

Operating Systems

Lecture 1

Introduction, history and usage of operating systems

Lecture topics

- Introduction, history and usage of operating systems
- Computer system and operating system structure
- Processes, their management and synchronization
- Deadlocks
- Memory management
- Virtual memory
- File systems
- Input/output subsystem
- Disk management
- Distributed filesystems

Bibliography

- Books:
 - A.Silberschatz, P.B.Galvin, *Operating system concepts* (also in polish)
 - M.J.Bach, *The Design of the UNIX Operating System* (also in polish)
- Slides to the lectures (extended version):

<http://codex.cs.yale.edu/avi/os-book/OS9/os9c/index.html>

Summary

- This lecture:
 - Shows aims and tasks of operating systems.
 - Briefly describes history of OS.
 - Describes different types of OS.

What is an Operating System

- Lies between user and hardware.
- Exposes to programs a *virtual machine*.
- Allocates hardware resources to programs.
- Supervises program execution.
- Creates safe and convenient environment for users.
- Collects and stores users' data.

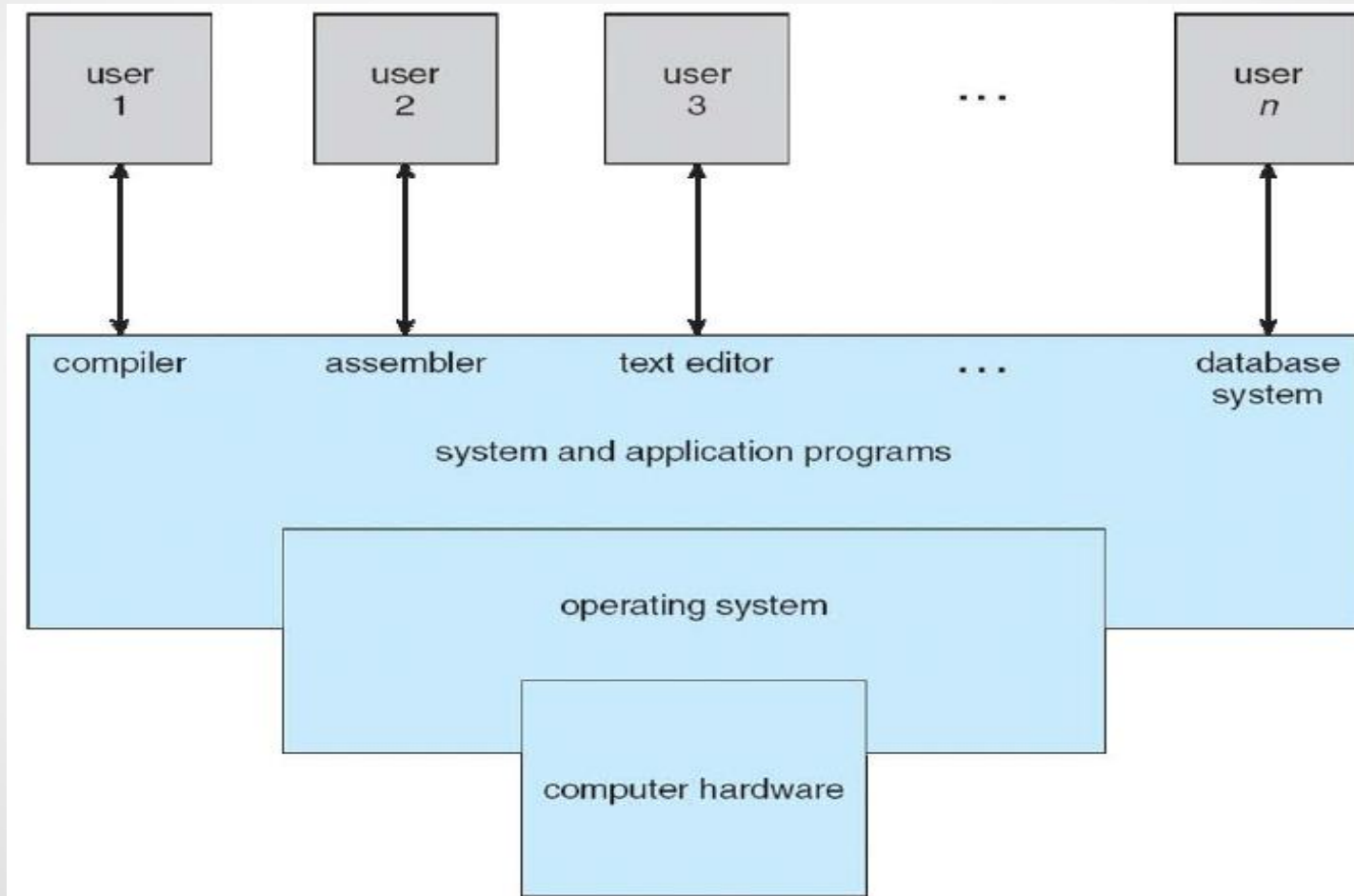
What is an Operating System

- Lies between user and hardware.
- Exposes to programs a *virtual machine*.
- Allocates hardware resources to programs.
- Supervises program execution.
- Creates safe and convenient environment for users.
- Collects and stores users' data.

Components of the computer system

- Computer system can be divided into four components:
 - Hardware – provides basic computing resources
 - CPU, memory, I/O devices
 - Operating system
 - Controls and coordinates use of hardware among various applications and users
 - Application programs – define the ways in which the system resources are used to solve the computing problems of the users
 - Word processors, compilers, web browsers, database systems, video games
 - Users
 - People, machines, other computers

Components of the computer system



What is an Operating System

- Lies between user and hardware.
- Exposes to programs a *virtual machine*.
- Allocates hardware resources to programs.
- Supervises program execution.
- Creates safe and convenient environment for users.
- Collects and stores users' data.

Virtual machine

- Operating system hides many technical details of the hardware.
- In such way, a program „sees” a system in the same way, regardless of the real hardware implementations.
 - For instance, program can access hard disk in the same way as a network drive.

What is an Operating System

- Lies between user and hardware.
- Exposes to programs a *virtual machine*.
- **Allocates hardware resources to programs.**
- Supervises program execution.
- Creates safe and convinient environment for users.
- Collects and stores users' data.

Resource allocation

- Anything in a computer system is a resource:
 - Processor
 - Memory
 - I/O devices
 - ...
- OS assigns these resources to programs and supervises their usage.

