ASEG Workshop

August 15, 2013

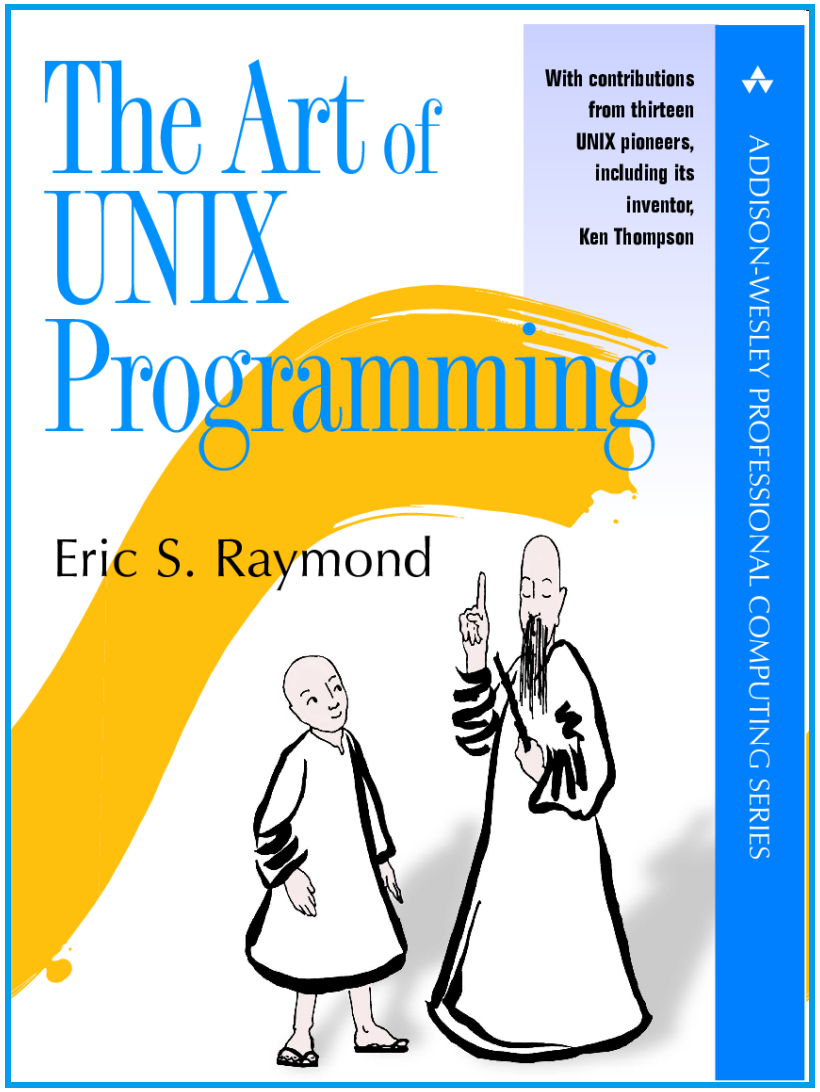
Melbourne, Australia

Software as a Research Tool

Outline

- State of the Madagascar project
- Madagascar philosophy

Software versus Science



"**Abandoning the habit of secrecy** in favor of process transparency and peer review was the crucial step by which alchemy became chemistry. In the same way, it is beginning to appear that open-source development may signal the long-awaited maturation of software development as a discipline." *Eric Raymond*

ohloh.net about Madagascar

In a Nutshell, Madagascar…

…has had 9,517 commits made by 70 contributors
representing 629,407 lines of code
…is mostly written in C
with an average number of source code comments
…has a well established, mature codebase
maintained by a very large development team
with increasing Y-O-Y commits

Very High Activity

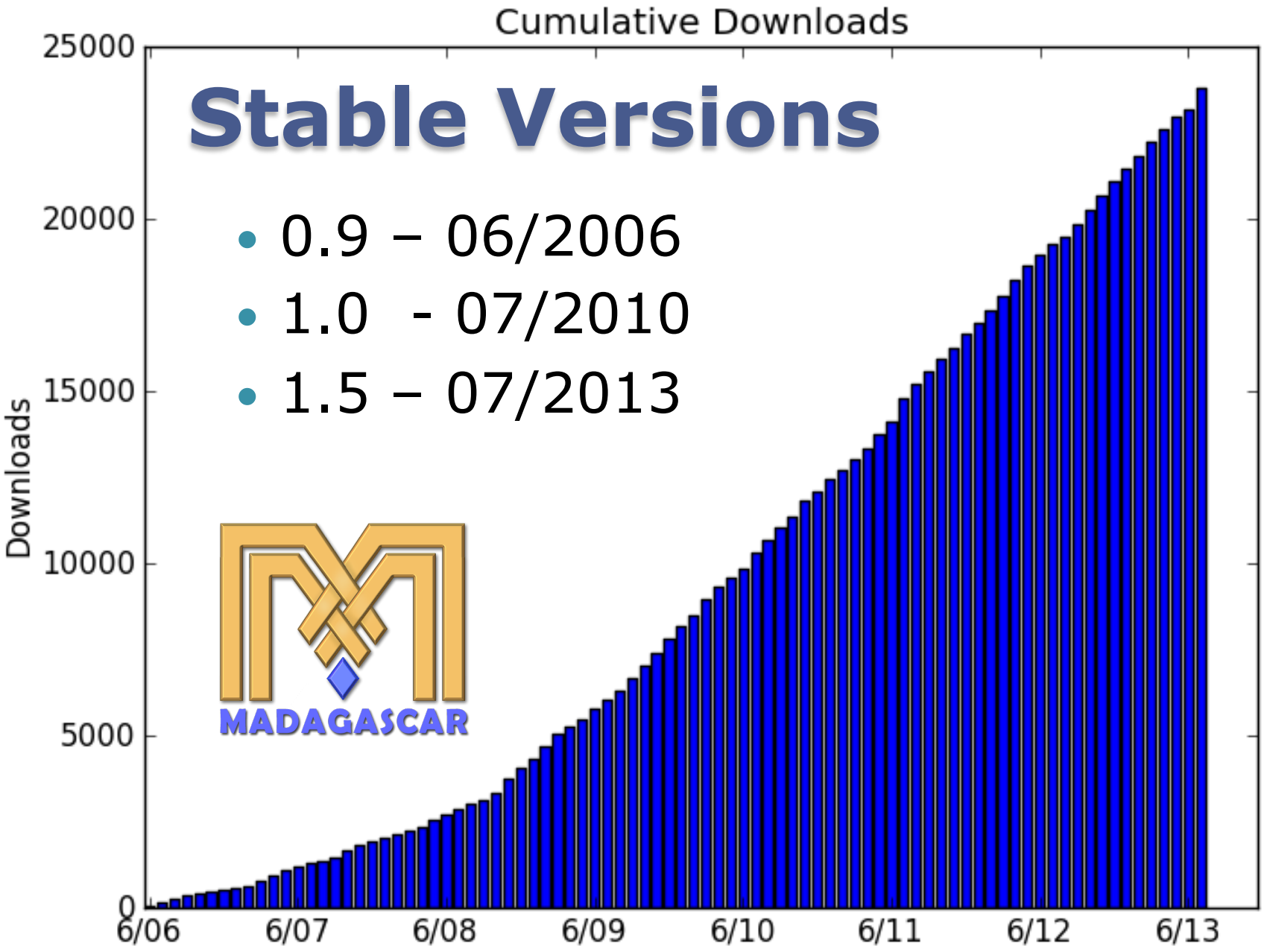
…took an estimated 170 years of effort
starting with its first commit in May, 2003
ending with its most recent commit about 2 hours ago

