



Process Management

presented by

C.Namrata Mahender



Process Management

- **Process - fundamental concept in OS**
 - **Process is a program in execution.**
 - **Process needs resources - CPU time, memory, files/data and I/O devices.**
- **OS is responsible for the following process management activities.**
 - **Process creation and deletion**
 - **Process suspension and resumption**
 - **Process synchronization and interprocess communication**
 - **Process interactions - deadlock detection, avoidance and correction**



- Program - static entity
- Process - active entity
 - **a program in execution ,process execution must progress in sequential fashion.**
- A process includes:
 - **program counter**
 - **stack**
 - **data section**



Process State

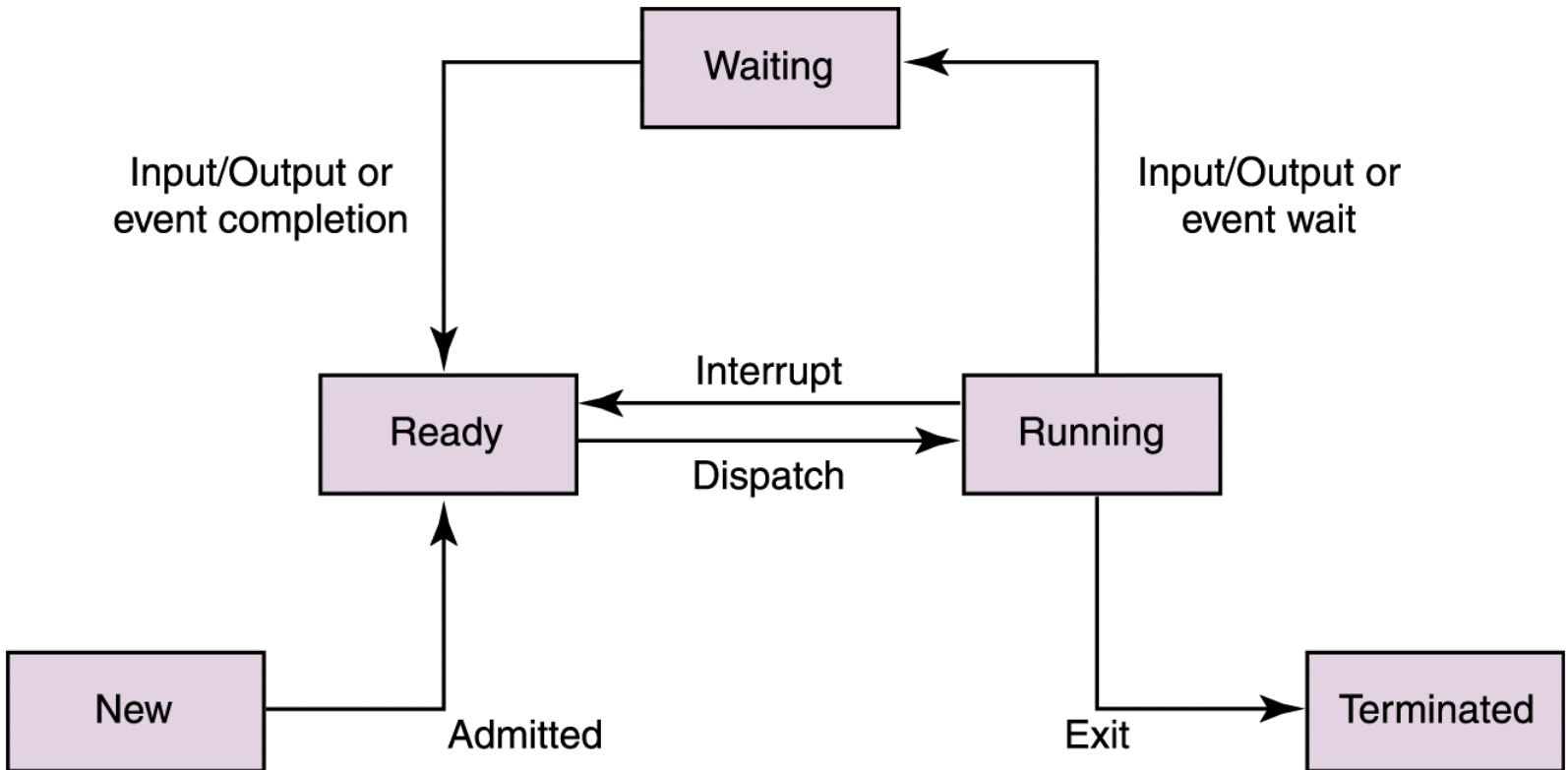


Fig 3.1 Process Life cycle



Process State

- **New** - The process is being created.
- **Running** - Instructions are being executed.
- **Waiting** - Waiting for some event to occur.
- **Ready** - Waiting to be assigned to a processor.
- **Terminated** - Process has finished execution



