”Life is too short for imperative programming”

John Hughes

Sorting in Haskell

```
sort [] = []
sort (x:xs) =
     sort [y | y <- xs, y<x]
  ++ [x]
  ++ sort [y | y <- xs, y>=x]
```

Sorting in Pascal

```
{ Use quicksort to sort the array of integers. }
PROCEDURE Quicksort(size: Integer; VAR arr: IntArrType);
    { This does the actual work of the quicksort.  It takes the
      parameters which define the range of the array to work on,
      and references the array as a global. }
    PROCEDURE QuicksortRecur(start, stop: integer);
        VAR
            m: integer;

            { The location separating the high and low parts. }
            splitpt: integer;

        { The quicksort split algorithm.  Takes the range, and
          returns the split point. }
        FUNCTION Split(start, stop: integer): integer;
            VAR
                left, right: integer;       { Scan pointers. }
                pivot: integer;             { Pivot value. }

            { Interchange the parameters. }
            PROCEDURE swap(VAR a, b: integer);
                VAR
                    t: integer;
                BEGIN
                    t := a;
                    a := b;
                    b := t
                END;
```

Sorting in Pascal, page 2

```
    BEGIN { Split }
        { Set up the pointers for the hight and low sections, and
          get the pivot value. }
        pivot := arr[start];
        left := start + 1;
        right := stop;

        { Look for pairs out of place and swap 'em. }
        WHILE left <= right DO BEGIN
            WHILE (left <= stop) AND (arr[left] < pivot) DO
                left := left + 1;
            WHILE (right > start) AND (arr[right] >= pivot) DO
                right := right - 1;
            IF left < right THEN
                swap(arr[left], arr[right]);
        END;

        { Put the pivot between the halves. }
        swap(arr[start], arr[right]);

        { This is how you return function values in pascal.
          Yeccch. }
        Split := right
    END;

BEGIN { QuicksortRecur }
    { If there's anything to do... }
    IF start < stop THEN BEGIN
        splitpt := Split(start, stop);
```

Sorting in Pascal, page 3

```
            { This is how you return function values in pascal.
              Yeccch. }
            Split := right
        END;

    BEGIN { QuicksortRecur }
        { If there's anything to do... }
        IF start < stop THEN BEGIN
            splitpt := Split(start, stop);
            QuicksortRecur(start, splitpt-1);
            QuicksortRecur(splitpt+1, stop);
        END
    END;

BEGIN { Quicksort }
    QuicksortRecur(1, size)
END;
```

Sorting in Java

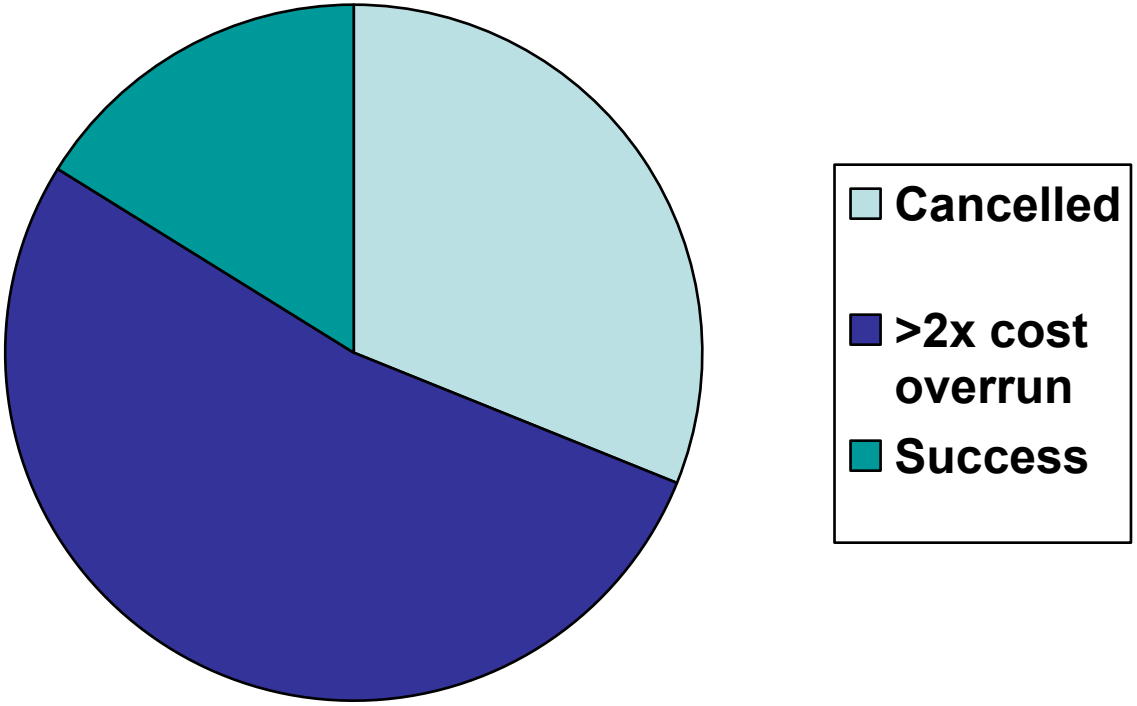
```
private void quicksort(int low, int high) {
      int i = low, j = high;
      int pivot = numbers[low + (high-low)/2];
      while (i <= j) {
            while (numbers[i] < pivot) {
                  i++;
            }
            while (numbers[j] > pivot) {
                  j--;
            }
            if (i <= j) {
                  exchange(i, j);
                  i++;
                  j--;
            }
      }
```

Sorting in Java, page 2

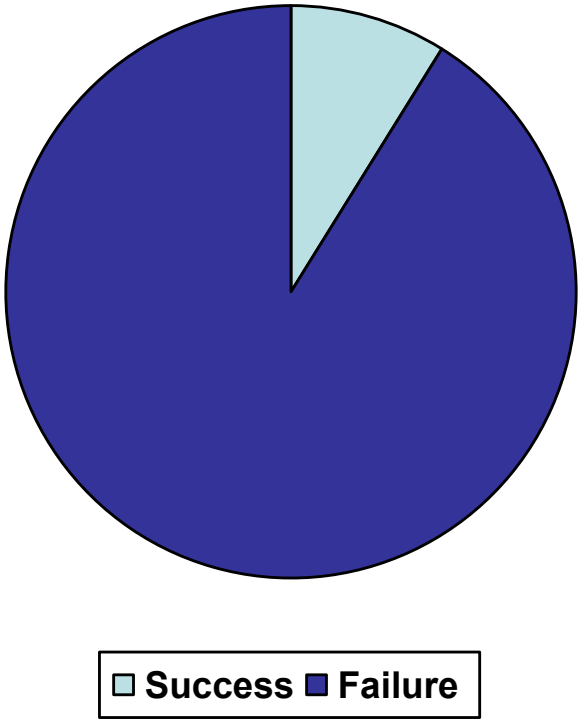
```
        if (low < j)
              quicksort(low, j);
        if (i < high)
              quicksort(i, high);
}

private void exchange(int i, int j)
{
        int temp = numbers[i];
        numbers[i] = numbers[j];
        numbers[j] = temp;
}
```