Contributors

Salah Al-Hadab, Tariq Alkhalifah, Vladimir Bashkardin, Filippo Broggini, Jules Browaeys, Cody Brown, William Burnett, Yihua Cai, Maria Cameron, Lorenzo Casasanta, Yangkang Chen, Zhonghuan Chen, Jiubing Cheng, Luke Decker, Joseph Dellinger, Esteban Diaz, Gang Fang, Sergey Fomel, Jeff Godwin, Gilles Hennenfent, Jie Hou, Jingwei Hu, Yin Huang, Trevor Irons, Jim Jennings, Jun Ji, Long Jin, Parvaneh Karimi, Roman Kazinnik, Alexander Klokov, Siwei Li, Guochang Liu, Yang Liu, Yujin Liu, Xuxin Ma, Douglas McCowan, Henryk Modzelewski, Jack Poulson, James Rickett, Sean Ross-Ross, Colin Russell, Christos Saragiotis, Paul Sava, Karl Schleicher, Reza Shahidi, Jeffrey Shragge, Eduardo Filpo Silva, Xiaolei Song, Yanadet Sripanich, Junzhe Sun, Ioan Vlad, Robin Weiss, Zedong Wu, Jia Yan, Lexing Ying

Stable Versions

- 0.9 – 06/2006
- 1.0 - 07/2010
- 1.5 – 07/2013



MADAGASCAR

Madagascar Schools

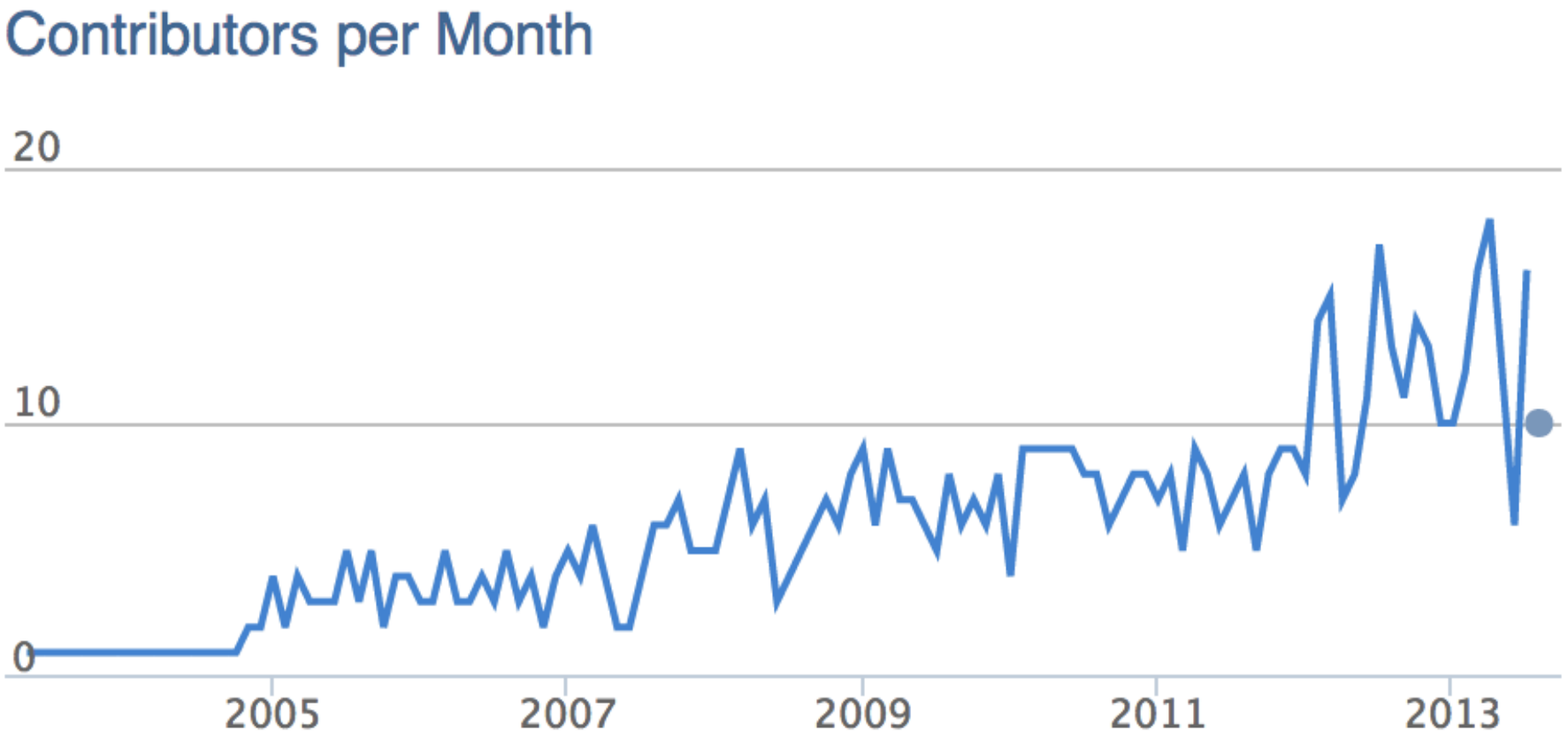
- 2006 – Vancouver, Canada
- 2007 – Austin, Texas, USA
- 2008 – Golden, Colorado, USA
- 2009 – Delft, Netherlands; Bahia, Brazil
- 2010 – Houston, Texas, USA
- 2011 – Beijing, China
- 2012 – Austin, Texas, USA
- 2013 – Melbourne, Australia

