Threads : Java

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What is a Thread?

- **facility to allow multiple activities to coexist within a single process.**
- **Represents a separate path of execution of a group of statements**
- Java is the first language to include threading within the language, rather than treating it as a facility of the OS

➢ **Video Game example**

1. one thread for graphics
2. one thread for user interaction
3. one thread for networking

➢ **Server Example**

1. Do various jobs
2. Handle Several Clients

Main Thread

- Default Thread in any Java Program
- JVM uses to execute program statements
- **Program To Find the Main Thread**

```
Class Current
{
   public static void main(String args[])
   {
      Thread t=Thread.currentThread();
      System.out.println("Current Thread: "+t);
      System.out.println("Name is:
      "+t.getName());
```

Output:

```
C:\> javac Current.java
C:\>java Current
Current Thread: Thread[main,5,main]
Name is: main
```

Threads in Java

Creating threads in Java:

- Extend java.lang.Thread class
  - run() method must be overridden (similar to main method of sequential program)
  - run() is called when execution of the thread begins
  - A thread terminates when run() returns
  - start() method invokes run()

OR

- Implement java.lang.Runnable interface

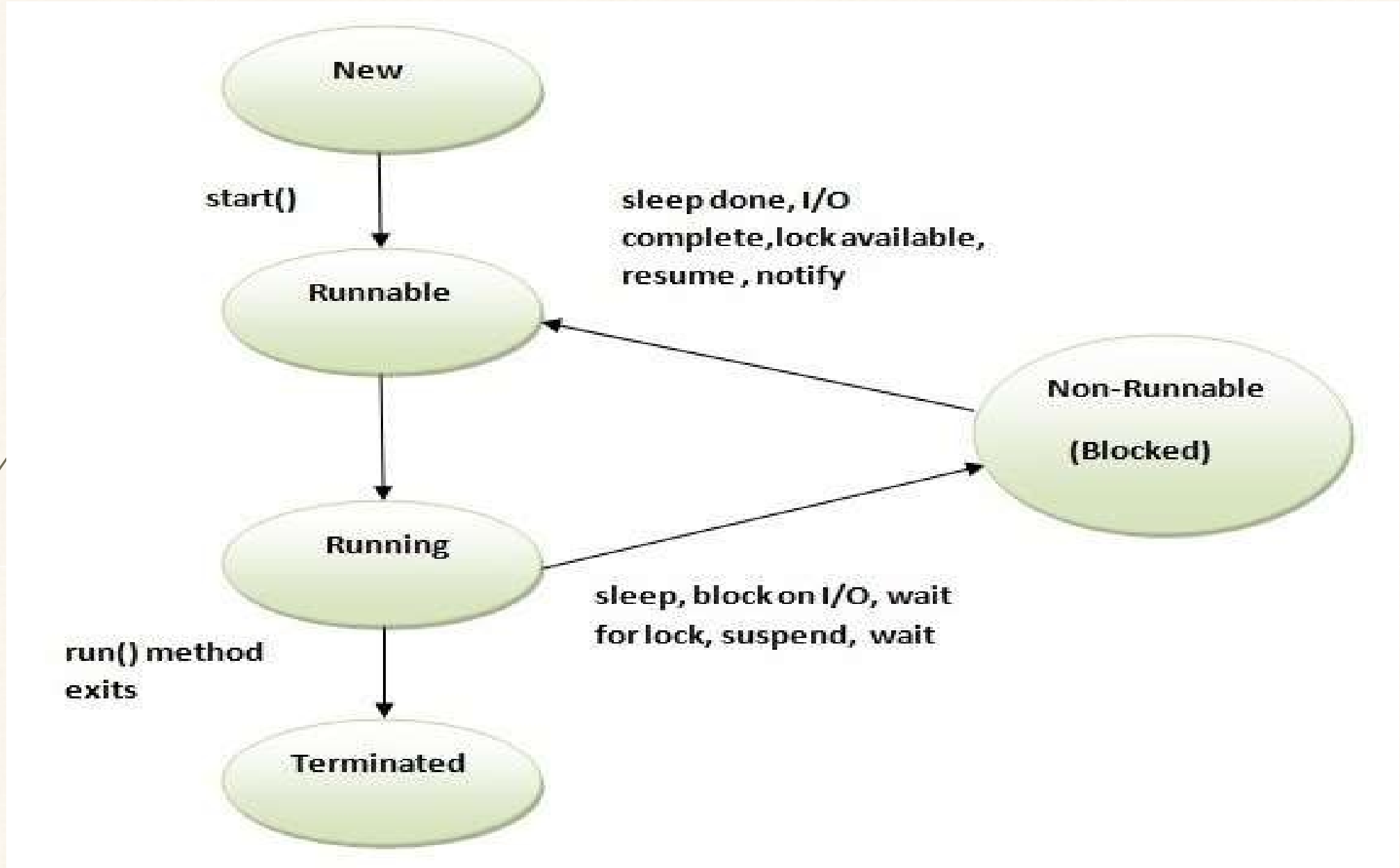
Thread class:

Thread class:

Thread class provide constructors and methods to create and perform operations on a thread.Thread class extends Object class and implements Runnable interface.Commonly used Constructors of Thread class:

Thread()
Thread(String name)
Thread(Runnable r)
Thread(Runnable r,String name)

Life cycle of a Thread



- **New**

  The thread is in new state if you create an instance of Thread class but before the invocation of start() method.

- **Runnable**

  The thread is in runnable state after invocation of start() method, but the thread scheduler has not selected it to be the running thread.

- **Running**

  The thread is in running state if the thread scheduler has selected it.

- **Non-Runnable (Blocked)**

  This is the state when the thread is still alive, but is currently not eligible to run.

