ITP 30002 Operating System

Introduction to Operating Systems

(OSTEP:Ch.2)

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What's Operating System?

- a program first loaded when a computer starts

- a suite of programs to operate a computer system with various hardware devices to run given multiple programs efficiently

    - supports construction and executions of application programs
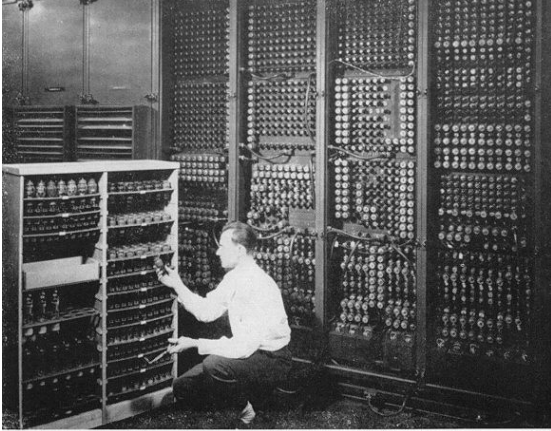   - works as a platform for application programs

Motivation - Demands

Replacing a bad tube meant checking among ENIAC's 19,000 possibilities.

- importing programs from other systems
- constructing a new system by combining existing programs
- managing a diversity and variety of hardware devices
- providing interactive features in a software system (e.g., networking)
- storing information persistently

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Motivation - Problems

- portability issue (hardware-dependency)
- interoperatability issue
- scheduling issues
- resource management issue (efficiency and scalability)
- safety & security issues

Approach

- Virtualize a computer system
  - provide a consistent and simple view to applications and programmers
    (for portability)
  - provide common interfaces for an application program to communicate
    with hardware units and other application programs
    (for interoperability)
  - distribute hardware resources to efficiently serve requests from
    application programs (for concurrency, efficiency and scalability)
  - forbid an application to access the critical control and the internals of a
    computer system and the other programs (for safety and security)

- Provide different policies of coordinating application programs,
  such that a suitable one will be used at a specific context

Solution: Kernel

- Have a library program that provides "helper" functions with common interfaces to application programs
  - for controlling HW devices, and for communicating with other programs

- Let these helper functions exclusively process sensitive operations under protection
  - It's more like "officer" than just "helper"
  - extends a computer architecture to provide a special instruction to call these officer functions (requires HW support)

- When they work, officer functions not only response to given requests, but also regulate and manage the resources that the application uses, especially in consideration with other application programs in the system
  - Then it's more like "governor" than "officer"
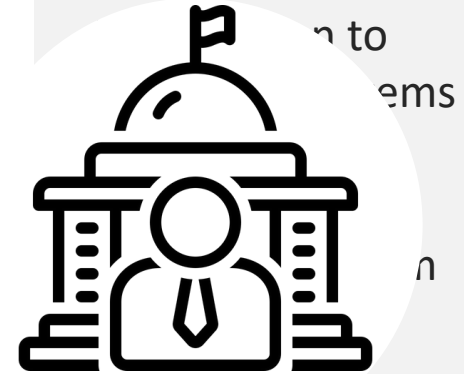
Solution: System Programs

- To make a human user and an application easily interact each other, there exists parts of operating systems running upon kernel called *system programs*

    - e.g., compiler, linker, loader, shell, service daemons

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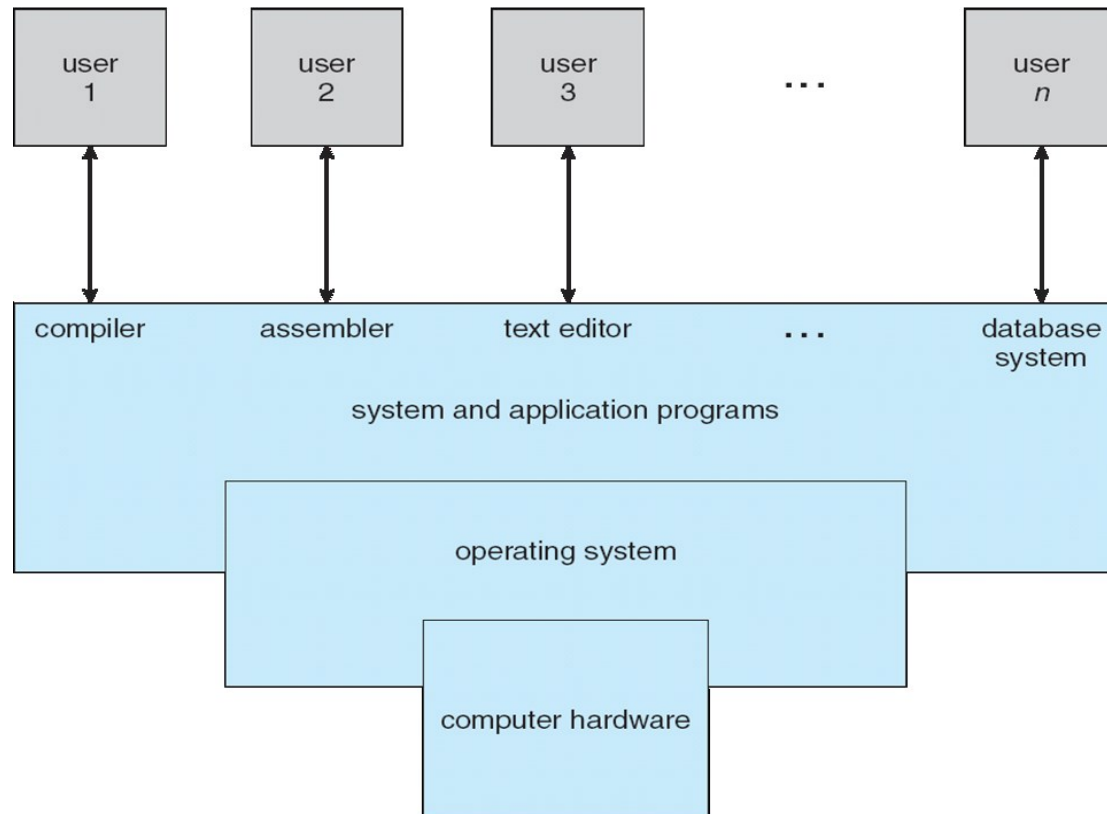
Solution: Abstraction

