CS 343 - Operating Systems

Module-2A

Introduction to Process Concept & Process States

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Session Outline

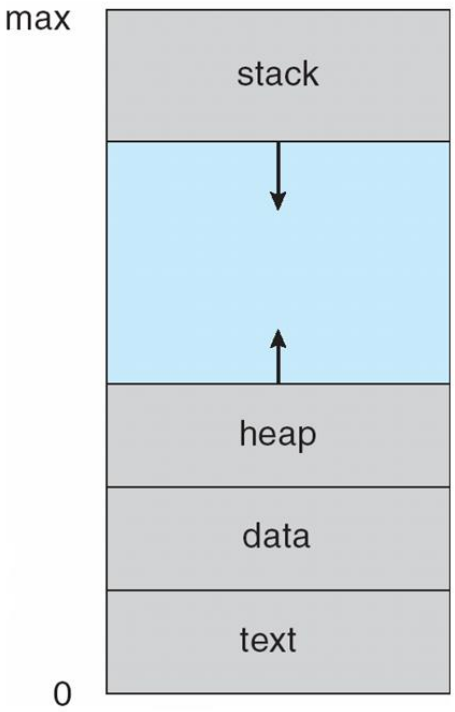
- Process Concept
- Process State Diagram
- Process Control Block
- Context Switching between Processes
- Process Scheduling
- Long Term Vs Short Term Scheduler

Process Concept

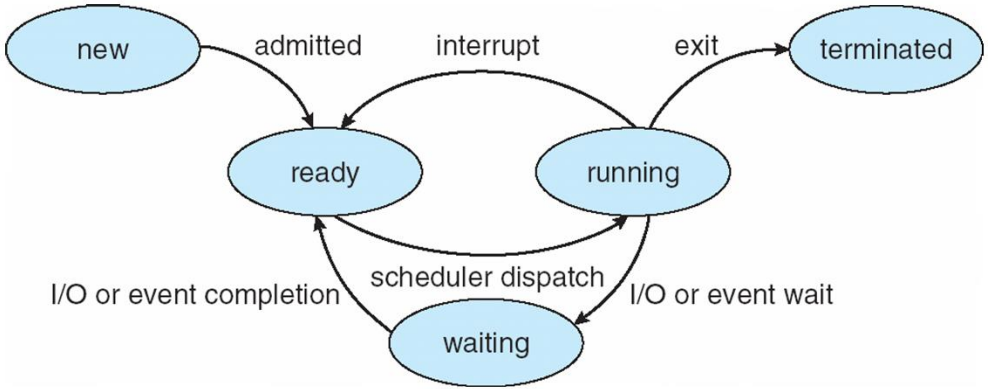
- A process is a program in execution
- It is a unit of work within the system
- Program is a passive entity, process is an active entity
- Process needs resources to accomplish its task
- These resources include CPU, memory, I/O, files, etc.
- Program becomes process when executable file loaded into memory
- Program execution is initiated by GUI mouse clicks / command line entry

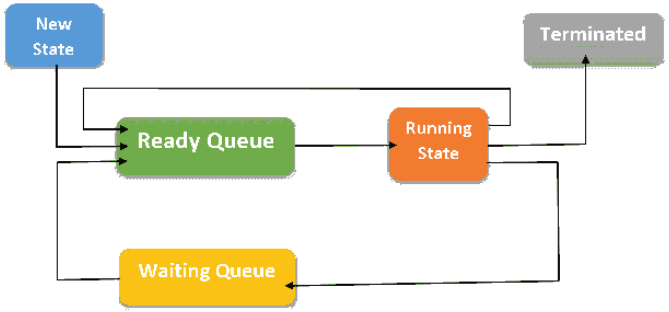
Process Concept

- One program can have several processes
- **Process** has multiple parts
  - The program code, also called **text section**
  - Current activity - **program counter**, registers
  - **Stack** containing temporary data like function parameters, return addresses, local variables
  - **Data section** containing global variables
  - **Heap** -dynamically allocated memory during run time



