“Київський фаховий коледж зв’язку”

Циклова комісія комп’ютерної та програмної інженерії

**ЗВІТ ПО ВИКОНАННЮ**

**ЛАБОРАТОРНОЇ РОБОТИ №1**

з дисципліни: «Операційні системи»

**Тема: “Знайомство з робочим середовищем віртуальних машин та особливостями операційної системи Linux”**

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Перевірила викладач

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**Мета роботи:**

1. Знайомство з гіпервізорами різного типу, віртуалізацією при роботі з операційними системами.

2. Знайомство з основними видами сучасних ОС, короткий огляд їх можливостей.

**Матеріальне забезпечення занять**

1. ЕОМ типу IBM PC.

2. ОС сімейства Windows та віртуальна машина Virtual Box (Oracle).

3. ОС GNU/Linux (будь-який дистрибутив).

4. Сайт мережевої академії Cisco netacad.com та його онлайн курси по Linux

**Завдання для попередньої підготовки**

***Готував матеріал студент Корольов Є.***

1. Прочитайте короткі теоретичні відомості до лабораторної роботи та зробіть невеличкий словник базових англійських термінів з питань класифікації ОС.

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| --- | --- |
| Термін англійською | Термін українською |
| **Virtualization** | віртуалізація |
| **Virtual machine** | віртуальна машина |
| Hypervisor | гіпервізор |
| Type 1 Hypervisor (Bare-metal) | гіпервізор першого типу (безпосередньо на апаратному рівні) |
| Type 2 Hypervisor (Hosted) | гіпервізор другого типу (запускається на операційній системі) |
| Full Virtualization | повна віртуалізація |
| Paravirtualization | паравіртуалізація |
| Hardware-assisted Virtualization | віртуалізація з апаратною підтримкою |
| Guest OS | гостьова операційна система |
| Host OS | хостова операційна система |
| Binary translation | бінарна трансляція |
| Kernel | ядро операційної системи |
| Java Virtual Machine (JVM) | віртуальна машина Java |
| Command-line interface (CLI) | інтерфейс командного рядка |
| Graphical user interface (GUI) | графічний інтерфейс користувача |

1. Прочитавши матеріал з коротких теоретичних відомостей дайте відповіді на наступні питання:

***Готував матеріал студент Горохов Д.***

* 1. Охарактеризуйте поняття «гіпервізор». Які бувають їх типи?

A hypervisor is a software layer that enables multiple virtual machines (VMs) to run on a single physical machine by managing the hardware resources. It allows each VM to operate independently, with its own operating system, while sharing the underlying hardware.

There are two main types of hypervisors:

1. **Type 1 (Bare-metal Hypervisors):** These run directly on the host's hardware, offering better performance and efficiency. Examples include VMware ESXi and Microsoft Hyper-V.
2. **Type 2 (Hosted Hypervisors):** These run on top of an existing operating system, making them easier to install but generally slower. Examples include Oracle VirtualBox and VMware Workstation
   1. Основні компоненти та можливості гіпервізорів. Варіант 3. Горохов Данило

Xen Hypervisor is an open-source type 1 (bare-metal) hypervisor known for its high performance and security. Here are the key components and features:

1. **Dom0:** A privileged domain (or control domain) that manages hardware and VMs.
2. **DomU**: Unprivileged domains (guest VMs) that run on the hypervisor.
3. **Xen Hypervisor:** The core component that manages CPU, memory, and other hardware resources.
4. **Paravirtualization (PV):** A virtualization technique allowing guest OS to directly interact with the hypervisor for better performance.
5. **Hardware-Assisted Virtualization (HVM):** Supports full virtualization using hardware features like Intel VT-x or AMD-V.

Xen provides high scalability, security, and supports both PV and HVM guests.

**Хід роботи**

***Готував матеріал студентка Коваленко С.***

1. Перерахуйте етапи для розгортання операційної системи на базі віртуальної машини VirtualBox.

Here are the basic steps to deploy an operating system on a virtual machine using VirtualBox:

1. Install VirtualBox: Download and install VirtualBox from the official website.

2. Create a New Virtual Machine: Open VirtualBox, click "New," and follow the prompts to name your VM, select the OS type, and allocate memory.

3. Configure Virtual Hardware: Set up virtual hard disk size, CPU cores, and other hardware settings for your VM.

4. Mount the OS Image: Attach the ISO file of the operating system by going to "Settings" > "Storage" and adding the ISO as a virtual optical disk.

