

COMPUTER ORGANIZATION AND ARCHITECTURE

Lecture 8

Operating System and Utility Programs Introduction to Application Software

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INTRODUCTION

This lecture is all about software. During this lecture, we review the instructions that tell the computer what to do. We will first review the System software. We will review what an operating system is, the functions, and the types of operating systems. Next, we look at utility programs and their role. Finally, we will review application software and more specifically the types of software based on license.

Learning objectives

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

1. Identify types of operating system
2. Discuss the functions of an operating system
3. Understand the types and need for application software

OVERVIEW

During the first lecture, we introduced the concept known as software. We defined software as the instructions that tell the computer what to do. Software is an integral part of a computer as it is the bridge between the user and the hardware. Software as we saw is divided into system software and application software. We will review both during the lecture.

SYSTEM SOFTWARE

System software contains the operating system and utility programs. System software is programs that can startup, also known as booting a computer, can load the application software and allows only authorized users to use the computer [4].

Operating System

The operating system or the O/S of the computer is sometimes considered the brain or the heart of the computer. This is because it oversees all the critical processes of the computer including managing the processor. The O/S can be viewed as a collection of programs that manage and coordinate the activities that take place within the PC [4]. The operating system is considered as the link between the user and hardware and has several functions that it performs. The functions are discussed below.

1. User Interface

The computer without an operating system is just pieces of hardware attached. When an operating system is introduced then the pieces of hardware have a purpose. For any user to use a computer, it is integral that there is software that allows the interaction. The O/S, therefore, takes the role of the intermediary. It allows various users to access the computer by logging in and out. Additionally, the operating system allows a user to be able to load various software and work with the software. Previously operating systems operated using a command interface, but with the development of systems, users are now able to work with a graphical user interface (GUI) [4].

2. Booting of a Computer

Booting is the act of bringing on a computer and loading the necessary software to ensure that the machine runs. During booting, the operating system is loaded onto memory and will remain there as long as the computer is running. Please note, it is not the entire operating system that is loaded onto the memory, but the critical component that is directly related to the booting of the computer. The other parts of the operating system that reside on the hard disk are accessed as needed. During the boot process, the O/S will determine whether all hardware required is attached to the machine (such as the keyboard), whether all internal components are running ok and then the O/S proceeds with the loading instructions.

3. Device Configuration

Several hardware devices are connected to the computer, either as integral components or as components that provide additional functionality. For these hardware devices to run, they require the presence of drivers. **Drivers** can be defined as small programs that allow various hardware devices to communicate and operate. An operating system normally comes with drivers already available. Previous versions of operating systems normally expected a user to have the drivers separately and to install them once the operating system was installed for the first or any subsequent times. Nowadays, when a hardware component is plugged into the computer, the operating system can automatically detect the device and install appropriate drivers. The drivers are configured in an area called the device manager (figure 1) and can be accessed through the control panel.

