

LHC@home:
volunteer computing
for high energy physics

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Vague but exciting ...

CERN DD/OC

Information Management: A Proposal

Tim Berners-Lee, CERN/DD

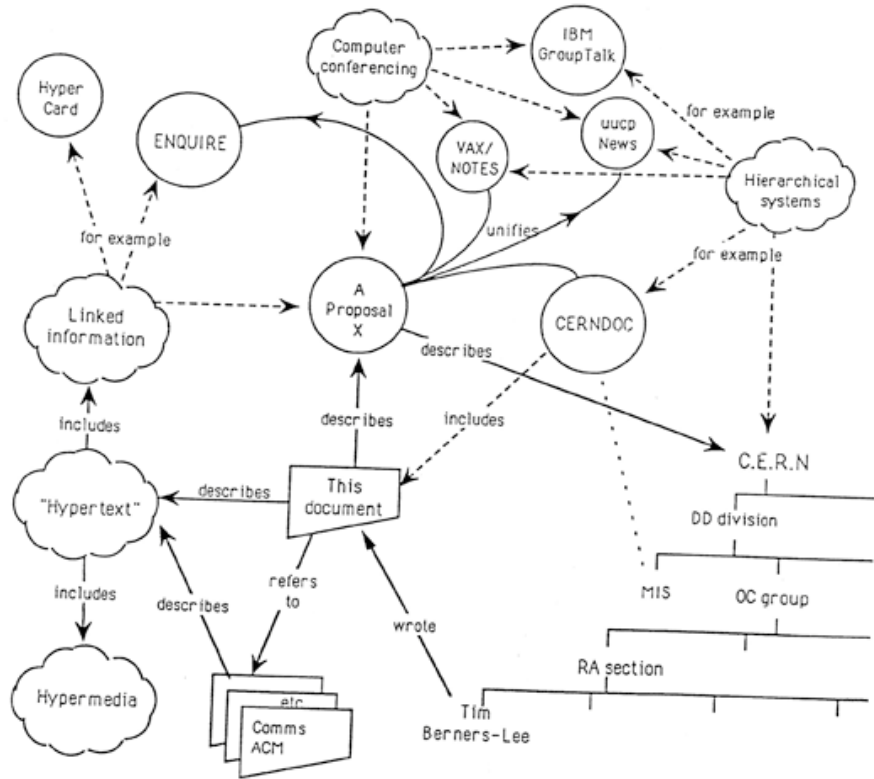
March 1989

Information Management: A Proposal

Abstract

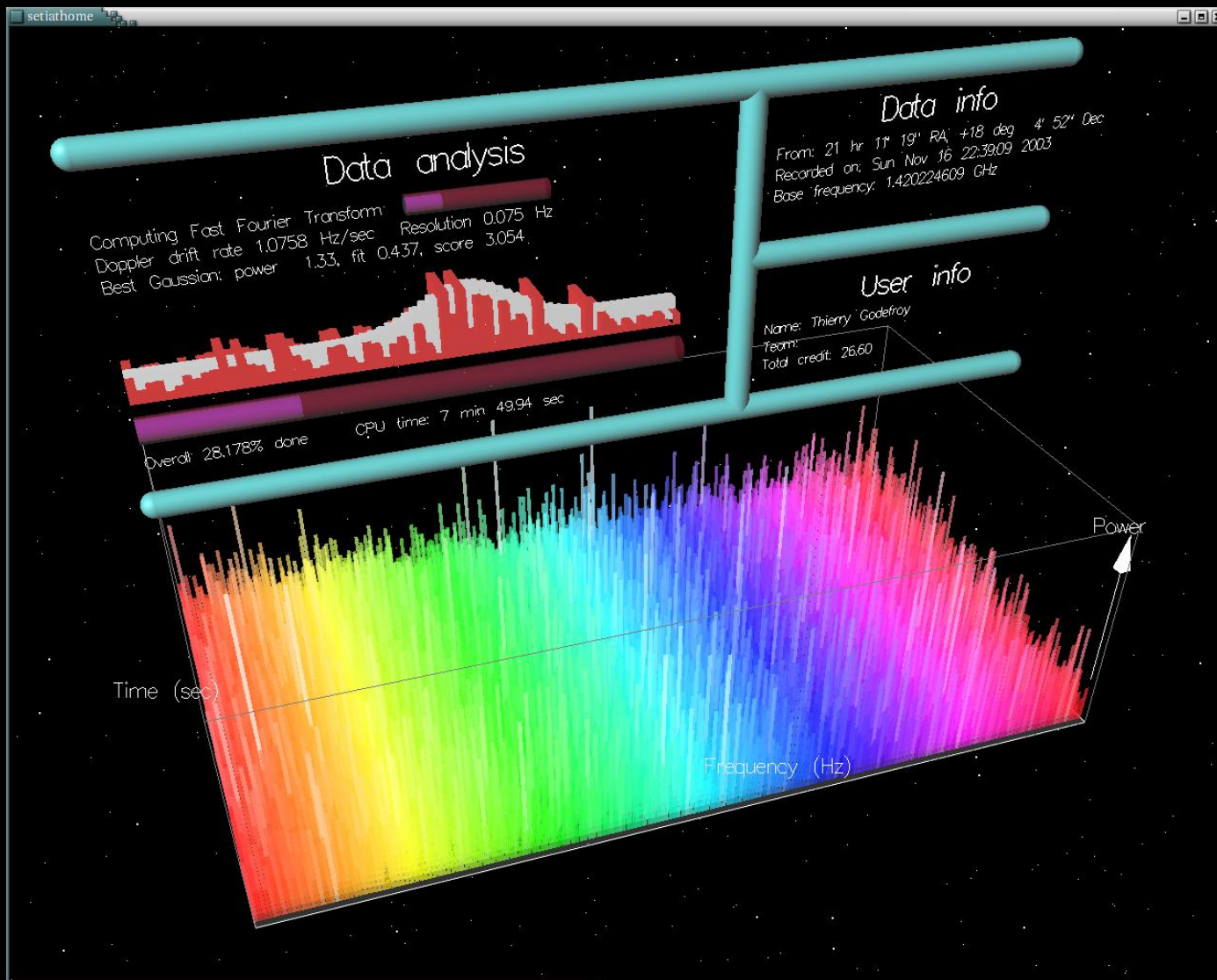
This proposal concerns the management of general information about accelerators and experiments at CERN. It discusses the problems of loss of information about complex evolving systems and derives a solution based on a distributed hypertext system.