Vancouver-2006

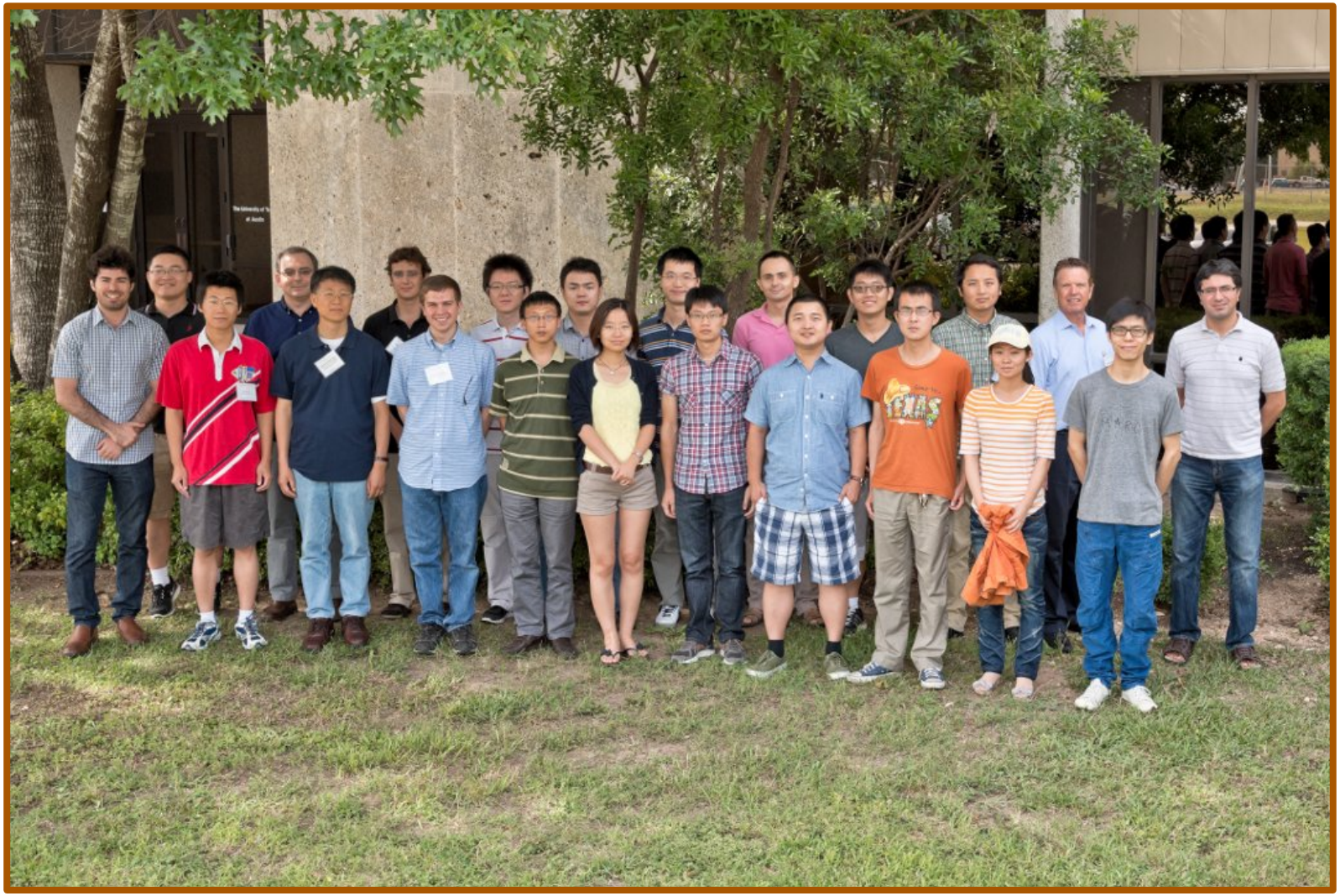
photo by Joe Dellinger

Beijing-2011

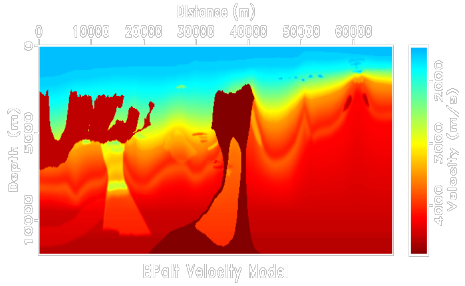
ohloh.net about Madagascar

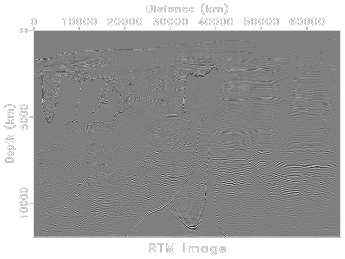


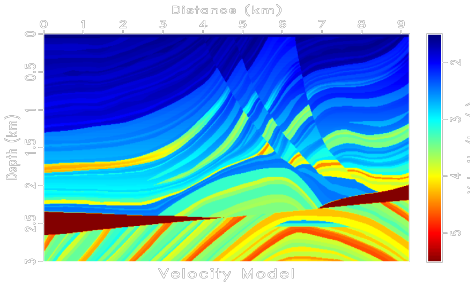
Austin-2013 (Working Workshop)