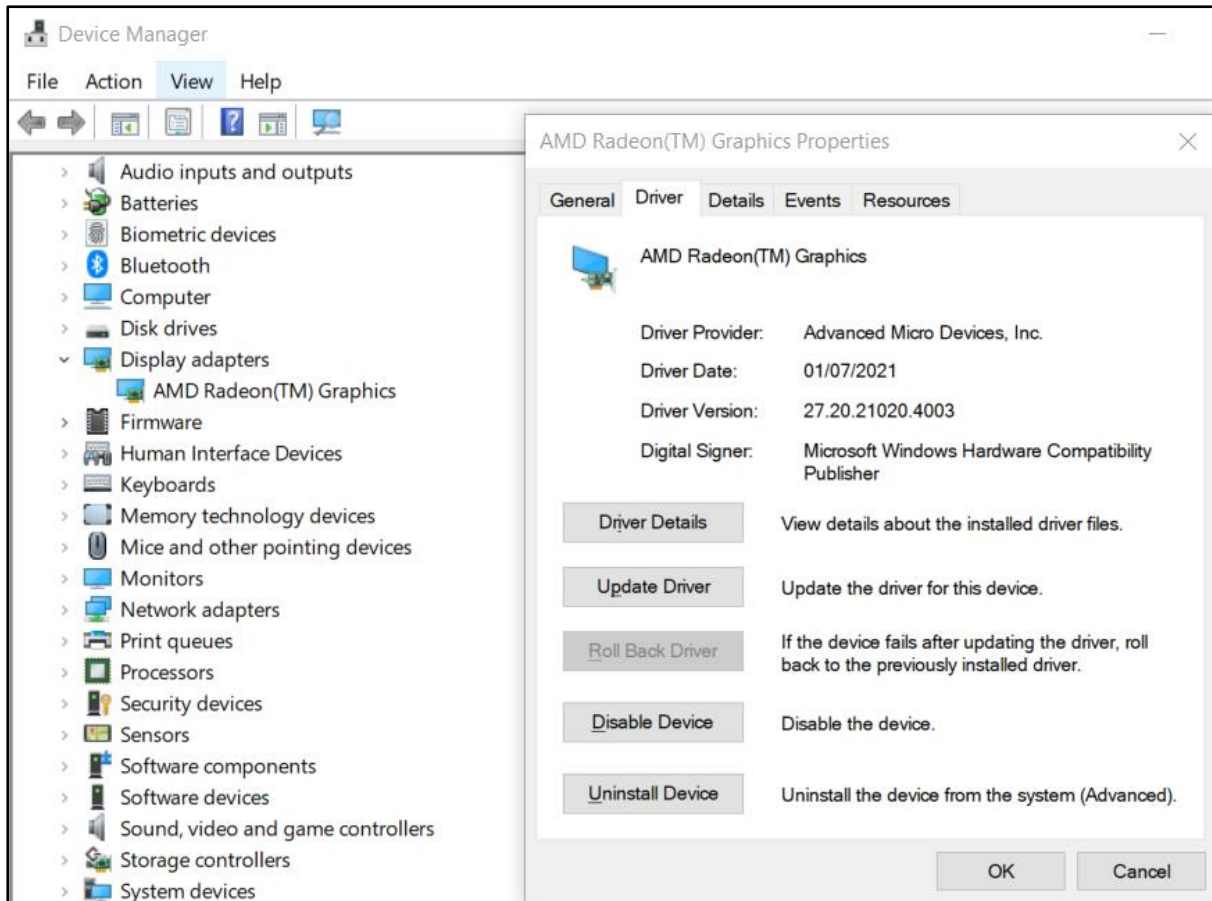


Figure 1: Device Manager and Driver Properties

4. Resource Monitoring

An operating system oversees assigning resources to various programs and various hardware components. For instance, a user may be looking to get a document, or several documents printed, at the same time, they may run an antivirus check while at the same time downloading a document from the internet. The operating system will oversee allocating various memory and processor resources to each of these tasks. Resource monitoring is a complex task and can be explained further by the definition of the following terms.

Multitasking: This is the ability of an operating system to run more than one program at a time. For instance, a user may be typing notes on a word processing program, while downloading a program and streaming music from a browser. The O/S being able to multitask allows the programs (Word, Download Manager and Chrome) to be able to run at the same time.

Multithreading: A **thread** is a sequence of instructions within a program [4]. Operating systems normally can run several threads at the same time known as multithreading. Additionally, the O/S can move from one thread to the next so that programs can perform their tasks faster [4].

Buffering and Spooling: A **buffer** is an area allocated by the O/S within the hard disk or memory that is used as a hold for various tasks. Buffering and Spooling is the process of placing items within the buffer. Now, why is all this necessary? As the processor is working on various tasks, it may require using various peripheral components to finish working on various tasks. The peripheral components may not be able to process or work on the tasks at the same speed as the processor. For instance, while a processor may require a job to be printed that contains 20 pages, the printer may take a couple of minutes to finish the job. During this time, the processor cannot just wait for the printer to finish, that would be a waste of time. Hence the use of buffering and spooling.