Keywords: Hypertext, Computer conferencing, Document retrieval, Information management, Project control

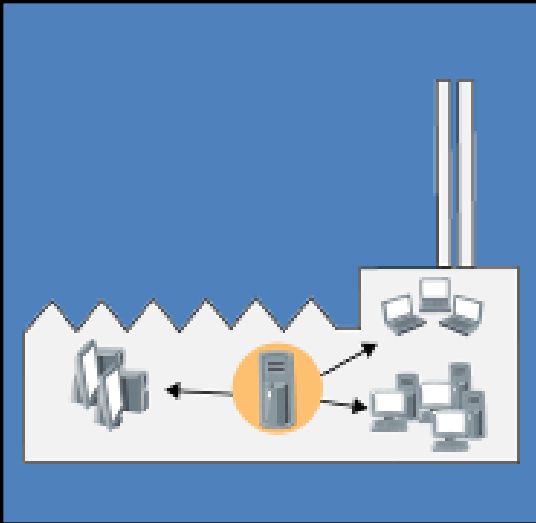


SETI@home

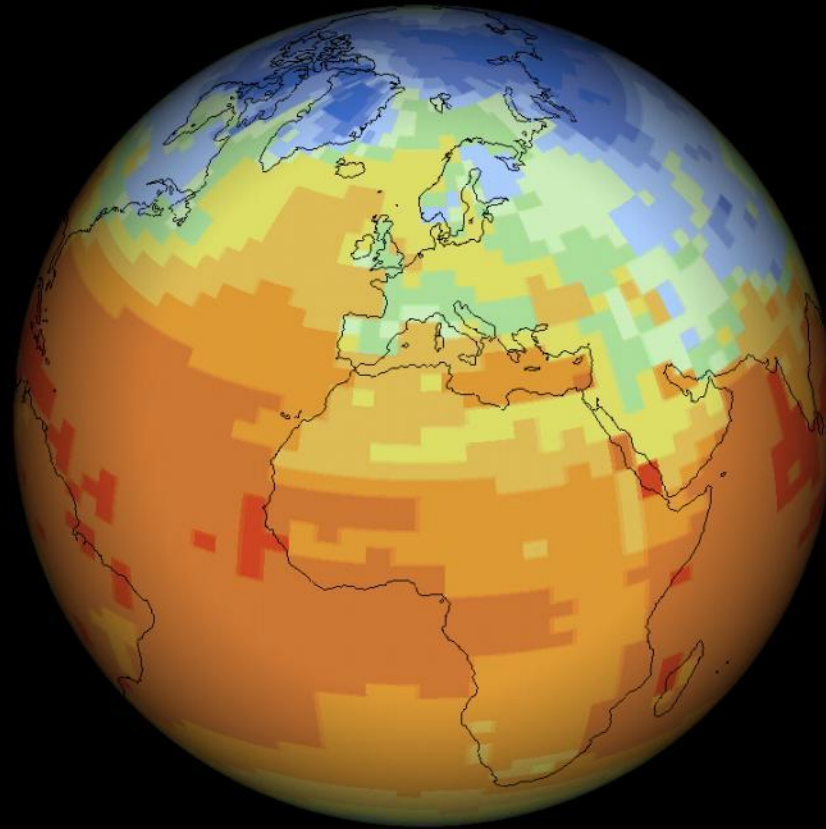
searching for extraterrestrial intelligence



