

Multithreading

CSSE 221

Fundamentals of Software Development
Honors

Rose-Hulman Institute of Technology

Announcements

- VectorGraphics: CRC Cards, UML diagrams, and user stories are due now

Joe Armstrong, Programming in Erlang

The World is Concurrent

Multithreading

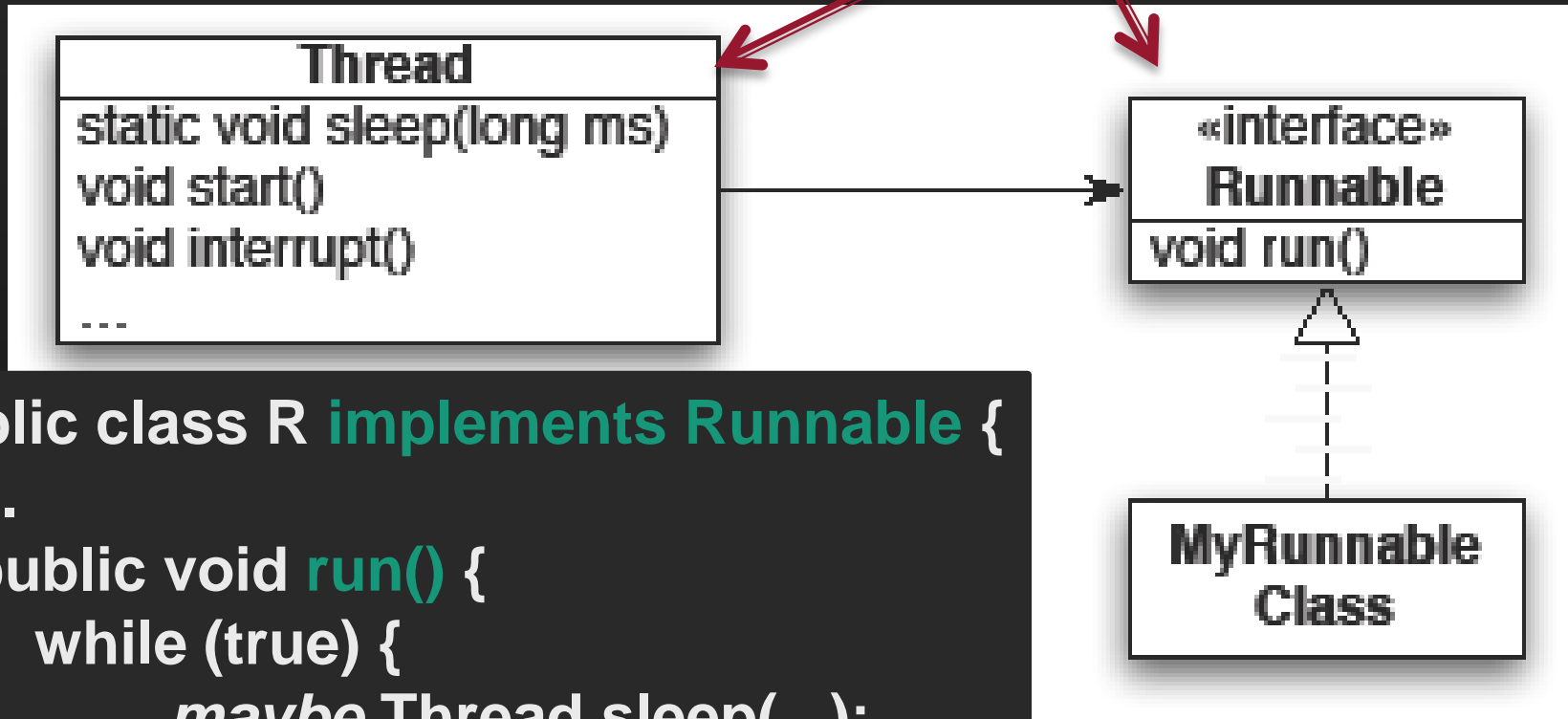
- A technique to:
 1. Run multiple pieces of code “simultaneously” on a single machine

Time → Slices	1	2	3	4	5	6	7	8	9	10	11	12	13	14
running thread 1														
running thread 2														

2. Run different parts of a program on different processor cores

Running Our Own Code Concurrently

From *java.lang*



```
public class R implements Runnable {  
    ...  
    public void run() {  
        while (true) {  
            ... maybe Thread.sleep(...);  
        }  
    }  
}
```

Wherever you want to start the Thread:
`new Thread(object of type R).start();`



Demo

Animation with Threads

- Example 1: A single object
 - “Animate” it with button clicks (done)
 - Animate it with a Timer

```
Timer timer = new Timer(50, animatorButton);  
timer.start();
```

- Animate it by
using a thread

```
public class R implements Runnable {  
    ...  
    public void run() {  
        while (true) {  
            ... maybe Thread.sleep(...);  
        }  
    }  
}
```

Wherever you want to start the Thread:

```
new Thread(object of type R).start();
```

Animation with Threads

- Example 2: Multiple objects
 - Use separate thread for each object's "brain"
 - Another thread asks Java to update the GUI



<http://www.roadsideamerica.com/story/8543>

Other thread methods

- `.interrupt()`
- `.sleep()`: throws an `InterruptedException` is interrupted
- `.join()`: to wait for a thread to finish before continuing
- `.run()`: Don't call it directly! What would happen if I did?

Other Uses for Threads

- Web servers: many users connecting
 - Any client-server architecture
- Desktop applications:
 - layout, spellchecking, auto-save, ...
- Scientific computing
- Weather forecasting
 - Any simulation (hint, hint)

Caution!

- What if one thread is in the middle of performing an action when its time slice ends?
- What if a second thread's action interferes the first's action?
- Demo bank example