5. File management

Computers were invented to handle large amounts of data and information. In this regard, computers store quite an amount of information and files. All these files (documents, images, videos, pictures, etc.) need some order in which they are stored to ensure better and easier retrieval. It is the work of the operating system to manage files within the computer. During lecture 7 we discussed storage devices and how data is retrieved. This is the work of the operating system.

6. Security

For users to access a machine, they need credentials such as a username and a password. This is managed by the operating system. Additionally, the operating system oversees conducting updates to ensure security updates are installed both to the operating system and the other application software. These updates are aimed at fixing any vulnerabilities that can be exploited.

Types of Operating Systems

Various operating systems exist based on the device they are developed for. Remember the categories we discussed during the first lecture, most of these computers have a specific operating system that runs on them. We discuss three main

types, the mobile operating system, the PC operating system, and the server operating system.

1. Mobile operating system

These are the operating systems that work within a mobile device. The operating system for a mobile device is determined by the specifications and capabilities of the device. Some examples of mobile devices include a smartwatch, mobile phone, iPod, ATMs etc. The most common mobile operating systems include Android, Windows, iOS, Blackberry, and Linux based systems.

2. Personal Computer Operating System

These are the operating systems that most people are familiar with. When one switches on a computer, whether desktop or laptop, these computers will have an operating system that will be in charge of various features. These operating systems are designed to give an optimal performance to the user and to allow the user to perform everyday tasks. The most common operating systems are Windows, Linux, MAC OS and Unix.

3. Server Operating systems

As we learnt during the first lecture, servers are machines that are used to manage resources and allow for a central repository and access. Servers ensure that resources can be accessed by all clients. The server requires an operating system that can handle all the requests by other computers. The most common O/S for servers include Windows and Linux.

Utilities

The second category of system software is utilities. Maintenance is one of the core things that a computer must go through to ensure that it is running optimally. Utilities are programs that ensure that the computer is running optimally. Various programs are considered utility programs. We will review a couple of these programs below.

File management: As discussed in the previous section, one of the core functions of an O/S is file management. File management is a utility program that oversees the arranging, storing and retrieval of files. Within the Windows operating system, this is achieved using windows explorer.

Disk Management: This utility program ensures that the various storage disks are running ok and without problems. Additionally, it also oversees the partitioning of disks. Disk management (figure 2) is used to partition various disks within the computer while renaming them and formatting them.

