

# What the Enterprise Can Learn from Your Mom

Jim Weirich  
Chief Scientist  
EdgeCase



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# Mom?

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# TANSTASFL

## **The Free Lunch Is Over**

**A Fundamental Turn Toward Concurrency in Software**

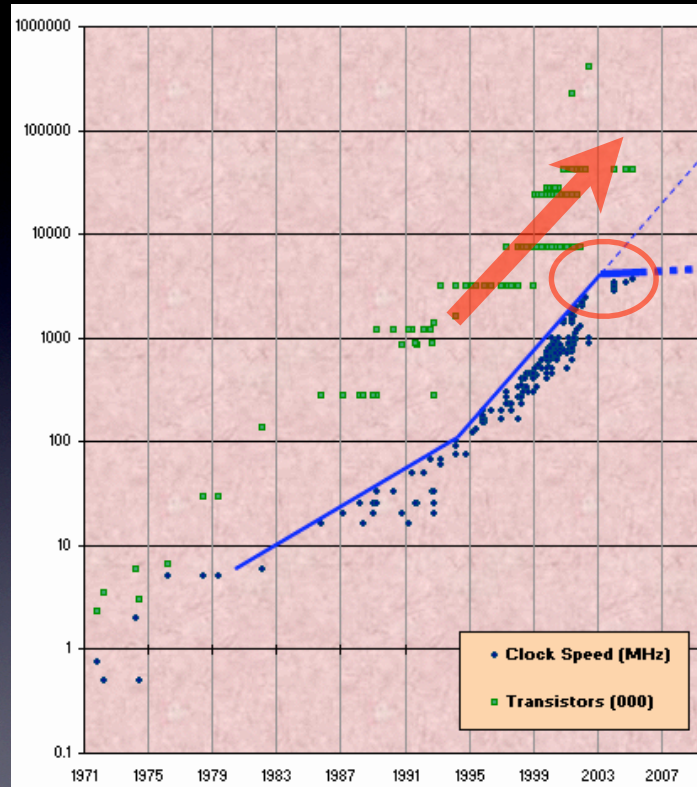
**By Herb Sutter**

- <http://www.gotw.ca/publications/concurrency-ddj.htm>
- Published early 2005

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## Moore's Law

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## Past Performance Gains

- Clock Speed
- Execution Optimization
- Cache


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**MacBook Pro** Design Features Wireless Performance Mac OS X + iLife Tech Specs [Buy Now](#)



**Nimble,  
meet quick.**

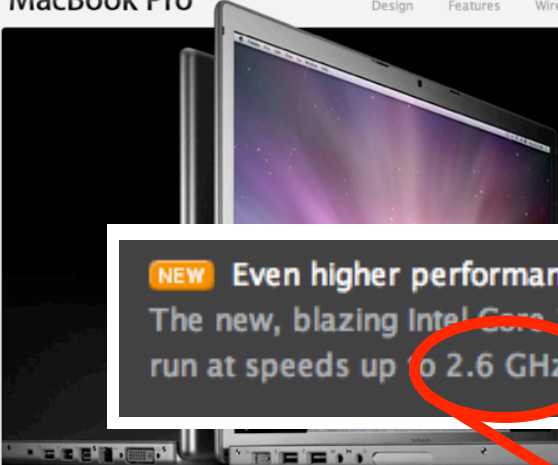
**The new, more powerful MacBook Pro.**  
The latest Intel processor, a bigger hard drive, plenty of memory, and even more new features all fit inside just one liberating inch. The new MacBook Pro has the performance, power, and connectivity of a desktop computer. Without the desk part.

**NEW Even higher performance.**  
The new, blazing Intel Core 2 Duo processors run at speeds up to 2.6 GHz. [Learn more >](#)

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MacBook Pro

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# Nimble, quick.

**NEW** Even higher performance.

The new, blazing Intel Core 2 Duo processors run at speeds up to 2.6 GHz. [Learn more](#)

**The new, more powerful MacBook Pro.**

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**Even higher performance.**

The new, blazing Intel Core 2 Duo processors run at speeds up to 2.6 GHz. [Learn more](#)

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Mac Pro

Overview Design Technology Performance Tech Specs [Buy Now](#)




# The new Mac Pro.

## Tower of 8-core power.




**The new 8-core standard.**

It was once only top-of-the-line processing power. Now it's at the heart of the new Mac Pro. [Learn more](#)



**The fastest Mac ever.**

Up to 2x faster than the previous Mac Pro, with new Quad-Core Intel Xeon processors up to 3.2GHz. [Learn more](#)



**Graphics. The next generation.**

Introducing all-new, high-end, blow-you-away graphics. [Learn more](#)



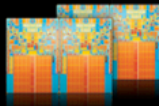
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## Future Performance Gains


- Hyperthreading
- Multicore
- Cache


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Mac Pro


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## Back to Herb Sutter!