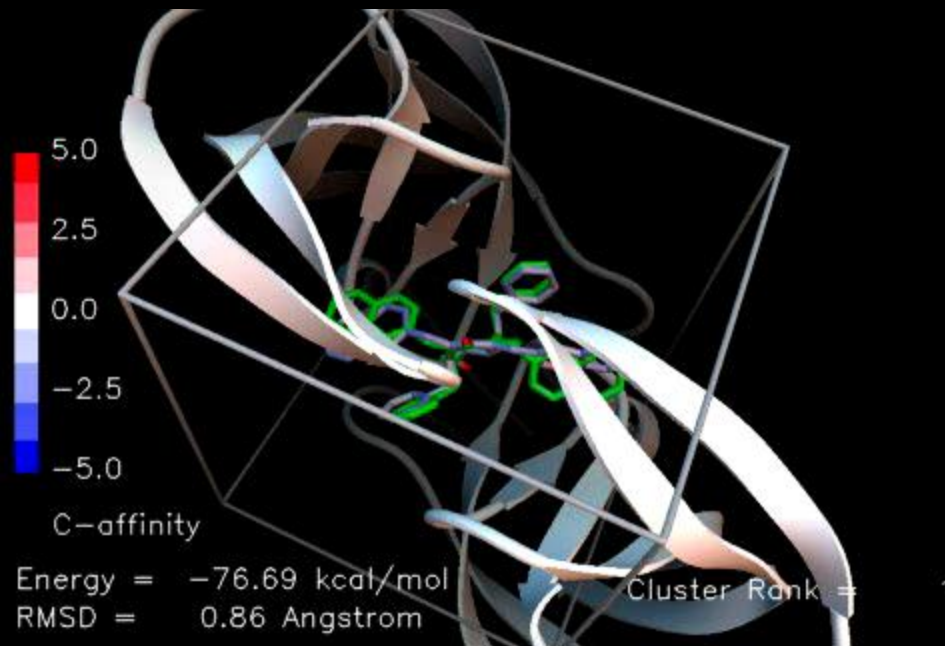
Different definitions of grid



ClimatePrediction.net
modeling the future of Earth's climate



FightAids@home: modelling drug candidates for AIDS



MalariaControl.net: health impact



6171054912832631

6252792570914711

6334530228996791

6416267887078871

6498005545160951

6579743203243031

6661480861325111

6743218519407191

6824956177489271

6906693835571351

6988431493653431

7070169151735511