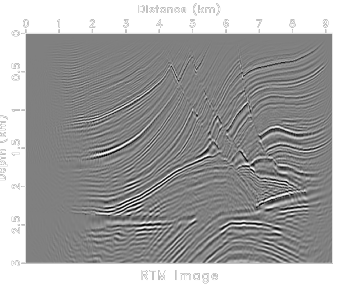


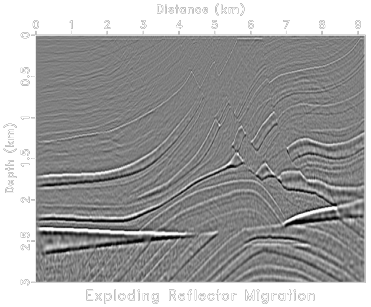
Migration Gallery

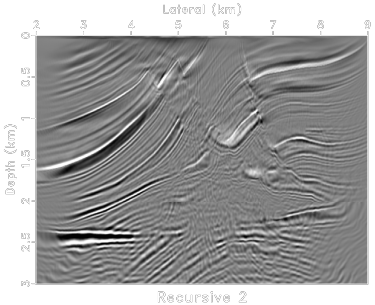


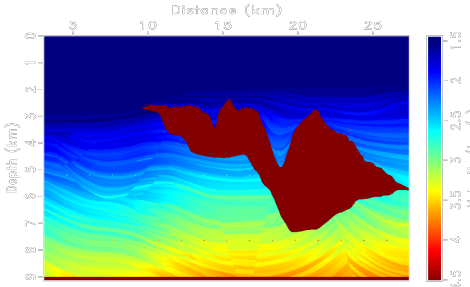


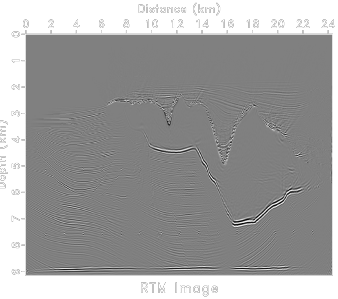


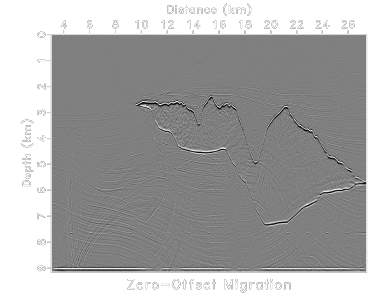


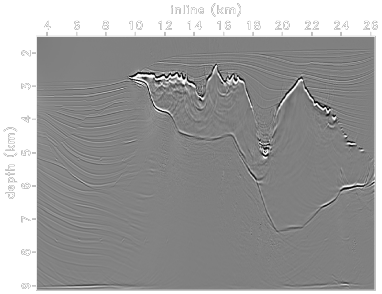


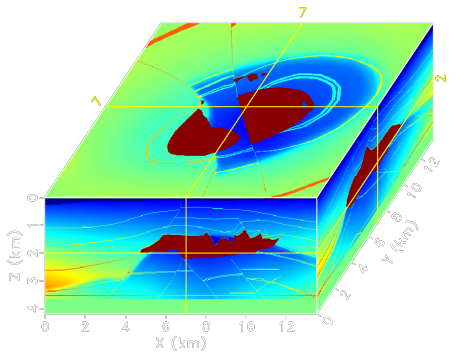




