The Global Status of Citizen Cyberscience

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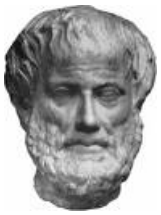
Citizen Science



Science

Citizens

500 B.C.

1780

Citizen Cyberscience

1900s

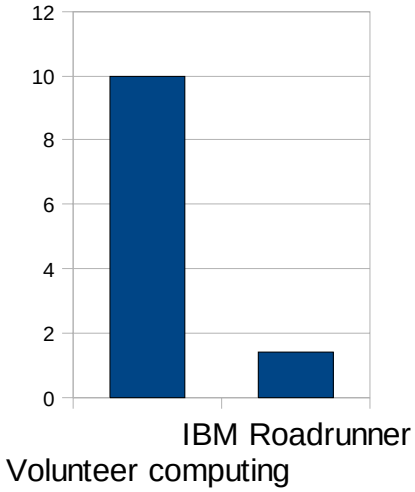
The Internet Age

Volunteer computing

- Early projects
  - 1997: GIMPS, distributed.net
  - 1999: SETI@home, Folding@home
- Today
  - 50 projects
  - 500K volunteers
  - 900K computers
  - 10 PetaFLOPS

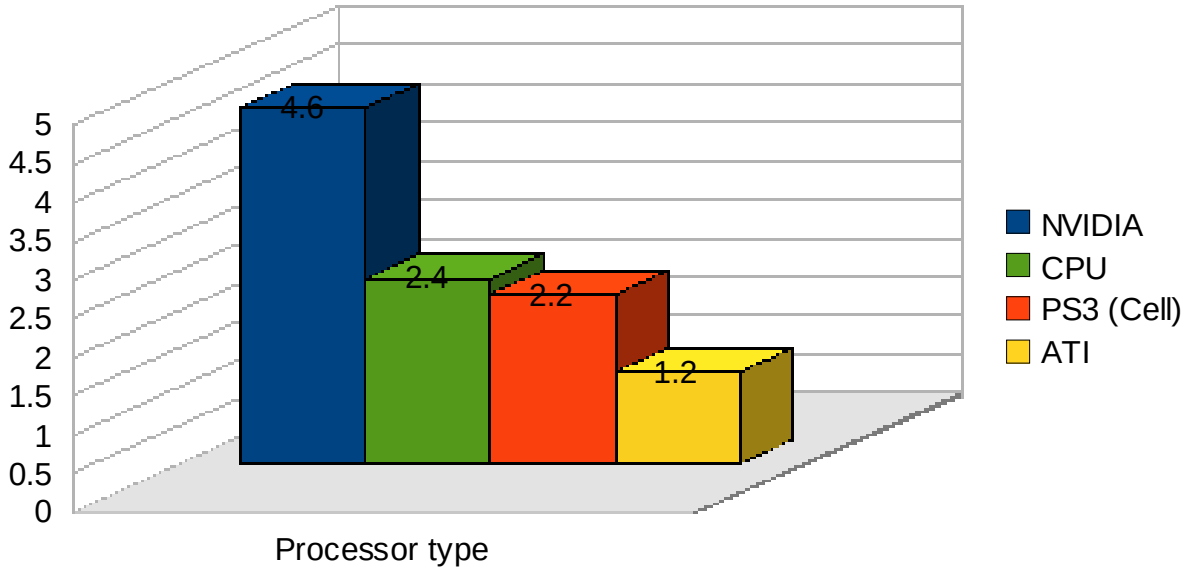
Paradigm comparison

- Clouds
  - 10 TFLOPS = US$4.3 billion/year on Amazon EC2
- Grids
  - about 1% the throughput of volunteer computing
- Supercomputers



ExaFLOPS potential

- Current PetaFLOPS breakdown:



- Potential: ExaFLOPS by 2010
  - 4M GPUs * 1 TFLOPS * 0.25 availability

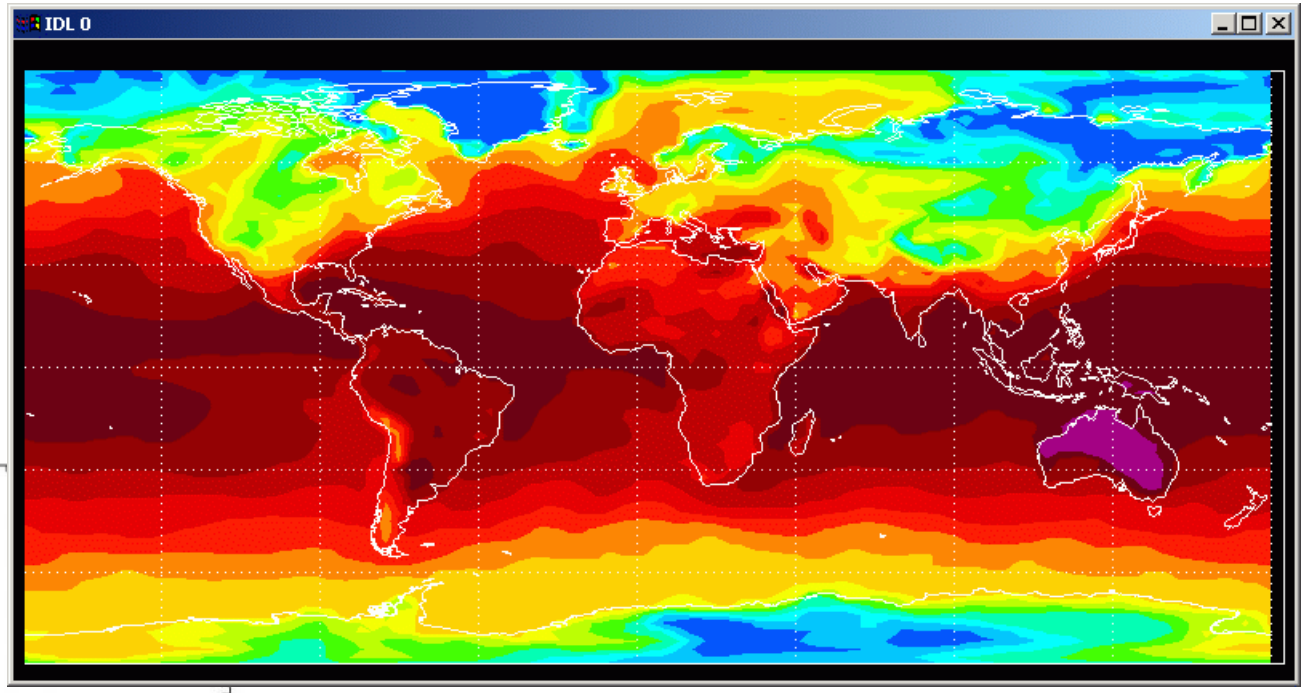
BOINC

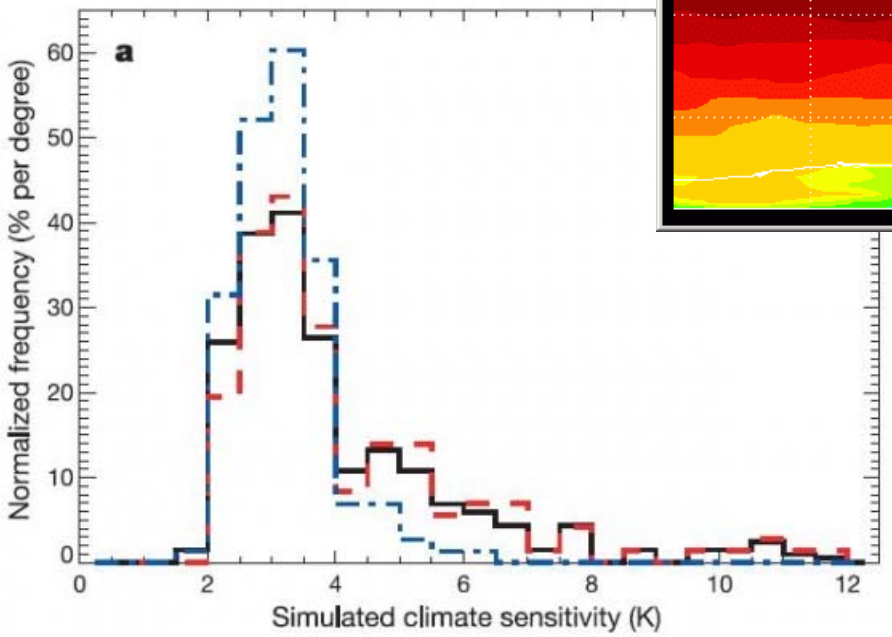
- Middleware for volunteer computing
  - client, server, web
- Based at UC Berkeley Space Sciences Lab
- Open source (LGPL)
- NSF-funded since 2002
- http://boinc.berkeley.edu