- Three models
  - Process
    - an abstract object representing a running instance of a program and all resources that it uses

  - Virtual memory
    - an abstraction of memory locations

  - File system
    - an abstract object for communication channel (streams)
      - to storage devices (i.e., perment memory)
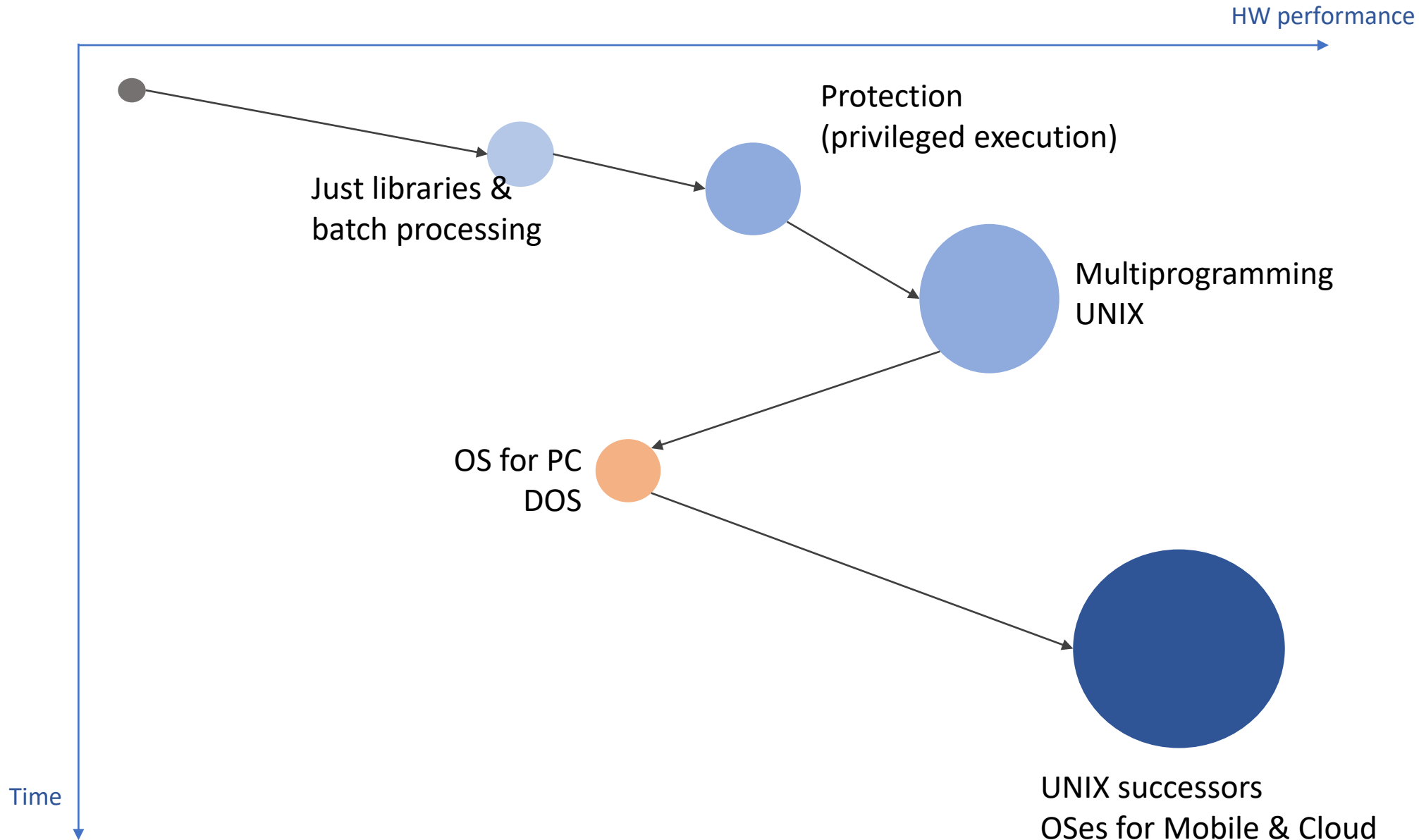   - to other programs
      - to other systems via network

Program Examples

- multi-processing
- multi-threading
- virtual memory
- file system operation

Quick History of Operating System

HW performance

Just libraries &
batch processing

Protection
(privileged execution)

Multiprogramming
UNIX

OS for PC
DOS

UNIX successors
OSes for Mobile & Cloud

Time

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