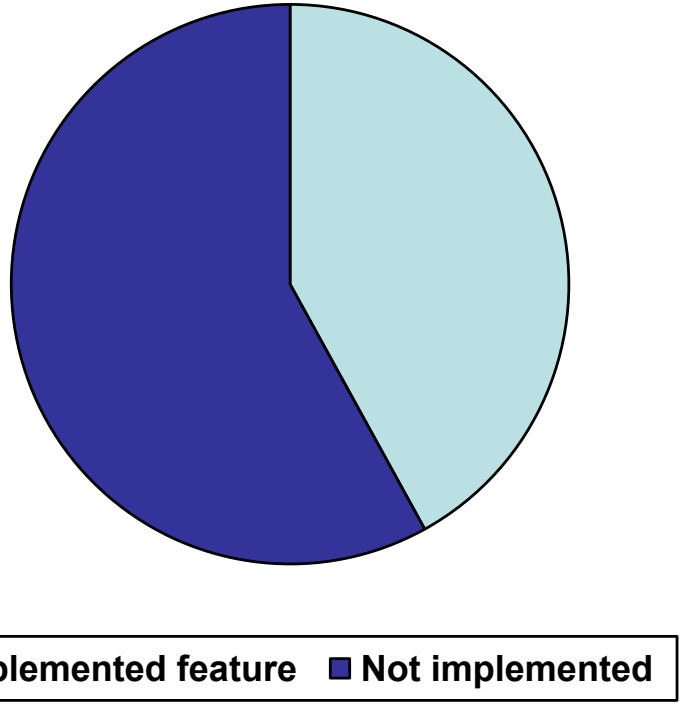
Software Crisis, 1968—today

- Software project outcomes

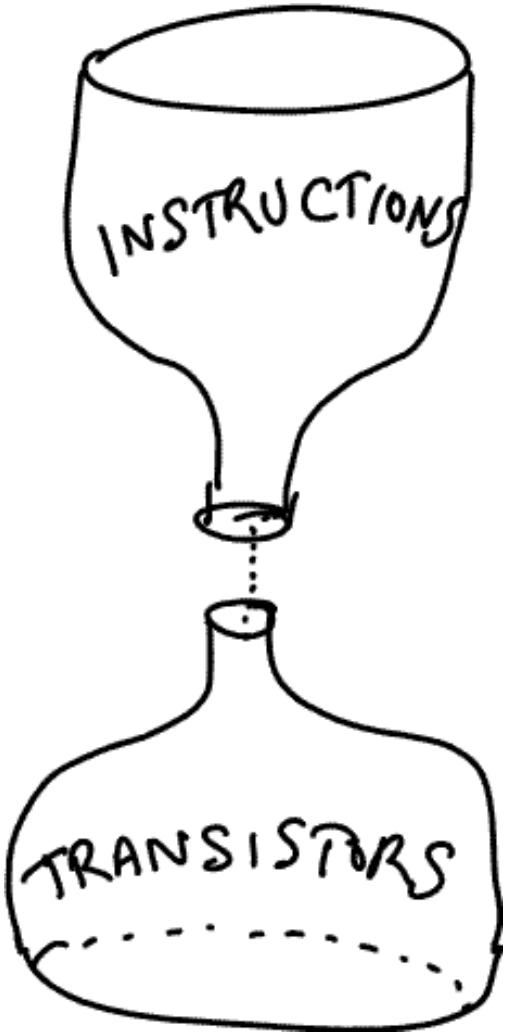


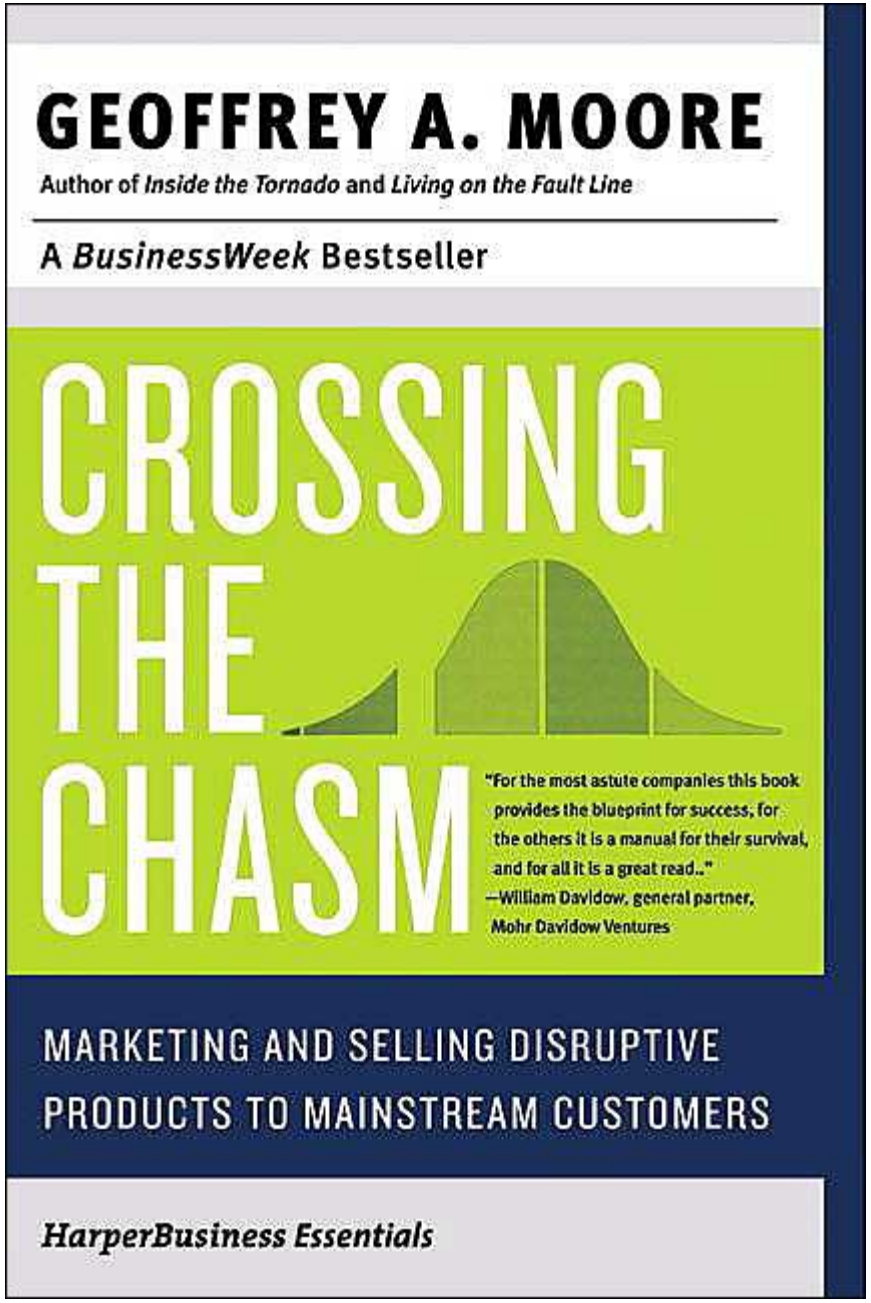
In Large Companies





The Von Neumann Bottleneck

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MARKETING AND SELLING DISRUPTIVE PRODUCTS TO MAINSTREAM CUSTOMERS
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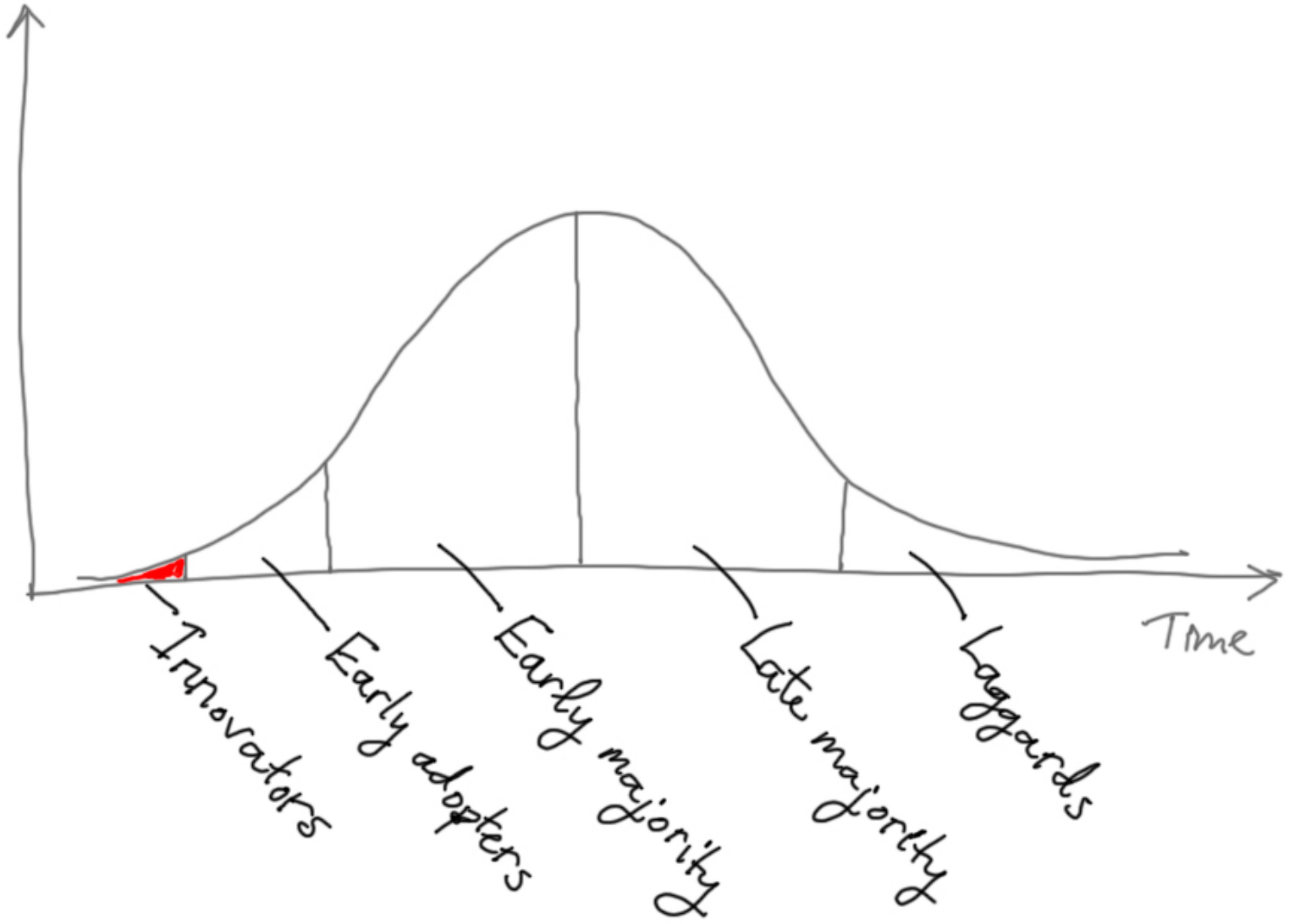
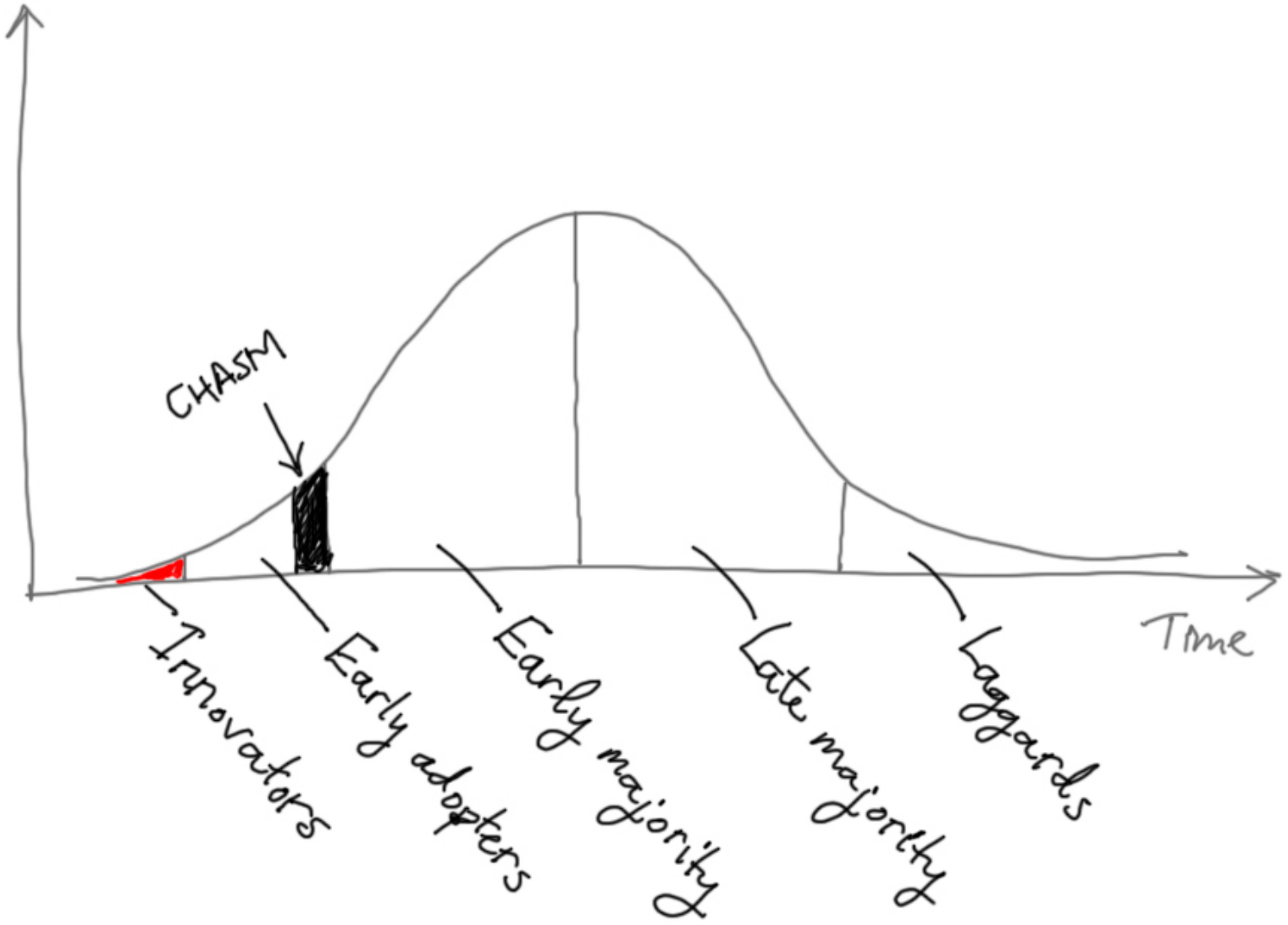
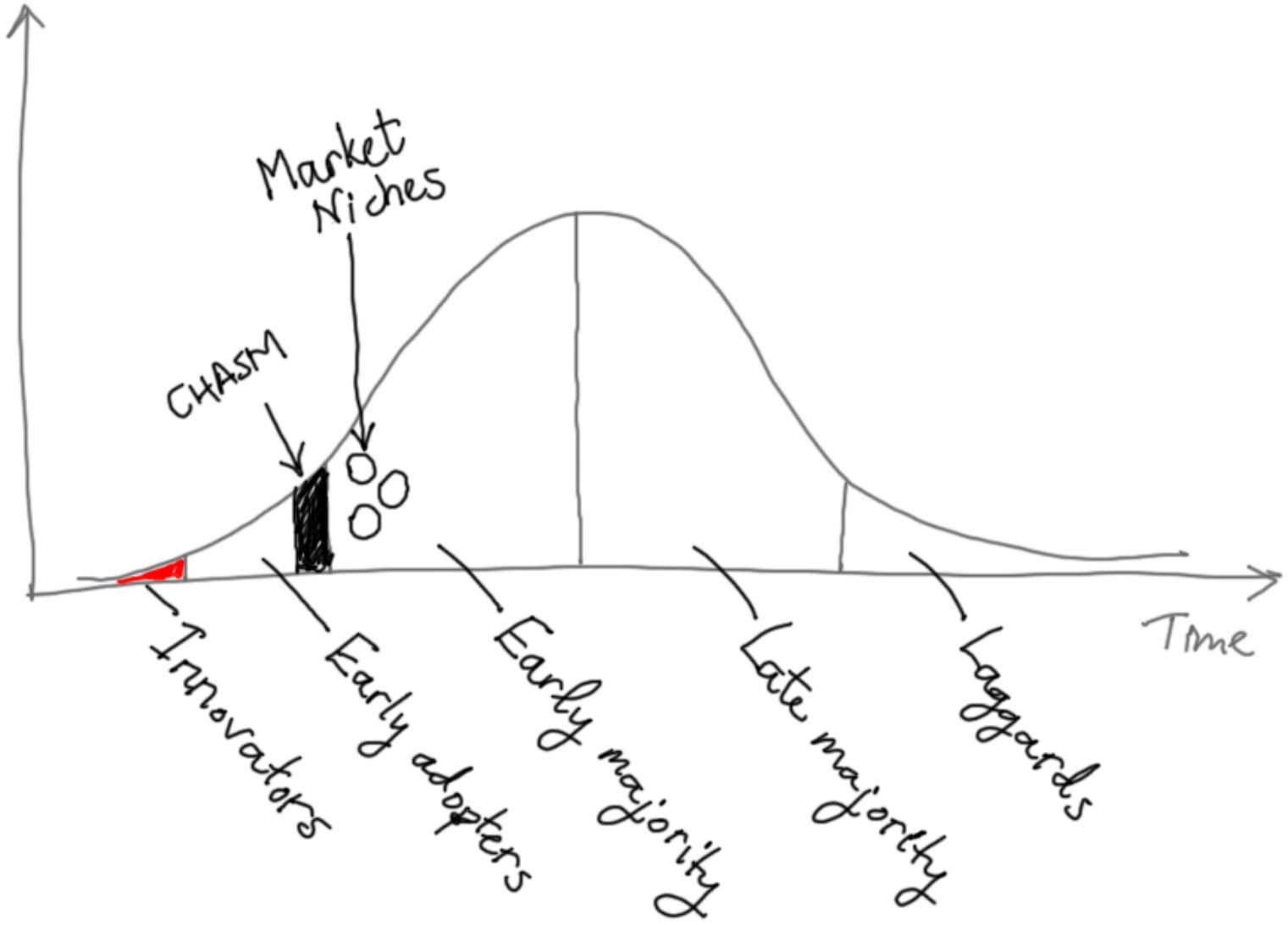
Technology adoption life cycle



Technology adoption life cycle



Technology adoption life cycle



The Erlang Story

- 1986—Erlang emerges at Ericsson
  - Functional language
  - Extra support for concurrency & fault tolerance
- Early 1990s—small products
- 1996
