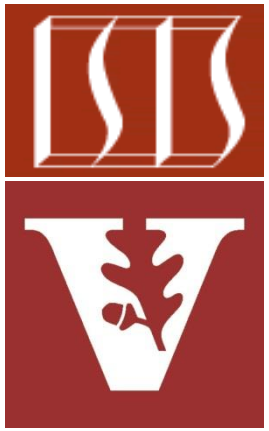
Managing the Java Thread Lifecycle: Overview of Stopping a Java Thread

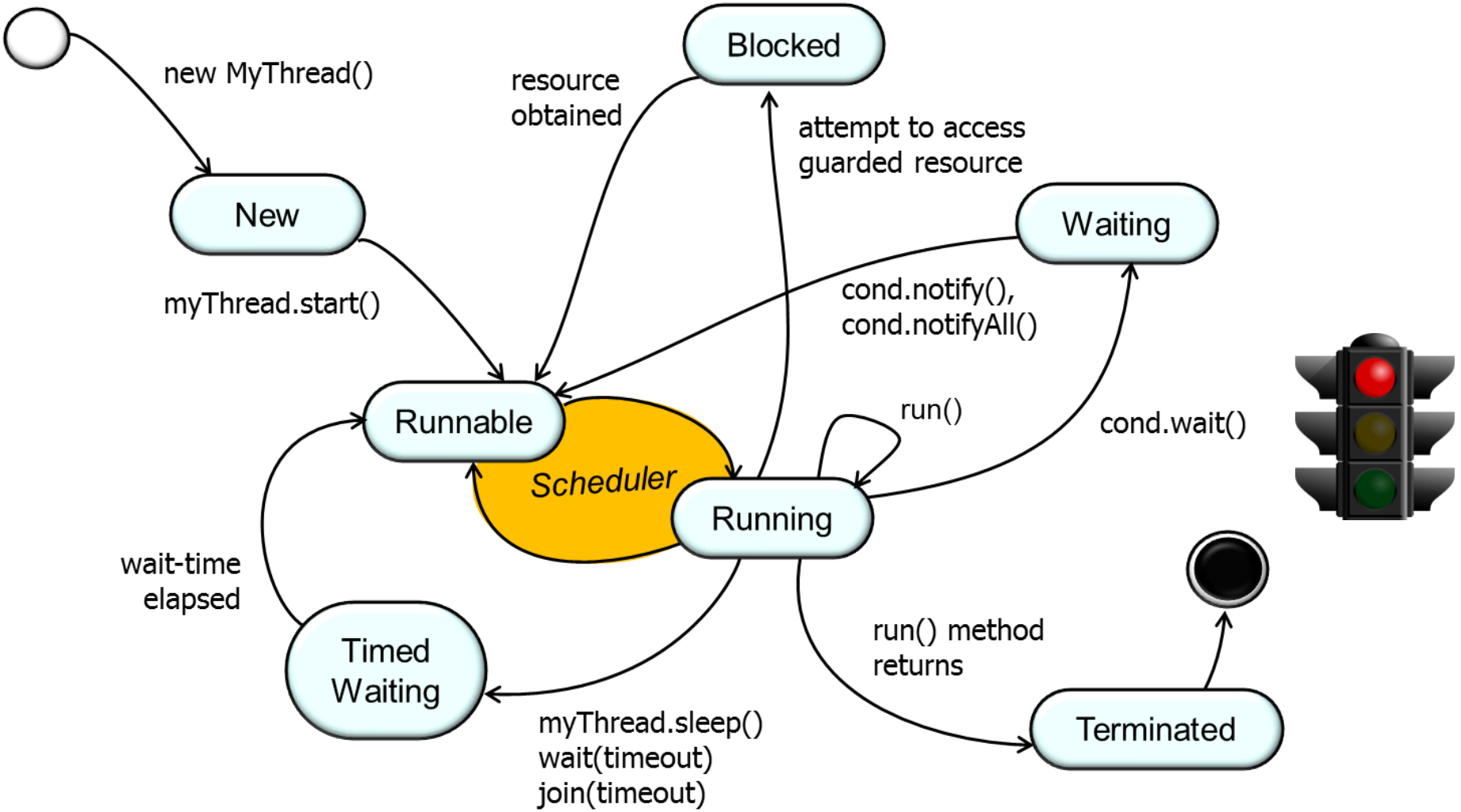


Douglas C. Schmidt
d.schmidt@vanderbilt.edu
www.dre.vanderbilt.edu/~schmidt

Institute for Software
Integrated Systems
Vanderbilt University
Nashville, Tennessee, USA