Science areas using BOINC

- Biology
  - protein study, genetic analysis
- Medicine
  - drug discovery, epidemiology
- Physics
  - LHC, nanotechnology, quantum computing
- Astronomy
  - data analysis, cosmology, galactic modeling
- Environment
  - climate modeling, ecosystem simulation
- Math
- Graphics rendering

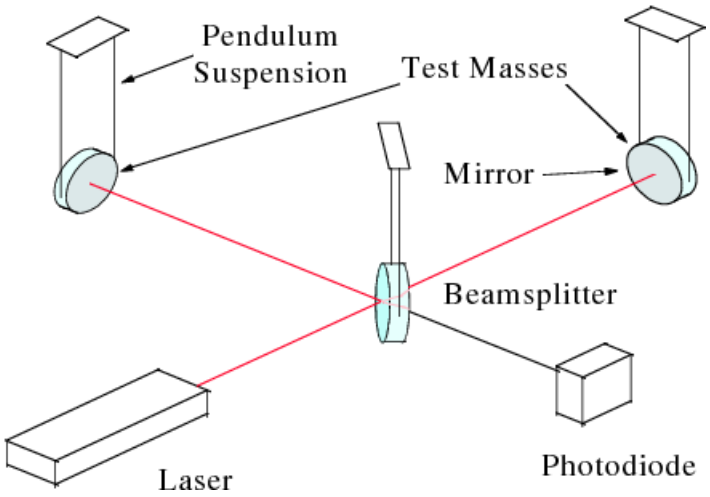
Climateprediction.net



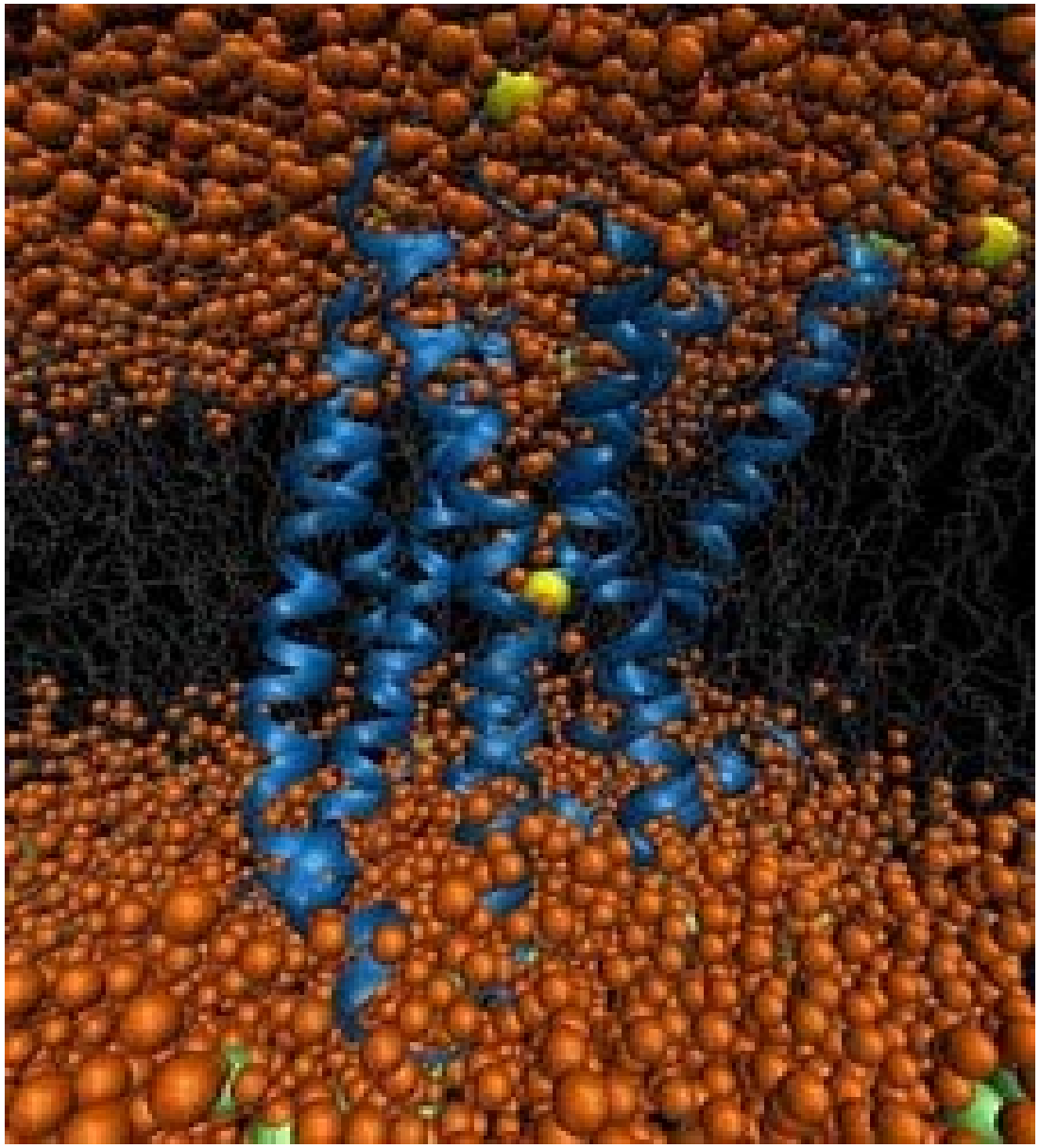


Einstein@home

- Gravitational waves; gravitational pulsars



GPUGRID.net



Other volunteer activities

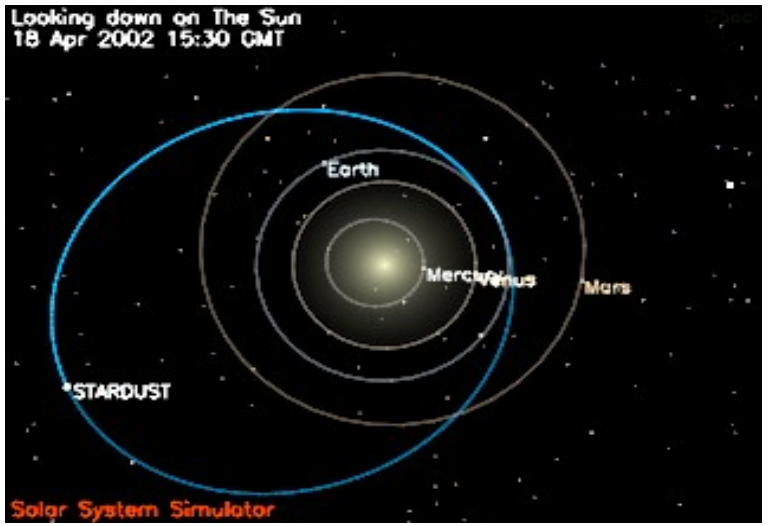
- Optimize, debug, port applications
- Language translations
- Software testing
- User support

