**The University of Azad Jammu and Kashmir, Muzaffarabad**



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**Bachelors of Science in Software Engineering (2022-26)**

**Department of Software Engineering**

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# Task NO 4

## ****What is a Virtual Machine (VM)?****

A **Virtual Machine** is a software-based simulation of a physical computer. It runs its own **operating system and applications** but uses the hardware resources (CPU, RAM, storage) of the **host machine**.

It’s managed by a **hypervisor**, which allows multiple VMs to run on one physical computer, each isolated from the others.

### ****Why Use a VM?****

* To run different operating systems (e.g., Linux on Windows)
* For software testing and development
* To save hardware costs (multiple servers on one machine)
* For secure, isolated environments

### ****Example:****

You can install Ubuntu in a Virtual Box VM on your Windows PC to test Linux tools without affecting your main system.

## ****What is a Linux-Based Operating System?****

A **Linux-based operating system** is an OS built on the **Linux kernel**, which is the core part of the system handling hardware interaction.

### ****Key Features:****

* **Open-source**: Free to use, modify, and distribute.
* **Secure**: Built-in permissions and user controls.
* **Customizable**: Multiple distributions (Ubuntu, Fedora, Delian, etc.).
* **Stable and Efficient**: Often used in servers, embedded systems, and cloud platforms.

### ****Common Uses:****

* Web servers (e.g., Ubuntu Server, CentOS)
* Developer environments
* Cybersecurity and networking
* IoT and embedded systems (e.g., Raspberry Pi OS)

## Draw a UNIX System Architecture.

Explanation of each part of the **UNIX System Architecture**:

### 1. ****User Interface****

* **What it includes**: Command-line interface (CLI) like **Shell** or graphical user interface (GUI).
* **Purpose**: Lets users interact with the system by entering commands or using windows/menus.

### 2. ****System Utilities****

* **What it includes**: Programs like cp, ls, mv, text editors, compilers, etc.
* **Purpose**: Provides tools for file handling, program development, and text processing.

### 3. ****System Call Interface****

* **What it includes**: API layer (like read (), write (), fork (), exec ()).
* **Purpose**: Acts as a bridge between user-space applications and the kernel. All user requests to the hardware go through here.

### 4. ****Kernel****

* **What it includes**:
* **Process Management**: Handles process creation, scheduling, termination.
* **Memory Management**: Allocates RAM, manages virtual memory.
* **File System Management**: Manages files and directories.
* **Device Drivers**: Interfaces with hardware like printers, disks, etc.
* **Purpose**: Core component that controls all lower-level operations and resources.

### 5. ****Hardware****

* **What it includes**: CPU, RAM, Hard Disk, Network card, I/O devices.
* **Purpose**: Physical resources used by the operating system and applications.