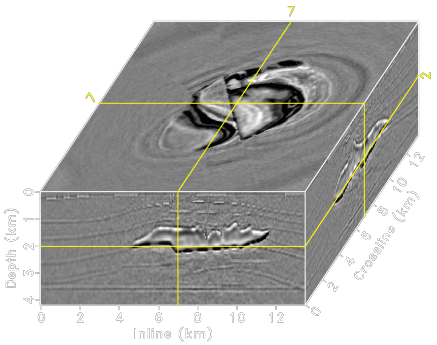


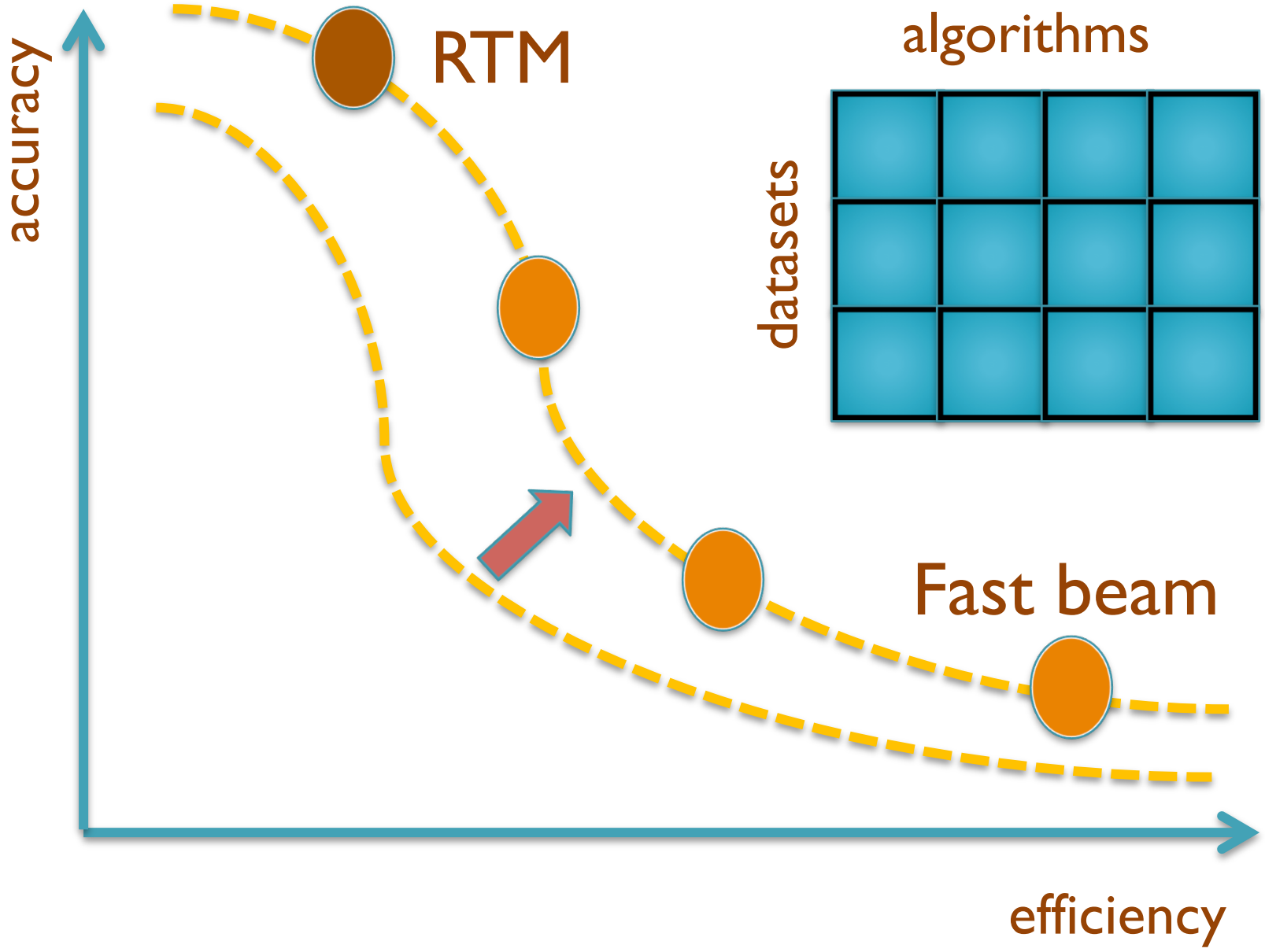






Zero-Offset Exploding Reflector Migration

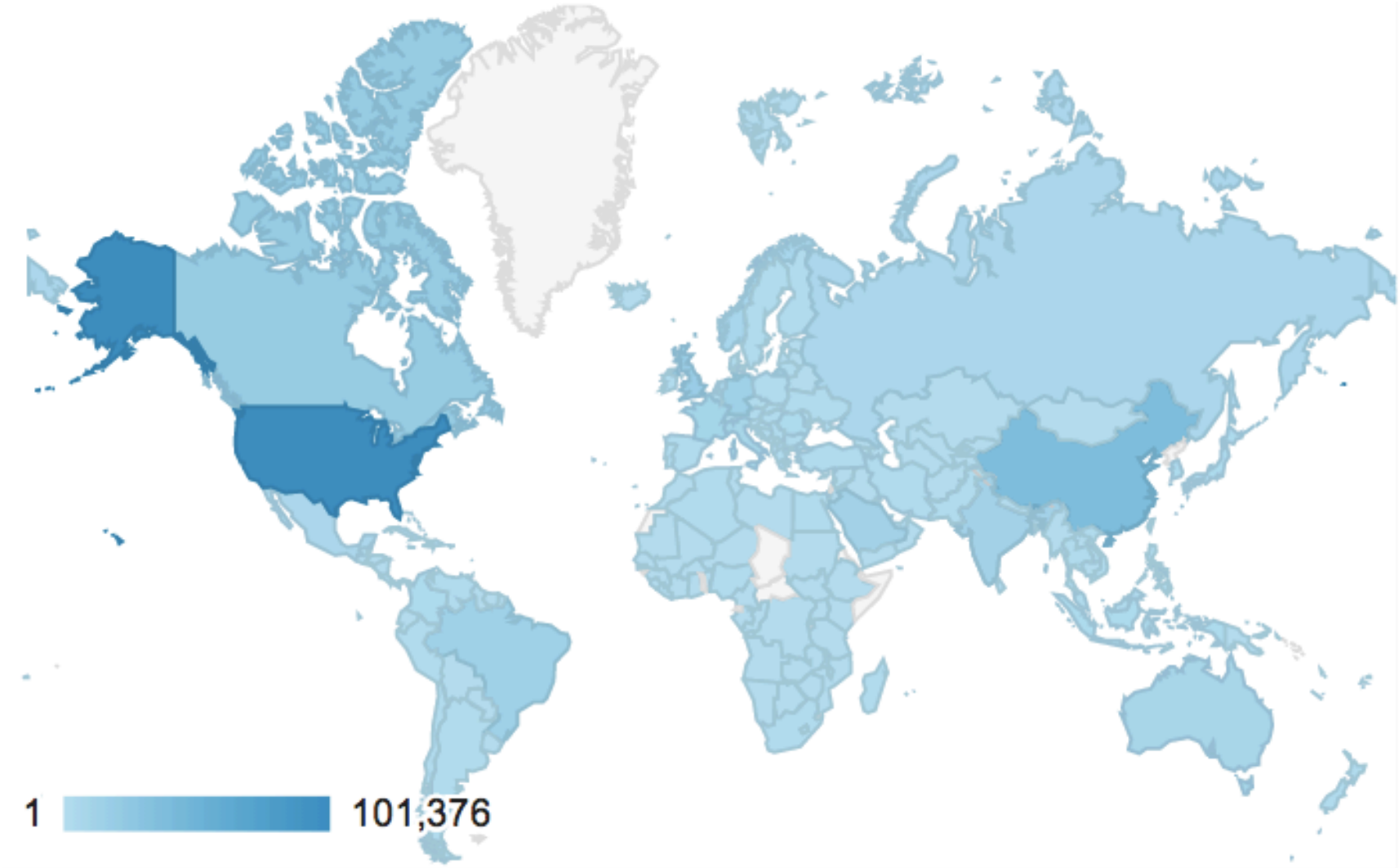



accuracy
RTM
algorithms
datasets
Fast beam
efficiency

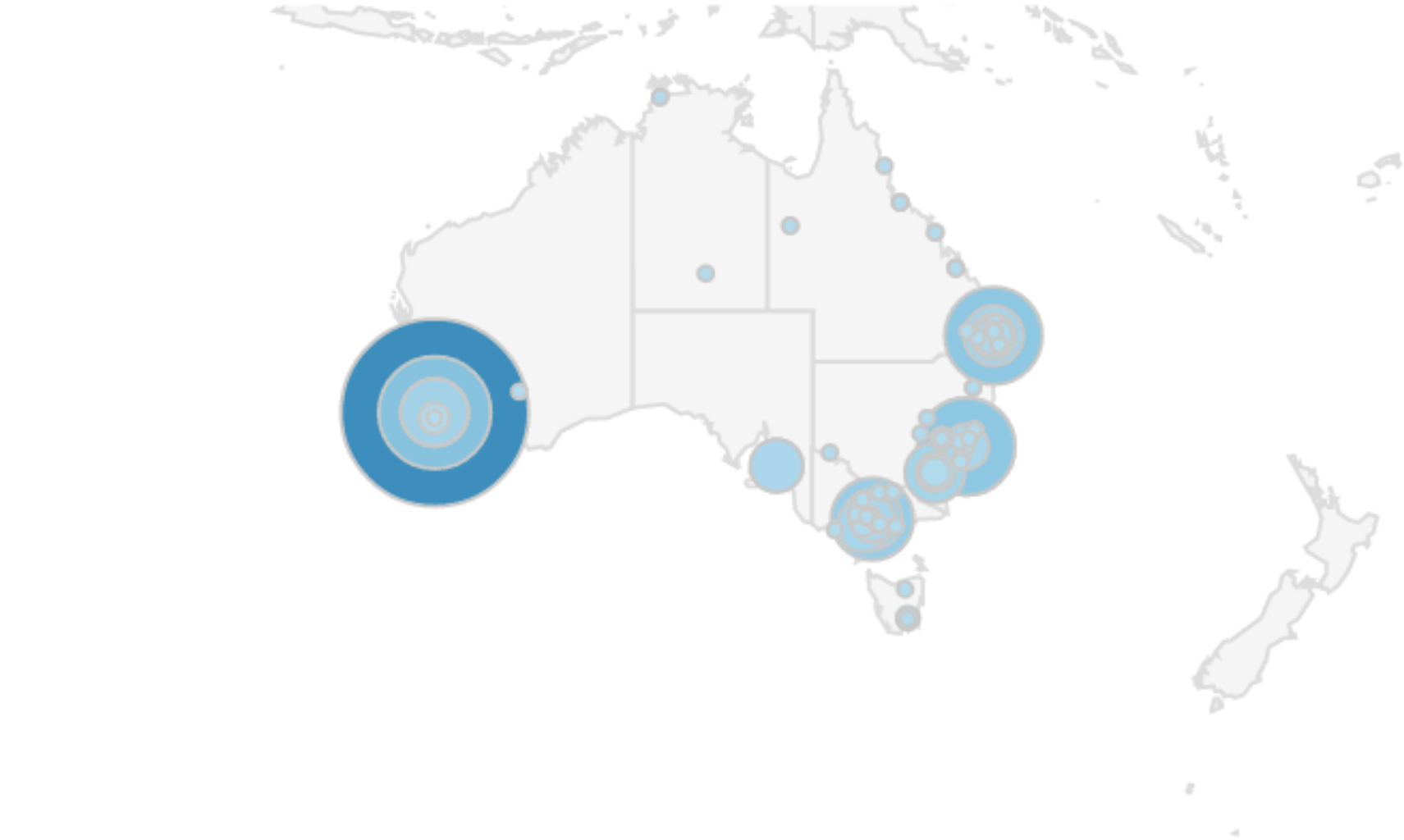
Future Goals

- Release 1.6
  - Migration gallery
- Release 2.0
  - Parallel computing examples
  - Field data processing examples

