A Vision of Computing in 10+ Years

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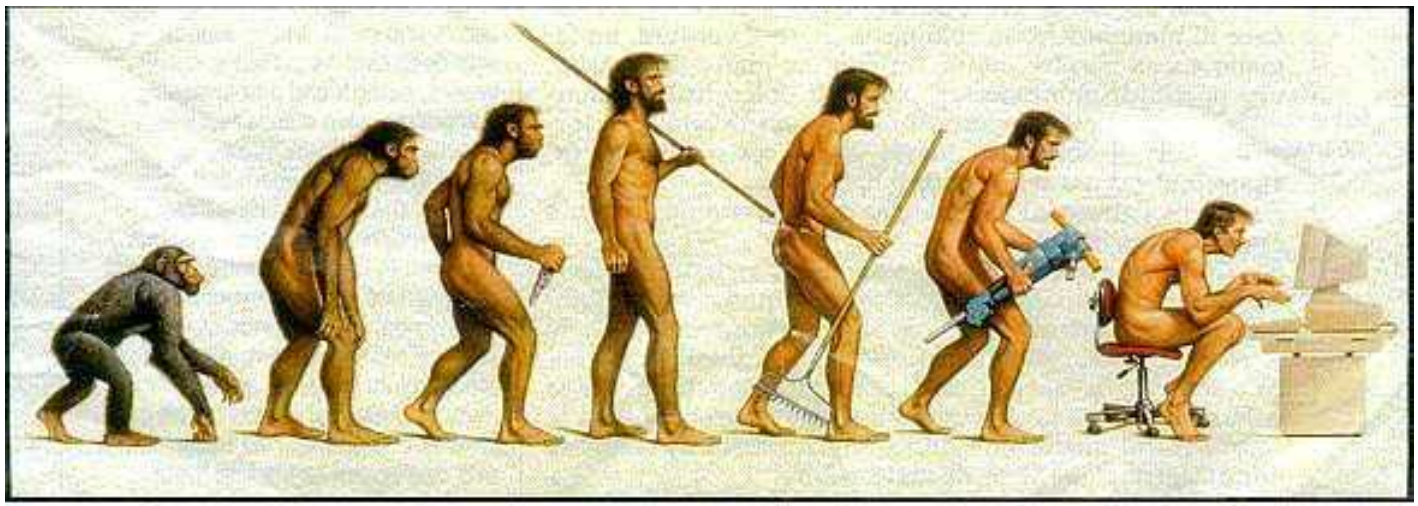
Why Did Homo Sapiens Succeed?

Many answers, somewhat inter-related...

1. Bigger Brains (Composite tools, etc.) Neanderthals had bigger brains
2. Better Abstract Thought (Language, Cave Paintings, etc.)
3. More Adaptable (Clothing, Fire)
4. More Social (Share Discoveries, Weapons)

Are scientists devolving? What can we learn?



Somewhere, something went terribly wrong

Source: http://1.bp.blogspot.com/-mHNFHwj4kwI/Uemj7zLRv-I/AAAAAAAABJo/WgMwhi1Nim4/s1600/evolution.jpg

What Does the Digital Scientist Need to Succeed?

1. Bigger Brains - Heroic programming efforts? Not quite...
2. Better Abstract Thought - Really hard to understand papers? Not quite...
3. More Adaptable - Simpler, more modular code, easier to change/replace the pieces?
4. More Social - Better documentation, standards, re-use?

Source: Planet of the Apes, 1968

Modularity

We need to be able to modularize the following things:

1. Science
2. Numerical Methods
3. Parallelism
4. Memory Optimizations

Source: https://www.linkedin.com/pulse/modularize-connect-acatar-resolves-dilemma-marie-norman

The Vision

We decouple science from numerical methods and optimization

1. DSL's
   1. Can be made very simple, easy for humans and machines to parse
   2. Can more naturally reflect scientific notation
2. Existing Languages
   1. C++ operator overloading
   2. Macros which understand the parse tree (Julia, etc.)

The Vision

We evolve away from NIH (Not Invented Here) and reuse basic infrastructure

1. common data structures
2. parameter files
3. checkpoint/restart
4. high performance I/O

Source: http://dilbert.com/2014-08-11/

The Vision

Recognition and Reward

1. Career paths for software developers will be supported, on a par with other scientists
2. Metrics for contribution to science will be more than papers authored or citations
3. Intelligent re-use of components will be as valuable as creating new software components

Source: http://3.bp.blogspot.com/-AcnXbcqHUa0/T41R7nCok9I/AAAAAAAAFns/KLmoEUcPmk4/s1600/recognition.png

The Vision

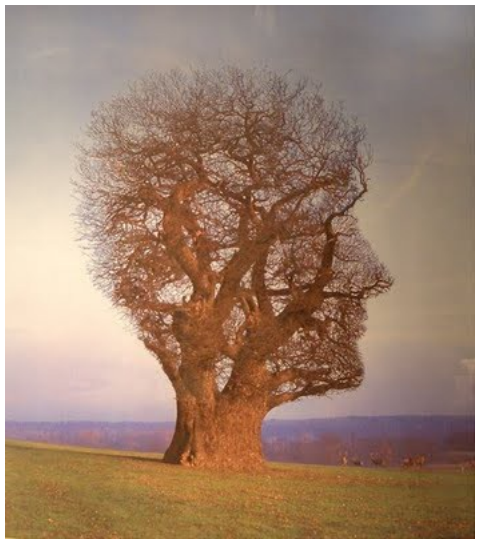
A Problem...

1. Papers are standalone and incomplete
2. Papers (or parts of them) are inaccessible to other scientists in slightly different disciplines

The Democratation of Science

1. Papers could reference all material required to understand them
2. Lesson plans culminating in the understanding of individual publications could be auto-generated

Papers become leaves on a tree of knowledge (e.g. wikipedia or knowen.org)



Source: https://hopespassage.files.wordpress.com