PES UNIVERSITY ONLINE

OPERATING SYSTEM

Services & Implementation

Dr. Rahul Nagpal

Computer Science

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Outline

- Operating System Services
- Operating System Design
- Operating System Implementation
- Policy vs. Mechanism

OPERATING SYSTEMS
Operating System Services

- Operating systems provide an environment for execution of programs and services to programs and users
- One set of operating-system services provides functions that are helpful to the user:
  - **User interface** - Almost all operating systems have a user interface (**UI**).
    - Varies between **Command-Line** **(CLI)**, **Graphics User Interface** **(GUI)**, **Batch**
  - **Program execution** - The system must be able to load a program into memory and to run that program, end execution, either normally or abnormally (indicating error)
  - **I/O operations** - A running program may require I/O, which may involve a file or an I/O device

Operating System Services (Cont.)

File-system manipulation - Programs need to read and write files and directories, create and delete them, search them, list file Information, permission management.

Communications – Processes may exchange information, on the same computer or between computers over a network

Communications may be via shared memory or through message passing (packets moved by the OS)

Error detection – OS needs to be constantly aware of possible errors in the CPU and memory hardware, in I/O devices, in user program

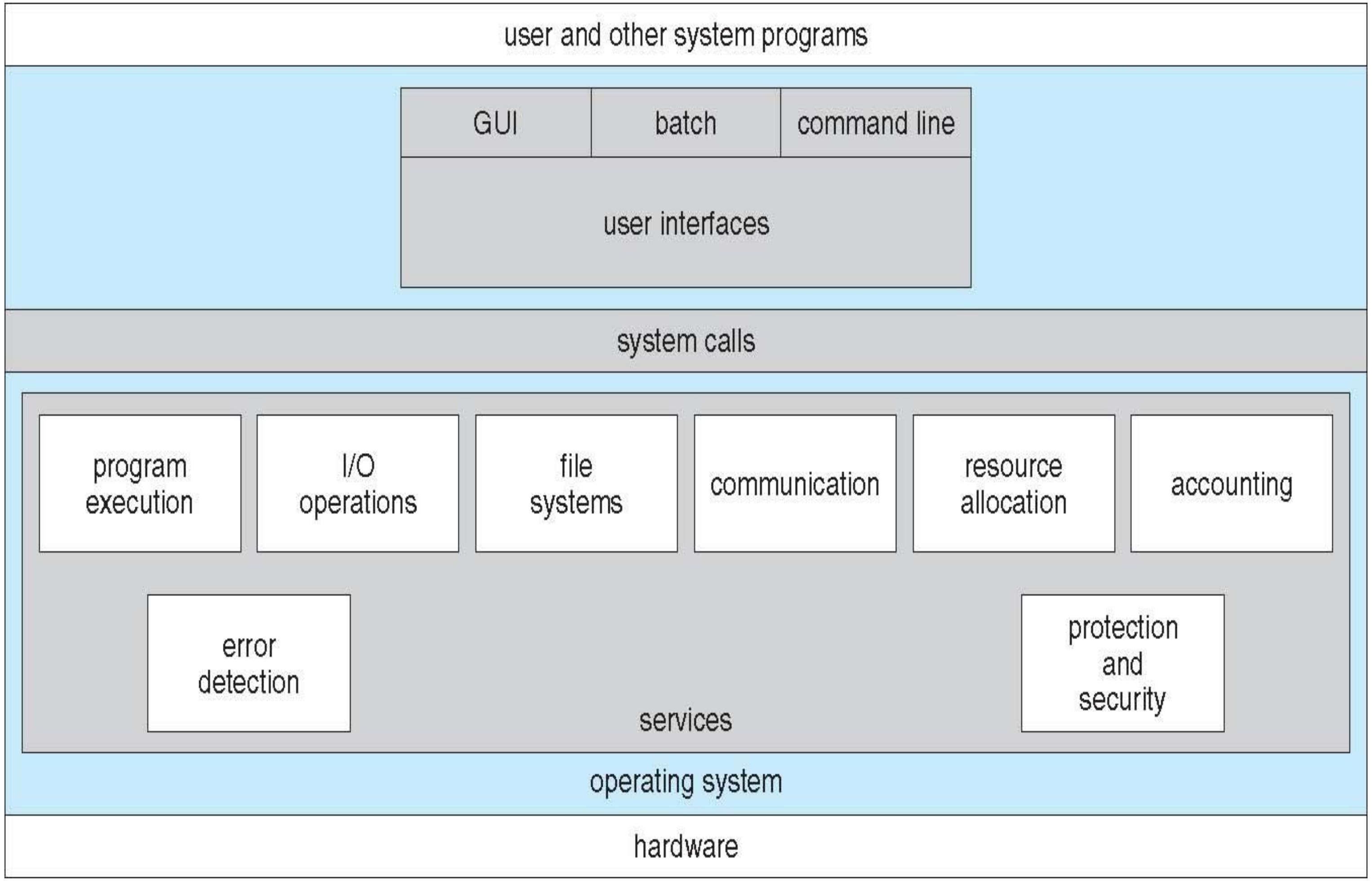
- For each type of error, OS should take the appropriate action to ensure correct and consistent computing
- Debugging facilities can greatly enhance the user’s and programmer’s abilities to efficiently use the system

Operating System Services (Cont.)

- Another set of OS functions exists for ensuring the efficient operation of the system itself via resource sharing
  - **Resource allocation -** When multiple users or multiple jobs running concurrently, resources must be allocated to each of them
    - Many types of resources - CPU cycles, main memory, file storage, I/O devices.
  - **Accounting -** To keep track of which users use how much and what kinds of computer resources
  - **Protection and security -** The owners of information stored in a multiuser or networked computer system may want to control use of that information, concurrent processes should not interfere with each other
    - **Protection** involves ensuring that all access to system resources is controlled
    - **Security** of the system from outsiders requires user authentication, extends to defending external I/O devices from invalid access attempts

OPERATING SYSTEMS

A View of Operating System Services



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OS Design and Implementation

Design and Implementation of OS is complex

Internal structure of different Operating Systems vary widely

Start the design by defining goals and specifications

Affected by choice of hardware, type of system

User goals – operating system should be convenient to use, easy to learn, reliable, safe, and fast

System goals – operating system should be easy to design, implement, and maintain, as well as flexible, reliable, error-free, and efficient

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OS Design and Implementation (Cont.)

Important principle to separate

Policy: ***What*** will be done?

Mechanism: ***How*** to do it?

The separation of policy from mechanism is a very important principle

Allows maximum flexibility if policy decisions are to be changed later

Specifying and designing an OS is highly creative task of **software engineering**

OS Implementation

Much variation

- Early OSes in assembly language
- Then system programming languages like Algol, PL/1
- Now C, C++

Actually usually a mix of languages

- Lowest levels in assembly
- Main body in C
- Systems programs in C, C++, scripting languages like PERL, Python, shell scripts

More high-level language easier to **port** to other hardware

- But slower

Emulation can allow an OS to run on non-native hardware

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THANK YOU

Dr Rahul Nagpal
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rahulnagpal@pes.edu