VMs.

• Resource Efficiency: Optimizes hardware utilaization.

• Testing and Development: Ideal for testing software in different environments.

• Cost-Effective: Reduces the need for multiple physical machines.

• Snapshotting: Allows you to revert to previous states of the VM.

1.8.2 Disadvantages:

• Overhead: Virtualization adds some performance overhead compared to running directly on the hardware.

• Resource Contention: VMs compete for resources (CPU, memory, disk I/O).

• Complexity: Managing multiple VMs can be complex.

• Licensing Costs: Some virtualization software (e.g., VMware Workstation) requires a paid license.

• Hardware Requirements: Requires a host computer with sufficient resources.

1.9. Conclusion

Installing Debian in a virtual environment is a convenient and efficient way to explore the operating system, test software, or emulate server environments. By following the steps outlined in this document and carefully configuring the VM, you can create a stable and reliable Debian installation for your specific needs.

1.10. Future Outlook / Recommendation

- Cloud Integration: Seamless integration with cloud platforms for deploying and managing Debian VMs.
- Containerization: Complementing virtualization with containerization technologies (e.g., Docker) for improved application isolation and portability.
- Automated Deployment: Utilizing tools like Vagrant or Ansible to automate the creation and configuration of Debian VMs.
- Improved Performance: Continued improvements in virtualization technology to minimize performance overhead.
- Dynamic Resource Allocation: Automatically adjusting resources allocated to VMs based on their needs.

Recommendation:

- For most users, starting with Oracle VM VirtualBox is a great option, as it is free and readily available.
- Ensure that you install the guest additions to improve integration between host and guest operating systems.
- Allocate sufficient resources to your Debian VM to ensure smooth operation.