  - Open Telecoms Platform (higher-order functions for robust telecom systems)
  - AXD 301 project starts

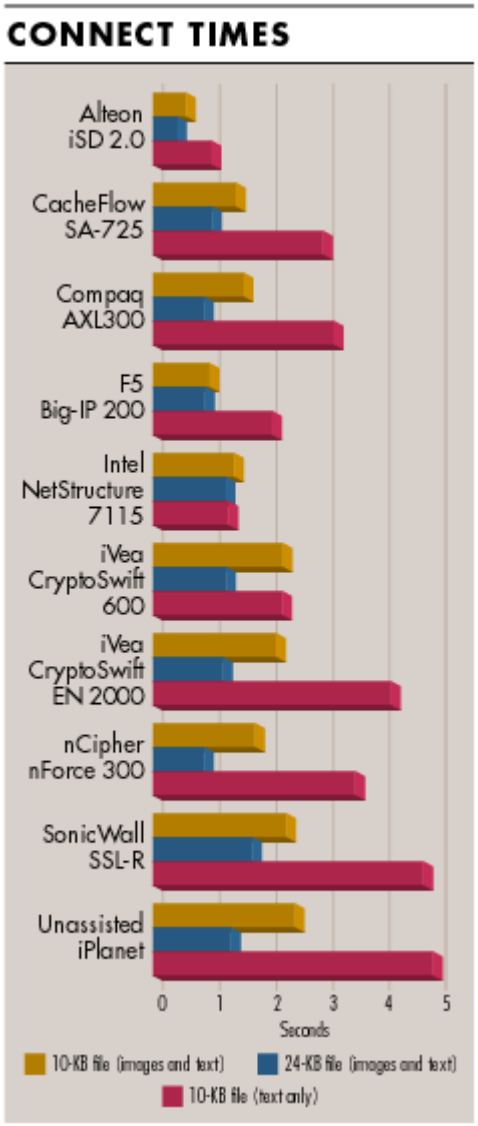
The AXD 301

- ATM switch (telephone backbone)
- Born out of a failed project!
- 1,5 MLOC Erlang
- *Seven nines* reliability
- 4-10x better productivity, quality

Erlang Story II

- 1998—Erlang banned for new projects
- 1998—Open source Erlang
- 1998—Bluetail
  - Jane Walerud VD
  - Mail robustifier, Web prioritizer

SSL Accelerator



- Alteon WebSystems' SSL Accelerator offers phenomenal performance, management and scalability.
  - *Network Computing*

KREDITOR

Ord

invoice

100:-

Fem år har gått och vi har vuxit till ett ambitiöst och kreativt gäng på 350 stycken. Vi har blivit utsedda till Årets företag -07 (skryt), ökat omsättningen med 13 570 % och lyckats bli marknadsledande i Norden (fakta).

