Introduction to Computer Systems

Computer Software

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Lecture 3 Recap

- Social Effects of the computers
- Computer Components

Lecture 4 Outline

- Computer Software
- Application Software
- System Software

Computer Software

Software is a set of instructions, data or programs used to operate computers and execute specific tasks.

Computer programs (collectively known as Computer Software) can generally be divided into two classifications:

1. **System Software** - software which provides an interface and services both for users and for other software. System software includes operating systems and utilities that coordinate the activities and functions of the hardware and other programs throughout the computer system
2. **Application Software** - software designed to provide specific services for users. Application software consists of programs that help users solve particular computing problems.

Both system and application software are written in coding schemes called **programming languages**. The primary function of a programming language is to provide instructions to the computer system so that it can perform a processing activity. Information systems professionals work with different programming languages, which are sets of keywords, commands, symbols, and rules for constructing statements that people can use to communicate instructions to a computer.

System Software

The system software is a collection of programs designed to operate, control, and extend the processing capabilities of the computer itself. System software is generally prepared by the computer manufacturers. These software products comprise of programs written in low-level languages, which interact with the hardware at a very basic level. System software serves as the interface between the hardware and the end users.

System software is often divided into two classifications:

1. **Operating Systems**
2. **Utility Programs**

Operating Systems

The operating system allows the components of a computer to work together.

An operating system would include programs that interface:

- users with hardware;
- users with software;
- software with hardware;
- software with other software.

Examples for Operating Systems:

- Personal computing OS – Windows, MacOS
- Mobile OS – Android, iOS
- Workgroup OS – Red Hat Linux, Windows Server
- Embedded OS - Palm webOS
- Enterprise OS – Linux, HP-UX

Computer & Mobile Operating systems

Personal Computing Operating Systems

A personal computer is a multi-purpose electronic computer whose size, capabilities, and price make it feasible for individual use. Personal computers are intended to be operated directly by an end-user who is not necessarily a computer expert or technician.

Examples of Personal computer operating systems – Windows, MacOS, Linux, Chrome OS

Mobile Operating Systems

A smartphone is a mobile phone with an operating system that normally combines features of a personal computer operating system with other features useful for mobile or handheld use. A smartphone typically has a color display with a graphical user interface. The display is almost always a touchscreen, and sometimes also has a touch-enabled keyboard. The user can press onscreen icons to activate "app" features, or he/she can use the virtual keyboard to type words and numbers. Smartphones now employ full-fledged personal computer operating systems

Examples for Mobile Operating systems - iOS (Apple), Android (Google)

Workgroup & Enterprise Operating systems

Workgroup Operating Systems

To keep pace with user demands, business technology must be able to support an environment in which network usage, data storage requirements, and data-processing speeds are increasing at a dramatic rate. Powerful and sophisticated operating systems are needed to run the servers that meet these business needs for workgroups.

Examples of Workgroup computer operating systems – Windows server, UNIX, Red hat Linux, Mac OS X Server

Enterprise Operating Systems

Mainframe computers provide the computing and storage capacity required for massive data-processing environments, and they provide systems that can support many users while delivering high performance and excellent system availability, strong security, and scalability. A wide range of application software has been developed to run in the mainframe environment, making it possible to purchase software to address almost any business problem. Hence, these enterprise Operating systems are capable of handling very heavy workloads, including serving thousands of concurrent users and running an organization’s critical applications.

Examples of Enterprise Operating systems – Linux, HP-UX

Embedded Operating systems

An embedded system is a computer system (including some sort of processor) that is implanted in and dedicated to the control of another device. Some embedded systems include specialized operating systems.

For example, Palm, an early smartphone manufacturer, developed its well-regarded Palm webOS operating system to run its Pre and Pixi smartphones, LG now uses the specialized software in its smart TVs to enable users to watch streaming movies and television shows and YouTube videos, connect to social networks, play games, get news, and download apps.

Functions performed by Operating Systems

Control common computer hardware functions

The OS enables applications to perform a variety of hardware-related tasks, such as the following:

- Get input from the keyboard or another input device
- Retrieve data from disks
- Store data on disks
- Display information on a monitor or printer

Each of these tasks requires a detailed set of instructions. The OS converts a basic request into instructions that the hardware can process. In effect, the OS acts as an intermediary between the application and the hardware.

