“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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**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**

***Prepared by student: Koshkin I., Sarapyn Y.***

|  |  |
| --- | --- |
| Термін англійською | Термін українською |
| **Operating System** | Операційна система |
| **Shared hosting** | Віртуальний хостинг |
| **Machine simulators** | Машинні тренажери |
| **Binary translation** | Двійковий переклад |
| **Host operating system** | Операційна система хоста |
| **Modularity** | Модульність |
|  |  |
|  |  |
|  |  |
|  |  |

***Prepared by student: Koshkin I.***

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

A hypervisor (also known as a Virtual Machine Monitor, VMM) is software or hardware that creates and manages virtual machines. It allows multiple operating systems to run on a single physical computer independently of each other.

**Types of hypervisors:**

**Type 1 hypervisors (Bare Metal or Native Hypervisors):**

* Operate directly on the physical hardware of the host machine, without an underlying operating system.
* Typically used in server environments and provide high levels of performance and security.
* Examples: VMware ESXi, Microsoft Hyper-V, Xen, KVM.

**Type 2 hypervisors (Hosted Hypervisors):**

* Run on top of an existing operating system installed on the physical computer.
* Often used on workstations for testing and software development, as they allow running multiple operating systems on a single computer.
* Examples: VMware Workstation, Oracle VirtualBox, Parallels Desktop.

Варіант 10 (Кошкін Ілля)

Hypervisor Hyper-V

**Hyper-V** - this is a hypervisor developed by Microsoft for creating and managing virtual machines on Windows platforms. It is part of the Windows Server operating system and is also available in Windows 10 and Windows 11 Pro editions.

**Main components of Hyper-V:**

**Hypervisor**:

* This is the core component that enables virtual machines to run directly on physical hardware. It manages the allocation of resources between guest operating systems.

**Virtual machines**:

* Guest operating systems that run on virtual machines created and managed by Hyper-V. Each VM has its own resources (processor, memory, network, and disk system).

**Virtual Switches**

* These are virtual network adapters used to connect virtual machines to physical networks or to create internal networks between virtual machines.

**Віртуальні жорсткі диски (VHD, VHDX)**:

* Files that contain virtual machine data. The VHD and VHDX formats are used to store operating system data and other files.

**Hyper-V Manager**:

* It is a graphical interface for creating, managing, and monitoring virtual machines and Hyper-V resources.

**Hyper-V Replica**:

* A feature that allows remote copying of virtual machines to another server for backup and disaster recovery.

**Failover Clustering**:

* Cluster support ensures high availability of virtual machines. If one server fails, another server can automatically take over the virtual machine's operation.

**Dynamic Memory**:

* A mechanism that allows dynamically adjusting the amount of memory allocated to virtual machines based on their needs.

**GPU virtualisation**:

* It allows virtual machines to use the graphical resources of the physical machine to perform tasks related to visualization, such as in VDI (Virtual Desktop Infrastructure) environments.

**Main features of Hyper-V:**

**Support for various operating systems:**

* Hyper-V supports various operating systems, including Windows, Linux, and FreeBSD, as guest operating systems.

**Extensive backup and recovery options:**

* Hyper-V Replica allows for creating backups and recovering virtual machines in case of a disaster.

**Scalability:**

* Hyper-V allows for the management of thousands of virtual machines in large data centers and cloud platforms.

**source isolation**:

* Virtual machines operate in isolation from one another, which ensures security and stability.

**Live Migration**:

* The ability to migrate virtual machines between physical hosts without interrupting their operation, which is important for maintaining continuous service.

***Prepared by student: Koshkin I.***

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

**Installing VirtualBox:**

* Download and install VirtualBox on your computer from the official Oracle website.

**Creating a New Virtual Machine:**

* Open VirtualBox and click on the "New" button.
* Specify the name of the virtual machine, choose the type of operating system (e.g., Linux, Windows), and its version (32-bit or 64-bit).

**Configuring Hardware Resources:**

* Specify the amount of memory to be allocated to the virtual machine.
* Create or attach a virtual hard disk for storing virtual machine data.

**Adding the OS ISO Image:**

* In the virtual machine settings, go to the "Storage" section.
* Add the ISO file with the operating system image to the virtual CD/DVD drive.

**Starting the Virtual Machine:**

* Click on the "Start" button to launch the virtual machine.
* VirtualBox will automatically boot the OS from the ISO image.

**Installing the Operating System:**

* After booting the OS from the ISO image, perform the standard installation process.

***2.2 Чи є якісь апаратні обмеження при встановленні 32- та 64-бітних ОС?***

Hardware limitations when installing 32-bit and 64-bit operating systems:

**32-bit OS:**

* Can run on any processor that supports 32-bit architecture (x86).
* Memory limitation: up to 4 GB RAM.