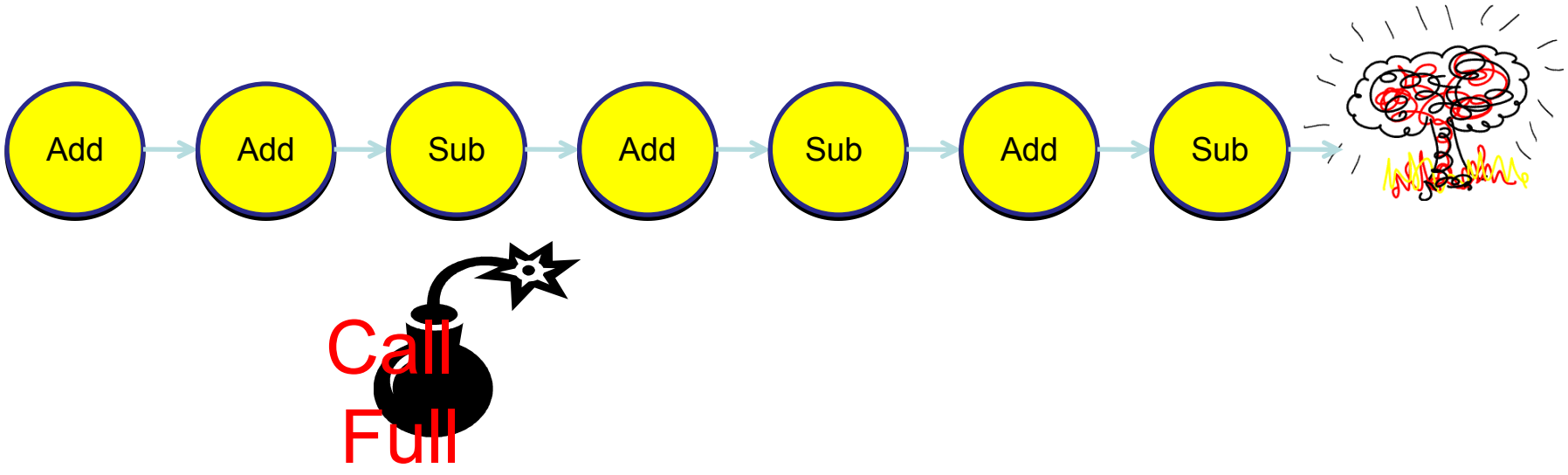
klarna

- Founded May 2006

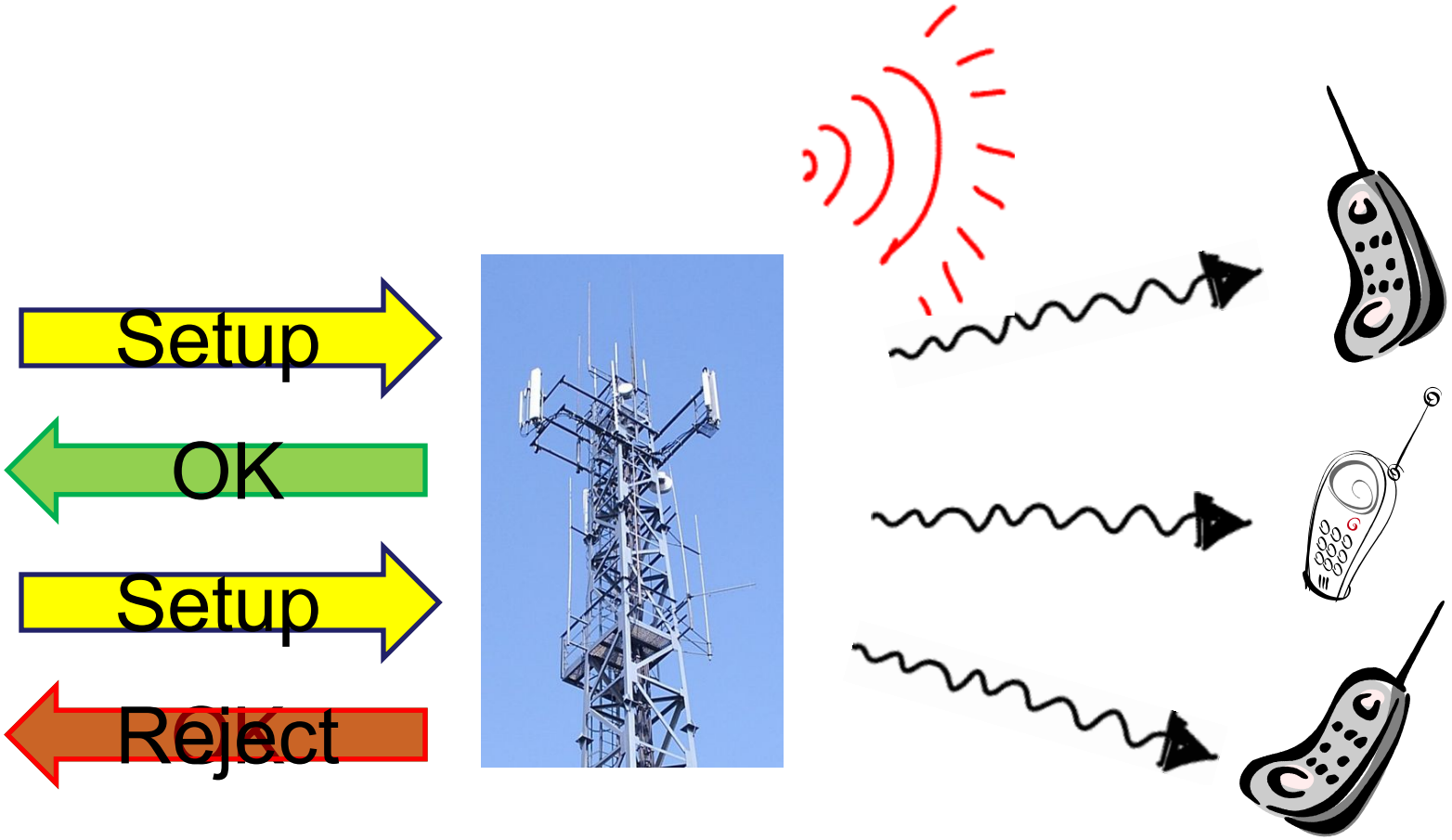
- Selling… QuickCheck!
  - Key feature: *simplifies* failing tests
  - Extensions for testing stateful systems

Media Proxy

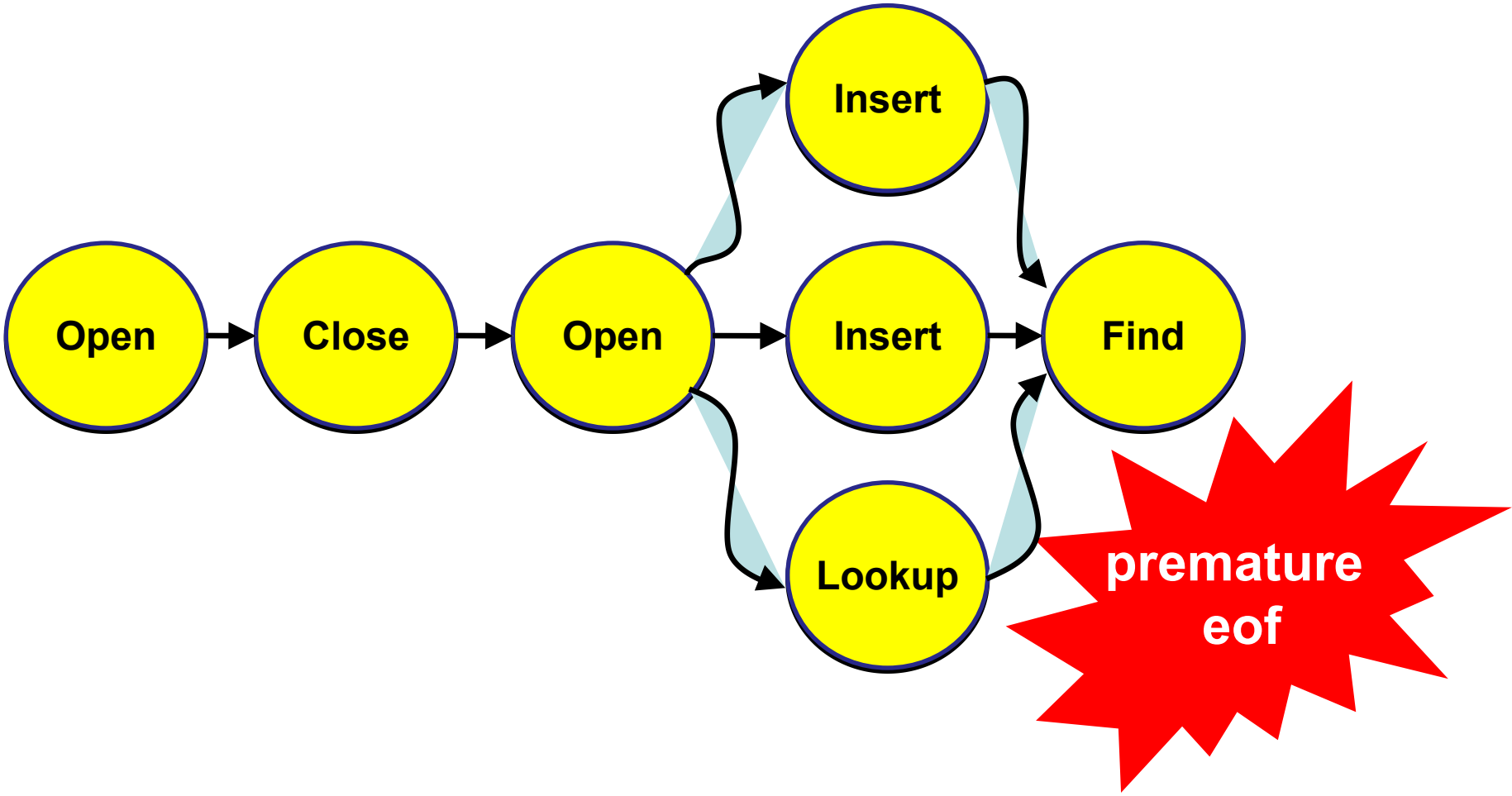
- Multimedia IP-telephony (IMS)
- Connects calls across a firewall
- Test adding and removing callers from a call



