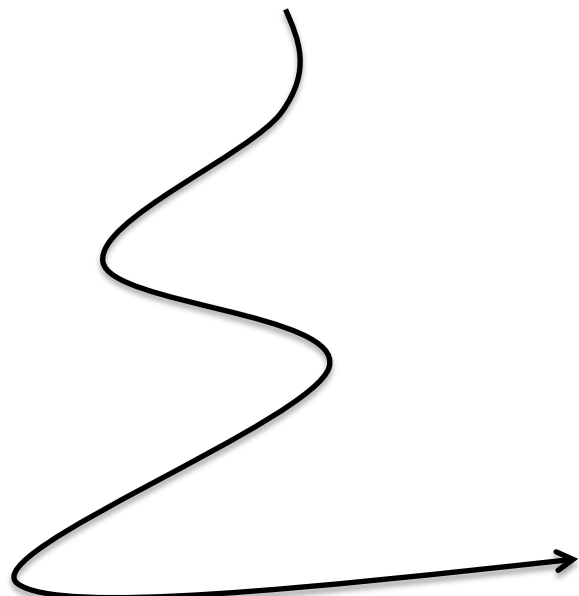


Today: Intro to Concurrency

1. What is a Thread? Why do we Need This?
2. The Java Thread API
3. Thread Scheduling
 - Yielding
 - Sleeping
 - Terminating
 - Daemon Threads
4. Joining Threads
5. How to Stop Worrying and Love the Thread

`Arrays.sort(names);`



What's in the box?

```
/*
 * Sort five evenly spaced elements around (and including) the
 * center element in the range. These elements will be used for
 * pivot selection as described below. The choice for spacing
 * these elements was empirically determined to work well on
 * a wide variety of inputs.
 */
int e3 = (left + right) >>> 1; // The midpoint
int e2 = e3 - seventh;
int e1 = e2 - seventh;
int e4 = e3 + seventh;
int e5 = e4 + seventh;

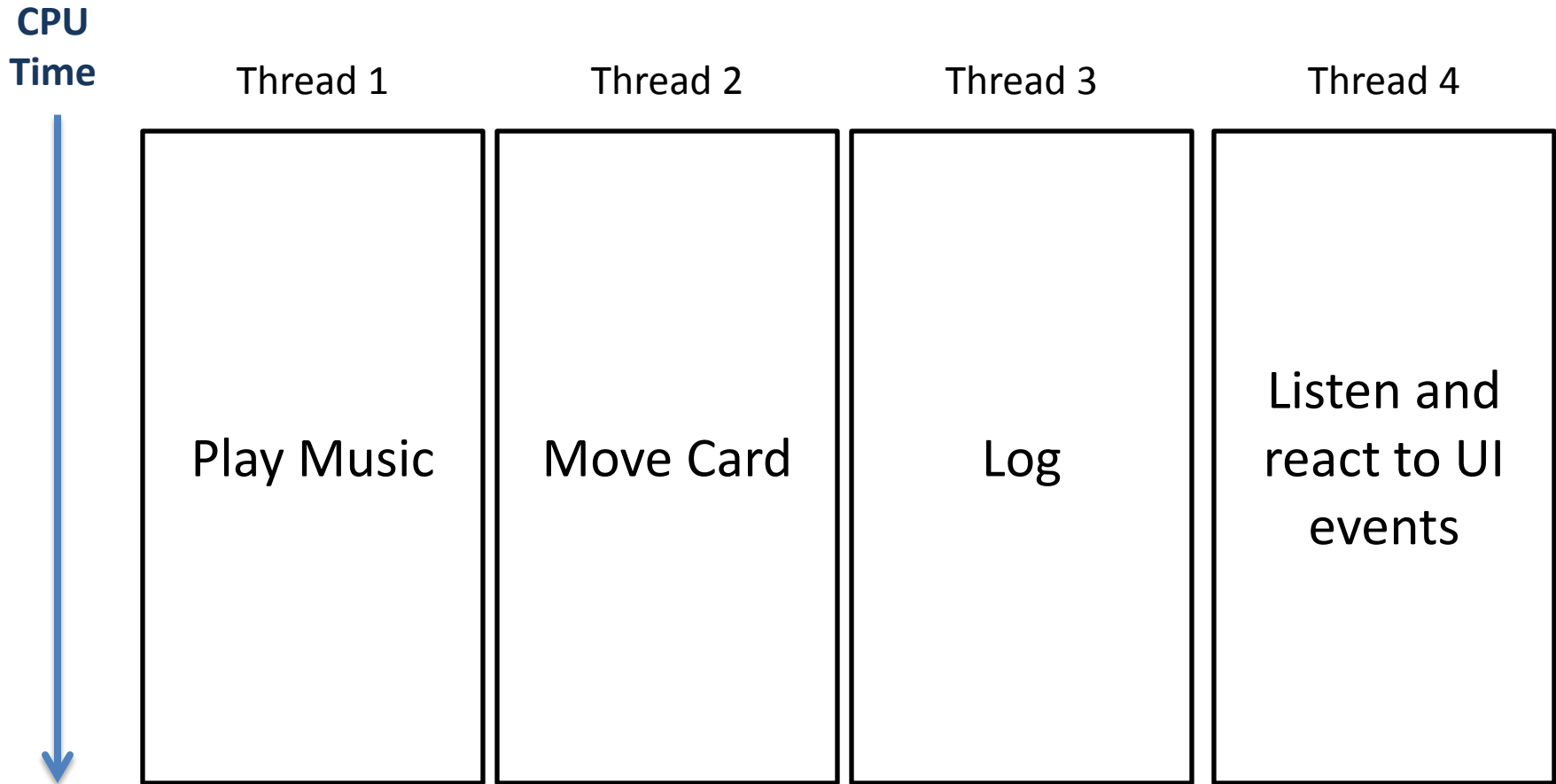
// Sort these elements using insertion sort
if (a[e2] < a[e1]) { int t = a[e2]; a[e2] = a[e1]; a[e1] = t; }

if (a[e3] < a[e2]) { int t = a[e3]; a[e3] = a[e2]; a[e2] = t;
    if (t < a[e1]) { a[e2] = a[e1]; a[e1] = t; }
}
if (a[e4] < a[e3]) { int t = a[e4]; a[e4] = a[e3]; a[e3] = t;
    if (t < a[e2]) { a[e3] = a[e2]; a[e2] = t;
        if (t < a[e1]) { a[e2] = a[e1]; a[e1] = t; }
    }
}
if (a[e5] < a[e4]) { int t = a[e5]; a[e5] = a[e4]; a[e4] = t;
    if (t < a[e3]) { a[e4] = a[e3]; a[e3] = t;
        if (t < a[e2]) { a[e3] = a[e2]; a[e2] = t;
            if (t < a[e1]) { a[e2] = a[e1]; a[e1] = t; }
        }
    }
}
}
```

