

The Java Threading API

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run

public void run()

This method is run by the thread when it executes. Subclasses of Thread may override this method.

This method is not intended to be invoked directly. If this thread is a platform thread created with a `Runnable` task then invoking this method will invoke the task's `run` method. If this thread is a virtual thread then invoking this method directly does nothing.

Specified by:

`run` in interface `Runnable`

Implementation Requirements:

The default implementation executes the `Runnable` task that the `Thread` was created with. If the thread was created without a task then this method does nothing.

```
jshell> chapter1.OurClass oc = new chapter1.OurClass();
oc ==> chapter1.OurClass@421faab1
```

Object created, when Thread class is not extended.

Normal object

```
package chapter1;
public class OurClass{
    @Override
    public void run(){
        int i;
        for(i = 0; i < 100; i++){
            System.out.println("Hello");
        }
    }
}
```

```
package chapter1;
public class OurClass extends Thread{
    @Override
    public void run(){
        int i;
        for(i = 0; i < 100; i++){
            System.out.println("Hello");
        }
    }
}
```

javt.lang.Thread.

To start the thread we need to call `start()` method.

This method will be executed by newly created thread.
Developers should override this method with the code they want new thread

```

    for(i = 0; i < 100; i++){
        System.out.println("Hello");
    }
}

jshell> chapter1.OurClass oc = new chapter1.OurClass();
oc ==> Thread[#39,Thread-0,5,main]

```

Developers should override this method with the code they want new thread to run.

Thread ID
Thread name
Priority

Which thread main.

Threading using the Thread class

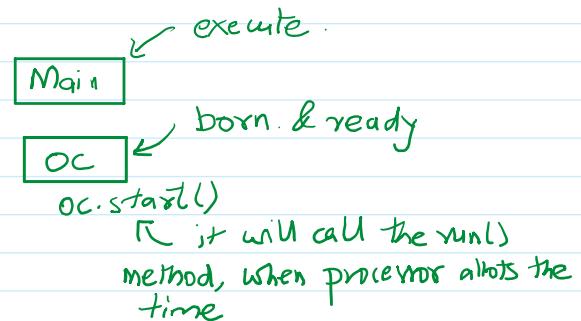
We consider threads as separate task that execute in parallel. These tasks are simply code executed by the thread, and this code is actually part of our program. The code may download an image from the server or may play audio file on the speakers or any other task. Because it is a code. It can be executed by our original thread. To introduce the parallelism we desire, we must create a new thread and arrange for the new thread to. execute the appropriate code.

```

package chapter1;
public class TestFirstThread {
    public static void main(String[] args) {
        OurClass oc = new OurClass();
        oc.start();
        for (int i = 0; i < 10; i++) {
            System.out.println("Main");
        }
    }
}

```

calls the run() method defined in this thread class.



run() vs main()

In essence, the run() method may be thought of as main() method of the newly formed thread. A new thread begins execution with a run() method in the same way a program begins execution with the main() method.

While the main() method receive its argument from argv parameter (which is typically set from the command line) The newly created thread must receive its arguments programmatically from the originating threads. Hence, parameters can be passed in via the constructor, the static instance variable, or any other technique designed by the developer.

sleep() methods:

public static void sleep(long milliseconds) throws InterruptedException: It puts the current executing thread to sleep for the specified number of milliseconds. This method is static and may be accessed through the thread class name.

public static void sleep(long milliseconds, int nanoseconds) throws InterruptedException: It puts the currently executing thread to sleep for a specified number of milliseconds and nanoseconds.

```

package chapter1;
public class FirstThread extends Thread{
    @Override
    public void run() {
        final int max = 10;
        for (int i = 0; i < max; i++) {
            System.out.println(i);
            try {
                Thread.sleep(1500);
            } catch (InterruptedException e) {
                e.printStackTrace();
            }
        }
    }
}

```

```

package chapter1;
public class FirstThreadTest {
    public static void main(String[] args) throws InterruptedException {
        FirstThread ft = new FirstThread();
        ft.start();
        for (int i = 0; i < 10; i++) {
            System.out.println("Main: " + i);
            Thread.sleep(1000);
        }
    }
}

```

Output:

```

0
Main: 0
Main: 1
1
Main: 2
2
Main: 3
Main: 4
3
Main: 5
4
Main: 6
Main: 7
5
Main: 8
6
Main: 9
7
8
9

```

Java supports single inheritance through classes.

public class className extends single class, implements multiple interfaces...

Thread using the Runnable interface

As simple as it to create another thread of control. There is one problem

with the technique we have outlined so far. It's caused by the fact that Java classes can inherit their behavior only from a single class, which means that inheritance itself can be considered a scarce resource and therefore expensive to the developer.

In our example, we are threading a simple loop so that it is not much of a concern, however. If we have a complete class structure that already has a detailed inheritance tree and want it to run its own thread, we cannot simply make this class structure inherit from the Thread class as we did before. One solution would be to create a new class that inherits from the thread and contains references to the instance of the class we need. This level of indirection is an annoyance.