Learning Objectives in this Part of the Lesson

- Know various ways to stop Java threads



Overview of Stopping a Java Thread

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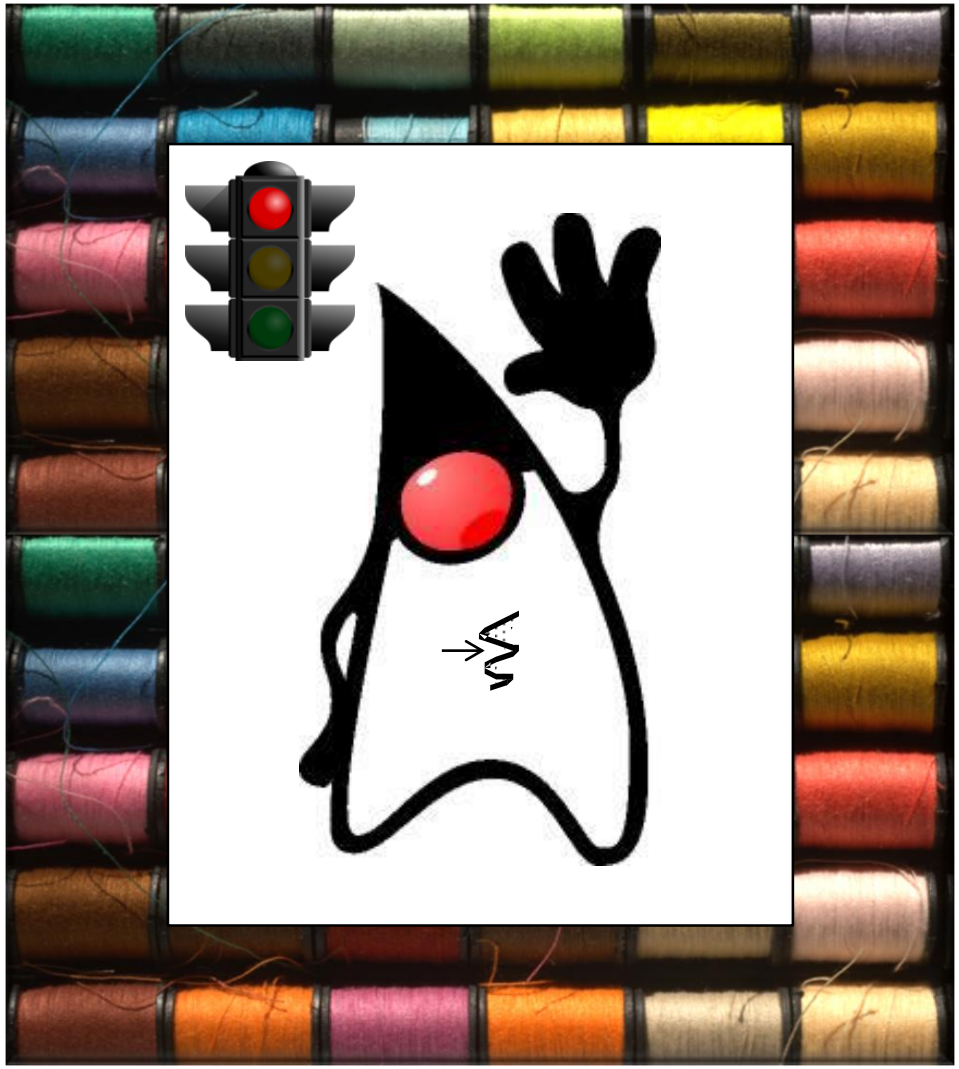
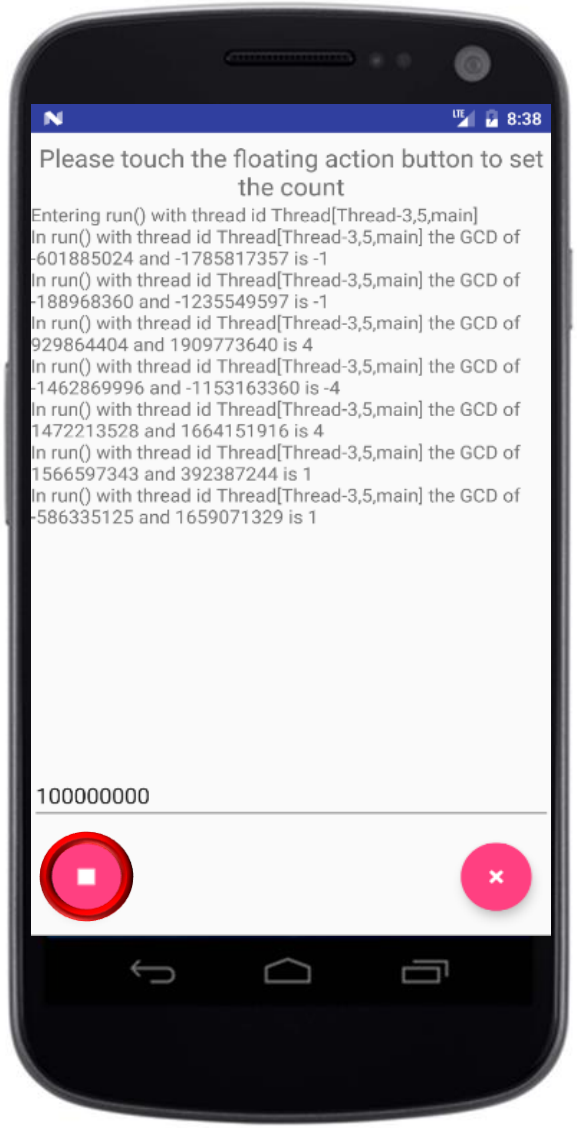
- It may be necessary to stop a Java thread for various reasons



