How did we end up here?

Todd Montgomery
Martin Thompson
DO NOT TOUCH ANY OF THESE WIRES
How bad can things really be?
## Software Project Success Rates

<table>
<thead>
<tr>
<th>Method</th>
<th>Successful</th>
<th>Challenged</th>
<th>Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ad-hoc</td>
<td>49%</td>
<td>37%</td>
<td>14%</td>
</tr>
<tr>
<td>Iterative</td>
<td>61%</td>
<td>28%</td>
<td>11%</td>
</tr>
<tr>
<td>Agile</td>
<td>60%</td>
<td>28%</td>
<td>12%</td>
</tr>
<tr>
<td>Traditional</td>
<td>47%</td>
<td>36%</td>
<td>17%</td>
</tr>
</tbody>
</table>

- Dr Dobbs 2010
<table>
<thead>
<tr>
<th>Method</th>
<th>&lt; 10</th>
<th>11 - 25</th>
<th>&gt; 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ad-hoc</td>
<td>70%</td>
<td>58%</td>
<td>40%</td>
</tr>
<tr>
<td>Iterative</td>
<td>88%</td>
<td>68%</td>
<td>55%</td>
</tr>
<tr>
<td>Agile</td>
<td>83%</td>
<td>70%</td>
<td>55%</td>
</tr>
<tr>
<td>Traditional</td>
<td>69%</td>
<td>51%</td>
<td>50%</td>
</tr>
</tbody>
</table>

- Dr Dobbs 2010
Well that’s the optimistic view!
Software Project Success Rates

Successful: 32%
Challenged: 44%
Failure: 24%

– Standish Group Chaos Report 2010
Software Project Failure Rates

< $350,000: 20%
$350,000 - $1,000,000: 25%
> $1,000,000: 28%

– Gartner 2012
In a study of over 5400 large scale projects (> $15m)

17% go so badly that they threaten the existence of the company undertaking them

– The McInsey Group with Oxford University 2012
Sacred Cows - It’s BBQ Time!!!
Enterprise Software
ent·ter·prise
noun ˈen-tə(r)-ˌprīz

: a project or activity that involves many people and that is often difficult

: the ability or desire to do dangerous or difficult things or to solve problems in new ways

Source: http://www.merriam-webster.com/
Naming Matters !!!
The Architect
BUILDING GREATER LIES
FOR THE GREATER GOOD
Product Management
Minimum Viable Product?
Product Owner ?
GO BACK
YOU ARE GOING WRONG WAY
Technologists ARE part of the business
Take responsibility for ROI
How can I get an answer for the minimum investment?
Agile Methods
CHILDREN MUST HAVE ADULT SUPERVISION
Water-scrum-fall
What really matters?
Need to focus on learning, feedback cycles, and outcomes
There is an uncomfortable truth…
“What would have been different if you were not involved?”
Manifestos
Build on the shoulders of giants
Shared Mutable State
“...Shared Mutable State...” the most feared words in computing
...if not they should be!
HERDING CATS.
Not so difficult actually.
Shared Mutable State should only be used for systems programming
Embrace append-only, single writer, and shared nothing designs
If you don’t...
math will hunt you down and
there is nowhere to hide!
Be ruthless in reducing complexity
Text Encoding
But it’s human readable...
Binary is hard to work with...
SHUT UP AND STOP WHINING
unstructured information data
Big Data
Communications
Battery life and bandwidth?
Synchronous Comms
Bad things will happen!!!
Synchronous Communication is the crystal meth of distributed programming
Causes a coupling in location and time
Errors need to be first class messages
Are your micro services on crystal meth?
Abstraction
“All non-trivial abstractions, to some extent, are leaky.”

- Joel Spolsky
“The detail of underlying complexity cannot be ignored.”
“the purpose of abstracting is not to be vague, but to create a new semantic level in which one can be absolutely precise”

- Dijkstra
We could say the main issue is that people don’t understand abstractions...but...
Sins committed in the name of Abstraction
Functional Programming
What is the biggest issue with functional programming?
Functional Programmers

I'm sorry, I can't hear you. Your inferiority is too loud.
Functional programming is **NOT** the answer to multi-core
Software Transactional Memory was a failed experiment!
Universal Scalability Law

The graph illustrates the speedup achieved with increasing processors, comparing Amdahl's Law (blue line) and the Universal Scalability Law (USL, red line). As the number of processors increases, the speedup with Amdahl's Law remains constant, while the USL shows a diminishing return, reflecting the limitations of scalability beyond a certain point.
No Mechanical Sympathy?
However there is genuine brilliance in functional programming
Collaborate and great things can happen...
Throw hardware at it... development is too expensive
The free lunch is over... we cannot be sloppy anymore...
Loops

L0 1534 µops

LB 28 µops

LB 28 µops
Code must be simple and composable
Cache Sub-System

- **L1(D) - 32K**
  - 128 bits / cycle
  - 32 Bytes / cycle

- **L1(I) - 32K**
  - 16 Bytes / cycle
  - 32 Bytes / cycle

- **L2 - 256K**
  - 32 Bytes / cycle

- **L3 - 8-20MB**

- **LF/WC Buffers**

- **MOB**

- **L0(I) - 1.5k µops**
  - 128 bits / cycle

- **TLB Pre-fetchers**

- **Ring Bus**

- **QPI Bus**

- **PCI-e Controller**

- **Memory Controller**

- **System Agent**
Patterns of access and locality are key to performance
Memory Sub-System Performance

- Accumulated Improvement
- Bandwidth
- Latency
- Time
What does this mean for software?
Think in terms of transformation and flow of data – not code!
Diversity
Testosterone Driven Development
What Happened To Women In Computer Science?

% Of Women Majors, By Field

- Medical School
- Law School
- Physical Sciences
- Computer science

Source: National Science Foundation, American Bar Association, American Association of Medical Colleges
Credit: Quoctrung Bui/NPR
What did the Carnegie Mellon studies show?
Fake it until you make it...
“As soon as you realise that most people don’t know what they are doing the world makes a lot more sense…”

– Farley’s second law
We need to look seriously at training programmers
Coaching and Apprenticeships
“The most important thing I've accomplished, other than building the compiler, is training young people.”

- Grace Hopper
"Do you think we can do this?" I say, ‘Try it.’ And I back 'em up.

They need that. I keep track of them as they get older and I stir 'em up at intervals so they don't forget to take chances.

- Grace Hopper
In closing...
What are the greatest achievements of the human race?
The Scientific Method
Understanding of Evolution
Don’t feel bad...
We are living in the era of Software Alchemy
Do epic shit, or die trying.
"It does not matter how intelligent you are, if you guess and that guess cannot be backed up by experimental evidence – then it is still a guess."

- Richard Feynman