The Java language deals with this lack of multiple inheritance by using the mechanism known as interfaces. This mechanism is supported by the Thread class and simply means that instead of inheriting from the Thread class, we can implement the Runnable interface(`java.lang.Runnable`) which is defined as follows:

An informative annotation type used to indicate that an interface type declaration is intended to be a *functional interface* as defined by the Java Language Specification. Conceptually, a functional interface has exactly one abstract method.

@FunctionalInterface

public interface Runnable

Represents an operation that does not return a result.

This is a functional interface whose functional method is run().

Since:

1.0

abstract method

The Runnable interface contains only one method, the run () method. The Thread class actually implements the Runnable interface. Hence when you inherit from Thread class, your sub class also implements the Runnable interface. However, in this case we want to implement the Runnable interface without actually inheriting from the Thread class. This is achieved by simply substituting the phrase "**implements Runnable**" for the phrase "**extends Threads**". No other changes are necessary in our thread creation process.

```
package chapter1;
public class FirstThread implements Runnable{
    @Override
    public void run() {
        final int max = 10;
        for (int i = 0; i < max; i++) {
            System.out.println(i);
            try {
                Thread.sleep(1500);
            } catch (InterruptedException e) {
                e.printStackTrace();
            }
        }
    }
}
```

```

package chapter1;
public class FirstThreadTest {
    public static void main(String[] args) throws InterruptedException {
        FirstThread ft = new FirstThread(); ← Object of user defined thread class.
        Thread t1 = new Thread(ft); ← Object of thread class is created, and we
        t1.start(); have passed the object of user-defined thread
        for (int i = 0; i < 10; i++) { class. To get access of start() method of
            System.out.println("Main: " + i); Thread class, which calls the run() method
            Thread.sleep(1000); of user-defined class.
        }
    }
}

```

Output:

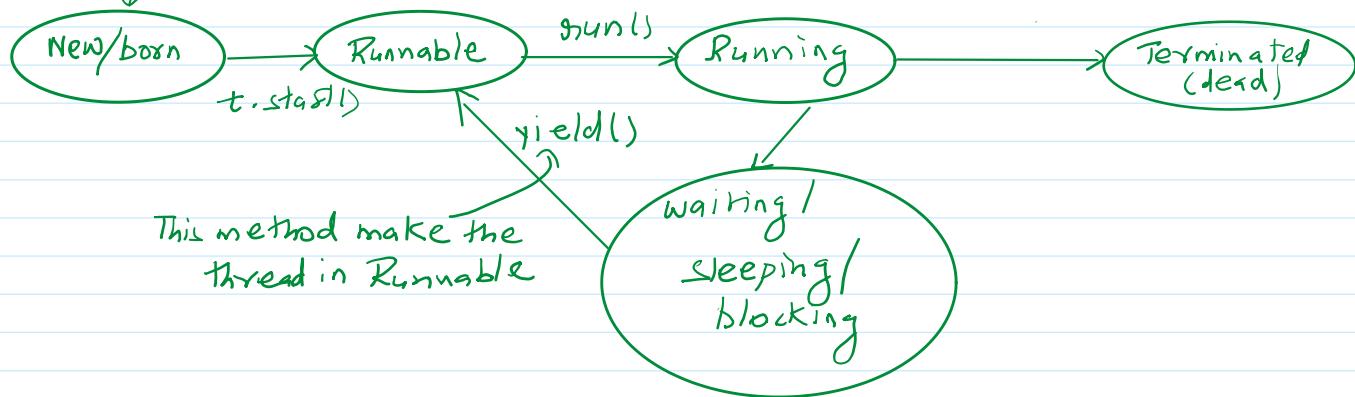
```

0
Main: 0
Main: 1
1
Main: 2
2
Main: 3
Main: 4
3
Main: 5
4
Main: 6
Main: 7
5
Main: 8
6
Main: 9
7
8
9

```

Life Cycle of a Thread in Java

Thread t = new Thread(ft);
 ↘ MyThread t = new MyThread();



A thread in Java goes through several states from creation to completion.

These states are defined in the Thread.State enum.

```
public static enum Thread.State  
extends Enum<Thread.State>
```

A thread state. A thread can be in one of the following states:

- NEW
A thread that has not yet started is in this state.
- RUNNABLE
A thread executing in the Java virtual machine is in this state.
- BLOCKED
A thread that is blocked waiting for a monitor lock is in this state.
- WAITING
A thread that is waiting indefinitely for another thread to perform a particular action is in this state.
- TIMED_WAITING
A thread that is waiting for another thread to perform an action for up to a specified waiting time is in this state.
- TERMINATED
A thread that has exited is in this state.

A thread can be in only one state at a given point in time. These states are virtual machine states which do not reflect any operating system thread states.

Since:

1.5