5. Start the Virtual Machine: Launch the VM by clicking "Start" and follow the installation steps for the OS.

6. Install Guest Additions (optional): Once the OS is installed, go to "Devices" > "Insert Guest Additions CD image" for enhanced performance and features.

7. Configure Settings: Adjust network, display, and other settings based on your needs. After these steps, your operating system will be running in VirtualBox.

1. Чи є якісь апаратні обмеження при встановленні 32- та 64-бітних ОС?

There are hardware limitations when installing 32-bit and 64-bit operating systems:

1. 32-bit OS: Can run on both 32-bit and 64-bit processors, but it is limited to 4 GB of RAM. Even if the system has more RAM, the 32-bit OS can't use it fully.

2. 64-bit OS: Requires a 64-bit processor and can handle more than 4 GB of RAM, often up to several terabytes depending on the system.

In summary, to fully utilize more RAM and advanced features, a 64-bit OS on a 64-bit processor is necessary.

1. Які основні етапи при встановленні OS Linux в текстовому режимі?

Here are the basic steps for installing a Linux OS in text mode:

1. Boot from Installation Media: Insert the installation media (USB, CD/DVD) and boot the system.

2. Select Installation Mode: Choose text-based installation or "Install in CLI" mode.

3. Configure Language and Keyboard: Set the desired language and keyboard layout.

4. Partition the Disk: Manually partition the disk using tools like fdisk or parted.

5. Select Software Packages: Choose minimal or custom package installation.

6. Set Root Password: Define the root user password and create additional users if necessary.

7. Install Bootloader: Install the bootloader (GRUB) on the primary disk.

8. Reboot and Login: After installation, reboot the system and log in to the Linux terminal. These steps cover the minimal installation process in text mode for Linux.

1. Яким чином можна до установити графічні оболонки Gnome та KDE в Linux, якщо вона вже встановлена в текстовому режимі (вкажіть необхідні команди та пакети)?

To install graphical environments like GNOME and KDE on a Linux system already running in text mode, you can use the following commands based on your Linux distribution:

For GNOME:

1. Debian/Ubuntu:
   1. sudo apt update sudo apt install gnome
2. Fedora:
   1. sudo dnf install gnome-desktop
3. CentOS/RHEL:
   1. sudo yum groupinstall "GNOME Desktop"

For KDE:

1. Debian/Ubuntu:
   1. sudo apt update sudo apt install kde-plasma-desktop
2. Fedora:
   1. sudo dnf install @kde-desktop
3. CentOS/RHEL:
   1. sudo yum groupinstall "KDE Plasma Workspaces"
4. Дайте коротку характеристику графічних інтерфейсів, що використовуються в різних дистрибутивах Linux  відповідно до 3 варіанту:

Xfce and FVWM are two different graphical environments used in Linux distributions.

Xfce is a lightweight desktop environment designed for speed and low resource usage. It provides a modern, user-friendly interface with traditional desktop elements such as a taskbar, icons, and window management. Xfce is known for its simplicity and stability, making it ideal for older or less powerful hardware.

FVWM (F Virtual Window Manager) is a highly configurable window manager that is also lightweight but offers much more customization than Xfce. It doesn’t include a full desktop environment by default but allows users to create highly personalized window management setups, typically favored by advanced users who prefer minimalist, efficient interfaces.

Both environments emphasize efficiency but differ in their approach: Xfce focuses on ease of use, while FVWM prioritizes customization and control.

**Відповіді на контрольні запитання**

***Готував матеріал студент Горохов Д.***

1. Розкрийте поняття «GNU GPL», яка його основна концепція??

The **GNU General Public License (GNU GPL)** is a widely used free software license created by the Free Software Foundation. Its primary concept is to ensure that software licensed under GPL remains free for all users. This means anyone can use, modify, and distribute the software, but any derivative works must also be distributed under the same GPL license, preserving the freedoms of the original software.

In essence, it promotes software freedom and ensures open collaboration.

***Готував матеріал студент Горохов Д.***

1. Порівняйте гіпервізори типу 1 та типу 2, яка між ними відмінність та сфера їх застосування?

**Type 1 Hypervisors (Bare-metal)** run directly on the physical hardware without needing a host operating system. They are more efficient, offer better performance, and are used in enterprise environments for large-scale virtualization. Examples include VMware ESXi and Microsoft Hyper-V. These hypervisors are ideal for data centers, cloud infrastructures, and production environments.

**Type 2 Hypervisors (Hosted)** run on top of a host operating system. They are easier to install and manage but generally have lower performance due to the extra OS layer. Examples include Oracle VirtualBox and VMware Workstation. Type 2 hypervisors are typically used for development, testing, and personal virtualization on desktops or laptops

1. В чому суть програмного забезпечення з відкритим кодом?