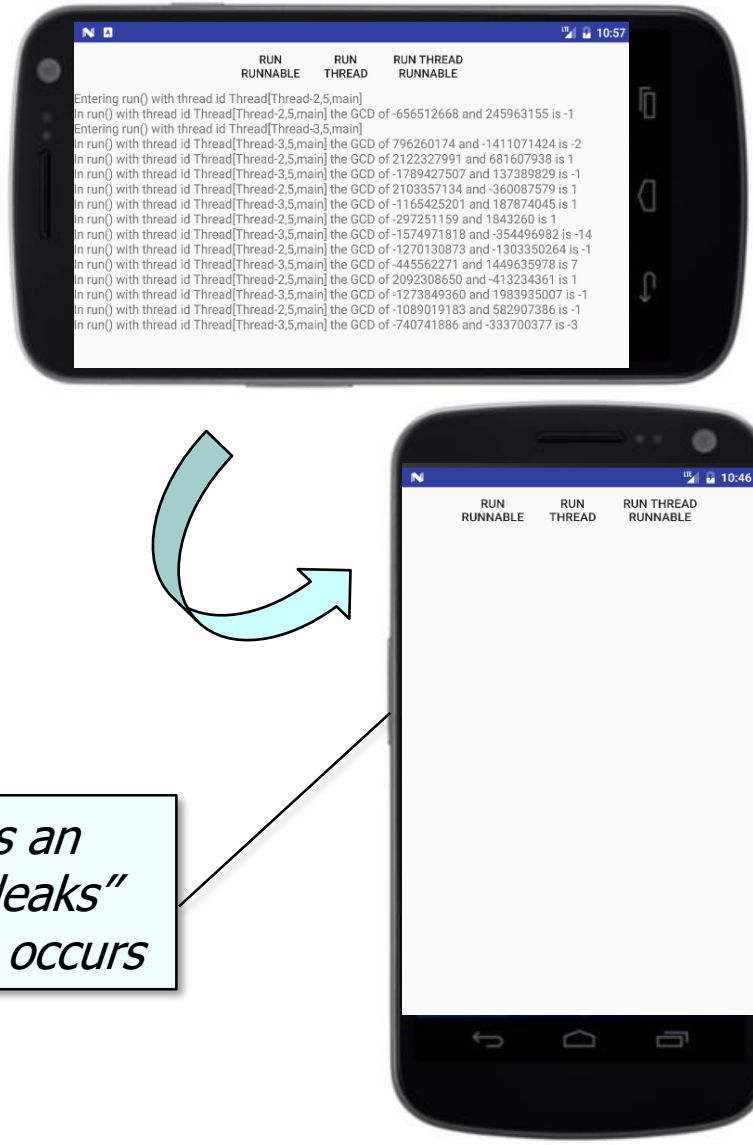
Overview of Stopping a Java Thread

- It may be necessary to stop a Java thread for various reasons, e.g.
  - Users may want to cancel a long-running operation
    - e.g., they get bored or tired of waiting for it to complete



Overview of Stopping a Java Thread

- It may be necessary to stop a Java thread for various reasons, e.g.