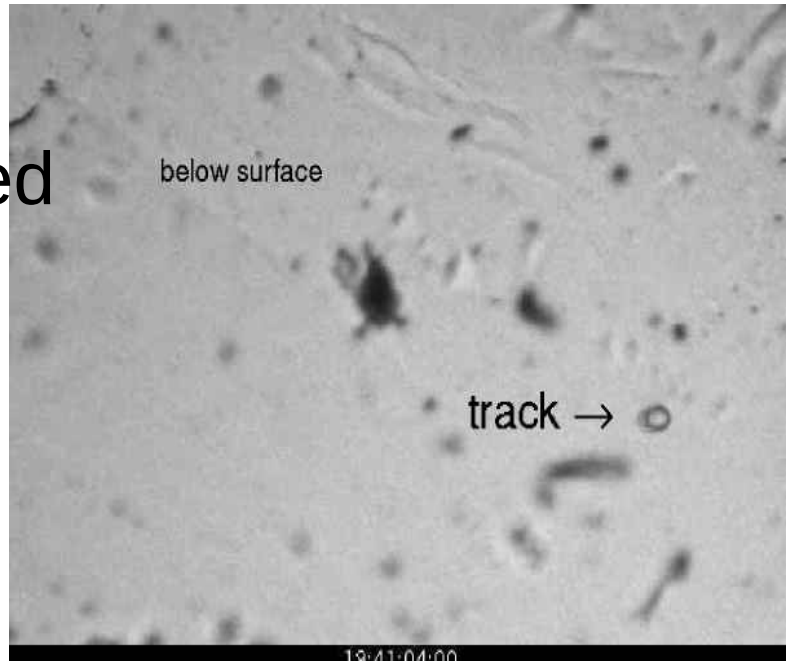
Distributed thinking

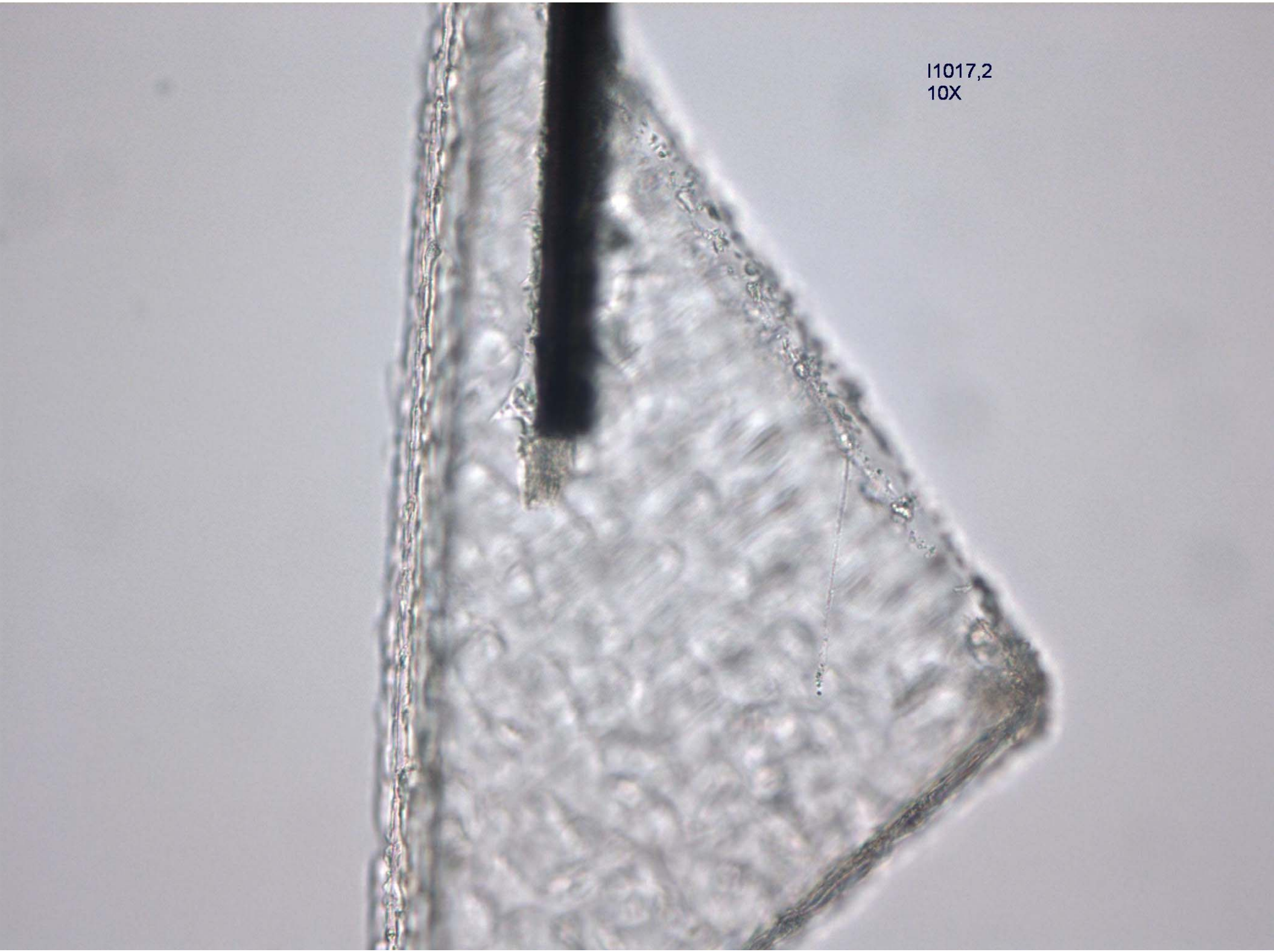
- The scientific process is mostly human
- What tasks can volunteers do?
  - cognition (vision); logical and spatial reasoning; creativity; real-world knowledge
- Spectrum of tasks
  - tasks that anyone can do quickly
  - tasks that require significant education/training
  - tasks where replication helps
  - hierarchies of tasks