Madagascar Website Visits



Madagascar Website Visits



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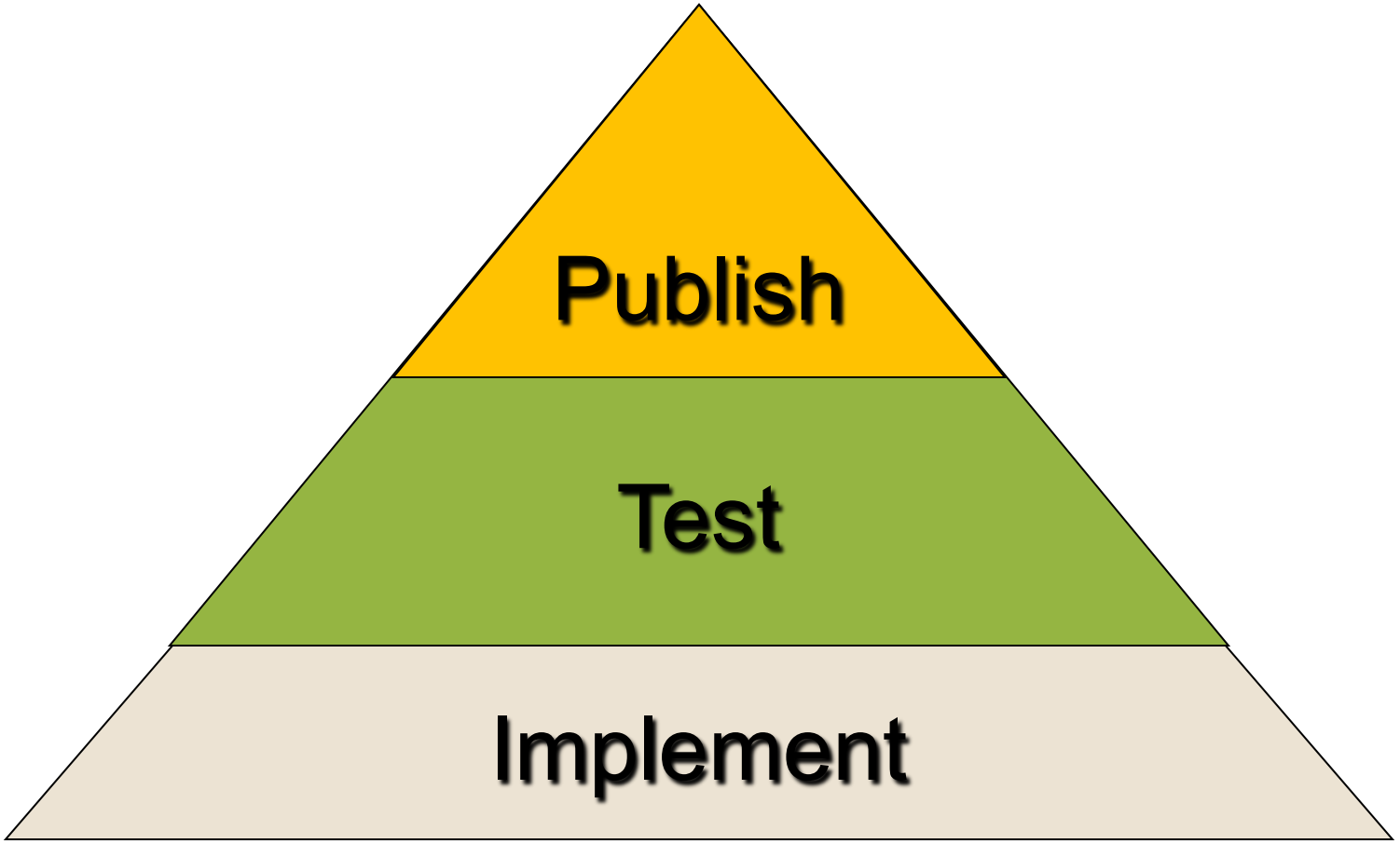
Research Pyramid