  - Users may want to cancel a long-running operation
  - An activity is destroyed, stopped, or paused
    - e.g., due to runtime configuration changes or pressing the "back" button

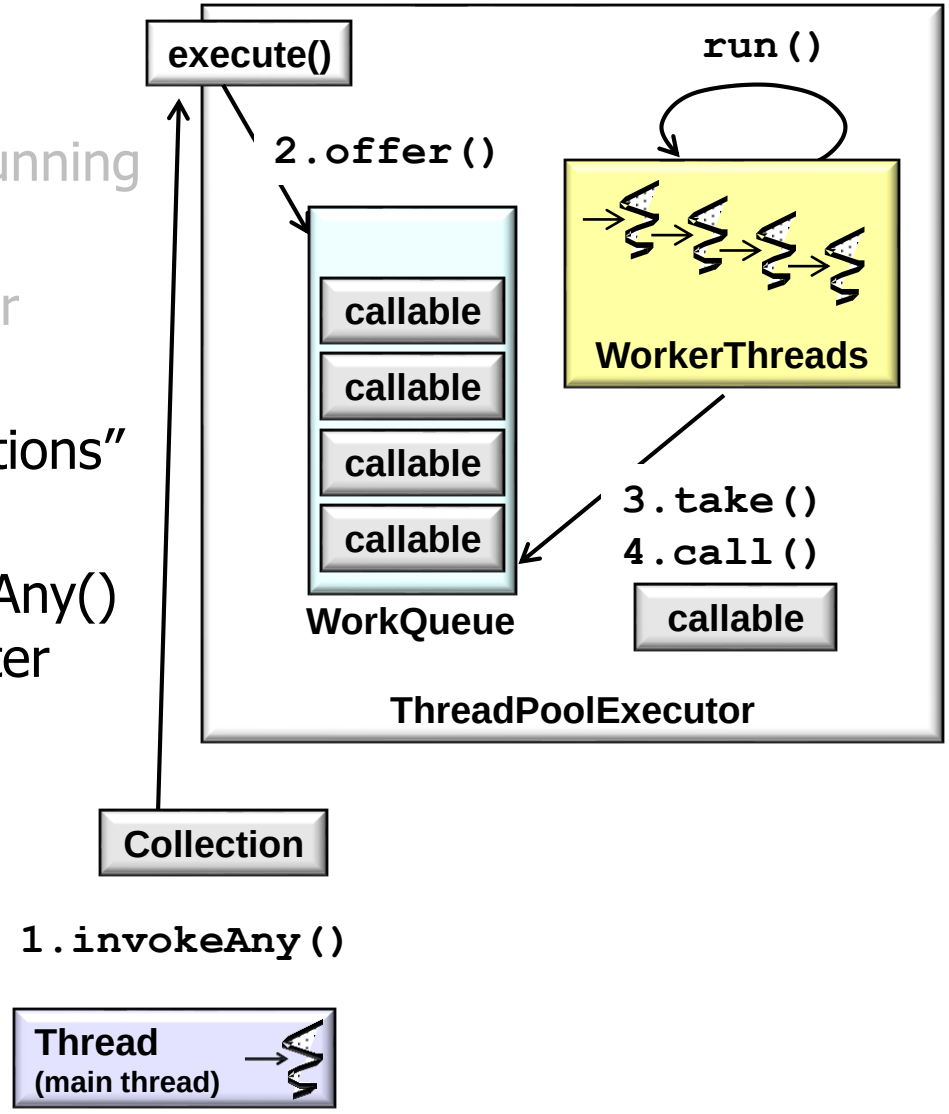


The GCD Concurrent app contains an (intentional) design flaw where it "leaks" threads when an orientation change occurs