- **Terminated**

  A thread is in terminated or dead state when its run() method exits.

Thread Priority

- Each thread is assigned a default priority of Thread.NORM_PRIORITY (constant of 5).
- You can reset the priority using setPriority(int priority).
- Some constants for priorities include:
  - Thread.MIN_PRIORITY
  - Thread.MAX_PRIORITY
  - Thread.NORM_PRIORITY
- By default, a thread has the priority level of the thread that created it.

❖ Thread Synchronization

A shared resource may be corrupted if it is accessed simultaneously by multiple threads.

Example: two unsynchronized threads accessing the same bank account may cause conflict.

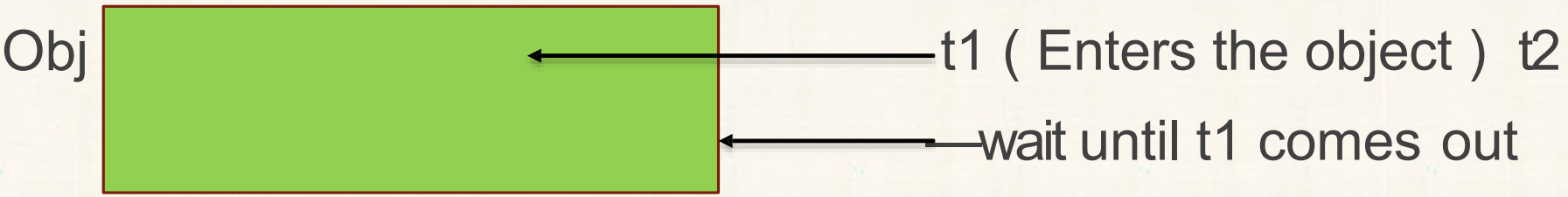
- Known as a *race condition* in multithreaded programs.

❑ A *thread-safe* class does not cause a race condition in the presence of multiple threads.

Synchronized

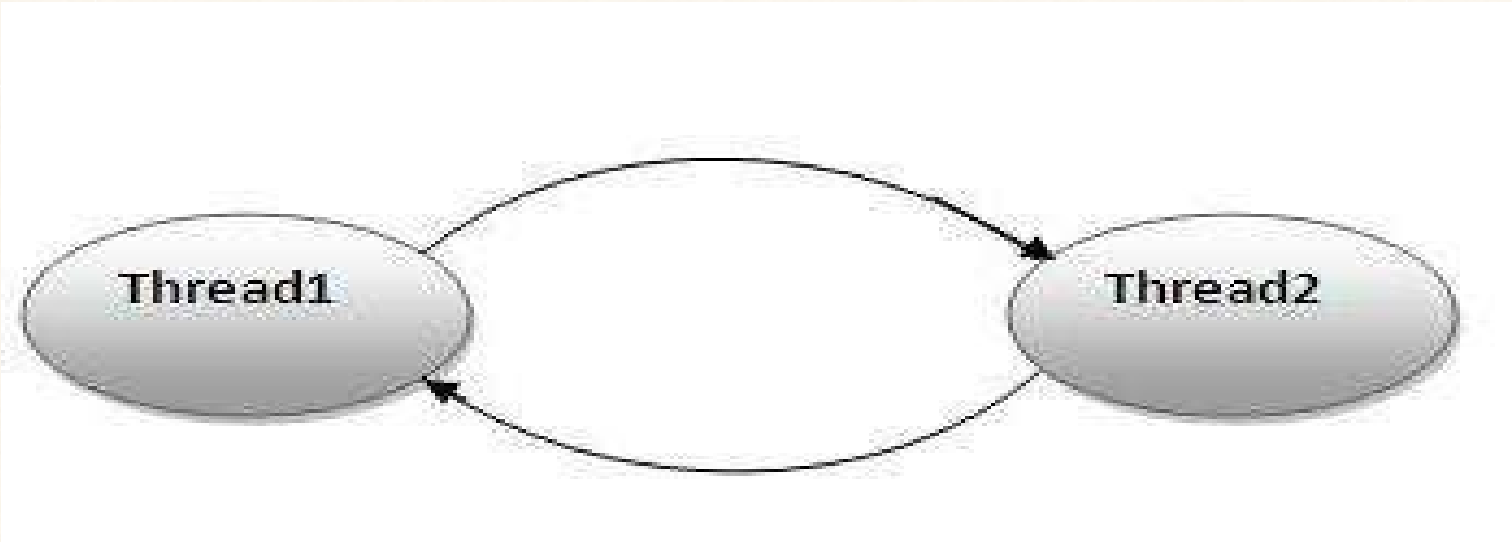
- **Problem** : race conditions
- **Solution** : give exclusive access to one thread at a time to code that manipulates a shared object.
- Synchronization keeps other threads waiting until the object is available.
- The synchronized keyword synchronizes the method so that only one thread can access the method at a time.

```
public synchronized void xMethod() {
   // method body
}
```



Deadlock :

- a part of multithreading
- can occur when a thread is waiting for an object lock, that is acquired by another thread and second thread is waiting for an object lock that is acquired by first thread
- Since, both threads are waiting for each other to release the lock, the condition is called deadlock



Preventing Deadlock

- Deadlock can be easily avoided by resource ordering.
- With this technique, assign an order on all the objects whose locks must be acquired and ensure that the locks are acquired in that order.
- Example:

Thread 1:

lock A lock B

Thread 2:

wait for A lock C(when A is locked)

Thread 3:

wait for A wait for B wait for C

Advantages of Threads:

- easier to program
- provide better performance
- allow any program to perform multiple tasks at once.
- multiple threads can share resources
- an Internet-aware language such as Java, this is a very important tool

Thank You !!!