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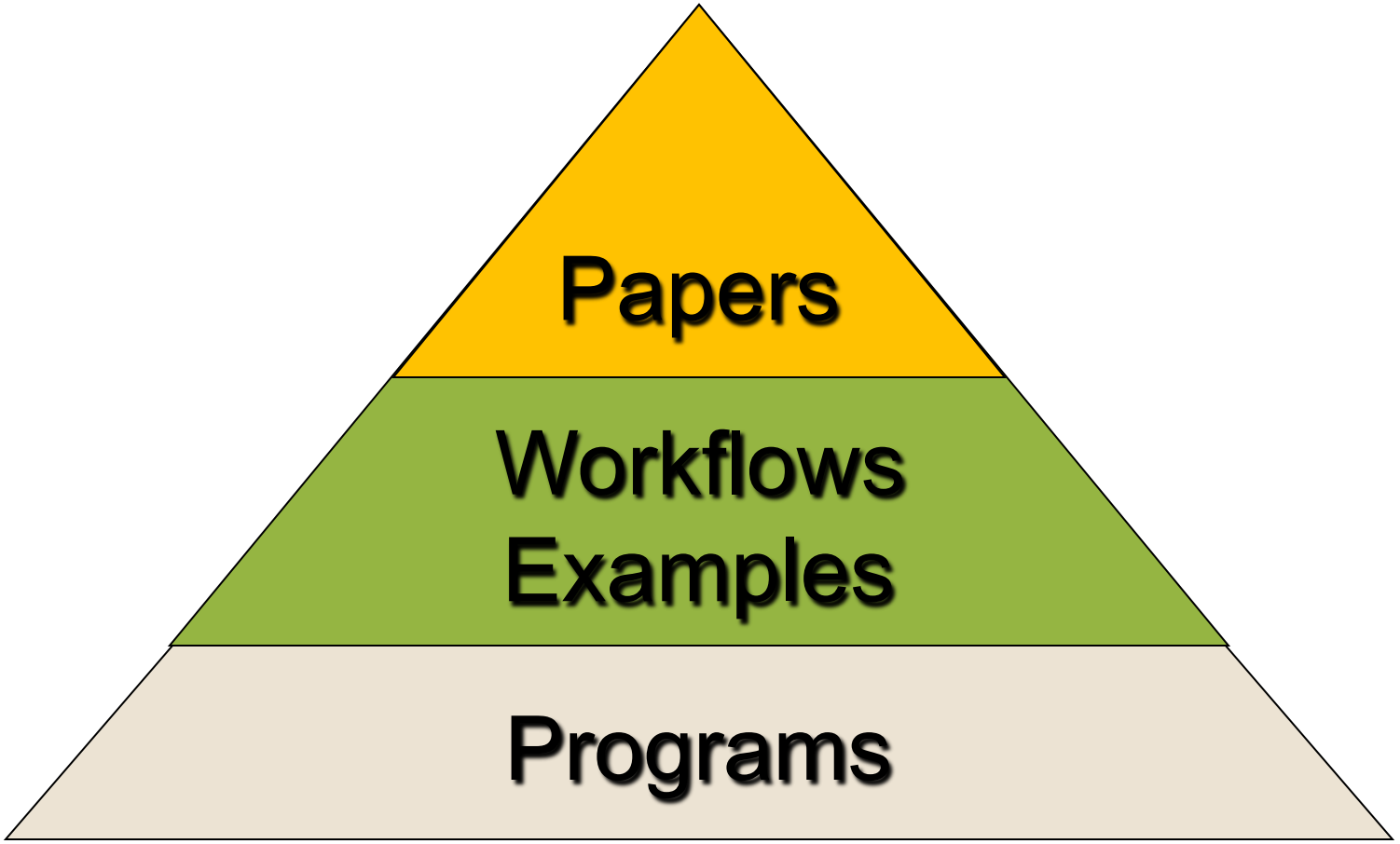
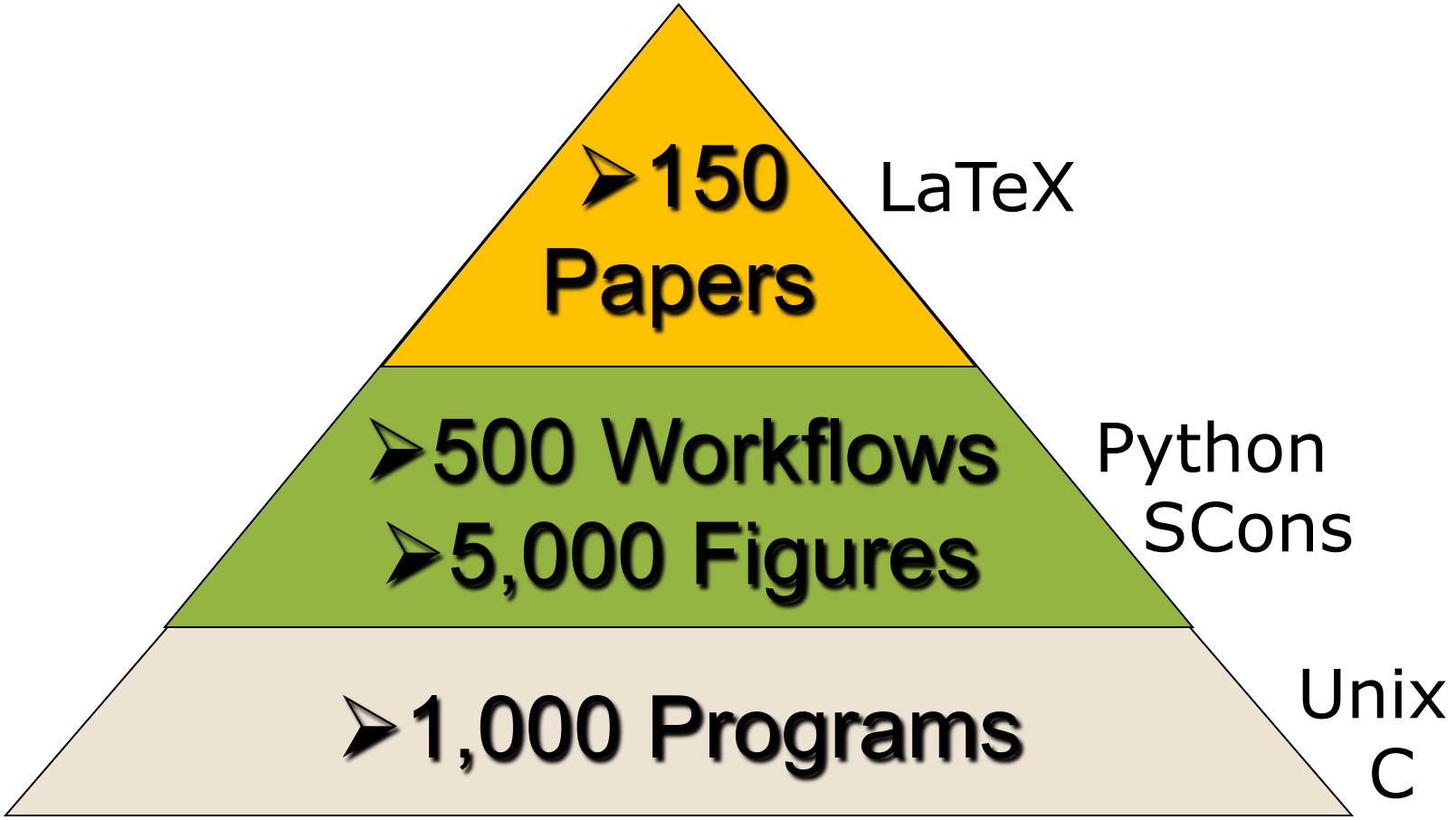
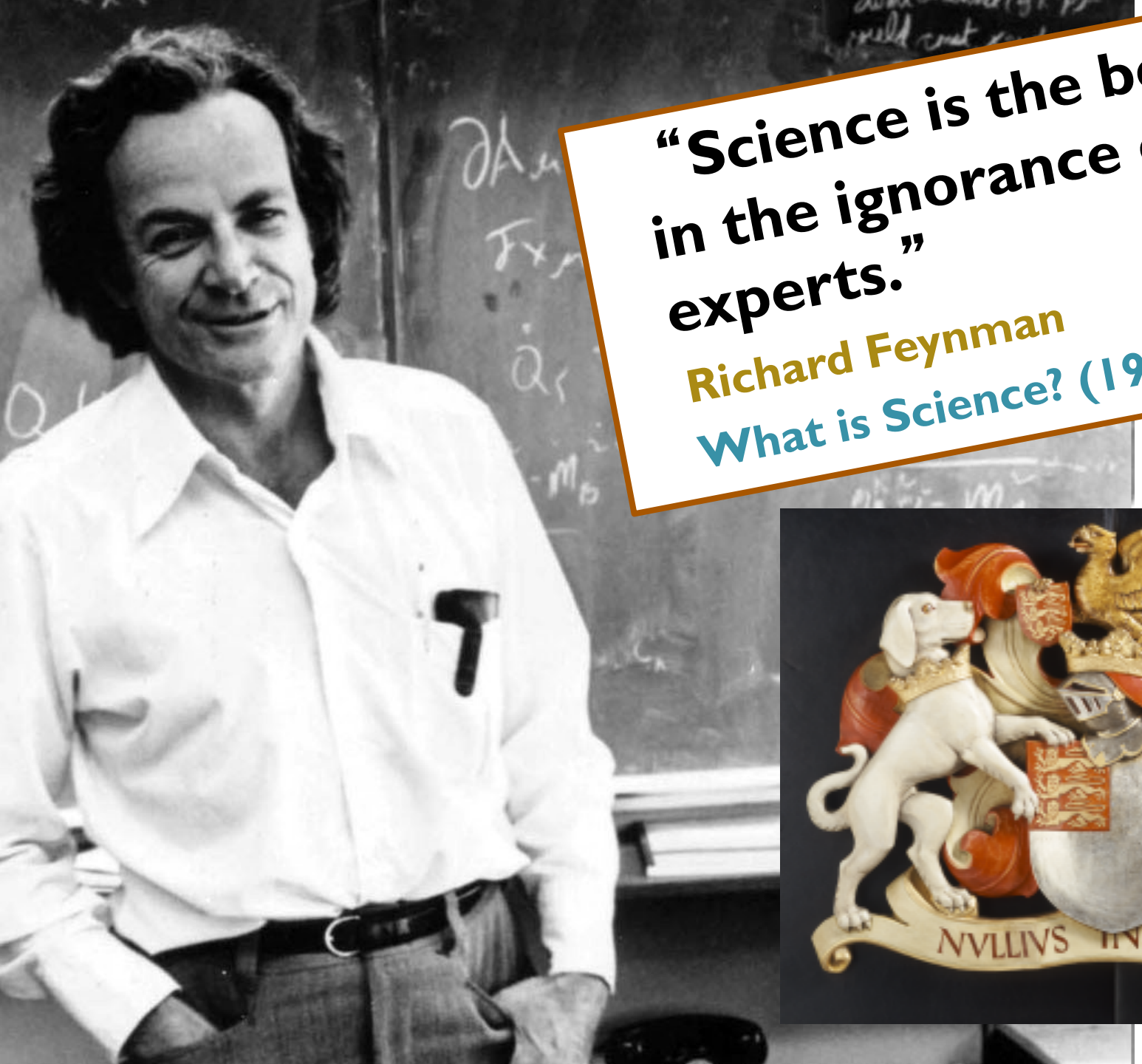


Research Pyramid



What is Science?