See github.com/douglascraigschmidt/POSA/tree/master/ex/M3/GCD/Concurrent

Overview of Stopping a Java Thread

- It may be necessary to stop a Java thread for various reasons, e.g.
  - Users may want to cancel a long-running operation
  - An activity is destroyed, stopped, or paused
  - Cancel other "speculative computations" results are found
    - e.g., The ExecutorService invokeAny() method cancels other threads after a result is found



See docs.oracle.com/javase/8/docs/api/java/util/concurrent/ExecutorService.html#invokeAny

Overview of Stopping a Java Thread

- Stopping Java threads is surprisingly hard

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- Stopping Java threads is surprisingly hard
  - i.e., the "Sorcerer's Apprentice" problem

See www.youtube.com/watch?v=5rzyuY8-Ao8

Overview of Stopping a Java Thread

- There's no safe way to stop a Java thread involuntarily

See docs.oracle.com/javase/8/docs/technotes/guides/concurrency/threadPrimitiveDeprecation.html

Overview of Stopping a Java Thread

- There's no safe way to stop a Java thread involuntarily
  - The stop() method is deprecated since it's inherently unsafe

See geekexplains.blogspot.com/2008/07/why-stop-suspend-resume-of-thread-are.html

Overview of Stopping a Java Thread

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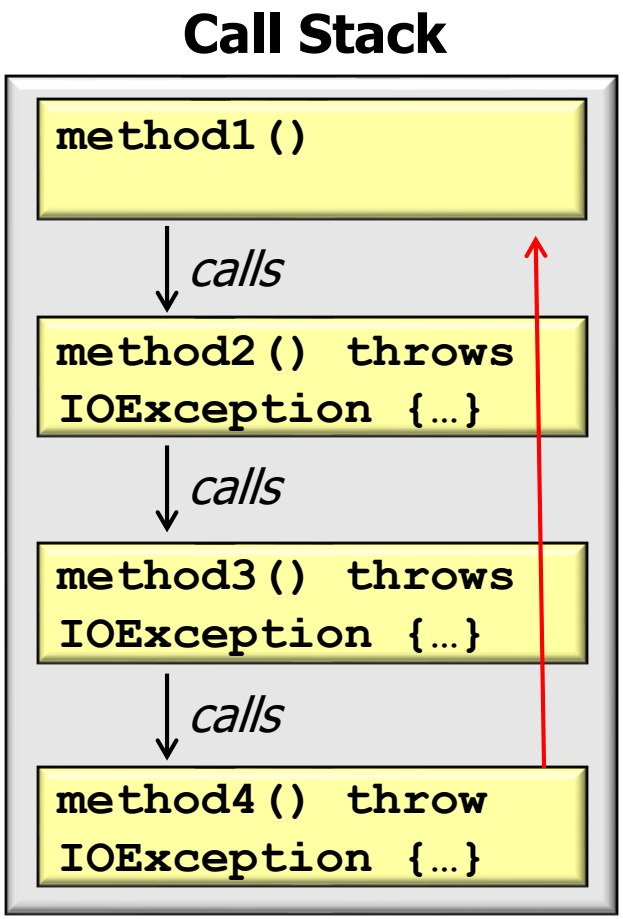