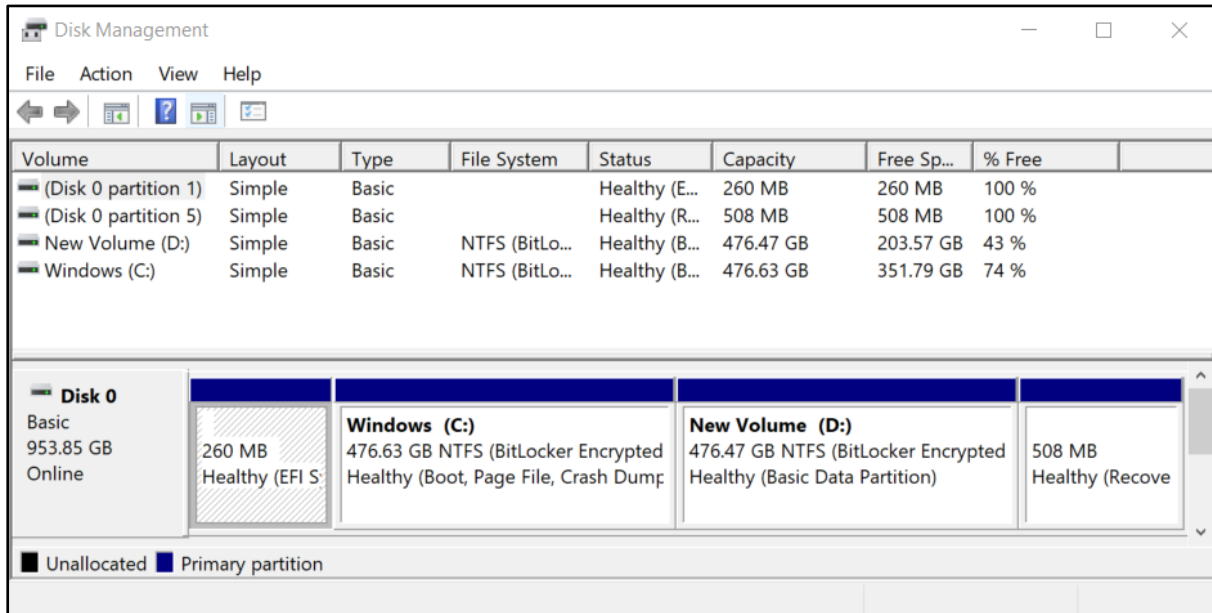


Figure 2: Disk Management

Uninstall and Clean-up: These are programs that help in the installation (adding) and uninstallation (removal) of programs. Users normally require various programs to work and at one point or another may no longer require some programs. The work of this utility program is to ensure when the programs are removed, a clean-up is done to delete all instances of the program.

Backup and Recovery: Sometimes computers will stop working for one reason or another. When a computer ceases to work, it could be catastrophic due to a loss of information. When data and information is backed up periodically, then there would be no disaster as there would be a point to recover from. The work of backup and recovery utilities is to ensure continuity if the system has some problems or becomes corrupt.

APPLICATION SOFTWARE

Application software is software created to perform a specific task. For instance, Microsoft Word was developed to aid in document editing while a program like VLC is used to play media content. Application software is normally available in many forms [1].

Packaged Software: this is software that is copyrighted and packaged to meet the needs of a variety of users. A good example of packaged software is software suites such as Microsoft Office.

Custom Software: this is software that is developed specifically for users or for a company to meet its unique needs. The company would request for the software to be developed for them.

Web Application: As discussed in lecture 2: this is a site where users can access and interact with software through any browser without having to install the software on their machines [1]. Web apps may either provide access free of charge or may charge to access services. Some examples include Google Sheets, One Drive and Netflix.

Open Source: this is software whose source code (base code) is given for use. this means it can be modified and redistributed [1]. The software does not normally have copyright implications and can be downloaded and used for free. A good example of this is Linux.

Shareware: this type of software is copyrighted and is available for a trial period. Once the trial period is over, then the user is required to pay for the software. An example is Adobe Acrobat 8.

Freeware: this is still copyrighted software that is provided at no cost. However, the company that developed the software retains all the rights. An example is Adobe PDF.

Public domain: This is software that is donated for public use. It has no software restrictions. An example is SQLite.

One of the most common ways that software is packaged is using software suites. For instance, Microsoft has a software suite called Office that contains a Word processor, Presentation, Spreadsheet and Database program. Within Office, these programs include Microsoft Word, Microsoft Excel, Microsoft PowerPoint, and Microsoft Access. Application software comes in many forms, and these include Apps available for the mobile phone. With the crossover of mobile operating systems and PC operating systems, many phone applications are usable on the PC.

SUMMARY

During this lecture, we have reviewed operating systems, their functions, and the various types. This then led to the review of utilities with examples of various utilities. Finally, a review of application software and the types based on licences was explored. During the next lecture, we review networks and data communications.

DISCUSSION TOPIC

As a follow up to the development and advancements of processors, operating systems have had to keep up pace with the developments. Some areas that have advanced within operating systems is multitasking and multithreading. Which other ways have operating systems improved to keep pace with the processors?

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