# **Laboratory Work №1**

**Topic:** Introduction to Virtual Machines and Features of the Linux Operating System

## **Purpose of Work**

1. To study hypervisors and virtualization when working with operating systems.
2. To get acquainted with modern operating systems and review their capabilities.

## **Preliminary Preparation**

### **Glossary of Terms**

* **Virtualization** – creating virtual computing resources.
* **Hypervisor** – software layer for creating and managing virtual machines.
* **Type 1 Hypervisor** – “bare-metal” hypervisor, runs directly on hardware.
* **Type 2 Hypervisor** – “hosted” hypervisor, runs on top of a host operating system.
* **Guest OS** – operating system installed inside a virtual machine.
* **Host OS** – operating system installed on a physical computer.
* **Kernel** – the core of the operating system.
* **Distribution (distro)** – a Linux distribution (kernel + utilities + applications).
* **CLI (Command Line Interface)** – text-based command interface.
* **GUI (Graphical User Interface)** – graphical interface with windows and icons.

### **Preparation Questions and Answers**

**1. What is a hypervisor? What types exist?** A hypervisor is specialized software that allows multiple virtual machines to run and be managed on a single physical machine.

Types:

* **Type 1 (bare-metal):** works directly with hardware, often used in enterprise (Hyper-V Server, VMware ESXi, Xen).
* **Type 2 (hosted):** runs on top of a host OS, often used for testing (VirtualBox, VMware Workstation).

**2. Main components and features of Hyper-V (variant 25):**

* Built into Windows Server and Windows 10/11 Pro/Enterprise.
* Supports running Windows, Linux, and other guest OS.
* Virtual networking (External, Internal, Private switches).
* Integration services (time sync, drivers, file copy).
* Checkpoints (snapshots) for recovery.
* Dynamic memory allocation.
* Support for clustering and live migration.

## **Work Progress**

**1. Steps of deploying an OS in Hyper-V:**

1. Enable hardware virtualization (Intel VT-x/AMD-V) in BIOS/UEFI.
2. Activate Hyper-V in Windows Features.
3. Create a new VM (set CPU, RAM, disk size).
4. Attach a Linux ISO image.
5. Configure network (External/Internal/Private).
6. Start the installation of the guest OS.

**2. Hardware limitations of 32-bit vs. 64-bit OS in Hyper-V:**

* 32-bit OS can run on standard x86 CPUs.
* 64-bit OS requires hardware support for **SLAT (Second Level Address Translation)** and virtualization extensions (Intel VT-x/AMD-V). Hyper-V will not run without them.

**3. Main steps of installing Linux in text mode:**

1. Boot from ISO.
2. Choose language and keyboard layout.
3. Partition disk.
4. Install base system and kernel.
5. Create user accounts and root password.
6. Finish installation and reboot.

**4. Installing graphical environments in Linux (if only CLI is available):**

# Debian/Ubuntu

sudo apt update

sudo apt install gnome-shell kde-plasma-desktop

# Fedora/CentOS/RHEL

sudo dnf groupinstall "Server with GUI"

sudo dnf install @kde-desktop

**5. Features of desktop environments (variant 25 – KDE Plasma and Fluxbox):**

* **KDE Plasma** – a modern, highly customizable desktop environment, user-friendly and similar to Windows.
* **Fluxbox** – lightweight window manager, very fast and minimalistic, suitable for weak PCs or servers.

## **Control Questions**

**1. Difference between Type 1 and Type 2 hypervisors:**

* Type 1 runs directly on hardware (Hyper-V, VMware ESXi).
* Type 2 runs on top of a host OS (VirtualBox, VMware Workstation).

**2. GNU GPL:** A free software license that allows users to run, modify, and redistribute software freely.

**3. Open-source software:** Software with publicly available source code, allowing modifications and redistribution.

**4. Linux distribution:** A ready-to-use operating system built on the Linux kernel with utilities and applications (Ubuntu, Debian, Fedora, etc.).

**5. Main Linux system administration tasks:**

* user management;
* server configuration;
* performance monitoring;
* network and security setup;
* automation with scripts.

**6. Relationship between Android and Linux:** Android is based on the Linux kernel but has its own framework and GUI.

**7. Embedded Linux:** A lightweight version of Linux designed for embedded systems (routers, TVs, IoT devices).

**8. Switching Linux boot modes (CLI/GUI):**

sudo systemctl set-default multi-user.target # boot to CLI

sudo systemctl set-default graphical.target # boot to GUI

## **Conclusion**

In this lab, the principles of virtualization and the operation of the Hyper-V hypervisor were studied. Its main features were explored: support for multiple operating systems, virtual networking, checkpoints, and dynamic memory. The process of installing Linux in both text and graphical modes was examined, as well as the installation of additional desktop environments. KDE Plasma and Fluxbox were compared as examples of modern and lightweight Linux interfaces. The acquired knowledge can be applied for educational purposes, system administration, and server deployment.