Stardust@home

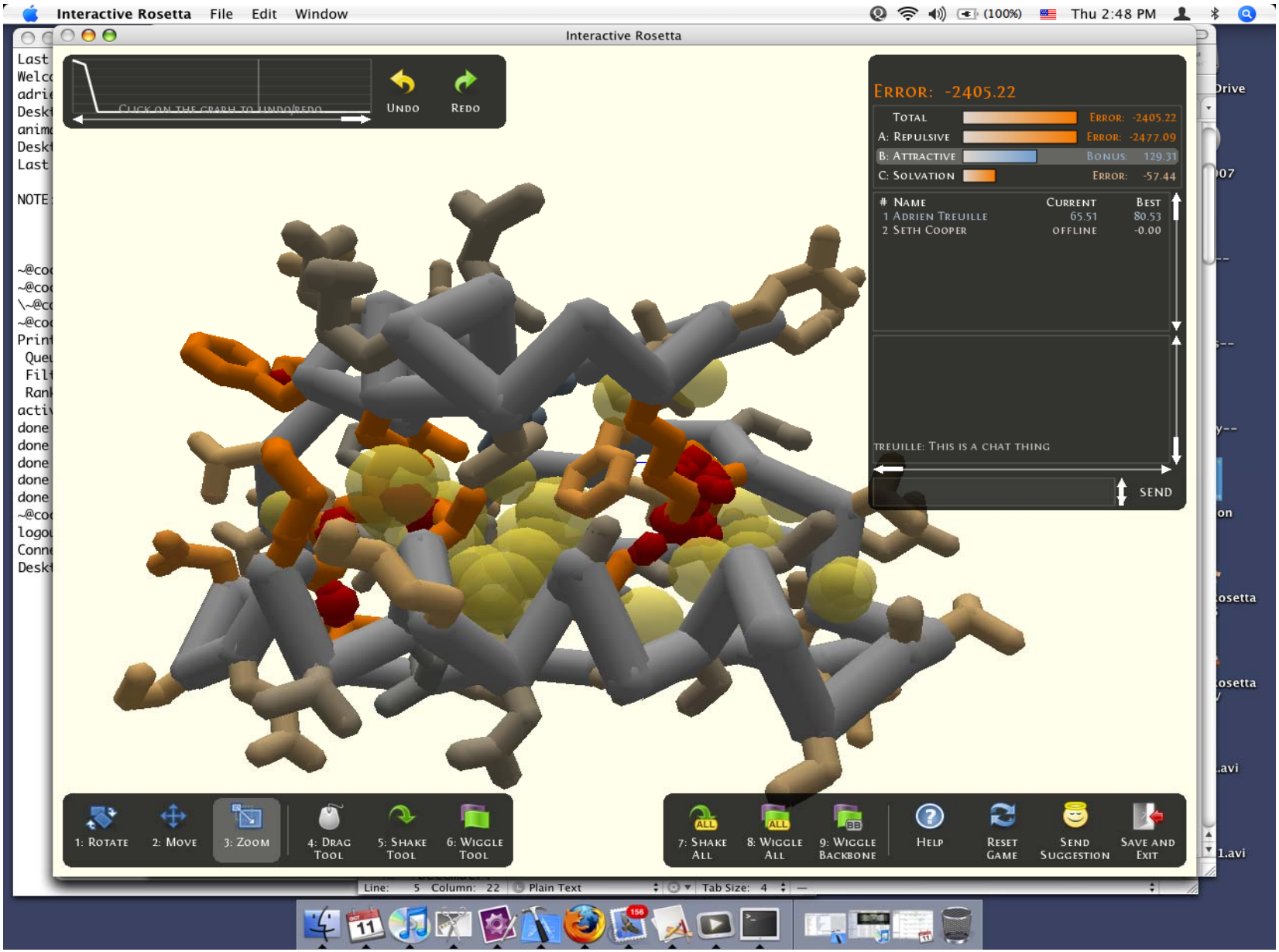
- The Stardust mission
- Where's the dust?
- Stardust@home
  - 23K volunteers
  - 43M viewings
  - 64 tracks found
  - 13 particles recovered






I1017,2
10X

Fold It!

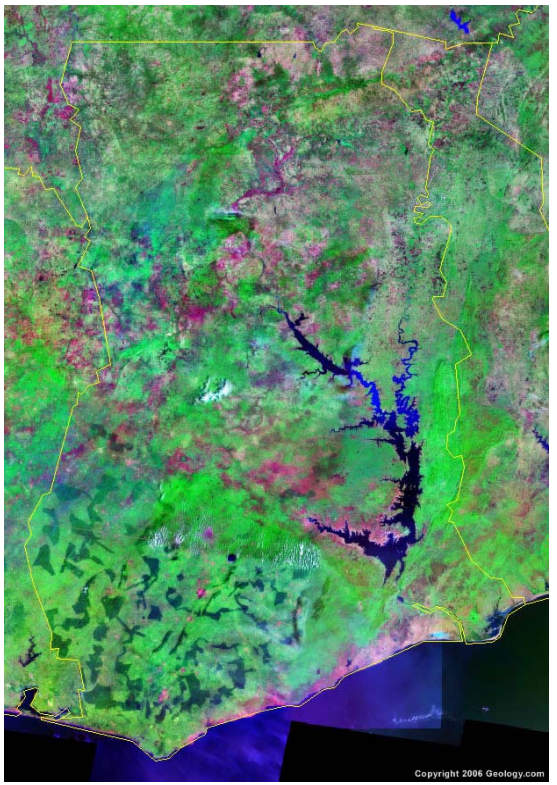

Interactive Rosetta File Edit Window
Thu 2:48 PM
Interactive Rosetta
Click on the graph to Undo/Redo
Undo
Redo
Error: -2405.22
Total Error: -2405.22
A: Repulsive Error: -2477.09
B: Attractive Bonus: 129.31
C: Solvation Error: -57.44
Name Current Best
1 Adrien Treuille 65.51 80.53
2 Seth Cooper offline -0.00
treuille: This is a chat thing
Send
1: Rotate
2: Move
3: Zoom
4: Drag Tool
5: Shake Tool
6: Wiggle Tool
7: Shake All
8: Wiggle All
9: Wiggle Backbone
Help
Reset Game
Send Suggestion
Save and Exit