A **distribution** (or "distro") is a package of software that includes an operating system and additional programs necessary for its installation and functionality. The term is most commonly used in the context of **Linux distributions**, where the operating system is bundled with various software, drivers, utilities, package managers, and other components to make installation and usage easier.

The primary goal of a distribution is to provide a ready-to-use environment tailored to specific user needs, whether for servers, workstations, or learning systems.

1. Які задачі системного адміністрування можна реалізувати на базі ОС Linux?

In **Linux**, system administration tasks encompass a wide range of responsibilities. Key tasks include:

1. **User and Group Management**: Creating, deleting, and managing users and groups.
2. **File System Management**: Mounting/unmounting drives, managing file permissions, and disk quotas.
3. **Network Configuration**: Setting up and managing network interfaces, firewalls, and routing.
4. **Package Management**: Installing, updating, and removing software packages using package managers like *apt*, *yum*, or *dnf*.
5. **Security**: Implementing user access control, managing firewalls (e.g., *iptables*), and configuring SELinux/AppArmor.
6. **System Monitoring**: Tracking system performance, using tools like *top*, *htop*, and *vmstat*.
7. **Backup and Recovery**: Setting up backup solutions and managing recovery processes.
8. **Automation**: Using shell scripts and automation tools (like *cron* and *Ansible*) for repetitive tasks.
9. Як пов'язані між собою ОС Android та Linux?

**Android** and **Linux** are closely related because Android is built on top of the **Linux kernel**, which is the core part of the operating system that manages hardware and system resources. The Linux kernel in Android handles tasks like memory management, process management, networking, and device drivers.

However, while they share the same kernel, Android and traditional Linux distributions differ significantly in terms of user interfaces, libraries, and software. Android uses its own framework, tools, and applications (such as Dalvik/ART for running apps), making it distinct from standard Linux distributions like Ubuntu or Fedora.

1. Основні можливості та сфера використання Embedded Linux?

**Embedded Linux** refers to the use of the Linux operating system in embedded systems, which are specialized computing devices designed to perform specific tasks. Key features of Embedded Linux include:

1. **Customization**: Highly adaptable, allowing developers to tailor the OS for specific hardware and application requirements.
2. **Lightweight**: Can be stripped down to consume minimal resources, making it ideal for devices with limited processing power and memory.
3. **Real-time capabilities**: Supports real-time operations, critical for devices requiring precise timing.
4. **Open-source**: Provides cost-effective, flexible solutions due to its open-source nature.

**Use cases** of Embedded Linux include:

* **IoT devices** (e.g., smart home systems)
* **Automotive systems** (e.g., infotainment systems)
* **Networking equipment** (e.g., routers)
* **Medical devices**
* **Industrial automation**

1. Яким чином можна змінити типу завантаження Linux: в текстовому режимі (3 рівень) або графічному (рівень 5)? Чим відрізняються режими CLI та GUI?

To change the **boot mode** of Linux between text mode (runlevel 3) and graphical mode (runlevel 5), you can modify the system’s **default target** (in modern Linux systems using **systemd**). Here's how:

1. **Switch to text mode (CLI - runlevel 3)**:
   * Run: sudo systemctl set-default multi-user.target
   * This sets the system to boot into command-line mode (text mode).
2. **Switch to graphical mode (GUI - runlevel 5)**:
   * Run: sudo systemctl set-default graphical.target
   * This sets the system to boot into graphical mode.

To switch modes temporarily without rebooting:

* For **text mode**: sudo systemctl isolate multi-user.target
* For **graphical mode**: sudo systemctl isolate graphical.target

**Difference between CLI and GUI:**

* **CLI (Command-Line Interface)**: A text-based interface where users interact by typing commands. It consumes fewer system resources and is often preferred for server administration and automation.
* **GUI (Graphical User Interface)**: A visual interface that allows users to interact with the system using graphical elements like windows, icons, and buttons. It is more user-friendly but requires more resources.

**Висновки**

The topic "Getting to know the working environment of virtual machines and the features of the Linux operating system" reveals the importance of virtualization for modern IT systems and the role of Linux in this area. Virtual machines allow efficient use of resources by running multiple operating systems on the same physical hardware. This is especially useful for servers and web hosting. As a powerful and flexible open source operating system, Linux is ideal for such environments, providing high stability, security and performance. Working with virtual machines in Linux allows users to master both graphical interfaces and a powerful command line for greater flexibility and automation of tasks.