Processes

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

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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

- **new** → **admitted** → **ready** → **running** → **scheduler dispatch** → **waiting** → **I/O or event completion** → **ready**

- **running** → **scheduler dispatch** → **waiting** → **I/O or event completion** → **ready**

- **ready** → **interrupt** → **terminated**

- **terminated** → **exit** → **new**
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,
  - ...

<table>
<thead>
<tr>
<th>process id</th>
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<tbody>
<tr>
<td>process state</td>
</tr>
<tr>
<td>program counter</td>
</tr>
<tr>
<td>registers</td>
</tr>
<tr>
<td>memory limits</td>
</tr>
<tr>
<td>list of open files</td>
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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

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