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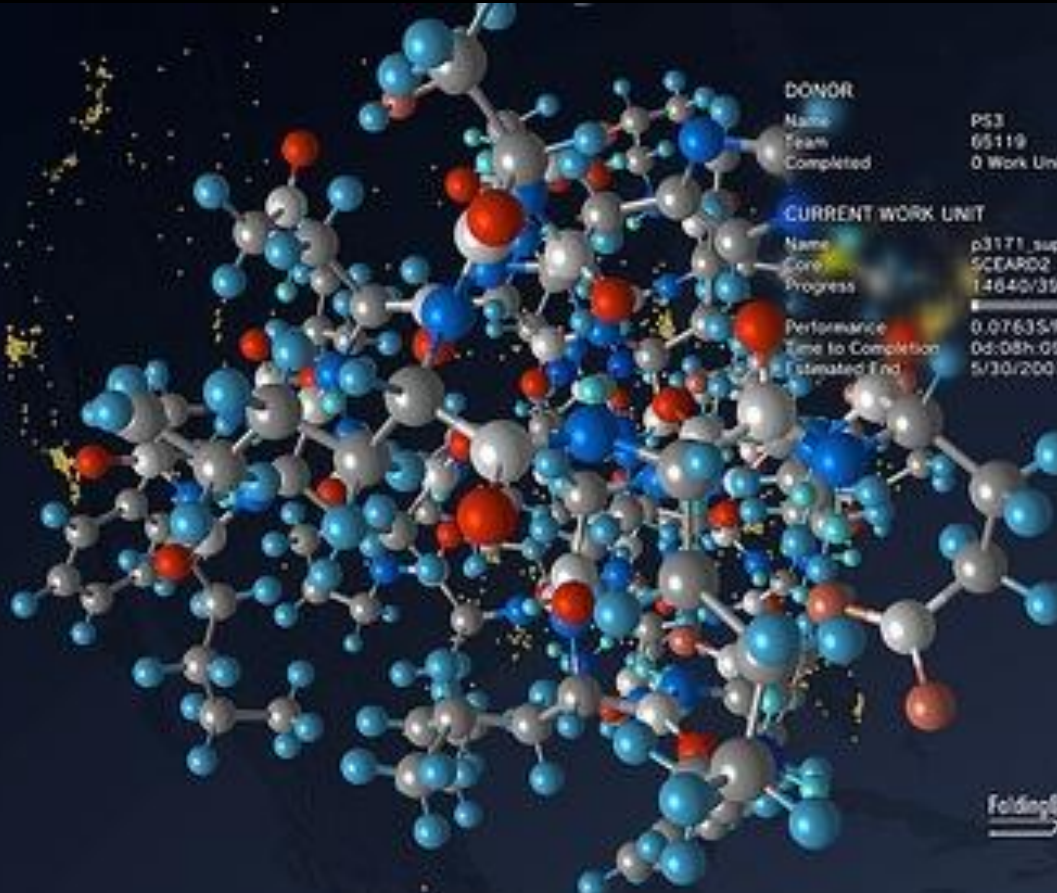
7969283390638391

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PrimeGrid

Folding@home using PlayStations




DONOR

Name	PS3
Team	65119
Completed	0 Work Units

CURRENT WORK UNIT

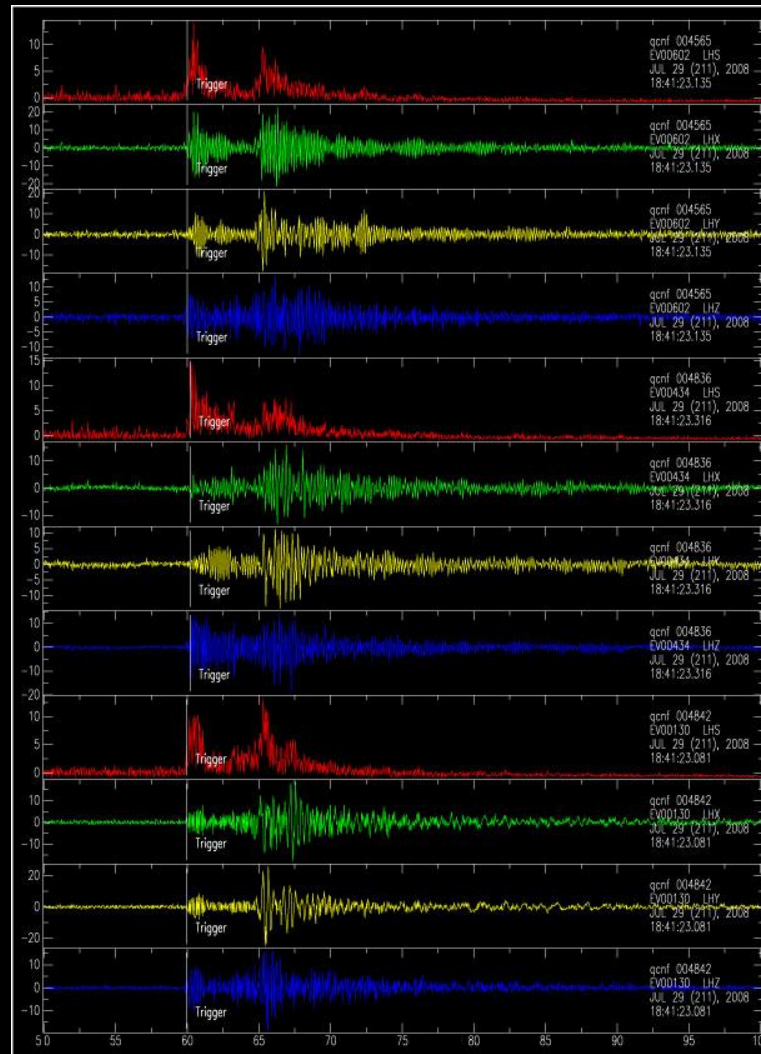
Name	p3171_supervillin_e1.25
Core	SCEAR02.1.10.76302
Progress	14640/399999
Performance	0.07635/Frame 226.59 NS/Day
Time to Completion	0d-08h-09m-47s
Estimated End	5/30/2007 Wed 10:01 PM