Naïve (= Ridiculous) Concurrency

```
while(true)
{
    playATinyBitOfMusic();
    possiblyLogSomeStuff();
    possiblyMoveOneCard();
    listenForUIEventsForATinyAmountOfTime();
}
```

Threads: Abstractions of Running Programs



What is a Thread? A Thread

java.lang

Class Thread

java.lang.Object

└ java.lang.Thread

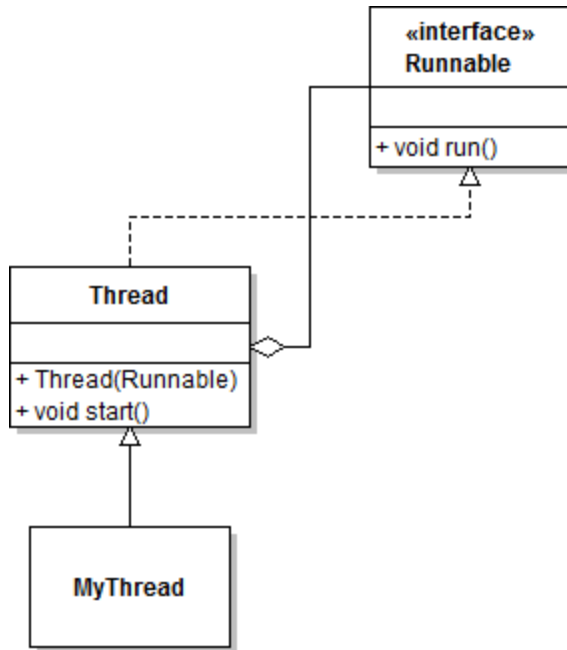
All Implemented Interfaces:

Runnable

```
public class Thread  
extends Object  
implements Runnable
```

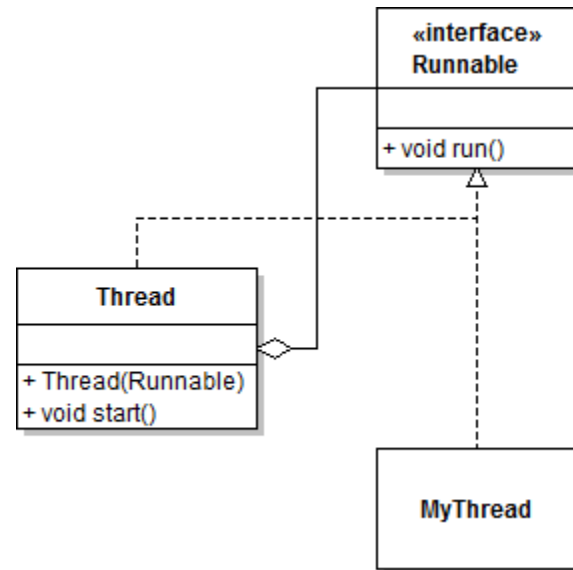
A *thread* is a thread of execution in a program. The Java Virtual Machine allows an application to have multiple threads of execution running concurrently.

Two Options for Threads



`new MyThread().start()`

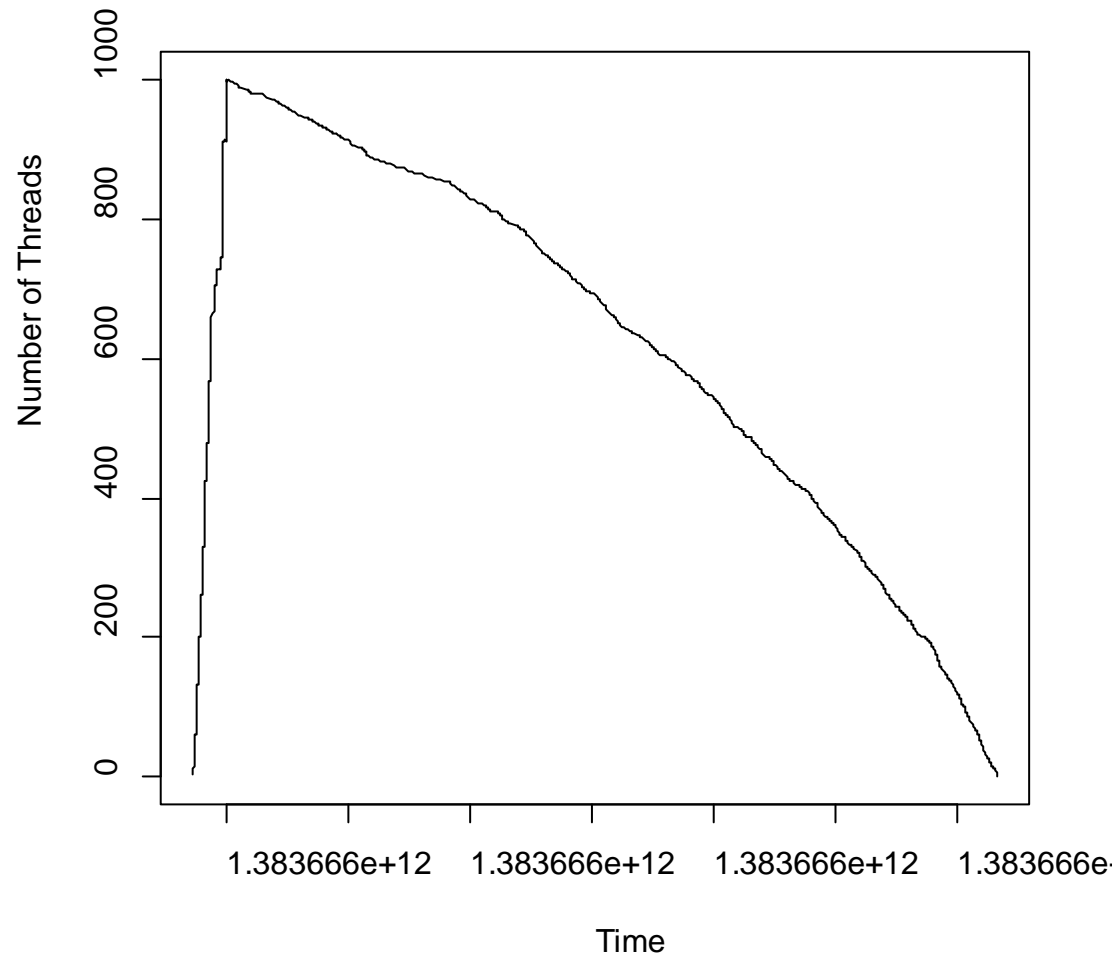
Inheritance



`new Thread(new MyThread()).start()`

Composition

Number of Threads in RandomLoop



Thread life cycle