Manage system memory

The OS also controls how memory is accessed, maximizing the use of available memory and storage to provide optimum efficiency. The memory-management feature of many OSs allows the computer to execute program instructions effectively and to speed processing. One way to increase the performance of an old computer is to upgrade to a newer OS and increase the amount of memory

Functions performed by Operating Systems

Provide a user interface and manage input/output management

One of the most important functions of any OS is providing a user interface, which allows people to access and interact with the computer system. User Interfaces – Command Line Interface, Graphical User Interface

Command Line Interface

In a system with a command line interface, the user would use the keyboard to enter a computer command. The computer would interpret the command and execute it. Then the computer would wait for the user to enter another command

Operating systems with command line interfaces were: AppleDOS, CP/M and MS-DOS.

Graphical User Interface

The graphical user interface (GUI), is a type of user interface that allows users to interact with electronic devices through graphical icons and visual indicators, instead of text-based user interfaces. GUIs were introduced in reaction to the perceived steep learning curve of command-line interfaces

Operating systems with GUI are Mac OS, Microsoft Windows, Linux Systems

Functions performed by Operating Systems

Provide a degree of hardware independence

Hardware independence refers to the ability of a software program to run on any platform, without concern for the specific underlying hardware, so that the underlying hardware can change without necessarily requiring a rewrite of the software applications. When new hardware technologies are introduced, the operating system, not the application software, is required to adjust to enable use of those changes

Network Capability

Most operating systems include networking capabilities so that computers can join together in a network to send and receive data and share computing resources. Operating systems for larger server computers are designed specifically for computer networking environments.

File Management

The OS manages files to ensure that files in secondary storage are available when needed and that they are protected from access by unauthorized users. Many computers support multiple users who store files on centrally located disks or tape drives. The OS keeps track of where each file is stored and who is cleared to access them

Functions performed by Operating Systems

Manage processing tasks

Operating systems use the five basic approaches to task management to increase the amount of processing that can be accomplished in a given amount of time.

- **Multiuser** - Allows two or more users to run programs at the same time on the same computer. Some operating systems permit hundreds or even thousands of concurrent users. The ability of the computer to handle an increasing number of concurrent users smoothly is called scalability.
- **Multiprocessing** - Supports running a program on more than one CPU
- **Multitasking** - Allows more than one program to run concurrently
- **Multithreading** - Allows different threads of a single program to run concurrently. A thread is a set of instructions within an application that is independent of other threads. For example, in a spreadsheet program, the thread to open the workbook is separate from the thread to sum a column of figures.
- **Real time** - Responds to input instantly. To do this, the operating system task scheduler can stop any task at any point in its execution if it determines that another higher priority task needs to run immediately. Realtime operating systems are used to control the operation of jet engines, the deployment of air bags, and the operation of antilock braking systems—among other uses

Functions performed by Operating Systems

Access to System Resources and Security

Because computers often handle sensitive data that can be accessed over networks, the OS needs to provide a high level of security against unauthorized access to the users' data and programs. Typically, the OS establishes a logon procedure that requires users to enter an identification code, such as a user name, and a password. Operating systems may also control what system resources a user may access. When a user successfully logs on to the system, the OS permits access to only the portions of the system for which the user has been authorized access. The OS records who is using the system and for how long, and it reports any attempted breaches of security.

Utility Programs

A program that helps to perform maintenance or correct problems with a computer system. These utilities can be used to boost the performance of a slow PC, repair errors in the registry and on a hard drive, remove unnecessary files, improve system security and privacy, and optimize sluggish system processes

Common types of Utility programs

- **Hardware utilities** - Hardware utilities can be used to check the status of all parts of the PC, to repair, maintain, and optimize a range of system types
- **Security Utilities** – Anti-malware utilities can be used to constantly monitor and protect a computer. If a virus or other malware is found, it can often be removed. Firewall software is another important security utility for protecting a computer system
- **File compression Utilities** - File-compression programs can reduce the amount of disk space required to store a file or reduce the time it takes to transfer a file over the Internet
- **Spam filtering utilities** - Spam-filtering utilities to assist users with filtering unwanted spam emails
- **Network and internet utilities** – Used to monitor hardware and network performance and trigger an alert when a server is crashing, or a network problem occurs
- **Server & mainframe utilities** - enhance the performance of servers and mainframe computers

Device Drivers

A device driver is a computer program that operates or controls a particular kind of device that might be attached to a computer. A driver provides an interface for a device.