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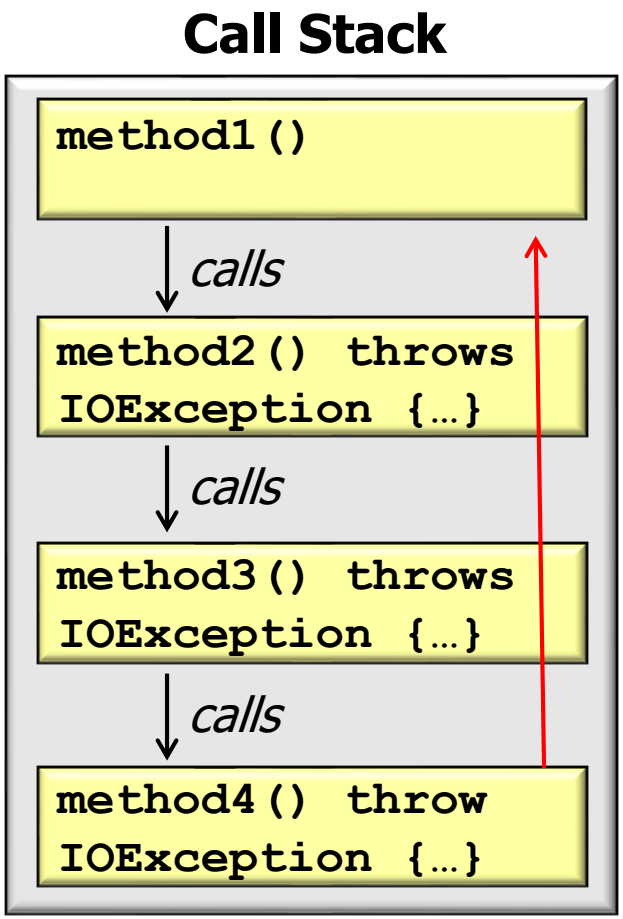

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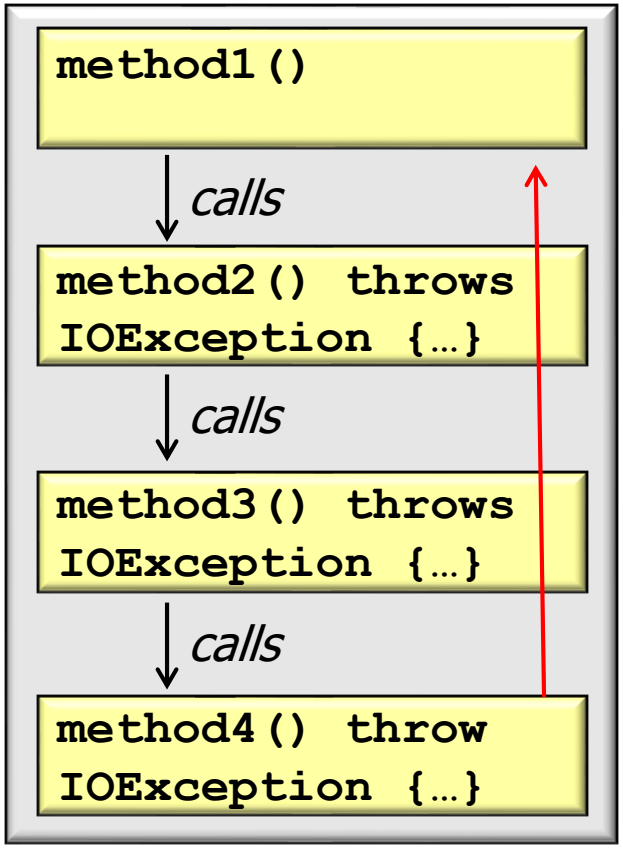
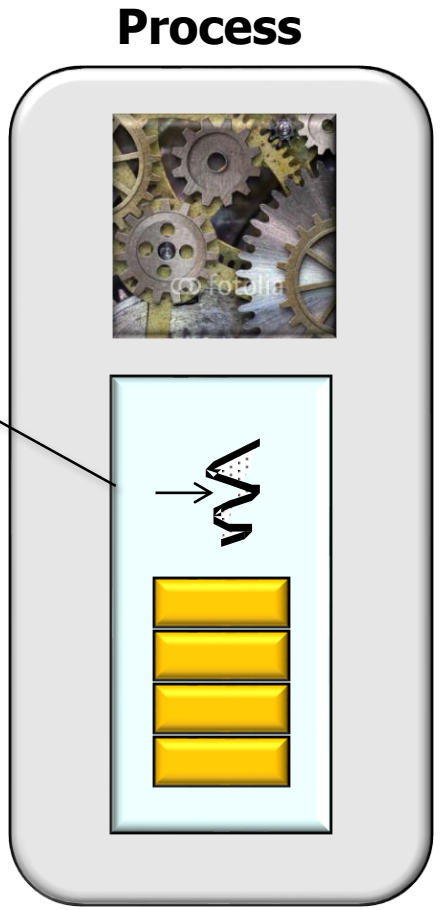
  - The stop() method is deprecated since it's inherently unsafe, e.g.
    - All locked monitors are unlocked as the exception propagates up the stack
    - Any objects protected by these monitors are thus left in an inconsistent state
  - There is no way for an object's methods to control *when* stop() takes effect..