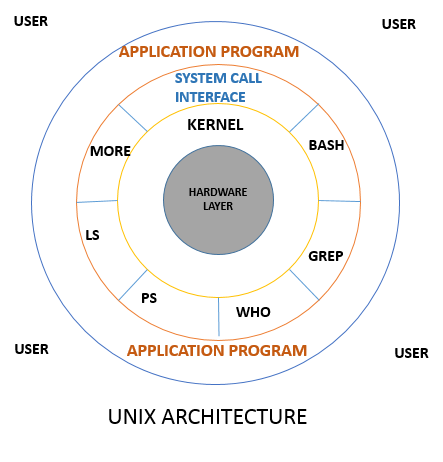


Figure 1: UNIC Architecture

## What is the difference between Ubuntu and Linux?

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| --- | --- | --- |
| Feature | Ubuntu | Linux |
| Definition | A specific **Linux distribution (distro)** developed by Canonical Ltd. | A **kernel**, i.e., the core part of an operating system. |
| Type | A complete OS built on top of the Linux kernel | Not an OS by itself, but the base on which many OSes are built |
| First Released | October 2004 | September 1991 |
| Created By | Canonical Ltd. (Mark Shuttle worth) | Linus Torvalds |
| User Interface | Comes with GUI (default: GNOME, others available like KDE, XFCE) | Has no GUI itself – GUI is added by distributions like Ubuntu |
| Target Users | Beginners, desktop users, developers, and enterprises | System developers, OS maintainers, and advanced users |
| Package Manager | APT (Advanced Package Tool), uses .deb packages | Depends on the distribution using the Linux kernel |
| Use Case Examples | Web servers, desktops, cloud deployments (e.g., Ubuntu Server) | Basis for distros like Red Hat, Ubuntu, Debian, Fedora, Arch, etc. |
| Updates & Support | Regular LTS releases (every 2 years), commercial support from Canonical | No direct support; support comes from specific distributions |
| Popularity | One of the most popular Linux distros | Linux itself underpins all Linux-based OSes (including Ubuntu) |
| Pre-installed Software | Includes pre-installed apps (Firefox, LibreOffice, etc.) | None – depends on distro built on Linux |
| Community | Large and user-friendly community | Global developer community; more technical |

## What is the difference between Kali Linux and Linux?

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| --- | --- | --- |
| Feature | Kali Linux | Linux |
| Definition | A **Linux distribution** designed for penetration testing and ethical hacking | The **kernel** (core) of many operating systems, including Kali Linux |
| Type | A specialized Linux-based OS | A kernel, not a full OS |
| Purpose | Security auditing, digital forensics, ethical hacking | Acts as the base of an operating system |
| Created By | Offensive Security Ltd. | Linus Torvalds |
| Target Users | Cybersecurity professionals, ethical hackers | OS developers, system integrators, and distros |
| Pre-installed Tools | Comes with 600+ tools like Metasploit, Nmap, Wireshark, Burp Suite | None – tools added by Linux-based distros |
| User Interface | Default GUI: XFCE or GNOME | No GUI – GUI comes from distros using the Linux kernel |
| Security Focus | High – intended for offensive security and testing | Not focused on a specific use case |
| Default User Privileges | Root user enabled by default | Depends on the distro |
| Updates & Support | Maintained by Offensive Security, regular tool updates | Maintained by the Linux community – no official support |
| Use Cases | Penetration testing labs, cybersecurity research, ethical hacking | Powering various OSes like Ubuntu, Fedora, Android, etc. |

## What is the difference between Kali Linux and Ubuntu?

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| --- | --- | --- |
| Feature | Kali Linux | Ubuntu |
| Purpose | Designed for penetration testing, digital forensics, and ethical hacking | General-purpose OS for desktops, servers, and development |
| Target Audience | Cybersecurity professionals, ethical hackers | General users, developers, and businesses |
| Default User Privileges | Root user enabled by default | Non-root user (scudo used for admin tasks) |
| Base Distribution | Based on **Delian Testing** | Based on **Delian Stable** |
| Pre-installed Tools | 600+ security tools (e.g., Metasploit, Nmap, Wireshark) | Essential desktop apps (e.g., Firefox, LibreOffice) |
| User Interface (GUI) | XFCE (lightweight), can use GNOME or KDE | GNOME by default (others optional) |
| Stability | Less stable due to latest/testing packages | More stable and tested for everyday use |
| Software Updates | Frequent updates focused on security tools | Regular LTS (Long Term Support) and interim releases |
| Security Focus | Offensive security (penetration testing) | Defensive security (firewalls, updates, encryption) |
| Learning Curve | Steeper – requires knowledge of cybersecurity concepts | Beginner-friendly with strong community support |
| Usage in Production | Not recommended for daily or production use | Widely used in production environments |
| Community & Support | Smaller, niche community (Offensive Security) | Large global community, official Canonical support available |
| Default Applications | Hacking and forensic tools | Desktop productivity and general-use apps |

## Which one is best for deployment: Linux, Ubuntu, or Kali Linux?

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| --- | --- | --- |
| OS | Suitability | Why / Why Not |
| Linux (General) | *Too generic* | "Linux" refers to the kernel, not a specific deployment-ready OS. You need a distribution like Ubuntu, CentOS, etc. |
| Ubuntu | **Best Choice** | Stable, widely supported, secure, user-friendly, and backed by Canonical. It’s the go-to OS for cloud servers (e.g., AWS, Azure, and GCP). |
| Kali Linux | *Not suitable* | Designed for penetration testing only. It’s not stable or secure enough for general deployment. |