3G Radio Base Station



"We know there is a lurking bug somewhere in the code. We have got 'bad object' and 'premature eof' every other month the last year. We have not been able to track the bug down since the file is repaired automatically next time it is opened.“
Tobbe Törnqvist, Klarna, 2007



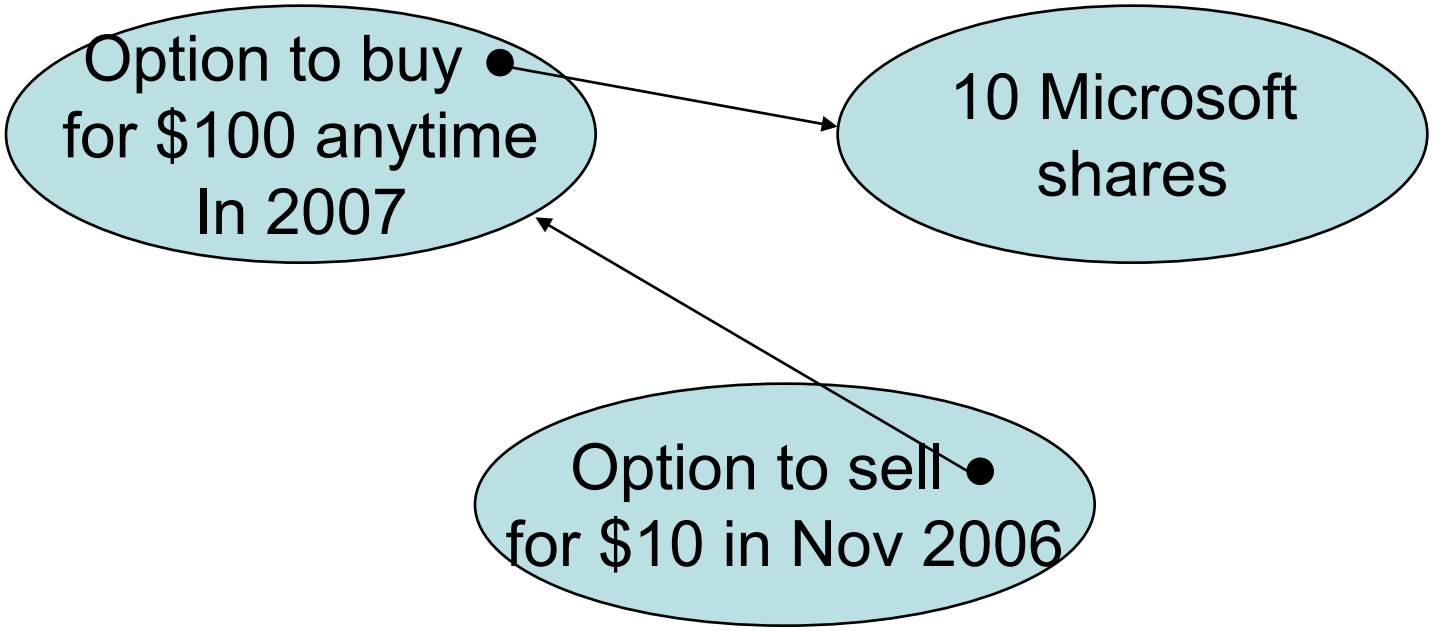
Most Influential ICFP Paper Award

Erlang in Ericsson

- 1998—BANNED!
- 2007—Recommended for ”complex state machines with high performance requirements”
- 2010—recruiting Erlang programmers in Göteborg

CREDIT SUISSE

- Derivatives trading in New York



Financial Contracts in Haskell

- The option to acquire 10 Microsoft shares, for $100, anytime between t1 and t2 years from now

```
anytime :: Contract -> Contract
-- Acquire the underlying contract at
-- any time before it expires (but
-- you must acquire it)
```

anytime: Choose when

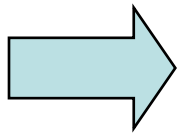
```
golden_handcuff = anytime shares

shares = zero `or` (scaleK -100 (one Dollar) `and`
                    scaleK 10 (one MSShare))
```

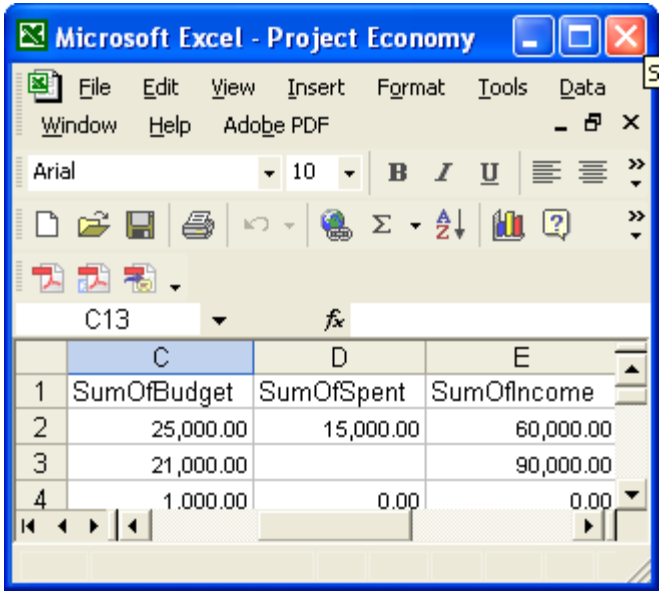
or: Choose whether

MS shares are a "currency"

