

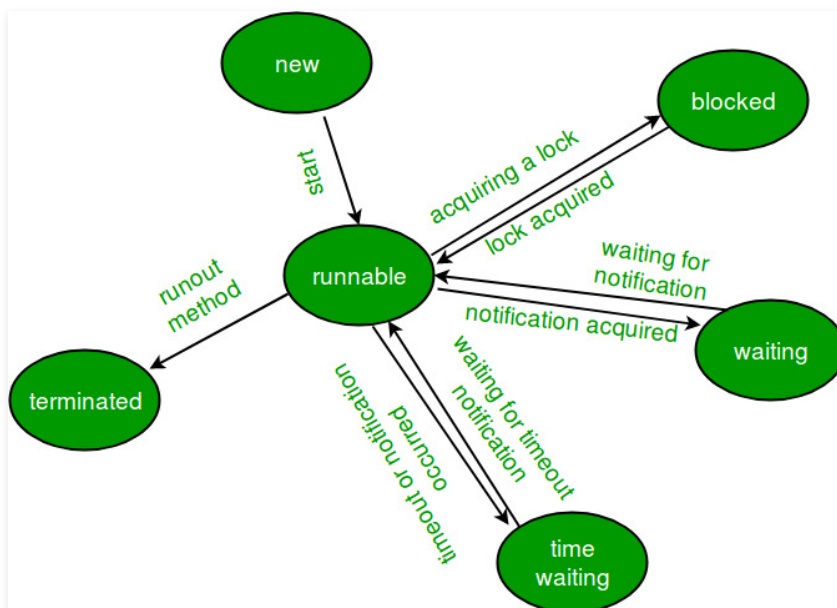
Lifecycle and States of a Thread in Java

Difficulty Level : Medium Last Updated : 03 Jan, 2022

A thread in Java at any point of time exists in any one of the following states. A thread lies only in one of the shown states at any instant:

1. New
2. Runnable
3. Blocked
4. Waiting
5. Timed Waiting
6. Terminated

The diagram shown below represents various states of a thread at any instant in time.



Life Cycle of a thread

1. **New Thread:** When a new thread is created, it is in the new state. The thread has not yet started to run when the thread is in this state. When a thread lies in the new state, its code is yet to be run and hasn't started to execute.
2. **Runnable State:** A thread that is ready to run is moved to a runnable state. In this state, a thread might actually be running or it might be ready to run at any instant of time. It is the responsibility of the thread scheduler to give the thread, time to run. A multi-threaded program allocates a fixed amount of time to each individual thread. Each and every thread runs for a short while and then pauses and relinquishes the CPU to another thread so that other threads can get a chance to run. When this

happens, all such threads that are ready to run, waiting for the CPU and the currently running thread lie in a runnable state.

3. **Blocked/Waiting state:** When a thread is temporarily inactive, then it's in one of the following states:
 - Blocked
 - Waiting
4. **Timed Waiting:** A thread lies in a timed waiting state when it calls a method with a time-out parameter. A thread lies in this state until the timeout is completed or until a notification is received. For example, when a thread calls sleep or a conditional wait, it is moved to a timed waiting state.
5. **Terminated State:** A thread terminates because of either of the following reasons:
 - Because it exists normally. This happens when the code of the thread has been entirely executed by the program.
 - Because there occurred some unusual erroneous event, like segmentation fault or an unhandled exception.

Implementing the Thread States in Java

In Java, to get the current state of the thread, use **Thread.getState()** method to get the current state of the thread. Java provides **java.lang.Thread.State** class that defines the ENUM constants for the state of a thread, as a summary of which is given below:

1. New

Declaration: `public static final Thread.State NEW`

Description: Thread state for a thread that has not yet started.

2. Runnable

Declaration: `public static final Thread.State RUNNABLE`

Description: Thread state for a runnable thread. A thread in the runnable state is executing in the Java virtual machine but it may be waiting for other resources from the operating system such as a processor.

3. Blocked

Declaration: `public static final Thread.State BLOCKED`

Description: Thread state for a thread blocked waiting for a monitor lock. A thread in the blocked state is waiting for a monitor lock to enter a synchronized block/method or reenter a synchronized block/method after calling `Object.wait()`.