What is an Operating System

- Lies between user and hardware.
- Exposes to programs a *virtual machine*.
- Allocates hardware resources to programs.
- Supervises program execution.
- Creates safe and convenient environment for users.
- Collects and stores users' data.

Program execution control

- Allows to execute programs
 - Reads the code to the memory,
 - Starts program execution,
 - After a program is finished, OS deallocates its resources.
- Controls, if programs use their resources in an acceptable way and counteracts possible errors.

What is an Operating System

- Lies between user and hardware.
- Exposes to programs a *virtual machine*.
- Allocates hardware resources to programs.
- Supervises program execution.
- Creates safe and convinient environment for users.
- Collects and stores users' data.

User interface

- Operating system provides an user interface:
 - CLI (Command Line Interface)
 - GUI (Graphical User Interface)
 - Touchscreen interface
 - ...
- Also includes programming interface, i.e. functions, which allow users' programs to interact with a computer system.

What is an Operating System

- Lies between user and hardware.
- Exposes to programs a *virtual machine*.
- Allocates hardware resources to programs.
- Supervises program execution.
- Creates safe and convenient environment for users.
- Collects and stores users' data.

Definition

There is no universally accepted definition of OS

Basic aims of an OS

- Allows users to execute their programs and helps to perform tasks given by users.
- Provides a comfortable and functional work environment to users.
- Helps to utilise computer system resources in the most efficient way.

History of OS

- Early batch systems
 - Very basic aim – to read a pile of punch cards with the user's program, execute it and collect the results.
 - The main efficiency measurement was *turnaround time* of a task.
 - Due to very low speed of loading initial program data from cards, execution efficiency could have been improved by **spooling** (*simultaneous peripheral operation on-line*).

History of OS (cont.)

- Multi-program systems
 - Loading several programs to the memory at once helps to utilize processor while I/O operations are performed.
- Systems with time division (multitasking)
 - Processor time is divided into periods called *quantums* and assigned to processes executed in the system.
- Operating systems for PCs

Kinds of operating systems

- Parallel systems
 - For systems with multiple processors (cores)
- Distributed systems
 - Systems with separate machines connected with a network
- Real-time systems
 - hard real-time systems
 - soft real-time systems

Conclusions

- The general idea of an operating system was presented.
- The evolution of OS'es was shown, from the batch systems to multitasking systems.
- Also different kinds of systems were described (parallel, distributed, real-time).