New Approach

Haskell contract models





C++ plugins

CREDIT SUISSE

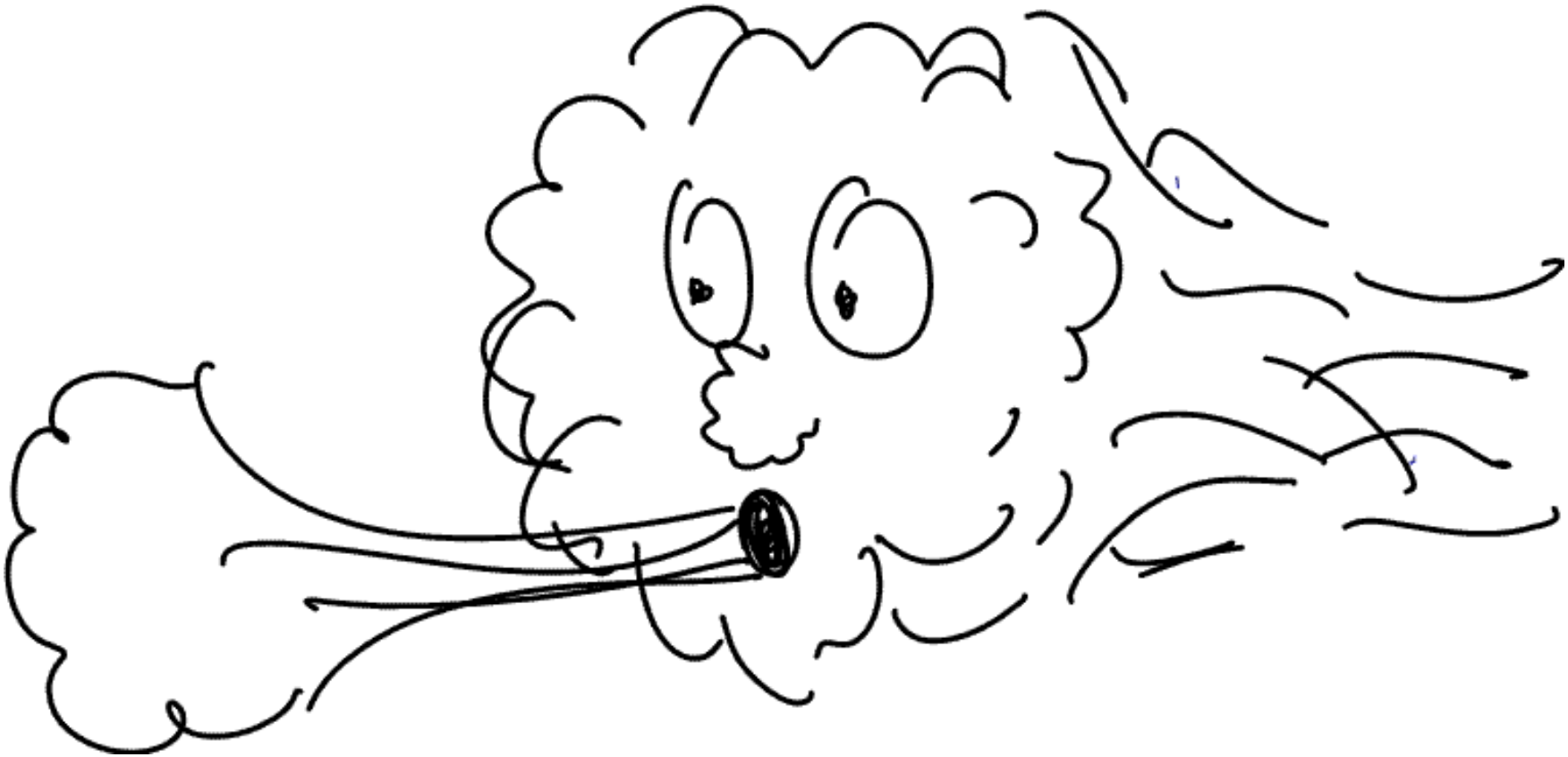
Standard Chartered

BARCLAYS CAPITAL

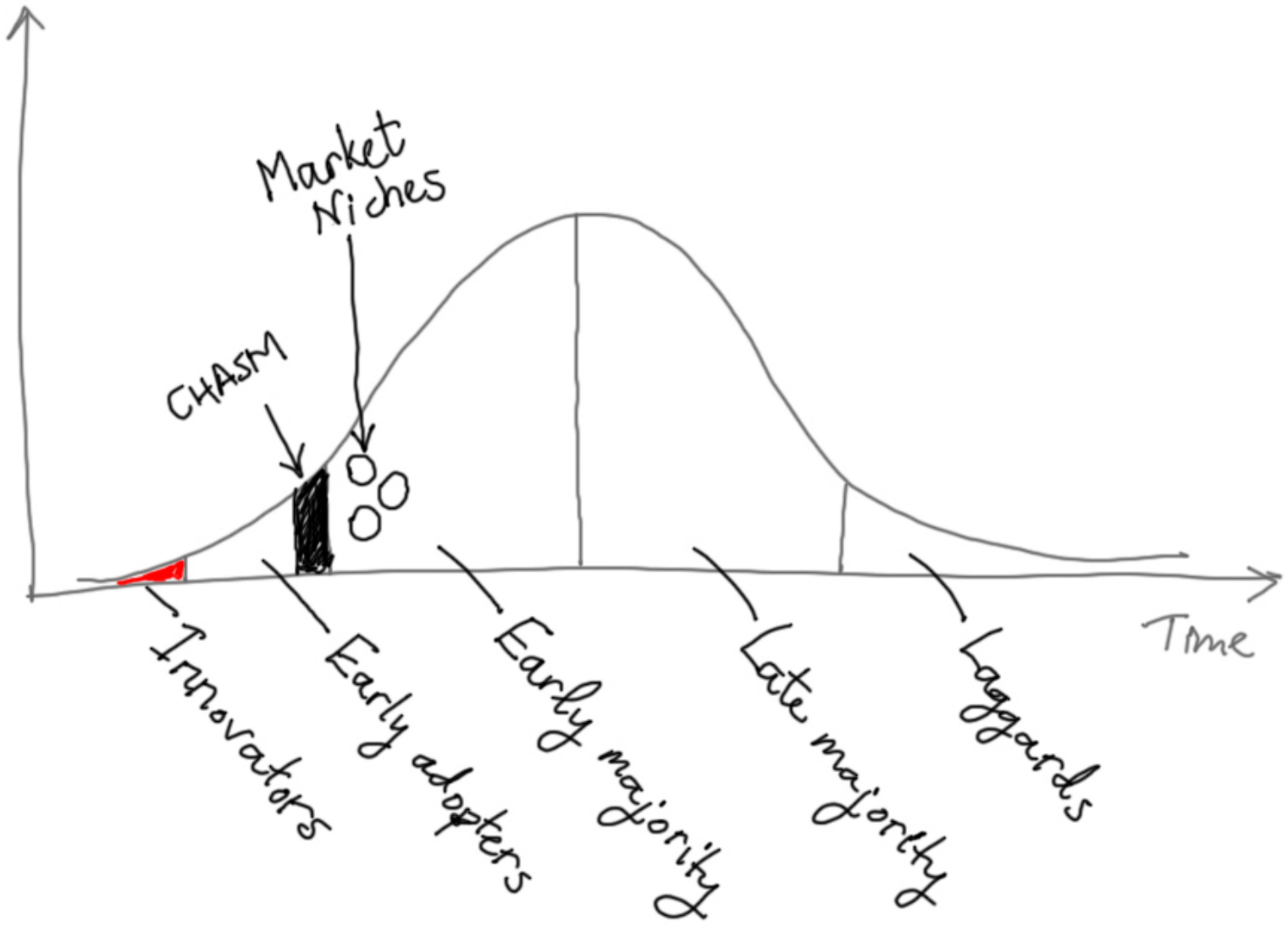
Bloomberg

Goldman Sachs

- ”Functional programming on Wall Street”
  - Proprietary trading
  - >100 people
  - Offices in New York, London, Tokyo
  - OCaml primary development language



Where are we?


Market Niches
CHASM
Time
Innovators
Early adopters
Early majority
Late majority
Laggards

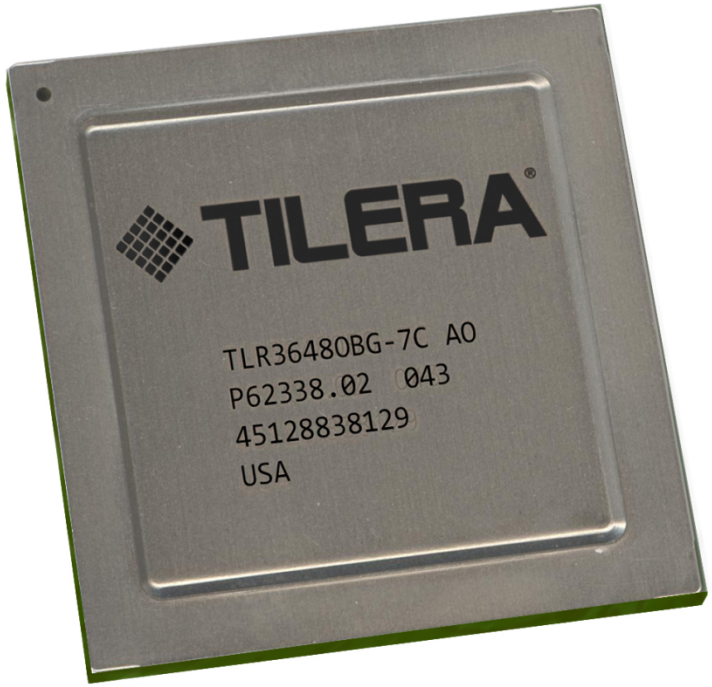
TIOBE Programming Language Index

Position Oct 2010	Position Oct 2009	Programming Language	Ratings Oct 2010	Delta Oct 2009
1	1	Java	18.166%	-0.48%
2	2	C	17.177%	+0.33%
…	…	…	…	…

Category	Ratings Oct 2010	Delta Oct 2009
Object-Oriented Languages	55.9%	+2.5%
Procedural Languages	38.9%	-3.4%
Functional Languages	3.5%	+0.6%
Logical Languages	1.6%	+0.2%

The Multicore Opportunity

4 cores



64 cores

- Stable compiler and selected high quality libraries
- Installers for multiple platforms
- For serious developers

- 200,000 downloads in 4 months for Windows alone!

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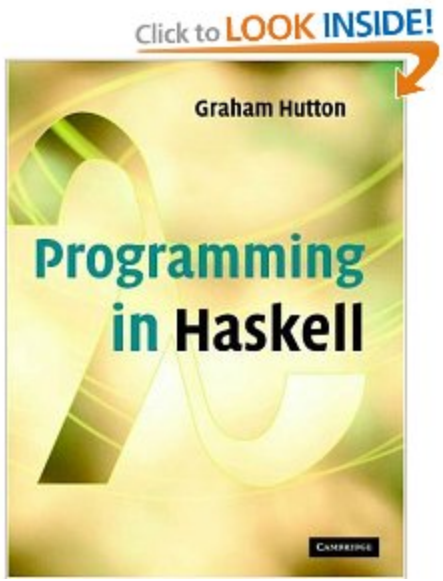
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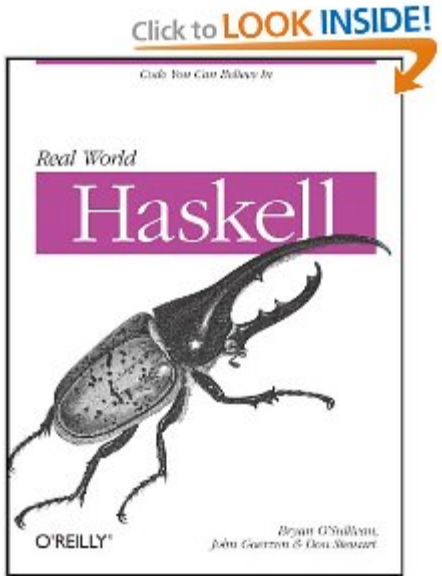
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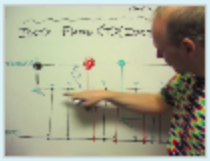
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Expe Expe Hicke Brian Beck