Applications will increasingly need to  
be concurrent if they want to fully  
exploit continuing exponential CPU  
throughput gains

Efficiency and performance  
optimization will get more, not less,  
important

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100 Core CPUs?

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So, What *Can* the  
Enterprise Learn from  
Your Mom?

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17

However ...

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# Charles Miller

In its place I would put *Java Concurrency in Practice*. Every new Atlassian developer gets handed this book and ordered to read it immediately. **Writing multi-threaded code is hard**, and a number of the things Java does under the hood to make its multi-threading more efficient makes it even harder. Unless you understand the subtleties described in this book of how Java shares data between threads, **you will screw it up** in some almost-impossible-to-debug way. [emphasis mine]

[http://fishbowl.pastiche.org/2008/08/07/recommended\\_reading\\_for\\_java\\_d/](http://fishbowl.pastiche.org/2008/08/07/recommended_reading_for_java_d/)

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So, you want to write a  
concurrent program ...

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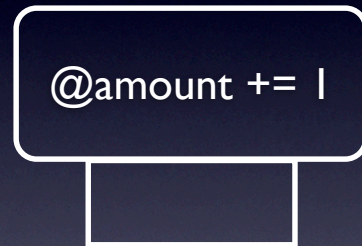
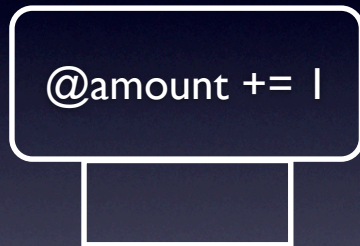
Demo: race1.rb

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What happened?

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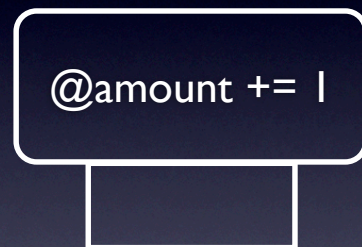
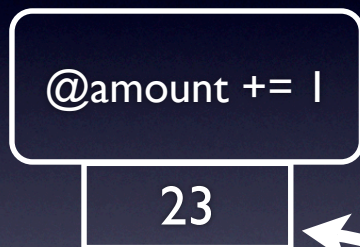
# The Setup



23

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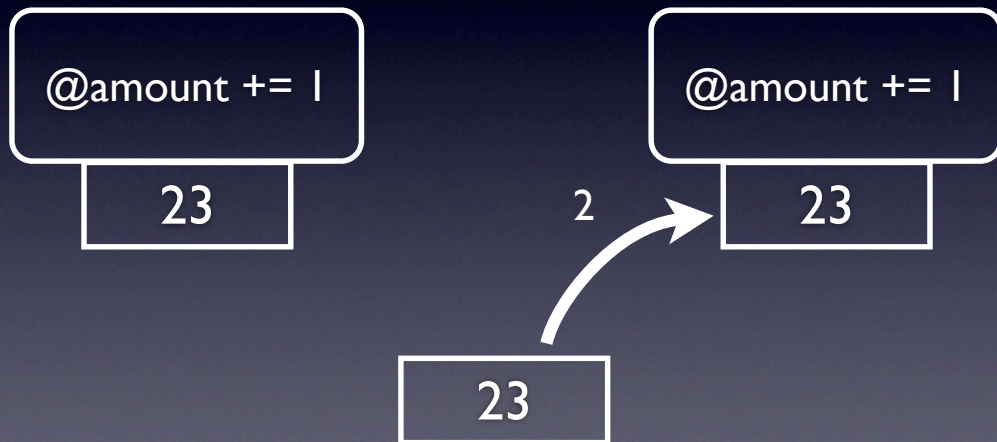
# Step 1