Process State Diagram

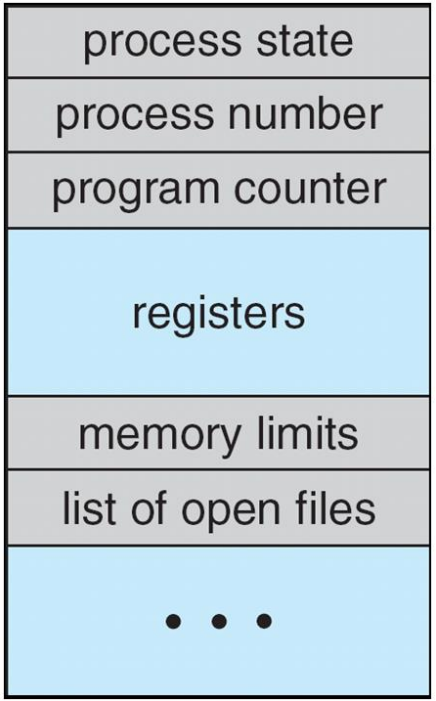




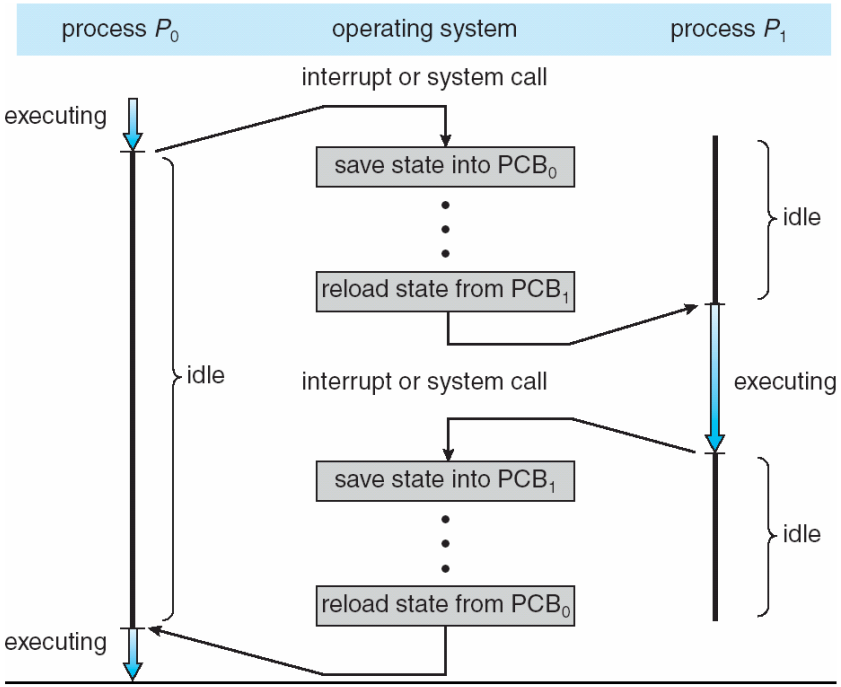
- **new**: The process is being created
- **running**: Instructions are being executed
- **waiting**: The process is waiting for some event to occur
- **ready**: The process is waiting to processor assignment.
- **terminated**: The process has finished execution

Process Control Block (PCB)

- Process state – running, waiting, etc
- Program counter – location of instruction to next execute
- CPU registers – contents of all process-centric registers
- CPU scheduling information- priorities, scheduling queue pointers
- Memory-management information – memory allocated to the process
- Accounting information – CPU used, clock time elapsed since start, time limits
- I/O status information – I/O devices allocated to process, list of open files



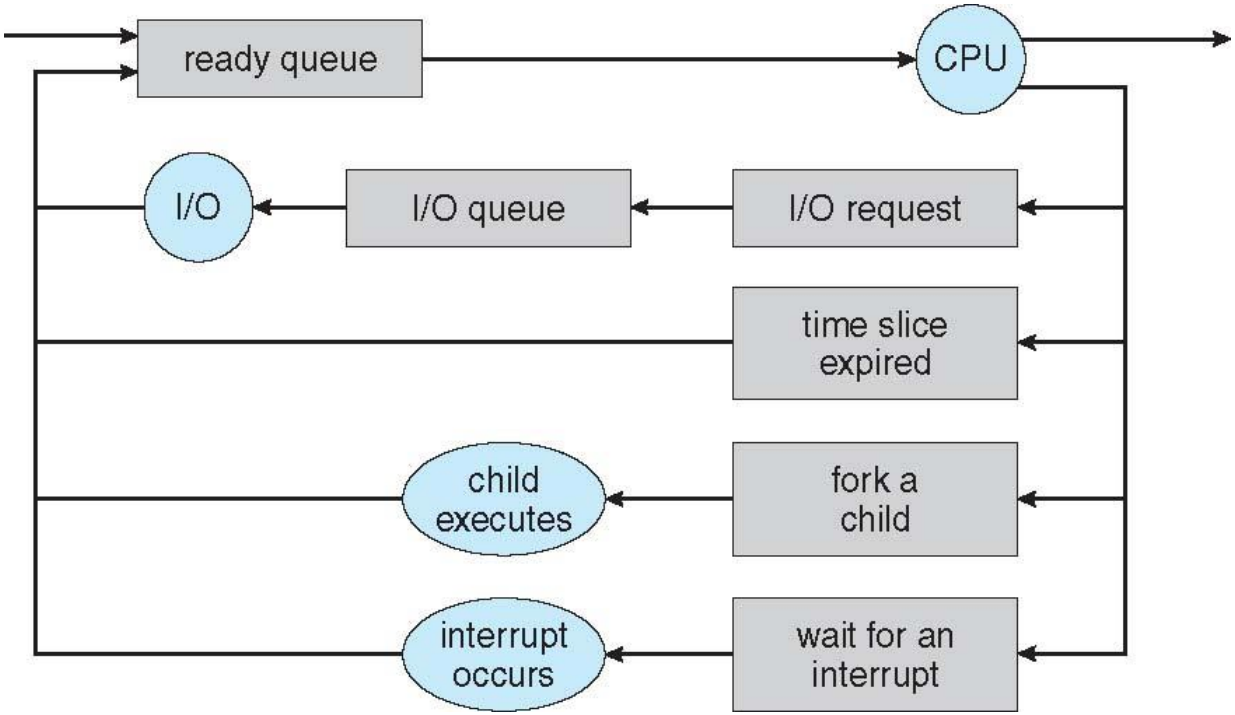
Context Switch From One Process to Another



Process Scheduling

- Maximize CPU use, quickly switch processes onto CPU for time sharing
- **Process scheduler** selects among available processes for next execution on CPU
- Maintains **scheduling queues** of processes
  - **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 among the various queues

Representation of Process Scheduling



Schedulers

- **Short-term scheduler (CPU scheduler)** – selects which process should be assigned to CPU for execution
  - Short-term scheduler is invoked frequently
- **Long-term scheduler (Job scheduler)** – selects which processes should be brought into the ready queue (RAM)
  - Long-term scheduler is invoked less frequently
  - It controls the **degree of multiprogramming**
  - **I/O-bound process** – spends more time doing I/O than computations, many short CPU bursts
  - **CPU-bound process** – spends more time doing computations; few very long CPU bursts
  - Long-term scheduler strives for good ***process mix***

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