**64-bit OS:**

* Requires a processor with 64-bit architecture support (x64).
* Can use more than 4 GB of RAM and supports larger computational capacities.
* In VirtualBox, installing a 64-bit OS requires **Intel VT-x** or **AMD-V** support in the processor, as well as enabling these features in the BIOS.

***2.3 Які основні етапи при встановленні OS Linux в текстовому режимі?***

**Main stages of installing OS Linux in text mode:**

* Boot from the installation disk or USB drive.
* Select language and regional settings.
* Configure the network (if needed).
* Partition the hard drive.
* Choose packages for installation.
* Install the system and bootloader.
* Configure users and complete the installation.

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

**Installing Gnome:**

* **Update the repository list and install the Gnome package:**

sudo apt update

sudo apt install gnome-core

**For the full version of GNOME:**

sudo apt install gnome

* **Reboot the system or switch to the graphical interface with the command:**

sudo systemctl start gdm

**Installing KDE:**

* **Update the repository list and install KDE Plasma:**

sudo apt update

sudo apt install kde-plasma-desktop

* **Reboot the system or switch to the graphical interface with the command:**

sudo systemctl start sddm

These commands allow you to add graphical environments after installing Linux in text mode. You can also switch between multiple graphical environments through the display manager at login.

***2.5 Kochubei S. (9v.)***

***\*\*Дайте коротку характеристику графічних інтерфейсів, що використовуються в різних***

***дистрибутивах Linux відповідно до свого варіанту (порядковий номер по журналу), табл.2..***

**Xfce, FVWM:**

**Xfce** and **FVWM** are two different window managers commonly used in Linux distributions, offering different philosophies in terms of design and functionality.

**Xfce:**

* **Lightweight and modular:** Xfce is known for being a lightweight desktop environment that focuses on speed and low resource consumption. It's ideal for older hardware or users who prefer a simple, efficient interface.
* **Modern features:** Xfce includes many modern desktop features such as a taskbar, system tray, and graphical settings manager, while maintaining a classic desktop metaphor.
* **Customizability:** Xfce is highly configurable, allowing users to adjust panel layout, add widgets, and modify themes, making it user-friendly yet versatile.

**FVWM:**

* **Minimalist and powerful:** FVWM (F Virtual Window Manager) is a highly configurable and minimalist window manager. It provides a bare-bones environment with great flexibility for those willing to manually tweak configuration files.
* **Scriptability:** FVWM shines with its scriptability, enabling advanced users to create custom layouts, key bindings, and automation tailored to their specific needs.
* **Retro feel:** FVWM has a more old-school Unix-like look and feel compared to Xfce, appealing to those who prefer functionality over aesthetics.

**Differences in Linux Distributions:**

Some **Linux distributions** customize Xfce or FVWM with their own themes, layouts, and additional software to offer users a unique experience. For example, **Xubuntu** uses Xfce with a modern, sleek theme, while some minimal distributions might include FVWM to provide a highly customizable yet resource-efficient environment.

**Контрольні запитання**

***Prepared by student: Sarapyn Y.***

1. Порівняйте гіпервізори типу 1 та типу 2, яка між ними відмінність та сфера їх застосування?
2. Розкрийте поняття «GNU GPL», яка його основна концепція?
3. В чому суть програмного забезпечення з відкритим кодом?
4. \*Що таке дистрибутив?
5. \*Які задачі системного адміністрування можна реалізувати на базі ОС Linux?
6. \*Як пов'язані між собою ОС Android та Linux?
7. \*\*Основні можливості та сфера використання Embedded Linux?
8. \*\*Яким чином можна змінити типу завантаження Linux: в текстовому режимі (3 рівень) або графічному (рівень 5)? Чим відрізняються режими CLI та GUI?

**Answers:**

**1. Type 1 Hypervisor (Bare-Metal):  
 Description:** A Type 1 hypervisor is installed directly on the physical hardware. This means it has direct access to the hardware resources, bypassing the host operating system.  
 **Examples:** VMware ESXi, Microsoft Hyper-V, Xen, KVM (when used as bare-metal).  
 **Advantages:** High efficiency and performance, as the hypervisor has direct access to hardware resources. Better suited for environments with high performance and security requirements.  
 **Use Cases:** Servers, data centers, corporate environments where high performance and security are needed.

**Type 2 Hypervisor (Hosted):  
 Description:** A Type 2 hypervisor runs on top of an existing operating system. It relies on the host OS for resources and does not have direct access to hardware resources.  
 **Examples:** VMware Workstation, Oracle VirtualBox, Parallels Desktop.  
 **Advantages:** Ease of setup and use, suitable for development, testing, and other less demanding tasks.  
 **Use Cases:** Personal computers, development environments, testing labs.

**2. GNU General Public License (GNU GPL)** is an open-source license developed by the Free Software Foundation (FSF).

**Key Concepts:**

* **Free Software:** Everyone can freely use, modify, and distribute the software.
* **Copyleft:** Any derivative work (modified versions of the software) must also be licensed under the GNU GPL. This ensures that the software remains free in the future.