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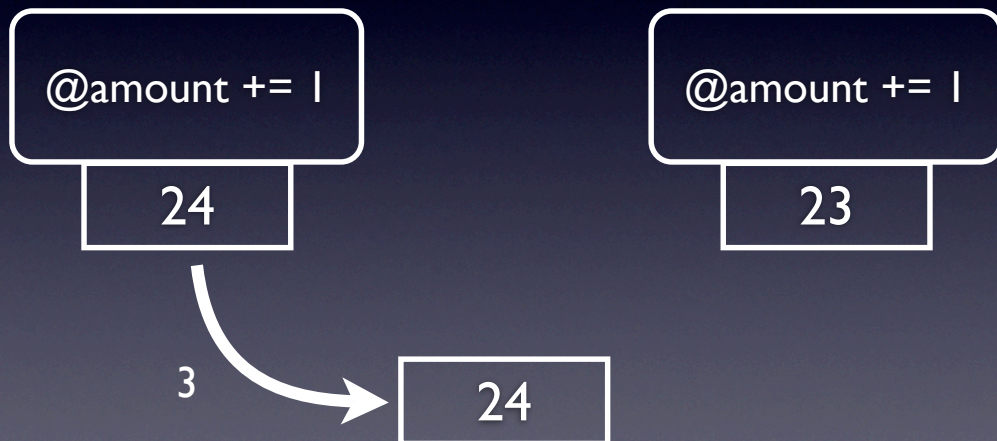
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## Step 2



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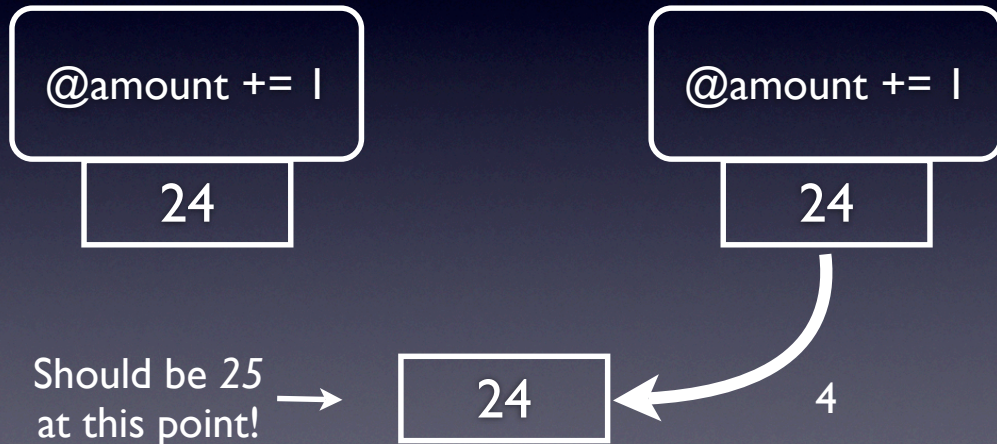
## Step 3



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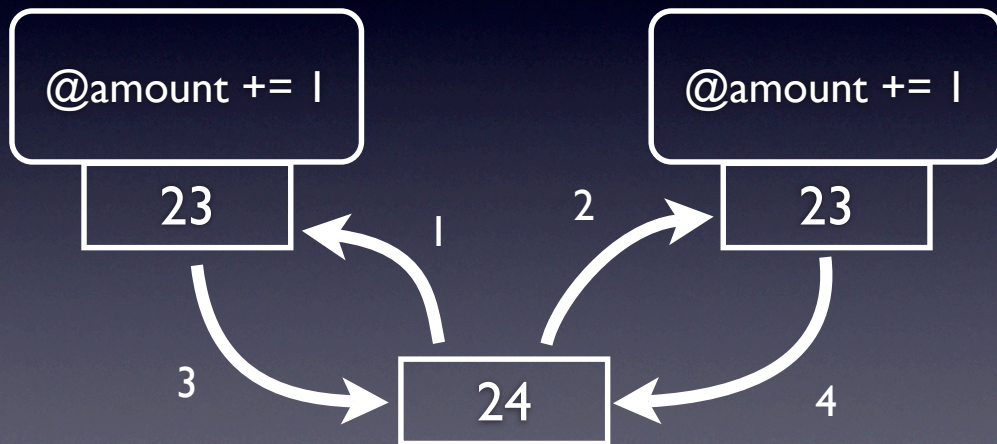