Process Control Block

OS represents each process by this information:

- Process state (new, running, waiting, ready)
- Program counter (address of next instruction)
- CPU registers (accumulator, index, stack ptr, flags)
- CPU scheduling info (priority, position in queue)
- Memory-management info (base, limit reg, page table)
- Accounting info (CPU time, real time, limits, etc)
- I/O status info (I/O devices needed, open files, etc)



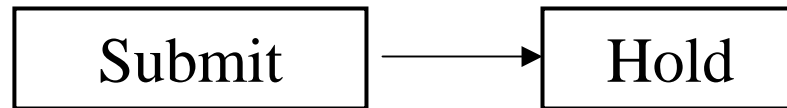
Process Control Block

pointer	process state
process number	
program counter	
registers	
memory limits	
list of open files	
⋮	

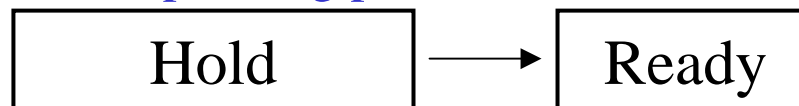


State Model

- Spooler : Place all submitted jobs into a form for processing by the job scheduler



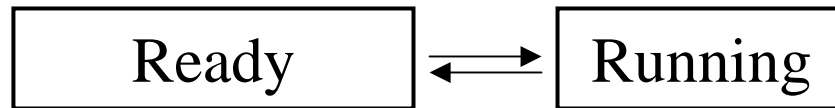
- Job Scheduler: a. Keep track of all jobs in the system
b. select a job to run and create corresponding process





State Model

- Process Scheduling: Select a process to run and allocate a processor



- Traffic controller:
 - Keep track of all processes
 - Provide the mechanism for changing process states
 - Coordinate interprocess synchronization and communication



Process Scheduling Queues

Scheduling: refers to the set of policies and mechanism built into the OS that governs the ordered in which the work to be done by the computer system is completed

- Job Queue - set of all processes in the system
- Ready Queue - set of all processes residing in main memory, ready and waiting to execute.



Process Scheduling Queues(cont..)

- Device Queues - set of processes waiting for an I/O device.
- Process migration between the various queues.
- Queue Structures - typically linked list, circular list etc.



Schedulers

A process migrates between various scheduling queues throughout its lifetime. The process of selecting processes from these queues is carried out by a *scheduler*



Schedulers

- **Long-term scheduler (or job scheduler)**
 - selects which processes should be brought into the ready queue.
 - invoked very infrequently (seconds, minutes); may be slow.
 - controls the degree of multiprogramming
- **Short term scheduler (or CPU scheduler)**
 - selects which process should execute next and allocates CPU.
 - invoked very frequently (milliseconds) - must be very fast
- **Medium Term Scheduler**
 - swaps out process temporarily
 - balances load for better throughput



Process Profiles

- I/O bound process -
 - spends more time in I/O, short CPU bursts, CPU underutilized.
- CPU bound process -
 - spends more time doing computations; few very long CPU bursts, I/O underutilized.
- The right job mix:
 - Long term scheduler - admits jobs to keep load balanced between I/O and CPU bound processes



Context Switch

- Task that switches CPU from one process to another process
 - the CPU must save the PCB state of the old process and load the saved PCB state of the new process.
- Context-switch time is overhead;
 - system does no useful work while switching
 - can become a bottleneck