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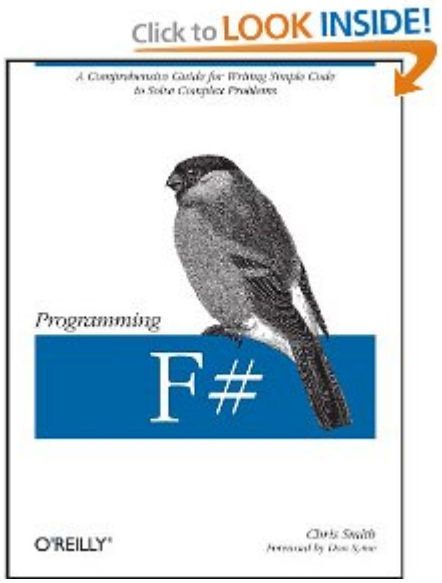
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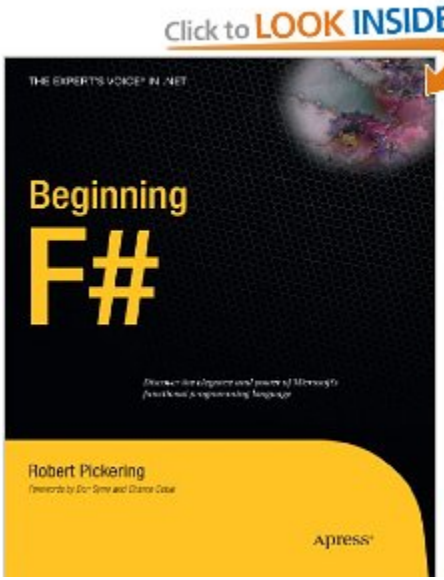
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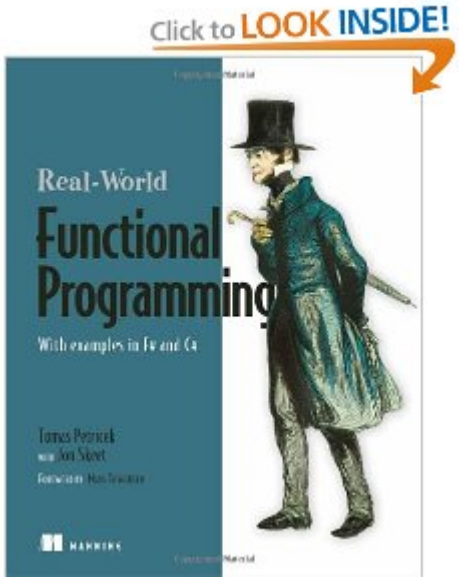
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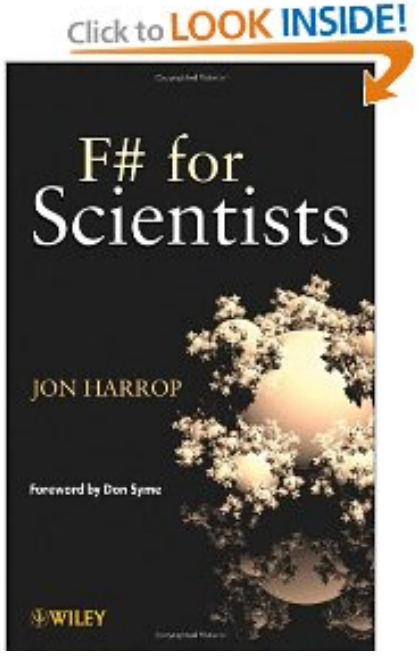
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2010-08-30 06:06

Microsoft chockar programmerarna

Av Lars Daniels son

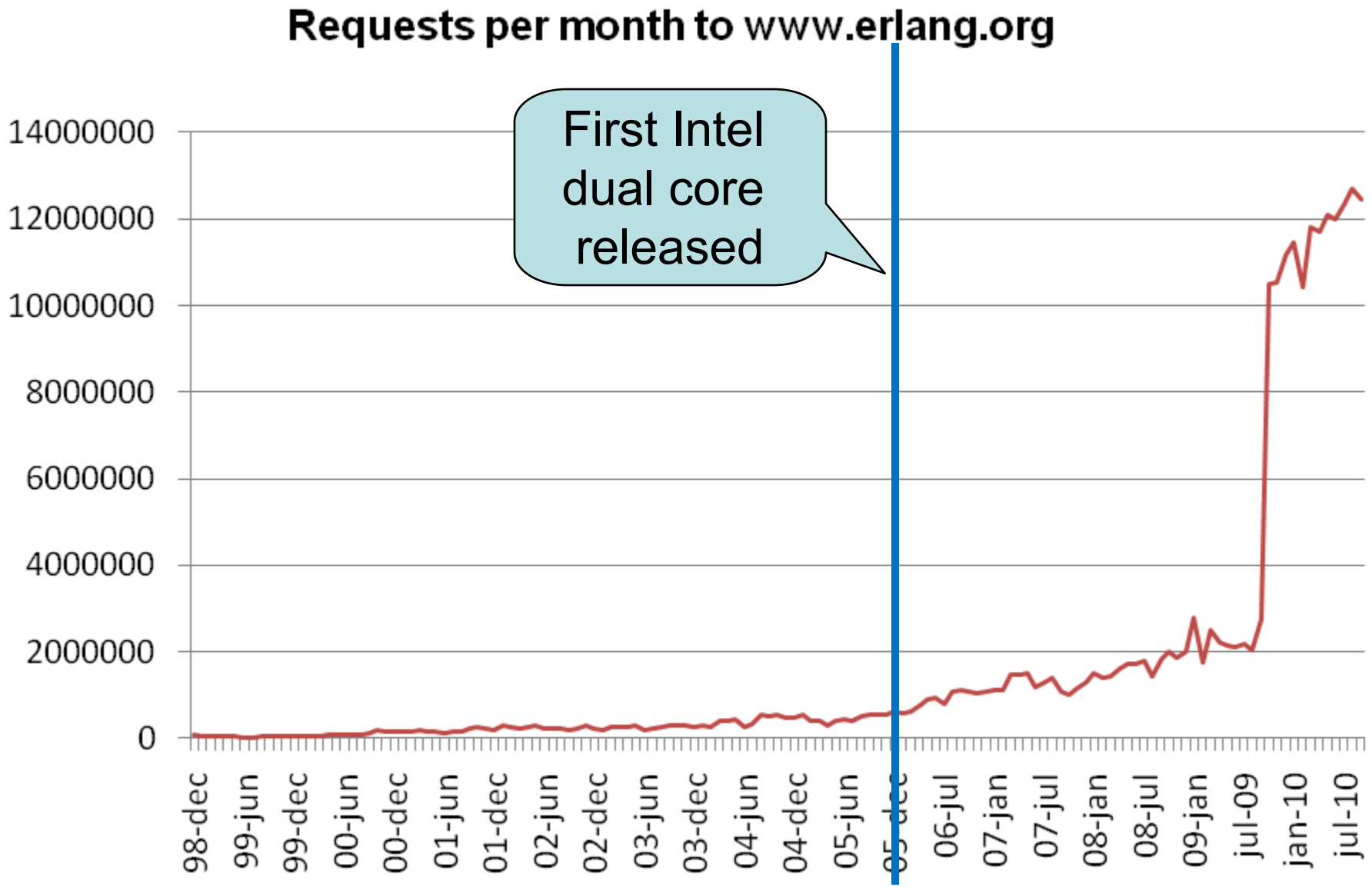
När all världens programmerare börjar få grepp om objektorientering är det dags för nästa paradigmskifte. Med Microsoft som härförare vinner funktionella språk mark. Programmerare får räkna med att lära om.

FAKTA

Helt annorlunda

- Funktionell programmering bygger på utvärdering av matematiska funktioner. Man undviker olika lägen (states) i program och att ändra datavärden.
- Det finns starka inslag av deklarativ programmering i funktionell programmering. Det innebär att programmeraren anger vad som ska göras, men inte hur.
- Det här innebär stora skillnader både mot äldre

När all världens programmerare börjar få grepp om objektorientering är det dags för nästa paradigmskifte. Med Microsoft som härförare vinner funktionella språk mark. Programmerare får räkna med att lära om.


Requests per month to www.erlang.org
First Intel dual core released
14000000
12000000
10000000
8000000
6000000
4000000
2000000
0
98-dec
99-jun
99-dec
00-jun
00-dec
01-jun
01-dec
02-jun
02-dec
03-jun
03-dec
04-jun
04-dec
05-jun
06-jul
07-jan
07-jul
08-jan
08-jul
09-jan
jul-09
jan-10
jul-10

Erlang Solutions Ltd.

- 60 people in 2010
- x2 every year!

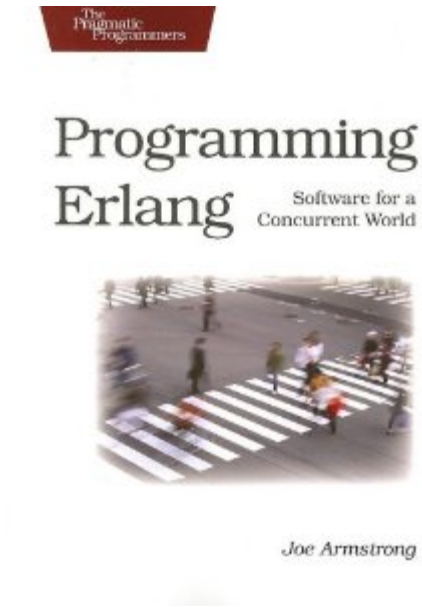
- Customers
  - Telecom
  - Internet services
  - Financial services
  - Automotive
  - …

