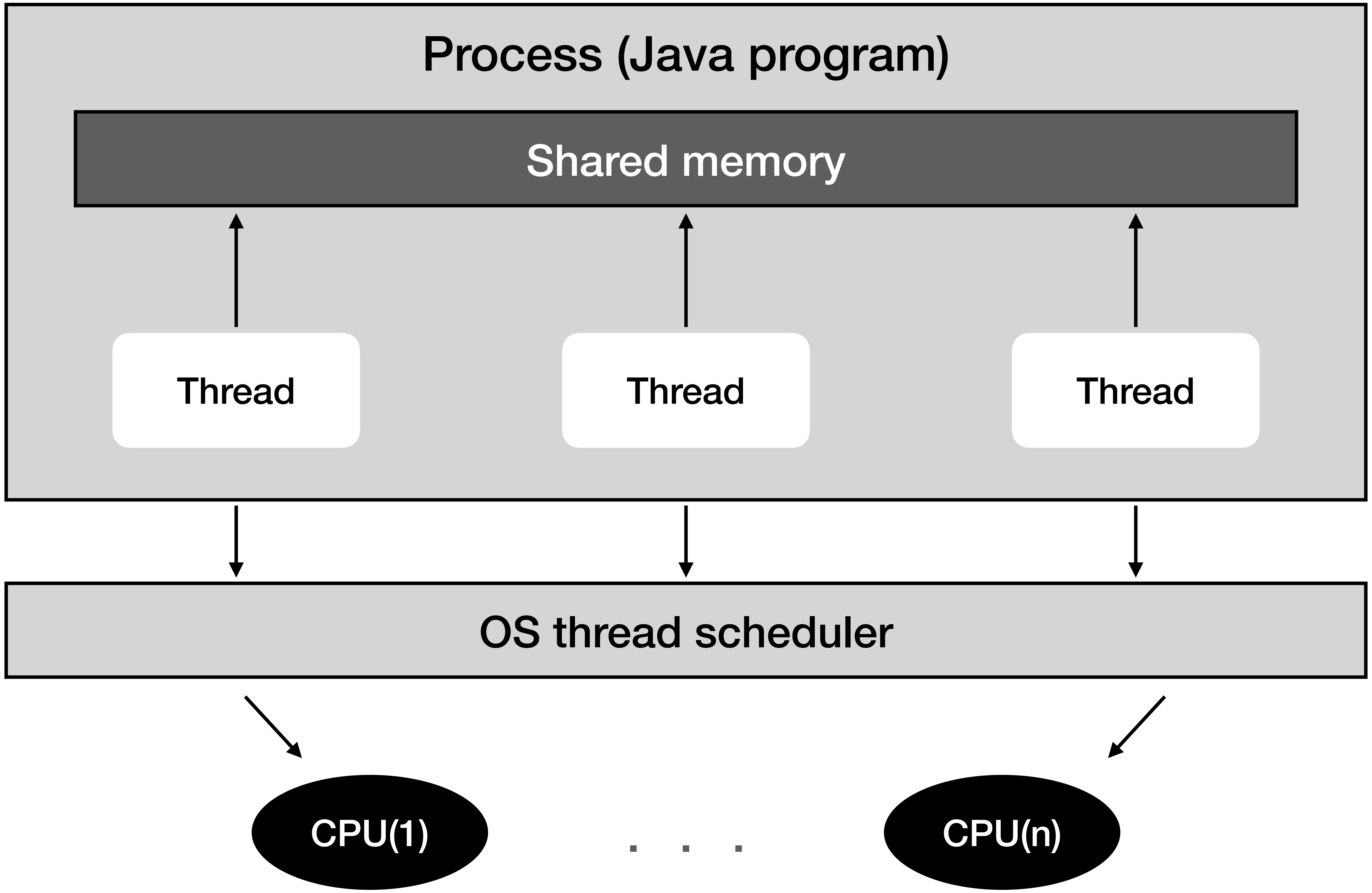
Concurrency

Thread Concurrency

Basic Terminology

- ***thread*** - smallest unit of execution that can be scheduled by the OS
- ***process*** - group of associated threads that execute in the same shared env
  - *single-threaded process* (only one thread)
  - *multi-threaded process* (more than one threads)
- ***shared environment*** - threads in same process share the same memory space
  - these threads can communicate directly with one another


Process (Java program)
Shared memory
Thread
Thread
Thread
OS thread scheduler
CPU(1)
. . .
CPU(n)

Basic Terminology (cont'd)

- ***task*** - single unit of work performed by the thread
  - usually implemented as a lambda expression in Java
  - thread can complete multiple independent tasks, but only one at a time
- ***shared memory***
  - static variables, plus instance and local variables passed to a thread
  - (remember, static variables are shared among all instances of a class)
  - if one thread updates the value of static member, this information becomes immediately available for other threads within the process

Thread Concurrency

- property of executing multiple threads and processes at the same time
- number of threads can exceed number of available CPU's
    - in that case OS uses ***thread scheduler*** to determine which threads should be currently executing
- ***content switch*** occurs then thread's alloted time is complete, but the thread has not finished processing
    - it's a process of storing thread's current state and later restoring the state
    - good thread scheduler minimizes the number of context switching
- ***thread priority*** is a numeric value associated with a thread
    - used by thread scheduler to determine which thread should be executing

Thread's Life Cycle

- after a thread is created it exists in one of six states:

  NEW - created but not started

  RUNNABLE - running or able to be run

  TERMINATED - task completed

  BLOCKED - waiting to enter synchronized block

  WAITING - waiting indefinitely until notified

  TIMED_WAITING - waiting a specified time