Overview of Stopping a Java Thread

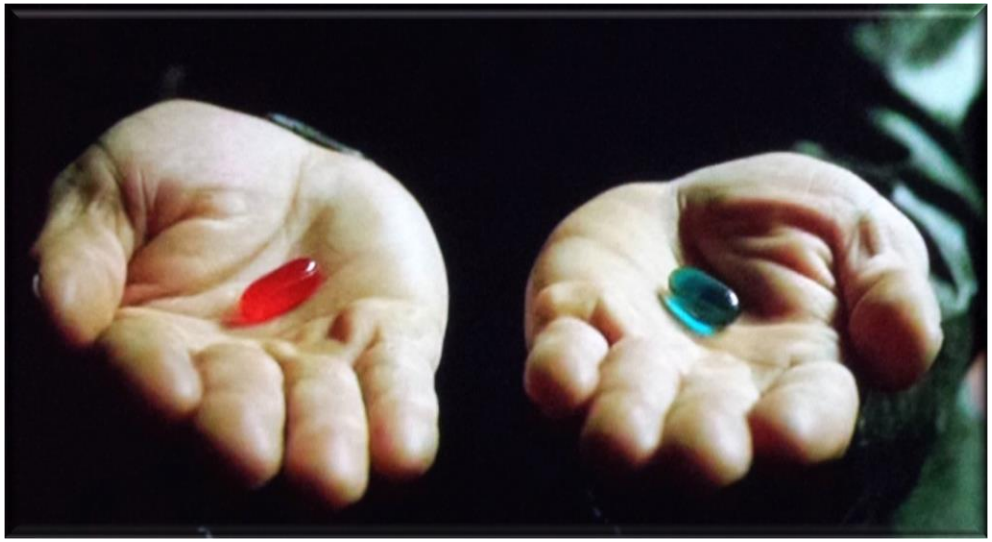
- Long running operations in a thread must be coded to stop *voluntarily*!

```
public void run(){
   while (true) {
      // Check if thread
      // should stop
   }
}
```



Overview of Stopping a Java Thread

- There are two ways to stop a Java thread voluntarily



Overview of Stopping a Java Thread

- There are two ways to stop a Java thread voluntarily
  - Use a volatile flag

```
public class MyRunnable
      implements Runnable {
  private volatile boolean
            mIsStopped = false;

  public void stopMe() {
    mIsStopped = true;
  }

  public void run() {
    while(mIsStopped != true) {
      // a long-running operation
    }
    ...
```

See en.wikipedia.org/wiki/Volatile_variable#In_Java

Overview of Stopping a Java Thread

- There are two ways to stop a Java thread voluntarily
  - Use a volatile flag
  - Use Java thread interrupt requests

Interrupts

An *interrupt* is an indication to a thread that it should stop what it is doing and do something else. It's up to the programmer to decide exactly how a thread responds to an interrupt, but it is very common for the thread to terminate. This is the usage emphasized in this lesson.

A thread sends an interrupt by invoking `interrupt` on the `Thread` object for the thread to be interrupted. For the interrupt mechanism to work correctly, the interrupted thread must support its own interruption.

See docs.oracle.com/javase/tutorial/essential/concurrency/interrupt.html

Overview of Stopping a Java Thread

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  - Thread interrupts are fragile since they require all parts of a program follow consistent usage patterns

See weblogs.java.net/blog/2009/03/02/cancelling-tasks-threadinterrupt-fragility

Overview of Stopping a Java Thread

- Stopping a Java thread voluntarily requires cooperation between threads
  - A thread must check periodically to see if it has been told to stop
  - Thread interrupts are fragile since they require all parts of a program follow consistent usage patterns
  - Voluntary checking is tedious & error-prone, but it's the only way to halt Java threads reliably

See stackoverflow.com/questions/8505707/android-best-and-safe-way-to-stop-thread

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