The Pragmatic Programmers

Programming Erlang

Software for a Concurrent World

Joe Armstrong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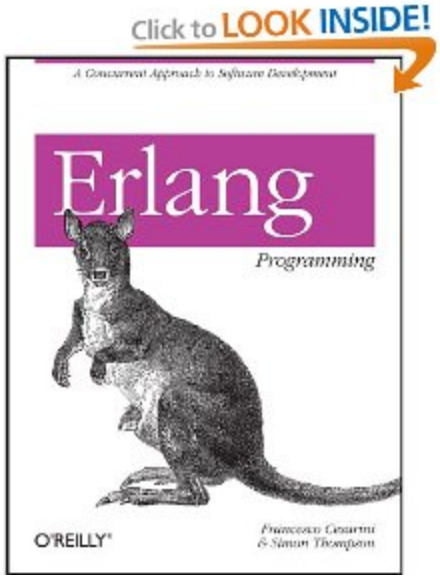
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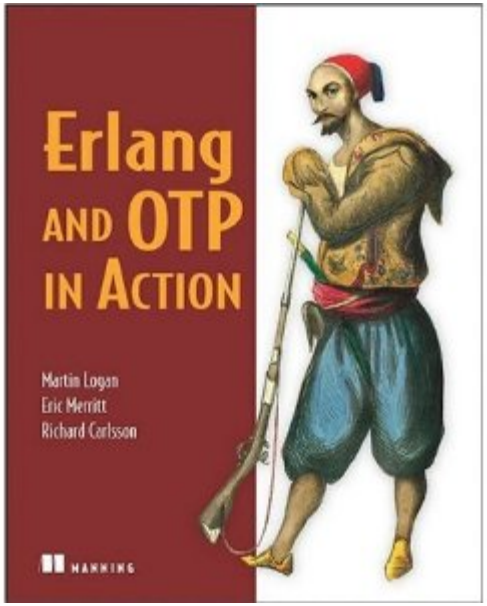
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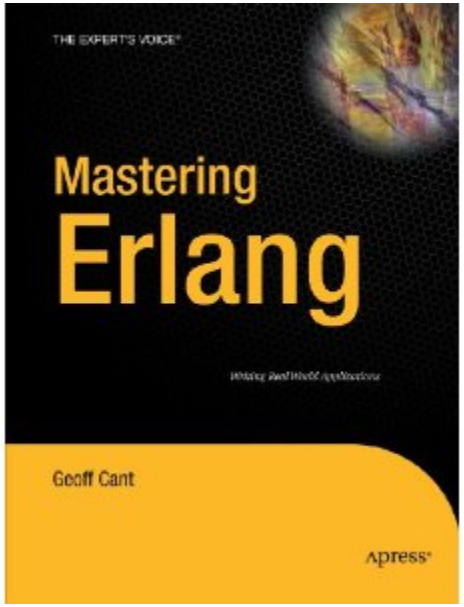
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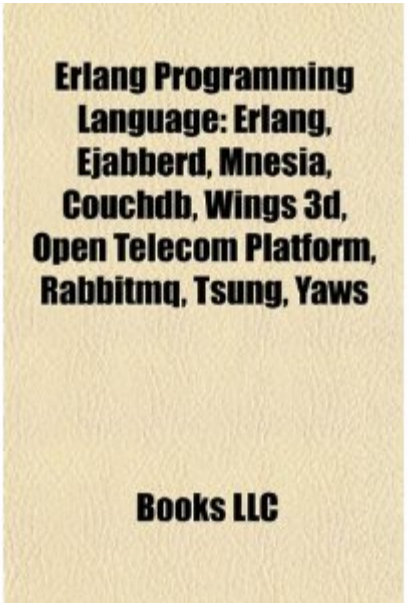
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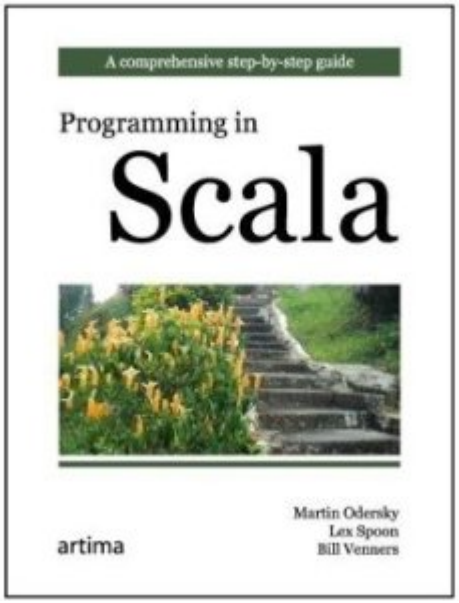
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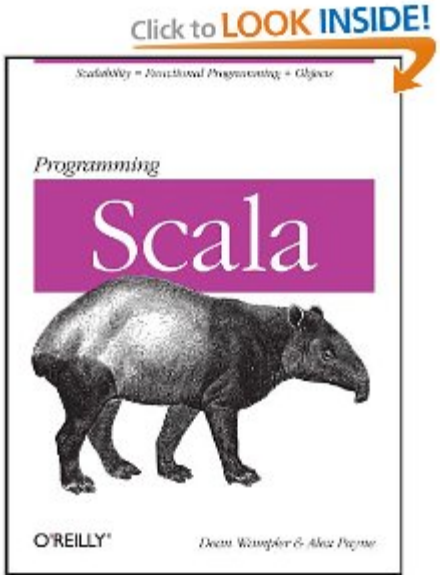
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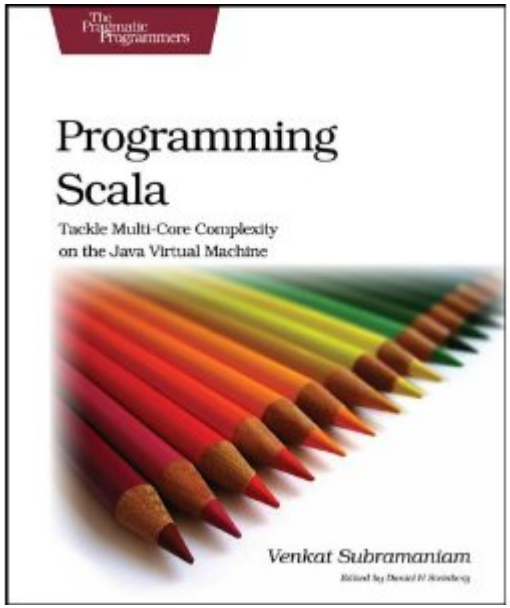
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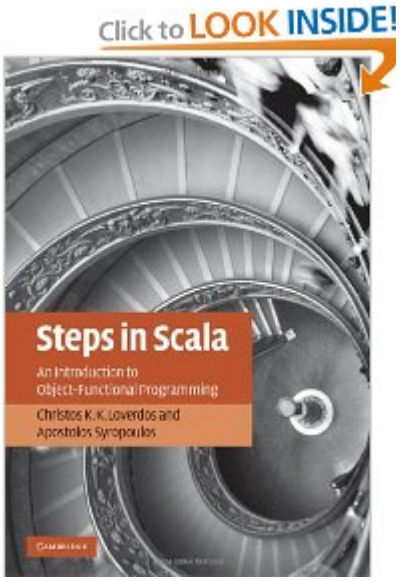
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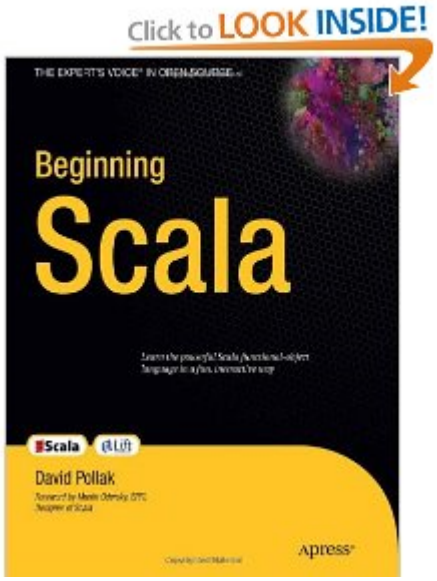
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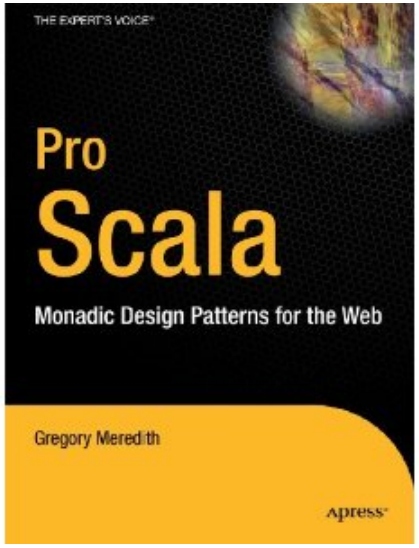
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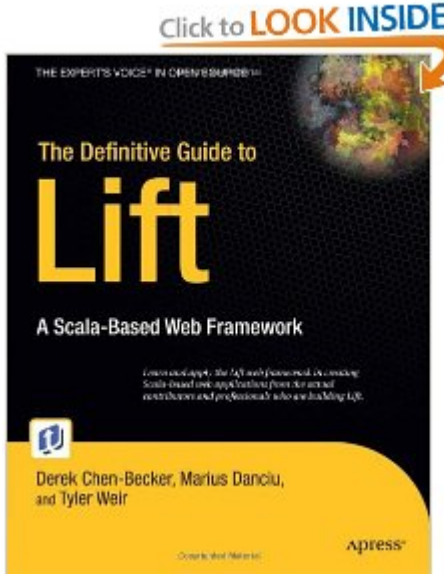
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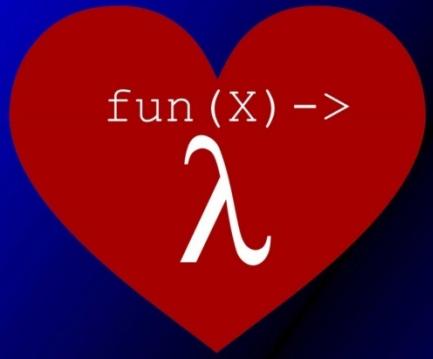

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