"Science is the belief in the ignorance of experts."

Richard Feynman

What is Science? (1966)

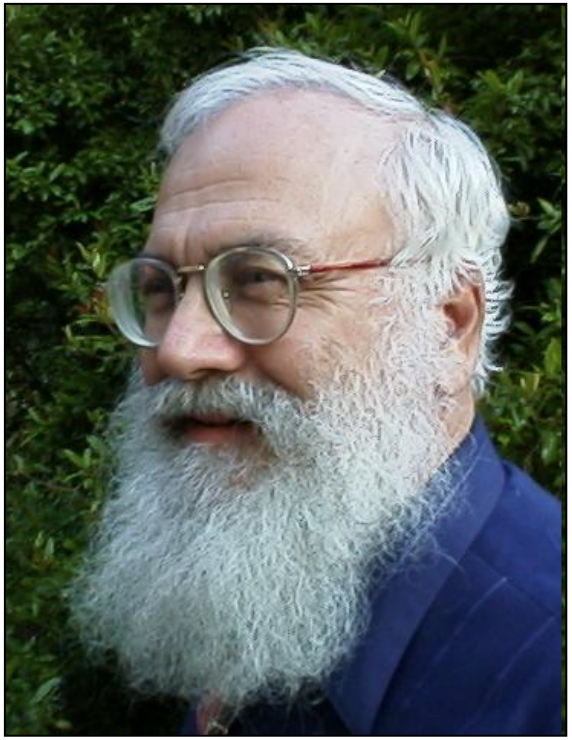
What is Science?

Science is the systematic enterprise of gathering knowledge about the universe and organizing and condensing that knowledge into testable laws and theories. The success and credibility of science are anchored in the willingness of scientists to expose their ideas and results to **independent testing and replication** by other scientists. This requires the **complete and open exchange of data, procedures and materials.**

Claerbout's Principle

"An article about computational science in a scientific publication is not the scholarship itself, it is merely advertising of the scholarship. The actual scholarship is the **complete software development environment and the complete set of instructions which generated the figures**."

(Buckheit and Donoho, 1995)



Reproducible Research

"It is a big chore for one researcher to reproduce the analysis and computational results of another […] I discovered that this problem has a simple technological solution: illustrations (figures) in a technical document are made by **programs and command scripts that along with required data should be linked to the document itself** […] This is hardly any extra work for the author, but it makes the document much more valuable to readers who possess the document in electronic form because they are able to track down the computations that lead to the illustrations."

(Claerbout, 1991)

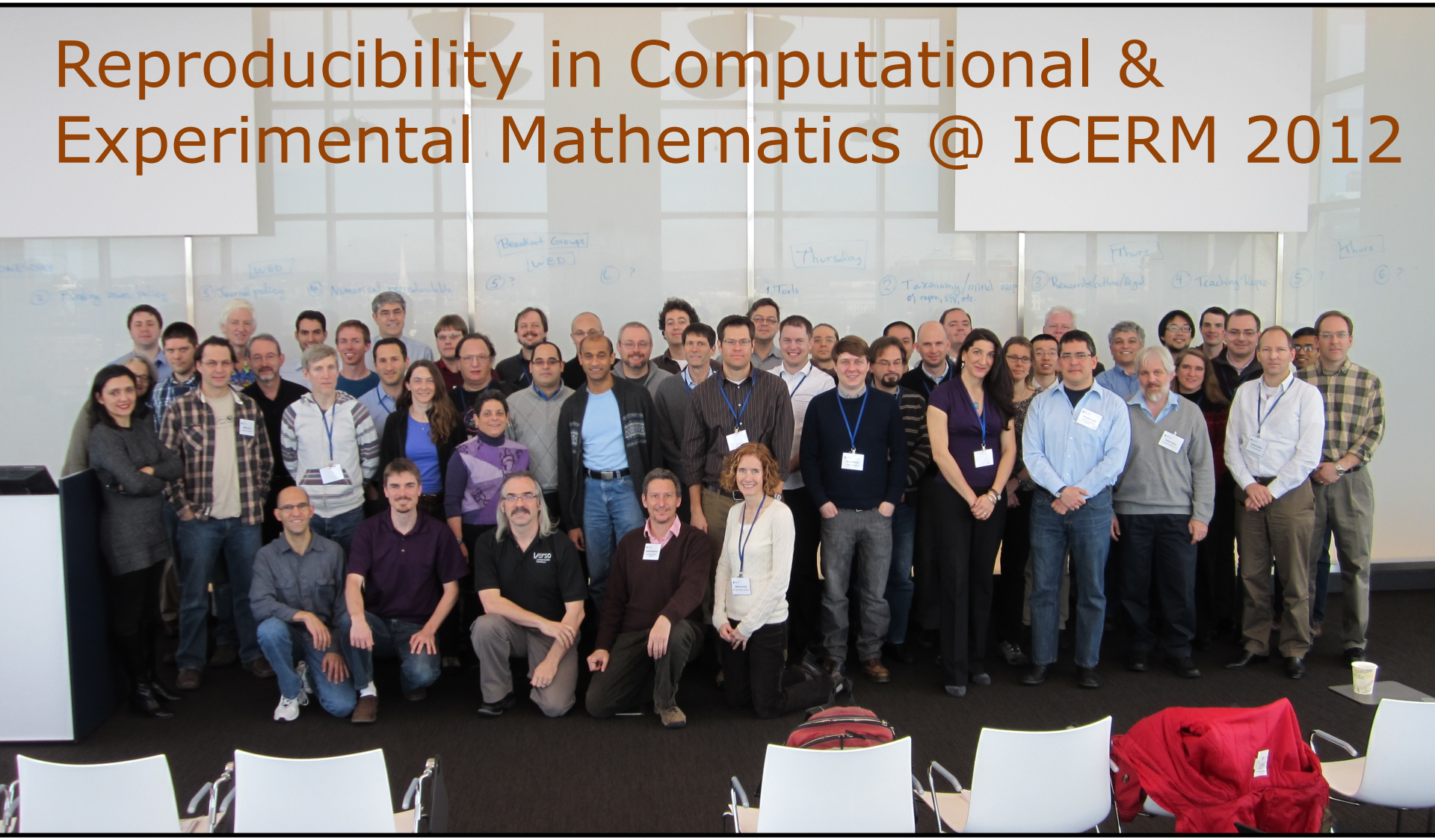
NEWS

Reproducible Research

Addressing the Need for Data and Code Sharing in Computational Science

By the Yale Law School Roundtable on Data and Code Sharing

Reproducibility in Computational & Experimental Mathematics @ ICERM 2012



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