Folding@home distributed computing 

Milkyway@home using GPUs

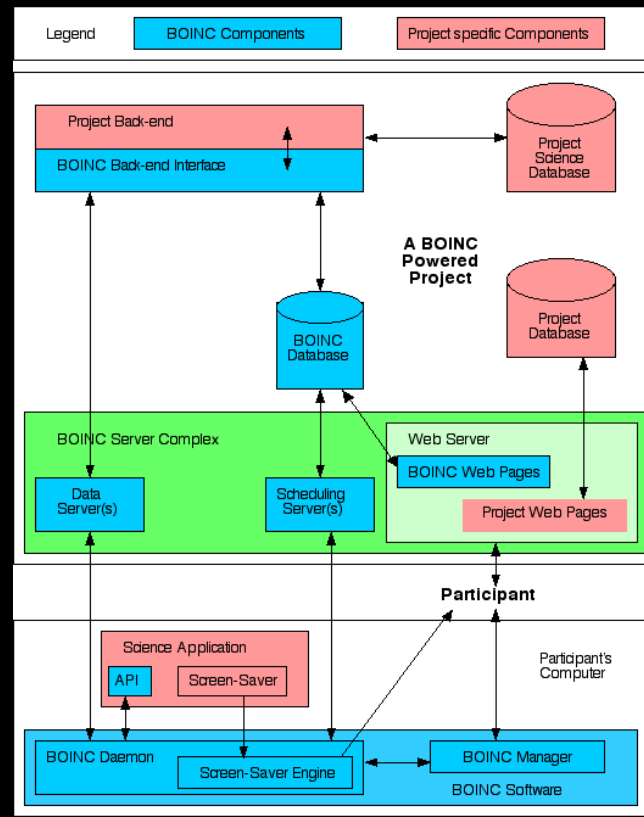


Quake Catcher Network using motion sensor chips



BOINC: Berkeley Open Interface for Network Computing

Client-Server model (not P2P), server managed by scientists
Optimal for large ration of CPU to I/O, trivially parallel computing
Validation of results by independent volunteer computers