## Step 4



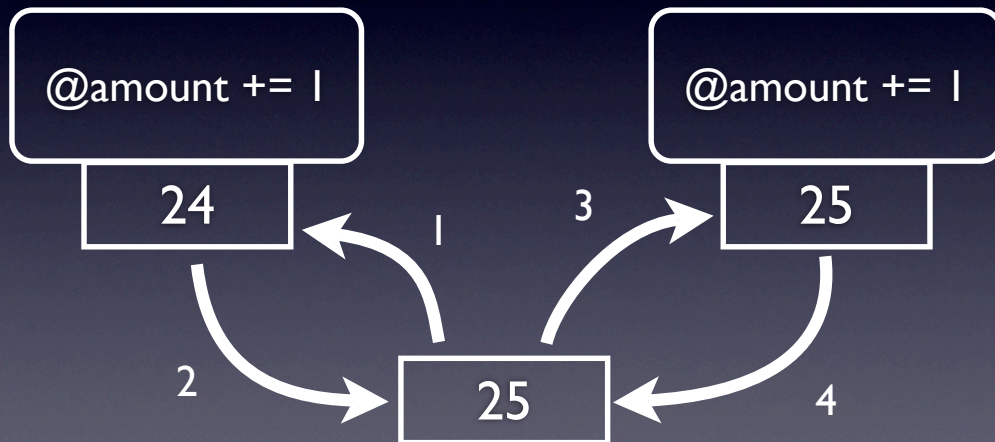
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## Race Condition



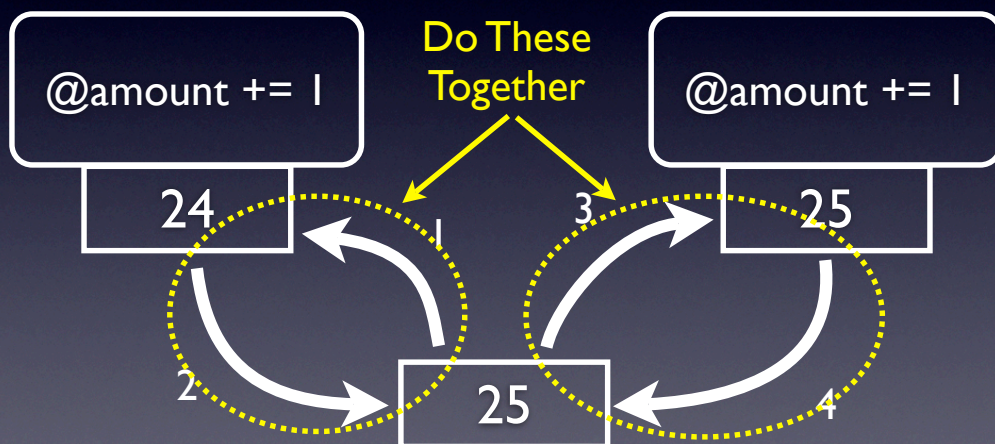
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# Reordering Steps



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# Mutual Exclusion



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```
DISABLE CONTEXT SWITCHING  
  account.credit(1)  
RE-ENABLE CONTEXT SWITCHING
```

33

```
require 'thread'  
mutex = Mutex.new  
  
...  
  
mutex.synchronize do  
  account.credit(1)  
end
```

34



Demo: race4.rb

35

Demo: race7.rb

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# To Be Safe, You Must:

(1) Protect **every** shared memory access with a synchronizing lock.

Yes, **EVERY** access.

37

# To Be Safe, You Must:

(2) Be aware of extended situations that need to be atomic.

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## To Be Safe, You Must:

(3) Have a strategy to avoid deadlock in the presence of multiple locks.

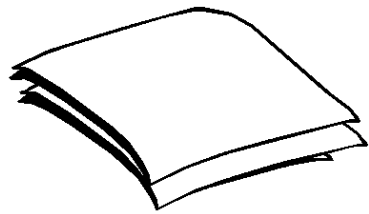
39

## To Be Safe, You Must:

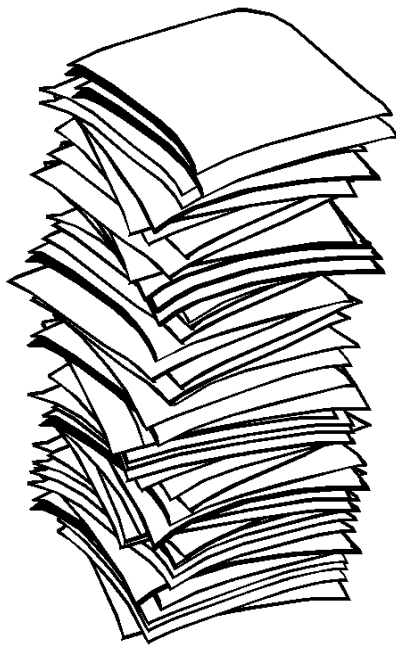
(4) Evaluate every single library used by your program to see if they also follow rules 1 - 3.

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# Horror Stories

- Real time data collection (1 in a million)
- Rake multitrack dependencies
- Double Checked Lock

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## Double Checked Lock