Drivers enable operating systems, and other computer programs, to access functions without needing to know precise details of the hardware. When a device is installed on a computer, its drivers must also be installed.

The OS uses Device Drivers provided by device manufacturers to communicate with and control a device. Hardware drivers are typically downloaded from the device manufacturer’s Web site or read from an installation DVD and installed when the hardware is first connected to the computer system.

Device Drivers examples - Keyboard Driver, Mouse Driver, Graphics Card Driver, Sound Card Driver, Network Adapter Driver, Printer Driver, Webcam Driver, Touchpad Driver, USB Driver, Bluetooth Driver

Application Software

Application software products are designed to satisfy a particular need of a particular environment.

Application software may consist of a single program, such as Microsoft's notepad for writing and editing a simple text. It may also consist of a collection of programs, often called a software package, which work together to accomplish a task, such as a spreadsheet package.

Examples of Application software are: Payroll Software, Student Record Software, Inventory Management Software, Income Tax Software, Railways Reservation Software, Microsoft Office Suite Software, Microsoft Word

Types of Application Software

- **Application suite**

  An application suite consists of Multiple applications bundled together. They usually have related functions, features and similar user interfaces. They are often able to interact with each other

  Examples - Microsoft Office, LibreOffice and iWork,

- **Enterprise Software**

  Enterprise software addresses the needs of an entire organization's processes and data flows, across several departments, often in a large distributed environment.

  Examples - enterprise resource planning systems, customer relationship management (CRM) systems and supply chain management software.

- **Enterprise infrastructure software**

  Provides common capabilities needed to support enterprise software systems.

  Examples - databases, email servers, and systems for managing networks and security

Types of Application Software

- **Information worker software**

  Information worker software lets users create and manage information, often for individual projects within a department, in contrast to enterprise management.

  Examples - time management, resource management, analytical, collaborative and documentation tools

- **Content access software**

  Content access software is used primarily to access content without editing, but may include software that allows for content editing. Such software addresses the needs of individuals and groups to consume digital entertainment and published digital content.

  Examples - media players, web browsers, and help browsers

- **Educational software**

  Educational software is related to content access software, but has the content or features adapted for use in by educators or students

  Examples - it may deliver evaluations (tests), track progress through material, or include collaborative capabilities.

Types of Application Software

- **Simulation software**

  Simulation software simulates physical or abstract systems for either research, training or entertainment purposes

- **Media development software**

  Media development software generates print and electronic media for others to consume, most often in a commercial or educational setting.

  Examples - graphic-art, desktop publishing, digital audio, multimedia development software, HTML editors