Middleware for distributed thinking

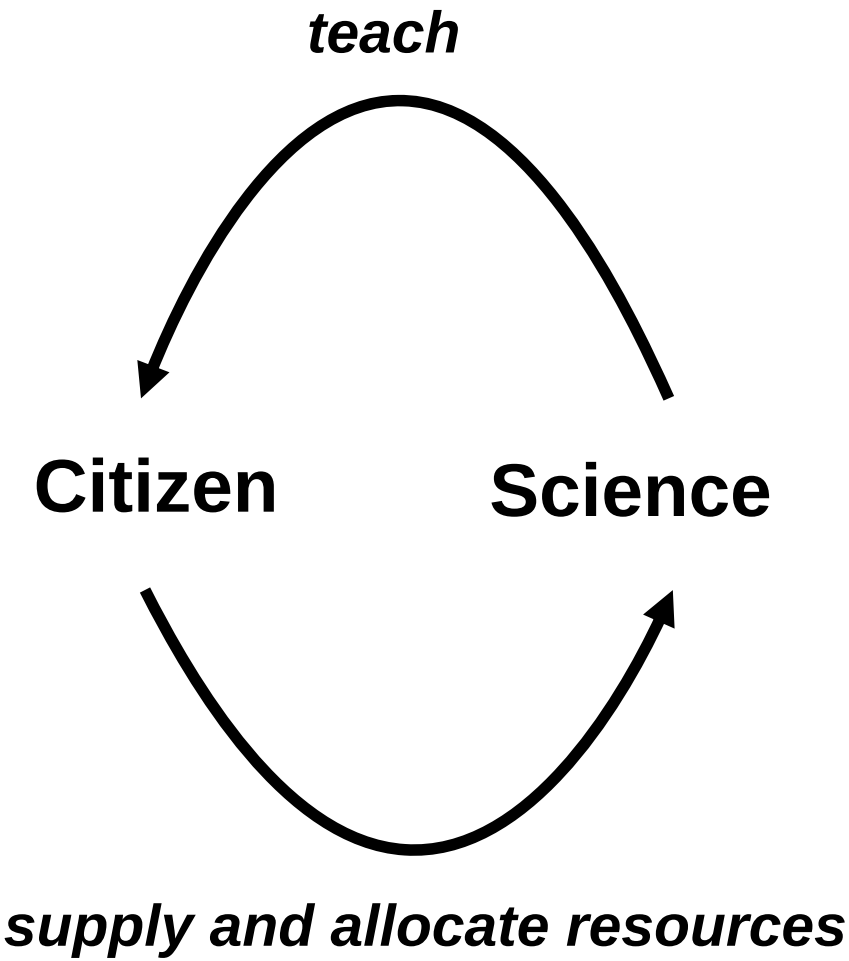
- Bossa: open-source middleware for volunteer thinking
  - volunteer assessment
  - calibration jobs
  - replication
  - http://bossa.berkeley.edu
- Bolt: open-source middleware for web-based training of diverse populations

Projects in development

- Hominids@home
  - Collect photos of Middle Awash (Ethiopia)
  - Look for hominid and other fossils
- AfricaMap



The importance of Citizen Cyberscience



The importance of CCC

- CC not widely used by scientists, especially in developing countries. Why?
  - lack of awareness
  - Infrastructure gap
  - technical gap
- CC not widely known to the public. Why?
  - lack of PR
- CCC can solve these problems