```
public static Singleton getInstance()
{
    if (instance == null)
    {
        synchronized(Singleton.class) { //1
            if (instance == null) //2
                instance = new Singleton(); //3
        }
    }
    return instance;
}
```

The theory behind double-checked locking is perfect.  
Unfortunately, reality is entirely different.

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Concurrent  
Programming is  
***HARD***

45

And it is hard because of  
***Shared  
Memory***

46



What can we do to  
make concurrent  
programming easier?

47

Avoid  
***Shared  
Memory***

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# Are We Blug Programmers?

... Languages less powerful than Blug are obviously less powerful, because they're missing some feature he's used to. But when our hypothetical Blug programmer looks in the other direction, up the power continuum, he doesn't realize he's looking up. What he sees are merely weird languages... Blug is good enough for him, because he thinks in Blug.

-- Paul Graham, *Beating the Averages*

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## The Power of Messsaging

(Erlang)

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# Imagine a Language with

- No variables
- No assignment statements
- No explicit loops

51

# Imagine a Language with

- No variables
- No assignment statements
- No explicit loops
- Only Constants
- Pattern Matching
- Recursion
  - (tail recursion)

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# Function Definitions

```
fact(0) ->  
    1;  
fact(N) ->  
    N * fact(N-1) .
```

53

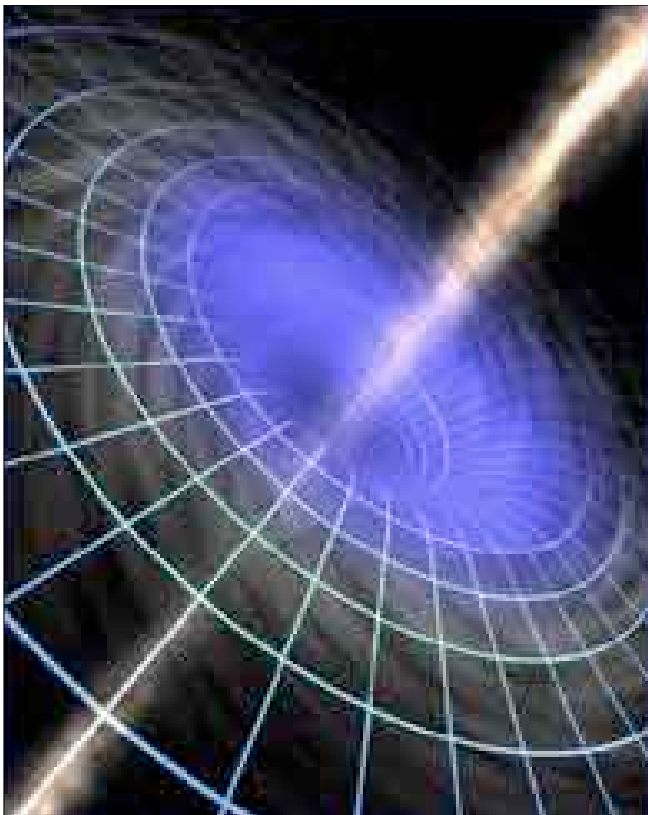
# Function Definitions

```
fact2(N) ->  
    fact2(N, 1) .  
  
