

# CSSE 220 Day 23

Multithreading

Checkout *Multithreading* project from SVN

# Questions

# Miscellania

- ▶ Exam Thursday night. 7–9 pm (but can stay until 10 pm)
  - Topic list posted on main schedule page
  - Questions?
  - Demo of Static BallWorlds
- ▶ Wrap up big-Oh notation from yesterday

# The World is Concurrent

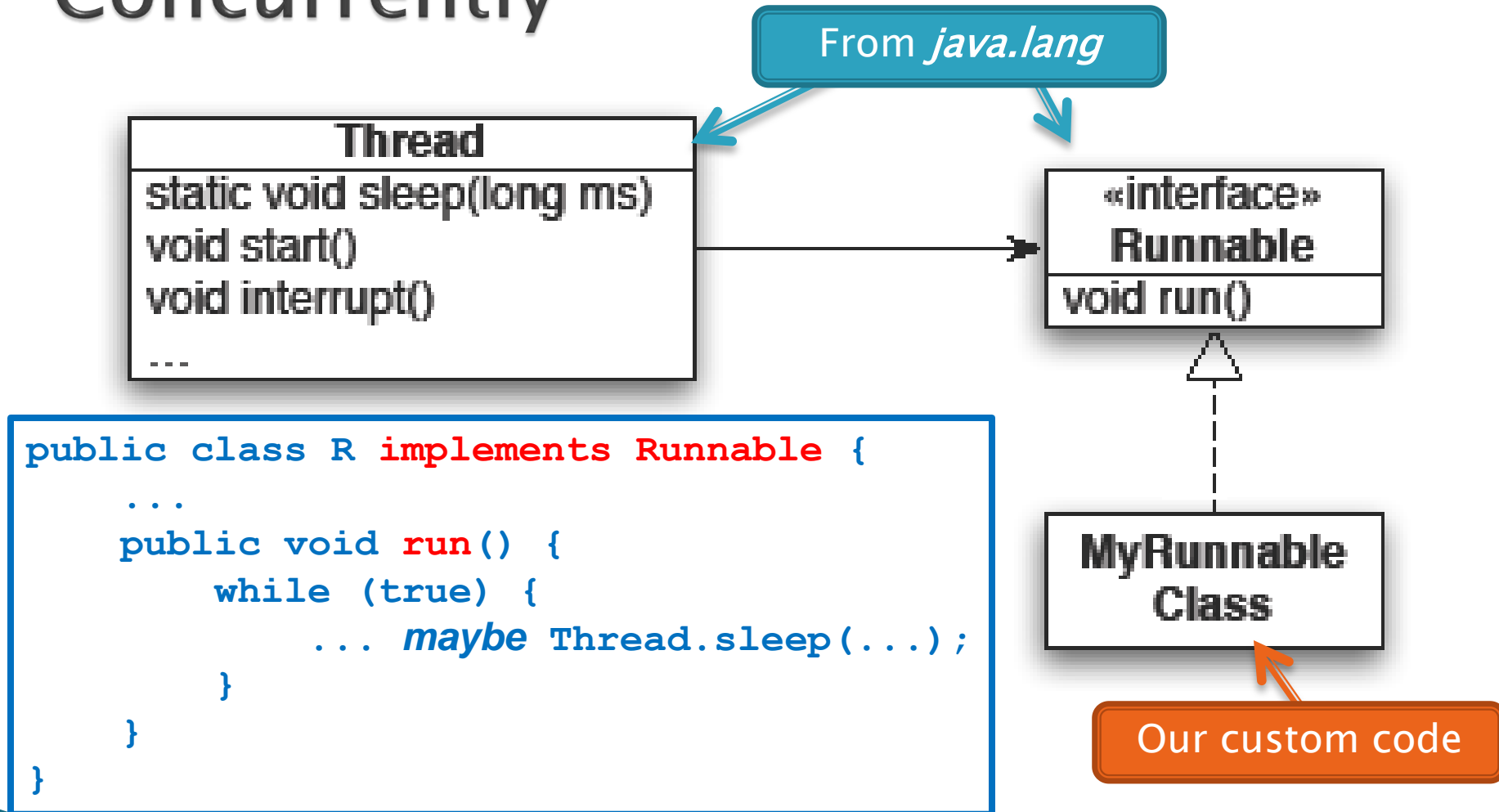
» Joe Armstrong,  
*Programming in Erlang*

# Multithreading

- ▶ A technique to:
  - Run multiple pieces of code “simultaneously” on a single machine
  - Run different parts of a program on different processor cores

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

# Running Our Own Code Concurrently



Wherever you want to start the Thread:

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

# 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();
```

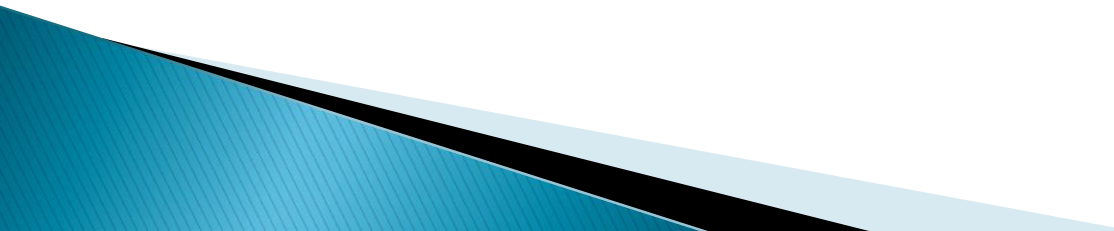
# Animation with Threads

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

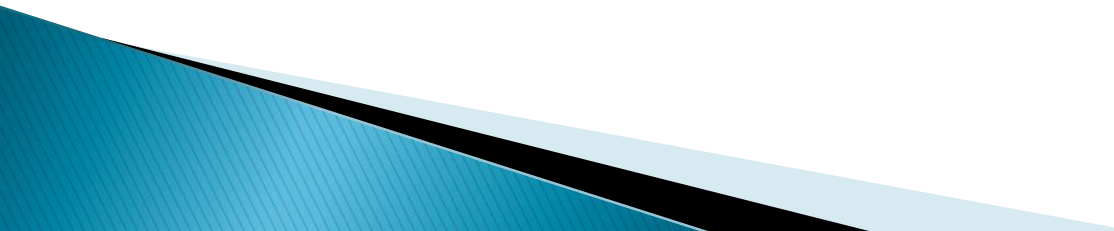




# Other Uses for Threads

- ▶ Web servers: many users connecting
  - ▶ Desktop applications:
    - layout, spellchecking, auto-save, ...
  - ▶ Scientific computing
  - ▶ Weather forecasting
  - ▶ ...
- 

# 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?
  - ▶ See bank example in today's project
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# Vector Graphics

»» Work time