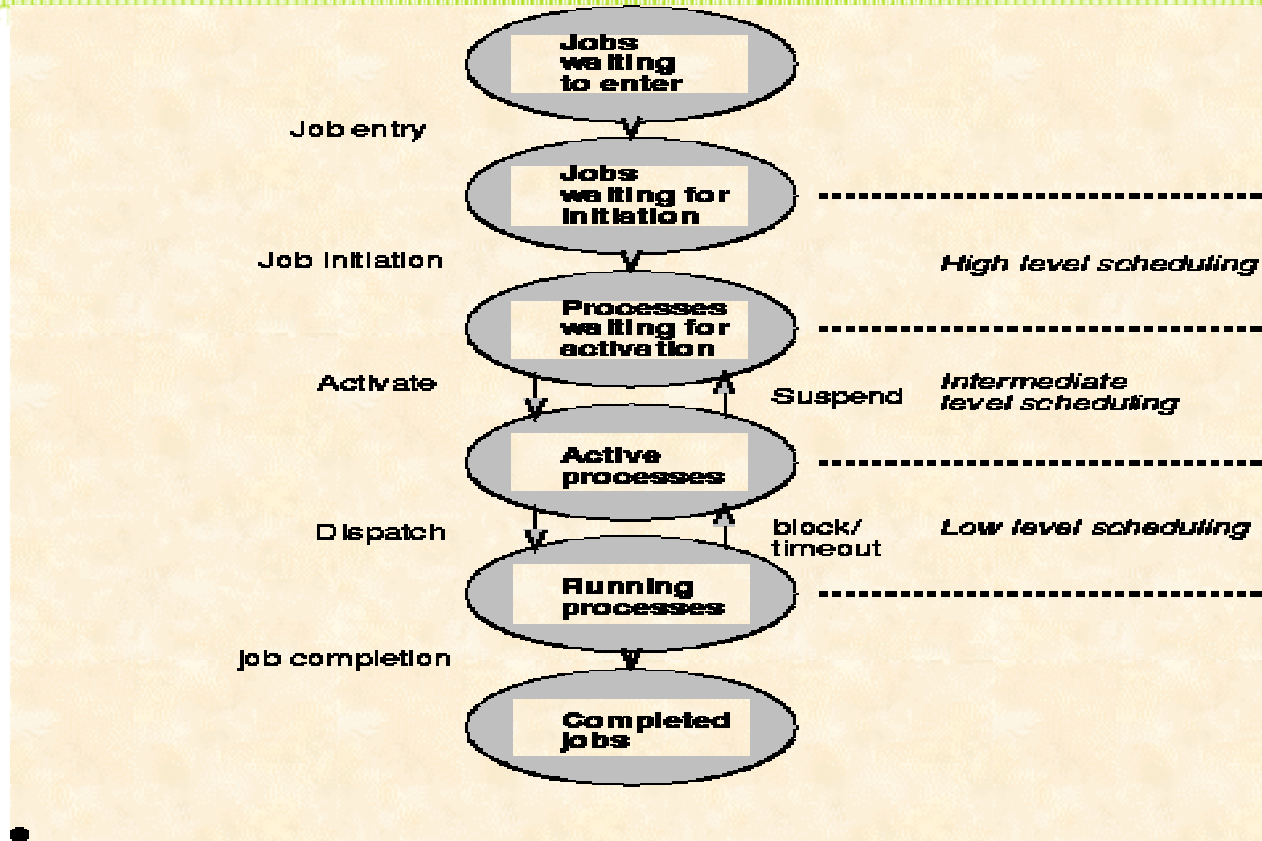


Levels of Scheduling

- High Level Scheduling or Job Scheduling
 - **Selects jobs allowed to compete for CPU and other system resources.**
- Intermediate Level Scheduling or Medium Term Scheduling
 - **Selects which jobs to temporarily suspend/resume to smooth fluctuations in system load.**
- Low Level (CPU) Scheduling or Dispatching
 - **Selects the ready process that will be assigned the CPU.**
 - **Ready Queue contains PCBs of processes.**



Levels of Scheduling





Dispatcher

- Dispatcher module gives control of the CPU to the process selected by the short-term scheduler. This involves:
 - **switching context**
 - **switching to user mode**
 - **jumping to the proper location in the user program to restart that program**
- **Dispatch Latency:**
 - **time it takes for the dispatcher to stop one process and start another running.**
 - **Dispatcher must be fast**



Scheduling Criteria

- CPU Utilization
 - Keep the CPU and other resources as busy as possible
- Throughput
 - Number of processes that complete their execution per time unit.
- Turnaround time
 - amount of time to execute a particular process from its entry time.



Scheduling Criteria(cont..)

- **Waiting time**
 - amount of time a process has been waiting in the ready queue.
- **Response Time (in a time-sharing environment)**
 - amount of time it takes from when a request was submitted until the first response is produced, NOT output.



Thank you