

OPERATING SYSTEMS

Lecture 1

Operating System Overview

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INTRODUCTION

Welcome to this unit: Operating systems. This first lecture is a brief or maybe not so brief overview of Operating Systems. We will first begin by reviewing what an operating system is and some of its functions. Next, we shall review the evolution of computers which should give way to the evolution of operating systems. We will also review the categories of an operating system. Finally, we will review the advancements made within the operating system field.

Learning objectives

By the end of this topic, you should be able to:

1. Show an understanding of what an operating system is and its functions.
2. Highlight the operating system timeline.
3. Describe operating system types

OVERVIEW

This first lecture is an overview of the concepts of the operating system. Previously, you may have learnt about the different types of operating systems and their uses. We start by defining an operating system. Before we do that, let us understand how a computer works. Any computer is divided into two main parts. The hardware and the software. Hardware is considered the tangible parts of a computer. A keyboard and a mouse are examples of hardware. Software on the other hand is the instructions that tell a computer what to do. Software is categorized as system software or application software. An operating system is categorized under system software.

An operating system has many definitions. It is best defined as the part of a computer that manages the hardware and software of a computer [1]. Some argue that it is the brain of the computer giving instructions to all the other parts of the computer, although others argue that the CPU would be the brain with the operating system considered the mind. That aside, the operating system can tell the computer what to do, when and how. Additionally, the operating system acts as the interface between the application software and the computer hardware [2].

FUNCTIONS OF AN OPERATING SYSTEM

All operating systems have universal functions regardless of the type or device they are made for. We will review five functions of the operating system.

Booting a computer [3]

Booting refers to the process of shutting down and switching on a computer [3]. The process of switching on involves several tests that check the functionality of various hardware. The tests check whether the required devices are connected and working successfully. The operating system oversees the entire process of booting the system.

Program management [3]

Software as reviewed above is divided into system software and application software. Application software is individualized programs that are designed with a specific function in mind. These applications or programs are managed by the operating system. When the programs are running and they require resources, the operating system will manage and allocate the resources.

Device management [3]

A computer requires different types of hardware to function. Specifically, lots of peripheral devices are used to create additional functionality for the computer. For these devices to work, the operating system allows for a functionality called plug-and-play [3]. This functionality allows the operating system to automatically configure a new device during installation.

File Management [3]

File management is a critical function of any computer. Users need to save files that they work on and can retrieve the files later. Additionally, users need to be able to open different types of files with the right software. An operating system ensures that files can be accessed as needed, perform backups, troubleshoot and fix problems among other functionalities involving user files.

Security Management [3]

Security is provided by the operating system. From the user accounts that separate user files and programs to secure the computer from intrusion is the work of the operating system. The operating system provides a provision where different user accounts are created on a computer to ensure that users only access allowed resources and programs. Additionally, the operating system using a firewall ensures that outside access is not possible unless authorized to.

EVOLUTION OF COMPUTERS

Before we can look at the evolution of the operating system, perhaps we need an understanding of computers and where they have come from and where they are headed to. Computers have had five generations with us currently the fifth generation. We will review each of the generations and understand the difference between each generation.

First Generation (1940 – 1950s) – The generation featured large computers that used vacuum tubes. The vacuum tubes were the main processing hardware. They were large and therefore used lots of electricity and broke down often resulting in numerous replacements.

Second Generation (1950s–1960s) – The generation featured the use of transistors as a replacement for vacuum tubes. The computers in this generation were smaller and much faster than the first generation.

Third Generation (1960s–1970s) – This generation saw hundreds of transistors placed within an integrated circuit. The integrated circuit saw much faster computers, and this was the introduction of the monitor and other output devices.

Fourth Generation (1970's to present) – This was the generation where the number of advancements was remarkable. From the introduction of the microprocessor to micro-computers. This generation has changed the computing scene.

Fifth Generation (Ongoing) – This generation is currently ongoing and uses artificial intelligence to make computers faster and better. There have been many advancements with systems that can think like human beings to robots.

With the above review of the computer, we now look at the evolution of the operating system.

EVOLUTION OF OPERATING SYSTEMS

The evolution of the operating system ran in parallel to that of the computer [1]. Development started in the 1940s around the same time the first computer was invented and went all the way to the present day.

First Generation (1940–1950s) – During this generation, there was no operating system as the computers were reserved fully to work on a specific problem [1]. A plug

board like a control panel acted as the operating system and involved rewiring the machine to perform tasks.

Second Generation (1950s–1960s) – This generation saw the invention of simple batch systems [2]. Due to the challenges of the processor staying idle in between jobs, it was necessary to develop a system that would take care of the time wasted [2]. The batch system had a monitoring software that was used to put several jobs together for processing. We will discuss batch operating systems in the next section.