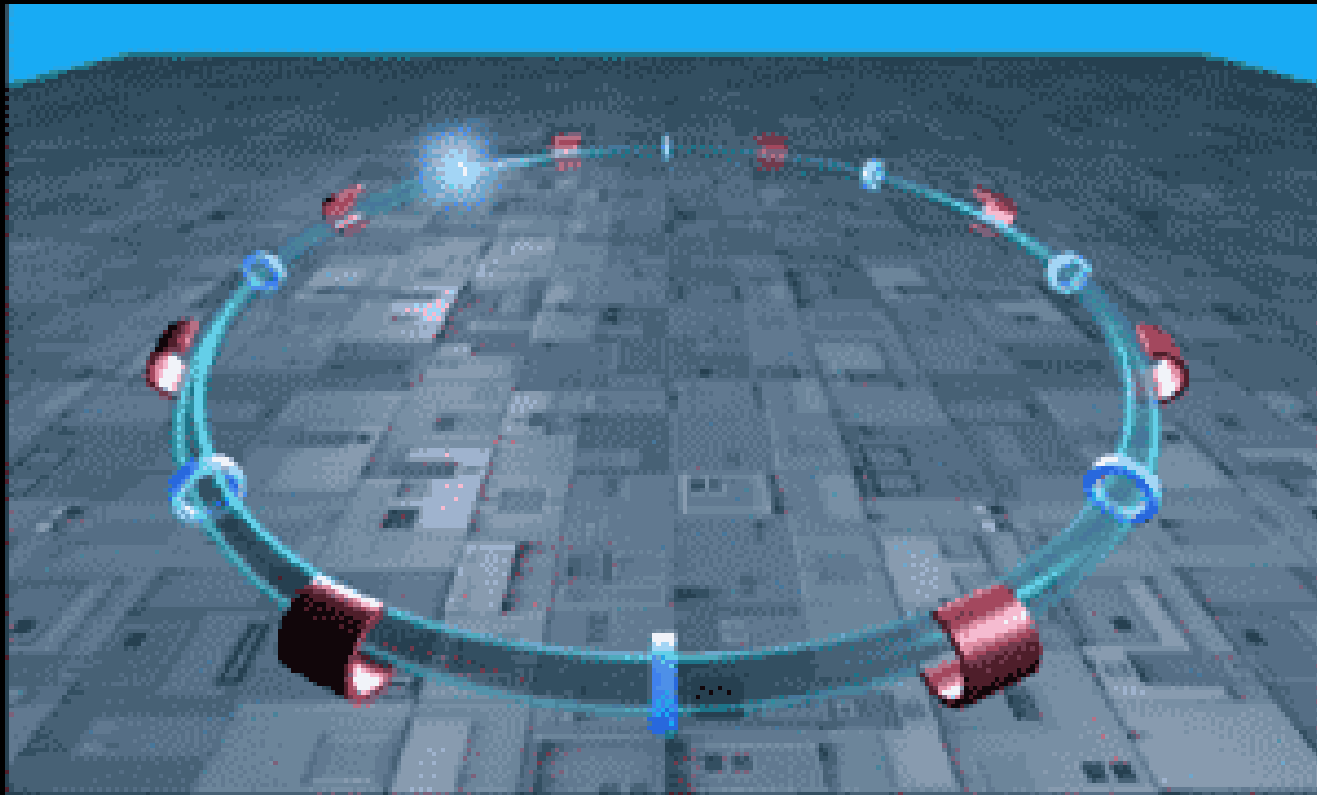


The Large Hadron Collider



LHC@home

studying LHC proton beam dynamics



LHC@home

- Calculates stability of proton orbits in LHC.
- System is nonlinear and unstable so numerically very sensitive.
- About 75 000 volunteers, installed on nearly 200 000 PCs.
- Over 7000 CPU years of processing.
- Started as an outreach project for CERN 50th Anniversary 2004.



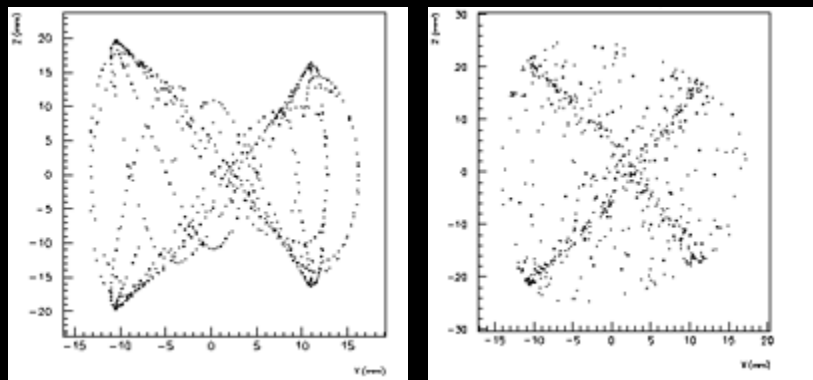
SixTrack program

SixTrack is a Fortran program based on DESY code.

SixTrack simulates 60 particles for 100k-1M LHC orbits.

Includes measured magnet parameters, beam-beam interactions

LHC@home revealed fundamental processor reproducibility issues

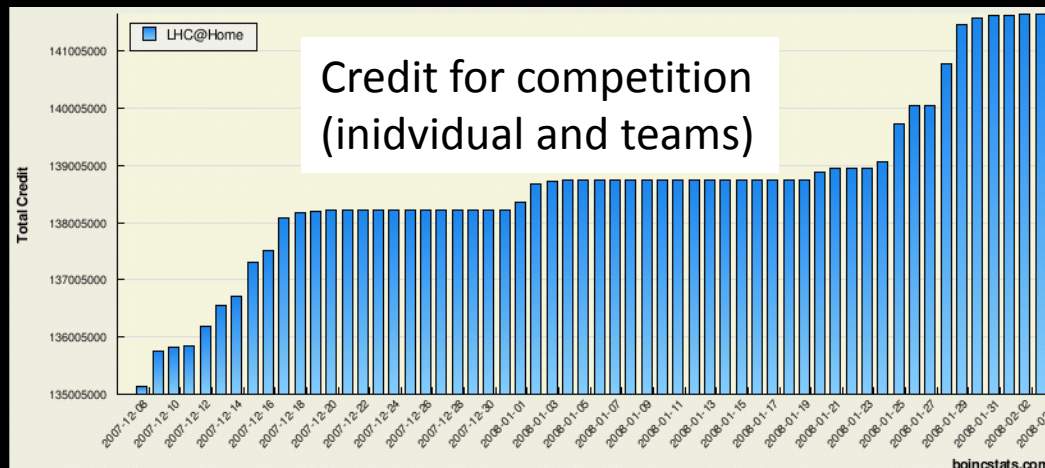


Phase space images of a particle for a stable orbit (left) and unstable chaotic orbit (right).

