BUCKNELL UNIVERSITY
Computer Science

CSCI 315 Operating Systems Design

Operating System Structures
&
Processes

Notice: The slides for this lecture have been largely based on those accompanying the textbook *Operating Systems Concepts with Java*, by Silberschatz, Galvin, and Gagne (2003). Many, if not all, the illustrations contained in this presentation come from this source.

Operating System Design Goals

- User goals – operating system should be convenient to use, easy to learn, reliable, secure, and fast.
- System goals – operating system should have a simple design, be easy to implement, and maintain, as well as be flexible, reliable, error-free, and efficient.

System Implementation

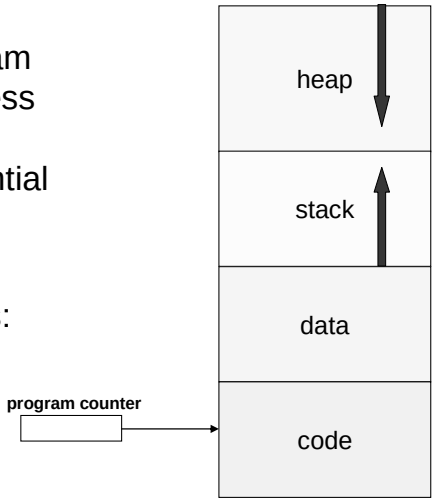
- Traditionally written in assembly language, operating systems can now be written in higher-level languages.
- Code written in a high-level language:
  - Can be written faster,
  - Is more compact, and
  - Is easier to understand and debug.
- An operating system is far easier to *port* (move to some other hardware) if it is written in a high-level language.

Chapter 3

Processes

Process Concept

- Process – a program in execution; process execution must progress in sequential fashion.
- A process includes:
  - program counter,
  - stack,
  - data section.

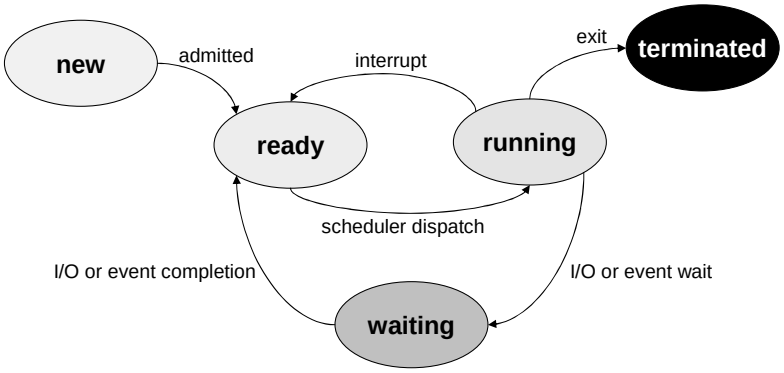


Process State

As a process executes, it changes ***state***:

- **new**: The process is being created.
- **running**: Instructions are being executed.
- **waiting**: The process is waiting for some event to occur.
- **ready**: The process is waiting to be assigned to a processor.
- **terminated**: The process has finished execution.

Process State Transition Diagram

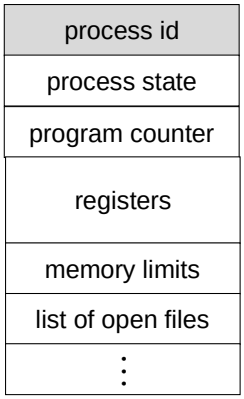


Process Control Block (PCB)

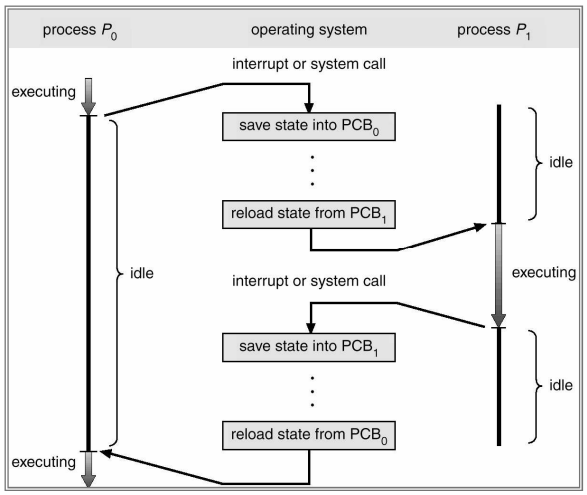
OS bookkeeping information associated with each process:

- Process state,
- Program counter,
- CPU registers,
- CPU scheduling information,
- Memory-management information,
- Accounting information,
- I/O status information,

⋮



CPU Switching

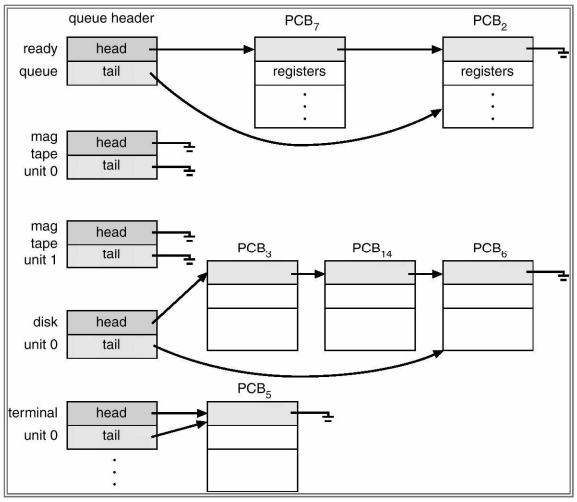


Process Scheduling Queues

- ***Job queue*** – set of all processes in the system.
- ***Ready queue*** – set of all processes residing in main memory, ready and waiting to execute.
- ***Device queues*** – set of processes waiting for an I/O device.

Processes migrate between the various queues.

Processes and OS Queues



Process Scheduling