Third Generation (1960s–1980s) – As computers got faster and smaller, there was a need for an operating system that could handle several jobs together. Thus, the invention of a multiprogramming system. Multiprogramming dealt with the drawbacks of the batch system where the processor still sat idle for periods especially when the processor was waiting for resources.

Fourth Generation (1980s to 2000s) – This generation was marked by networked computers and the invention of the internet. This brought about the need for an operating system that could deal with better connectivity and more secure systems. Additionally, this led to a demand for an operating system that could allow for more device compatibility, was more flexible and allowed for larger storage.

New generation (2000's to present) – This is probably not the name of the generation; however, it represents the new age of operating systems. Major internet advancements have led to virtualization. Virtualization is the ability to separate partitions of a server to support different operating systems [1]. Additionally, this new generation has seen the development of multicore processors which means operating systems have to be developed to support the new processors.

CATEGORIES OF OPERATING SYSTEMS

Operating systems generally fall into five categories that are based on response speed and data entry method [1]. We now discuss the five categories, some of which had been mentioned above.

Batch Operating systems

These are operating systems that enter jobs as a whole and in a particular sequence [1]. We saw batch systems were invented around the second generation. Batch

systems are somewhat like a visit to the doctor's office. Only one patient can go in to see the doctor at a time and no other patient can enter the room until the doctor finishes with the first patient. The number of jobs completed within a particular time determines the throughput of the system [1].

Interactive

These types of operating systems allow for multiple jobs to be processed simultaneously [1]. This is different from the batch operating system that allowed only one job at a time. The interactive systems were a form of early operating system and could allow users to interact with the computer using commands.

Hybrid Systems

Hybrid operating systems are those that are a combination of batch systems and interactive systems. This type of system allows users to enter multiple jobs while at the same time running batch programs in the background [1]. A hybrid combines the benefits of interactive and batch systems to ensure that free time between system usage is utilized optimally [1].

Real-Time Systems

Real-time systems are used in time-critical environments [1]. These systems are used where reliability and deadlines are critical [1]. Good examples of industries that are time critical and rely on strict deadlines include airport traffic control, space exploration, and medical systems among others. If this system was to fail, severe consequences would be felt. These systems provide for two types of systems that determine the type of consequence felt. The hard real-time system risk complete system failure in the event a deadline is missed [1]. The soft real-time system suffers performance degradation in the event a deadline is missed [1].

Embedded Systems

Embedded operating systems are used within embedded computers. Embedded computers are devices that are developed for other functions but when they get a CPU chip added their functionality increases. For instance, the TV is generally used for entertainment and to receive broadcasts. A TV with a CPU chip is known as a smart TV and can be used to visit websites online, social media and even stream movies

from a source online. An embedded operating system is specifically formulated for embedded computers.

POPULAR OPERATING SYSTEMS

Several operating systems exist. Some of the more popular operating systems for desktop computers include Windows, Linux, Mac OS, and Unix, while those that are used in mobile devices include Android and iOS.

Windows

This operating system came about in the 1980s and featured a command type of operating system where users were required to type in commands. This gradually changed and a graphical user interface was incorporated into the operating system making it more user-friendly. Microsoft ensured that the windows operating system was easy to use and was separated to cater for various needs such as in the home and office.

Linux

The Linux operating system is a popular operating system that is a multitasking UNIX-type of operating system [3]. Unlike Windows, which is proprietary software, Linux is non-proprietary software and is open source meaning that its base code is freely and readily available for the public to use and modify.

Mac OS

This operating system was released to work with Apple's Macintosh computers. It is proprietary software like Windows. It offers features like higher security and better utilization of resources. It can only be used by Macintosh computers.

UNIX

This is a multitasking operating system [3]. Mostly UNIX uses a command-based kind of interface. UNIX was mainly developed for larger computers, however, nowadays it is available for computers of all sizes [3].

Android and iOS are examples of mobile-based operating systems and are used on various mobile phones. iOS use is limited to apple devices while Android is used in a

majority of phones and allows developers to develop application software that can run on the phones.

SUMMARY

During this lecture, we reviewed the definition of a computer. We then went ahead and reviewed the evolution of computers in relation to the evolution of the operating system. We also reviewed the operating system types and finally conducted a review of the popular types of operating systems.

DISCUSSION TOPIC

The current computer generation that we are on is the fifth which features artificial intelligence. One of the greatest needs that artificial intelligence computers will need is a reliable operating system. Discuss the features that will be expected of an operating system that will be able to support an artificial intelligence system.

REFERENCES

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