



Module Code & Module Title - CT5052NP (Network Operating System)

Level 5 – Network Operating system

Assessment Type

Logbook - Report

Semester - 2023/24 Spring/Autumn

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Assignment Due Date: 30 september 2024

Assignment Submission Date: 30 september 2024

Submitted To: Prashant Adhikari

Word Count : 1559

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1. Introduction

A set of programs that controls , supervises and make communication possible between computer hardware and software. The core component and a small set of code of operating system which has direct access to the computer hardware and software which is a link or road which allows the computer application to function using the hardware resources. (Hossein Bidgoli, 2003)

The Components of kernels and their functions are :

- i. Process management
 - Starts and end the programs.
 - Allocates the CPU time for running the programs.
 - Allow multiple processing by context switching where it saves the current running process and loading the next scheduled process.
- ii. Memory management
 - Allocates the memory for the programs in RAM.
 - It creates virtual RAM to increase memory for the processes.
 - It secures the memory data since application system call has to be pass through it before kernel mode.
- iii. File system and device management
 - It allocates the memory for files to create, read, write the file and also to delete it , organizes the files in directories and control the access to the created files.
 - Kernels loads the drivers for specific hardware , stores the data temporarily in buffers or cache memory transferred between the input and output devices or between processing devices like CPU,RAM and GPU for better performance.

2. Objectives

To explore about operating system main core called kernel its different components with functions, history of kernel and popular operating systems.

3. Types of kernels

There are two divisions for kernels:

i. Based on Architecture

a. Monolithic kernel

This kernel has all the functionality of microkernel including virtual file system and protocol stacks. This enhances the system security but reduces flexibility required to users. Example are UNIX AND LINUX. (Dr. Manish Mahajan, Published 08 May 2021)

b. Micro kernel

This kernel have minimal 'built-in' functions or small set of codes responsible for memory management and inter-process communication. It controls hardware userland drivers or space where other all OS features are allocated. This type of kernel are more flexible but less secure. Example are 'Mach' and 'MINIX'. (Dr. Manish Mahajan, Published 08 May 2021)

ii. Based on Usage

a. General purpose kernels

It is the used for general purpose computers since this is designed to function for multi tasking and support wide range of applications which are suitable for personal computers ,servers or workstations. Examples are Linux kernel, maxOS(XNU).

b. Real-time kernels

It is the type of kernels which is computers which have to do the specific or determined tasks in critical time . It is mainly used in industrial control systems, robotics, communication , aerospace , gaming and so on. Examples are RTLinux, VxWorks.

4. Popular Kernels and their History

i. Vacuum tubes machines without operating systems

In early time, the first generation machines of 1940s and 1950s used to be operated without operating system. The first digital computer was designed by Charles Babbage (the English Mathematician) called analytical engine which didn't have an operating system but had the first software by Ada Lovelace known as first programmer.

ii. Rise and advancement of operating system (1955 onwards)

The first developed and used Operating systems were FMS (Fortran Monitor System) and IBSYS which has the feature of sequential job process like of modern OS and was developed by IBM. Then, the concept of Time-Sharing Systems came alternative to batch system where the multiple users can access the system and its resources simultaneously by rapid switching of tasks. After this the concept of personal computers arises and foundation of modern Operating systems were developed. (Tanenbaum, 2007)

iii. Most popular operating systems of modern times

Windows Operating system

MS-DOS was the first OS developed and released in 1981 by Microsoft which initially gained success and was used by IBM-compatible personal computers. Windows was a GUI-based system ran on top of MS-DOS. Many operating systems features were released using the underlying MS-DOS system for booting and old MS-DOS programs used, (Tanenbaum, 2007). Over time Microsoft released different versions of windows operating kernels or system upgrading the features of the system. The different versions of windows are given as Windows 1.0 to 3.x (Monolithic kernel with simple GUI), Windows NT (New Technology) (Hybrid kernel), Windows 95 (have integrated

DOS and a new GUI), Windows 98 and 98 SE (Hybrid kernel with internet access), Windows Me, Windows 2000, Windows (XP, Vista) (Stallings, 2008) Windows (7, 8, 8.1, 10, 11) were later improved versions of hybrid kernels.

iPhone Operating System

Apple first released OS was Mac OS which was especially designed for laptop and desktop computers, its first released OS was System 1 (1978) later Apple released different upgraded versions of Mac OS.

Apple first introduced iPhone to the public on January 2007 by Apple CEO Steve Jobs, later it officially came in market on June 2007. Version 1.0.2 was initially released on iPod Touch and updated version 1.1.1 provided interface for the calculator application and supported the TV providing adjustable volume and speakerphone. (Cheng). At the bottom of the iPhone operating system architecture, the Main OS layer is present. An extra Pre-occupation layer, media, cocoa-touch layer, and the core services layer of the iOS architecture is included with Mach kernel and the OS core layer has the planner to protect system and system or program data. (Dr. Manish Mahajan, Published 08 May 2021)

Ubuntu Operating System

Ubuntu is the complete operating system built on the top of the open source Linux kernel released in 2004 created by Mark Shuttleworth. Ubuntu is open source and free that can be downloaded, updated without any cost. Ubuntu is the operating system having most secure environments for users' program and data with wide range of hardware compatibility. Upgraded versions of Ubuntu are widely used in Cloud and IoT devices.

5. Boot Process

The process that a computer goes through when it is powered till the operating system is fully loaded and running is known to be as Boot Process.

The BIOS(Bask Input Output System) contains low-level I/O software and procedure to read the keyboard, write on screen, operate disk I/O and other processes which is held in a flash RAM that is non volatile but can be updated to fix bugs. (Tanenbaum, 2007)

Steps in the Boot Process :

POST

Power- ON Self Test (POST) is the first step on loading Operating System where program called BIOS firmware or UEFI firmware (Unified Extensible Firmware Interface) runs which checks the functionality of hardware components such as RAM, CPU, storage and other peripherals devices. If POST finds any issues it will alert by error messages or beep sound. If functionality of every hardware component is fine then the bootloader is loaded.

Bootloader

Bootloader which resides in MBR or GPT loads the operating system kernel.

Loading the kernel

Bootloader loads the selected operating system Kernel into the memory. Kernel is responsible for maintaining the stable and efficient communication between the hardware components and system applications or software. After kernel is loaded it starts system initialization.

Initramfs kernel and systemd Initialization

Temporary file system is created to load drivers , kernel initializes the hardware in real root file system and systemd starts system services for users.

User Login

System is ready for user interaction and job.

6. Conclusion

In conclusion, the operating system has a core part called kernel which is responsible for managing smooth and efficient communication and functioning between hardware and software. Many Operating systems has came in existence over time from Ms- Dos to windows, ios and ubuntu varying in security and performance. Kernels functions and operations make us understand about how actually computer computes data and functions properly and efficiently.

7. References

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