fact2(0, Acc) ->  
    Acc;  
fact2(N, Acc) ->  
    fact2(N-1, N * Acc) .
```

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# Erlang Demo

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## Bending Time and Space

(Clojure)

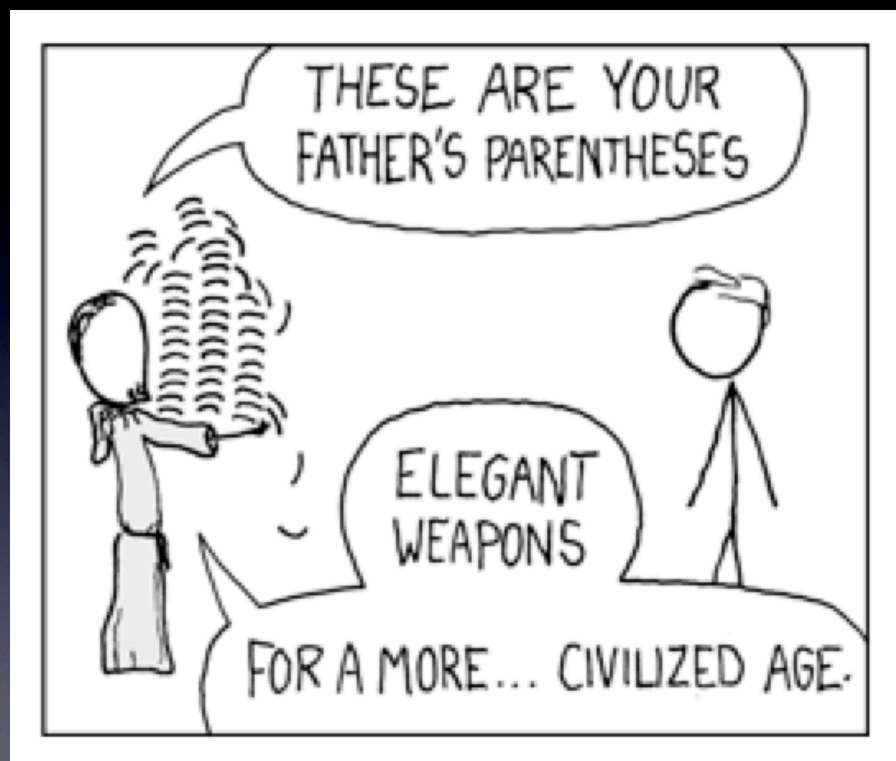


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# What? Lisp?

(isn't that Epic Fail?)

57



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# Quick Lisp Primer

59

## Data Structures

1 321	; Numbers
a fido	; Names
(1 2 3)	; Listss
[1 2 3]	; Arrays

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# Calling Functions

```
(+ 2 4)           ; => 6  
(count '(a b c)) ; => 3
```

```
'(+ 2 4) ; => (+ 2 4)
```

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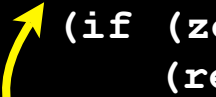
# Defining Functions

```
(defn factorial [n]  
  (if (zero? n) 1  
      (* (factorial (- n 1)))))
```

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# Defining Functions

```
(defn factorial [n]
  (loop [i n acc 1]
    (if (zero? i) acc
        (recur (- i 1) (* i acc) ))))
```



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# Sequences

```
(def s `(peanut butter and jelly))

(first s) ; => peanut
(rest s) ; => (butter and jelly)
(cons `fresh s)
          ; => (fresh peanut butter
               and jelly)

(take 2 s) ; => (peanut butter)
(drop 2 s) ; => (and jelly)
```

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# Other Cool Stuff

```
(repeat 1)           ; => (1 1 1 1 1 1...)
(cycle `(a b))       ; => (a b a b a b...)
(iterate (fn [n] (+ 1 n)) 0)
                      ; => (0 1 2 3 4 5...)
```

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# Java Interface

```
(import '(java.util.concurrent Executors))
(. Thread (sleep (* 1000 seconds)))
```

Argument to sleep  
(static) Method to call (sleep)  
Class (or object) to get method call  
Do a Java call

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# No Modifiable State

(except ...)

- Vars - Thread Local Variables (impossible to share)

```
(def v 123)

(binding [v 321] v) # => 321
```

- v is bound to 321, but only for the current thread.

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# No Modifiable State

(except ...)

- Refs - STM (Sharable, but only in a transaction)

```
(def r (ref 0))
(deref r) ; => 0

(ref-set r 1) ; FAILS
(dosync
  (ref-set r 1)) ; In Transaction
(deref r) ; => 1
```

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# Clojure Demo

69

# Summary

70



Concurrent Programming is Hard  
(primarily due to shared mutable state)

71

Hard enough that you probably want to  
avoid doing it in a traditional sequential  
programming language.

72

Functional Languages provide many advantages when dealing with concurrency.

73

Don't be a Blub Programmer.

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# Thank You!

[git://github.com/jimweirich/presentation\\_enterprise\\_mom.git](https://github.com/jimweirich/presentation_enterprise_mom.git)

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## Contact Info

- Jim Weirich
- Web: <http://onestepback.org>
- EMail: [jim.weirich@gmail.com](mailto:jim.weirich@gmail.com)
- Twitter: jimweirich

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