**3. Open Source Software** is software whose source code is available for viewing, using, modifying, and distributing.

**Key Principles:**

* **Access to Code:** Anyone can view and modify the code.
* **Community:** Development and maintenance are carried out by the community.
* **Free Availability:** The software is virtually free (not always in terms of cost, but rather in terms of the absence of restrictions).

**4. Distribution** - is a specific version of an operating system, usually Linux, which includes the kernel and a set of software (applications, utilities, libraries). It provides a ready-to-use system tailored to specific requirements and needs.

**5. System Administration Tasks in Linux OS:**

Linux OS enables the execution of various tasks, including:

* **User and Access Management:** Creating and deleting users, managing access rights to files and directories.
* **System Monitoring and Configuration:** Tracking resources, configuring network settings, managing processes.
* **Task Automation:** Setting up cron jobs for automatic execution of tasks.
* **Backups and Recovery:** Creating backups and restoring data.

**6. Relationship between Android OS and Linux:**

Android OS is a mobile operating system built on the Linux kernel. This means that Android uses the Linux kernel to manage hardware resources, but it has its own specific architecture and application environment that differs from traditional Linux.

**7. Embedded Linux** is a customized version of Linux used in embedded systems, such as routers, televisions, and Internet of Things (IoT) devices.

**Key Features:**

* **Modularity:** Easily customizable and optimized for specific needs.
* **Reliability and Stability:** High level of stability and support.
* **Expandability:** Ability to add necessary components and features.

**Applications:**

* **Embedded Devices:** Mobile phones, automotive systems, medical devices.
* **Internet of Things (IoT):** Various devices connected to the internet.

**8. Changing the Boot Mode in Linux:**

To change the boot mode in Linux (text or graphical mode):

* **For Text Mode (Runlevel 3):** Open the file **/etc/default/grub, find the line GRUB\_CMDLINE\_LINUX\_DEFAULT** and remove **quiet splash**. Save the changes and update GRUB with the command **sudo update-grub**. Then, reboot the system.
* **For Graphical Mode (Runlevel 5):** Configure the boot settings in **/etc/inittab or /etc/systemd/system/default.target**, depending on the distribution.

**CLI and GUI Modes:**

* **CLI (Command Line Interface):** A text-based interface where commands are entered manually. It offers greater control and automation of tasks.
* **GUI (Graphical User Interface):** A graphical interface where interaction with the system is through visual elements (windows, buttons). It is more user-friendly for those who are not familiar with the command line.

***Висновок: (Kochubei S. 9)***

* **Introduction to Hypervisors and Virtualization:**

**Hypervisor:** Software or hardware that creates and manages virtual machines, allowing multiple OSes to run independently on a single physical computer.

**Types of Hypervisors:**

* **Type 1 (Bare Metal):** Directly on physical hardware (e.g., VMware ESXi, Hyper-V).
* **Type 2 (Hosted):** Runs on top of an existing OS (e.g., VirtualBox, VMware Workstation).
* **Overview of Operating Systems:**
* Examples: Windows, Linux, and their virtualization compatibility via VirtualBox.
* **Material Requirements for Practical Sessions:**
* IBM PC, Windows OS, VirtualBox, Linux OS, and Cisco Netacad resources for learning.

**Key Concepts and Steps:**

* **Hypervisor Hyper-V:**
* Developed by Microsoft, supports Windows, Linux, and FreeBSD as guest OSes.
* Features: Virtual machines, virtual switches, dynamic memory, live migration, GPU virtualization, and Hyper-V Replica for disaster recovery.
* **Deployment of an Operating System on VirtualBox:**
* Download and install VirtualBox.
* Create a new VM and specify hardware resources (memory, disk).
* Add an OS ISO file and boot the VM to start the installation.
* **Hardware Limitations:**
* 32-bit OS: Supports up to 4GB RAM, runs on 32-bit processors.
* 64-bit OS: Requires a 64-bit processor, supports more than 4GB RAM, and needs virtualization features enabled (Intel VT-x or AMD-V).
* **Installing Linux OS in Text Mode:**
* Steps include partitioning the disk, choosing packages, configuring the bootloader, and setting up users.
* **Installing GNOME and KDE in Linux (after text-mode installation):**
* **Brief Characteristics of Linux Graphical Interfaces:**
* **Xfce:** Lightweight, modular, and customizable, with low resource consumption, making it ideal for older hardware.
* **FVWM:** Minimalist and highly configurable, ideal for users who prefer a Unix-like experience with a focus on functionality.

**Conclusion:**

This work covers the key aspects of hypervisors, virtualization, and the steps involved in deploying and configuring OSes using VirtualBox and Linux, along with installing graphical environments like GNOME and KDE. It also provides a comparison of lightweight Linux window managers, highlighting their usability in various distributions.