Motivations for citizen cyberscience

Message boards for social networking

Topic	Replies	User	Views
"UK boffins sniff for Higgs"	2	Alex	226
CAST - Cern Axion Space T spare parts.	7	ric	143
This website details the ATLAS detector.	11	PoorBoy	178
LHC and Muon??	5	Alex	503
Does 'protwelve' WU refer to tuning of magnet twelve?	1	leaden	481
[it] Physics special magazine issue	3	Arnaud	349
About the status report	2	qvxxvi	112
What exactly do we Calculate?	1	Guido.Waldenmeier.Remember	246
great link about the LHC	2		335
	1		188



The CERN Control Centre



LHC@home future plans

Sixtrack for LHC upgrade studies (W. Herr, CERN)

Sixtrack for other accelerators (Brookhaven National Lab)

Garfield: for the detailed simulation of gases in detectors

Rivet, Jetweb: Monte Carlo event generator and validator

BOINC and Virtualization

Established collaboration with the CernVM Project.

General interface to all CERN physics software.

Size of VM images now optimized and cached locally.

Build VMs for ATLAS, LHCb, ALICE (soon CMS) environments.

Tested a VM with full Athena environment.

Included an interface to physics groups' production chain.

Tested with ATLAS Panda job management.

NOTE: This is useful for Grid computing, too

From volunteer computing to
volunteer thinking

GalaxyZoo: classify galaxies



The interface shows a central galaxy image with a white crosshair indicating North (N), South (S), East (E), and West (W). A scale bar in the top left corner indicates 5 arcseconds. To the right of the image, the reference number is displayed as "Galaxy Ref: 587738568174207155". Below this, a prompt asks the user to "Choose the Galaxy Profile by clicking the buttons below". There are three main categories of buttons: "SPIRAL GALAXY" (with sub-options: CLOCK, ANTI, EDGE ON/UNCLEAR), "ELLIPTICAL GALAXY", "STAR / DON'T KNOW", and "MERGERS". At the bottom left of the image area, there is a checkbox labeled "Show Grid Overlay on the next Image" which is currently checked.

Galaxy Ref:
587738568174207155

Choose the Galaxy Profile
by clicking the buttons
below

CLOCK **ANTI** **EDGE ON/
UNCLEAR**
SPIRAL GALAXY

ELLIPTICAL GALAXY

**STAR /
DON'T KNOW** **MERGERS**

Show Grid Overlay on the next Image

If you find something REALLY unusual or strange and it does not look like anything in the [how to get started section](#) or in the [FAQ](#), then post it up on the [Forum](#) or drop us an email with the reference number.

Foldit

online game to fold proteins



The screenshot displays the Foldit game interface. On the left, a 3D protein structure is shown, composed of various colored segments (green, blue, red, yellow) and side chains. The structure is set against a dark background with a glowing effect. On the right, a dark grey panel displays the player's rank and score, along with two competition leaderboards. The top of the panel shows "Rank: 41" and "Score: 7054". Below this, the player's name "47: Human Fyn" is listed. The "Group Competition" section shows a table with 4 groups. The "Player Competition" section shows a table with 6 players. At the bottom left, a toolbar contains icons for "Shake Sidechains", "Wiggle Backbone", "Clear Locks and Bands", "Reset Puzzle", and "Mouse Help". Below the toolbar are menu items for "Actions", "History", "View", and "File". At the bottom right, there is a "Pull Tool" icon.

Rank: 41 Score: 7054

47: Human Fyn

▼ Group Competition

#	Group Name	Score
1	Window Group	9168
2	Truman College	9166
3	Street Smarts	9164
4	The Lone Folder	9162

▼ Player Competition

#	Player Name	Current	Best
1	ccarrico	-	9168
2	charlesabrams	-	9166
3	zzaltz	-	9164
4	ferzle	-	9162
5	Ninning	-	9158
6	Thor	-	9158