- **Product engineering software**

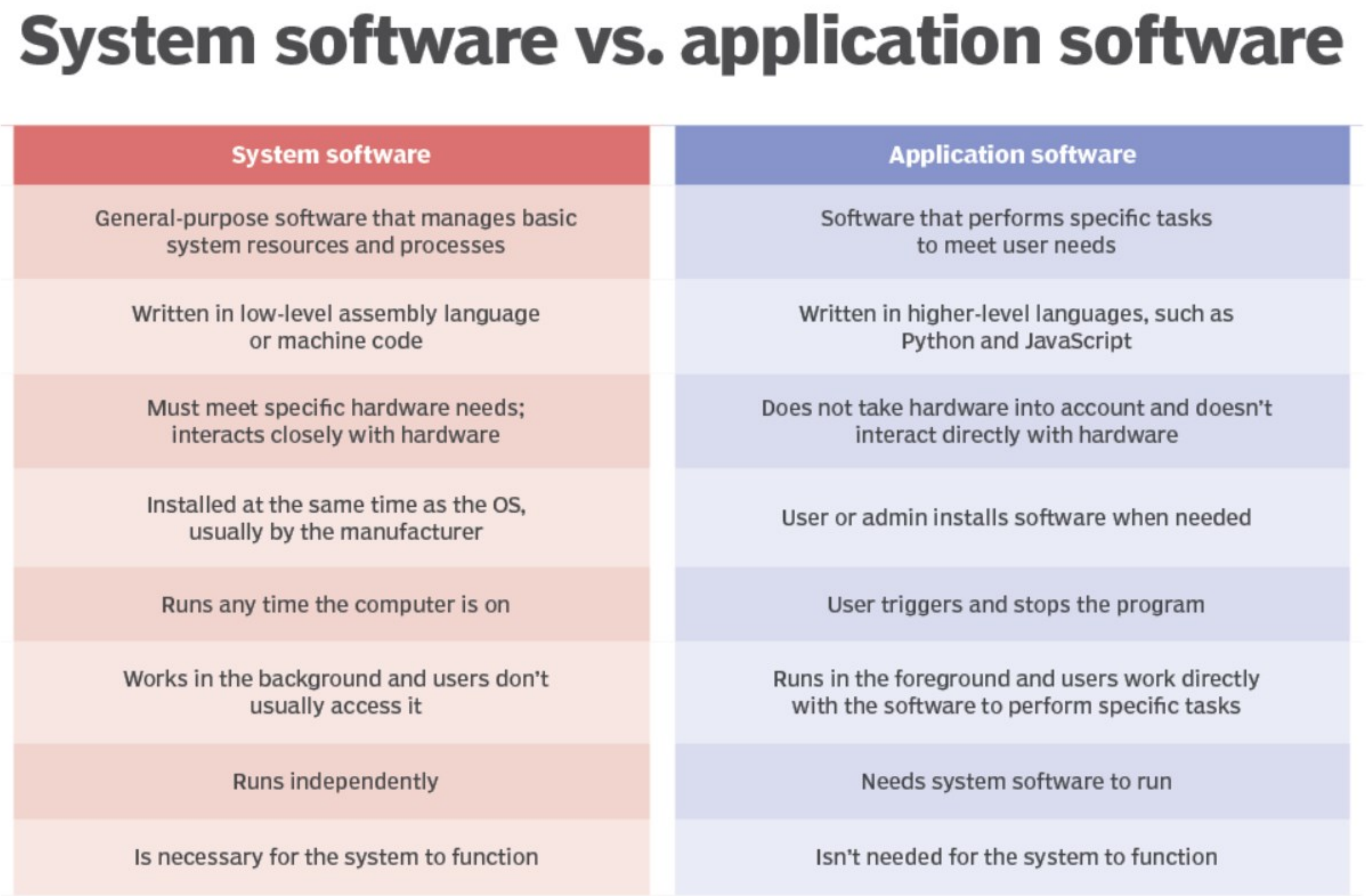
  Product engineering software is used in developing hardware and software products.

  Examples - CAD, CAE, computer language editing and compiling tools, and application programmer interfaces.

- **Entertainment software**

  Can refer to videogames, screensavers, programs to display motion pictures or play recorded music, and other forms of entertainment which can be experienced through use of a computing device.

Computer Software



System software vs. application software

System software	Application software
General-purpose software that manages basic system resources and processes	Software that performs specific tasks to meet user needs
Written in low-level assembly language or machine code	Written in higher-level languages, such as Python and JavaScript
Must meet specific hardware needs; interacts closely with hardware	Does not take hardware into account and doesn't interact directly with hardware
Installed at the same time as the OS, usually by the manufacturer	User or admin installs software when needed
Runs any time the computer is on	User triggers and stops the program
Works in the background and users don't usually access it	Runs in the foreground and users work directly with the software to perform specific tasks
Runs independently	Needs system software to run
Is necessary for the system to function	Isn't needed for the system to function

Lecture 4 Post Lecture Activities

- Complete the tutorial 01 and share the answers

Lecture 4 Next Week

- Ethical and Unethical usage of Computer software

Thank you