4. Waiting

Declaration: `public static final Thread.State WAITING`

Description: Thread state for a waiting thread. Thread state for a waiting thread. A thread is in the waiting state due to calling one of the following methods:

- `Object.wait` with no timeout
- `Thread.join` with no timeout
- `LockSupport.park`

5. Timed Waiting

Declaration: `public static final Thread.State TIMED_WAITING`

Description: Thread state for a waiting thread with a specified waiting time. A thread is in the timed waiting state due to calling one of the following methods with a specified positive waiting time:

- `Thread.sleep`
- `Object.wait` with timeout
- `Thread.join` with timeout
- `LockSupport.parkNanos`
- `LockSupport.parkUntil`

6. Terminated

Declaration: `public static final Thread.State TERMINATED`

Description: Thread state for a terminated thread. The thread has completed execution.

```
// Java program to demonstrate thread states
class thread implements Runnable {
    public void run()
    {
        // moving thread2 to timed waiting state
    }
}
```

```

        try {
            Thread.sleep(1500);
        }
        catch (InterruptedException e) {
            e.printStackTrace();
        }

        System.out.println(
            "State of thread1 while it called join() method on thread2 - "
            + Test.thread1.getState());
        try {
            Thread.sleep(200);
        }
        catch (InterruptedException e) {
            e.printStackTrace();
        }
    }
}

public class Test implements Runnable {
    public static Thread thread1;
    public static Test obj;

    public static void main(String[] args)
    {
        obj = new Test();
        thread1 = new Thread(obj);

        // thread1 created and is currently in the NEW
        // state.
        System.out.println(
            "State of thread1 after creating it - "
            + thread1.getState());
        thread1.start();

        // thread1 moved to Runnable state
        System.out.println(
            "State of thread1 after calling .start() method on it - "
            + thread1.getState());
    }

    public void run()
    {
        Thread myThread = new Thread();
        Thread thread2 = new Thread(myThread);

        // thread1 created and is currently in the NEW
        // state.
        System.out.println(
            "State of thread2 after creating it - "
            + thread2.getState());
        thread2.start();

        // thread2 moved to Runnable state
        System.out.println(
            "State of thread2 after calling .start() method on it - "

```

```
+ thread2.getState());

// moving thread1 to timed waiting state
try {
    // moving thread1 to timed waiting state
    Thread.sleep(200);
}
catch (InterruptedException e) {
    e.printStackTrace();
}
System.out.println(
    "State of thread2 after calling .sleep() method on it - "
    + thread2.getState());

try {
    // waiting for thread2 to die
    thread2.join();
}
catch (InterruptedException e) {
    e.printStackTrace();
}
System.out.println(
    "State of thread2 when it has finished it's execution - "
    + thread2.getState());
}
}
```

Output

```
State of thread1 after creating it - NEW
State of thread1 after calling .start() method on it - RUNNABLE
State of thread2 after creating it - NEW
State of thread2 after calling .start() method on it - RUNNABLE
State of thread2 after calling .sleep() method on it - TIMED_WAITING
State of thread1 while it called join() method on thread2 -WAITING
State of thread2 when it has finished it's execution - TERMINATED
```

Explanation: When a new thread is created, the thread is in the NEW state. When the start() method is called on a thread, the thread scheduler moves it to Runnable state. Whenever the join() method is called on a thread instance, the current thread executing that statement will wait for this thread to move to the Terminated state. So, before the final statement is printed on the console, the program calls join() on thread2 making the thread1 wait while thread2 completes its execution and is moved to the Terminated state.

thread1 goes to Waiting state because it is waiting for thread2 to complete its execution as it has called join on thread2.

This article is contributed by **Mayank Kumar**. If you like GeeksforGeeks and would like to contribute, you can also write an article using [write.geeksforgeeks.org](https://www.geeksforgeeks.org/write-a-blog/) or mail your article to review-team@geeksforgeeks.org. See your article appearing on the GeeksforGeeks main page and help other Geeks.

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