► Chat

Shake Sidechains Wiggle Backbone Clear Locks and Bands Reset Puzzle Mouse Help

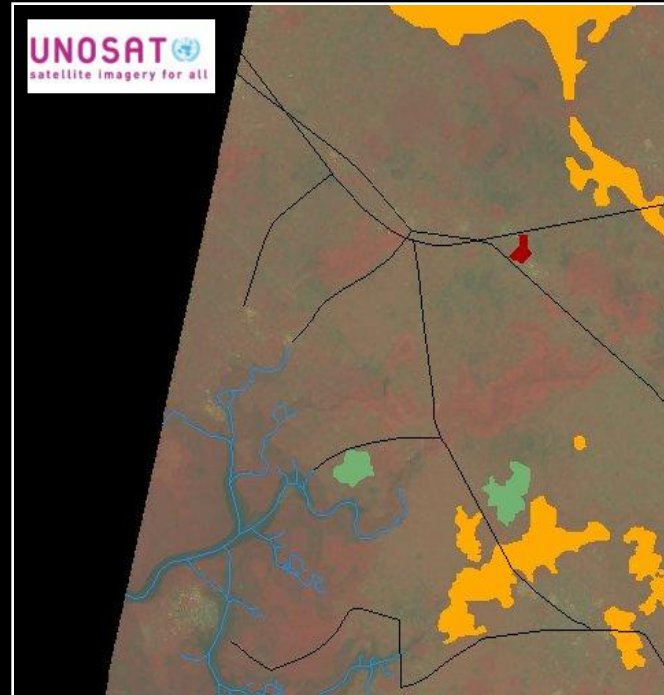
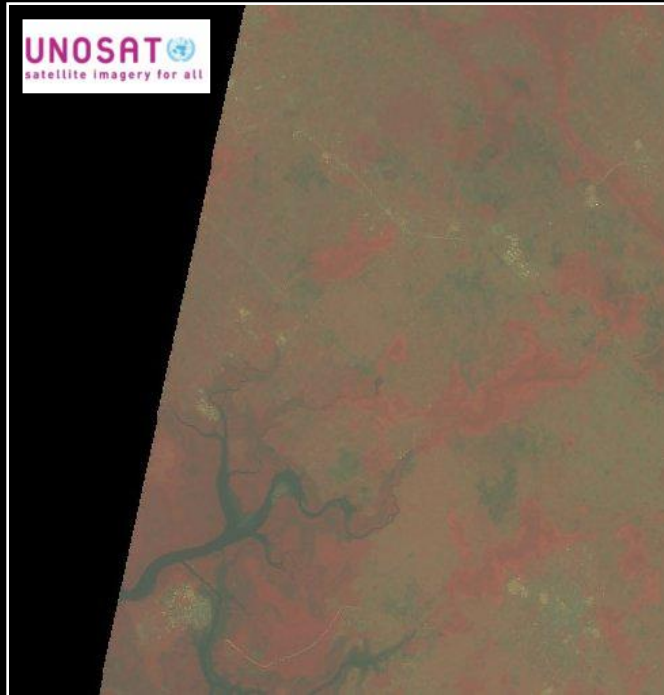
▲ Actions ► History ► View ► File

Pull Tool

Herbaria@home: digitize archives of natural history



AfricaMap: making maps from satellite images



Hominids@home

search for hominid fossils in



User name: [KBrudvik](#)

Last Login: [Yesterday](#)

Images viewed: [489](#)

1. What is this?

bovid mandible

2. What is this?

hominid molar

[Save](#)

[Reset](#)

[Next >](#)

HEP and volunteer thinking

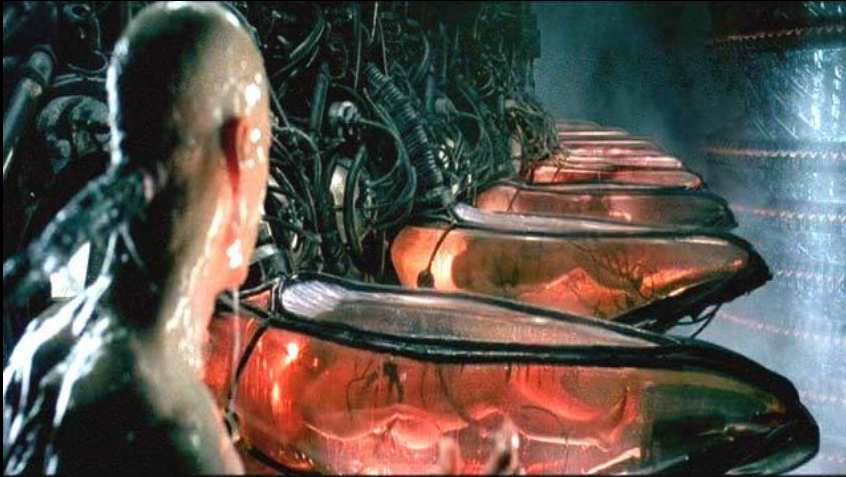
Volunteer thinking for LHC data analysis

Discussions with Jim Virdee, John Ellis

Return of the scanning girls?



Merging man and machine



freaky version



friendly version

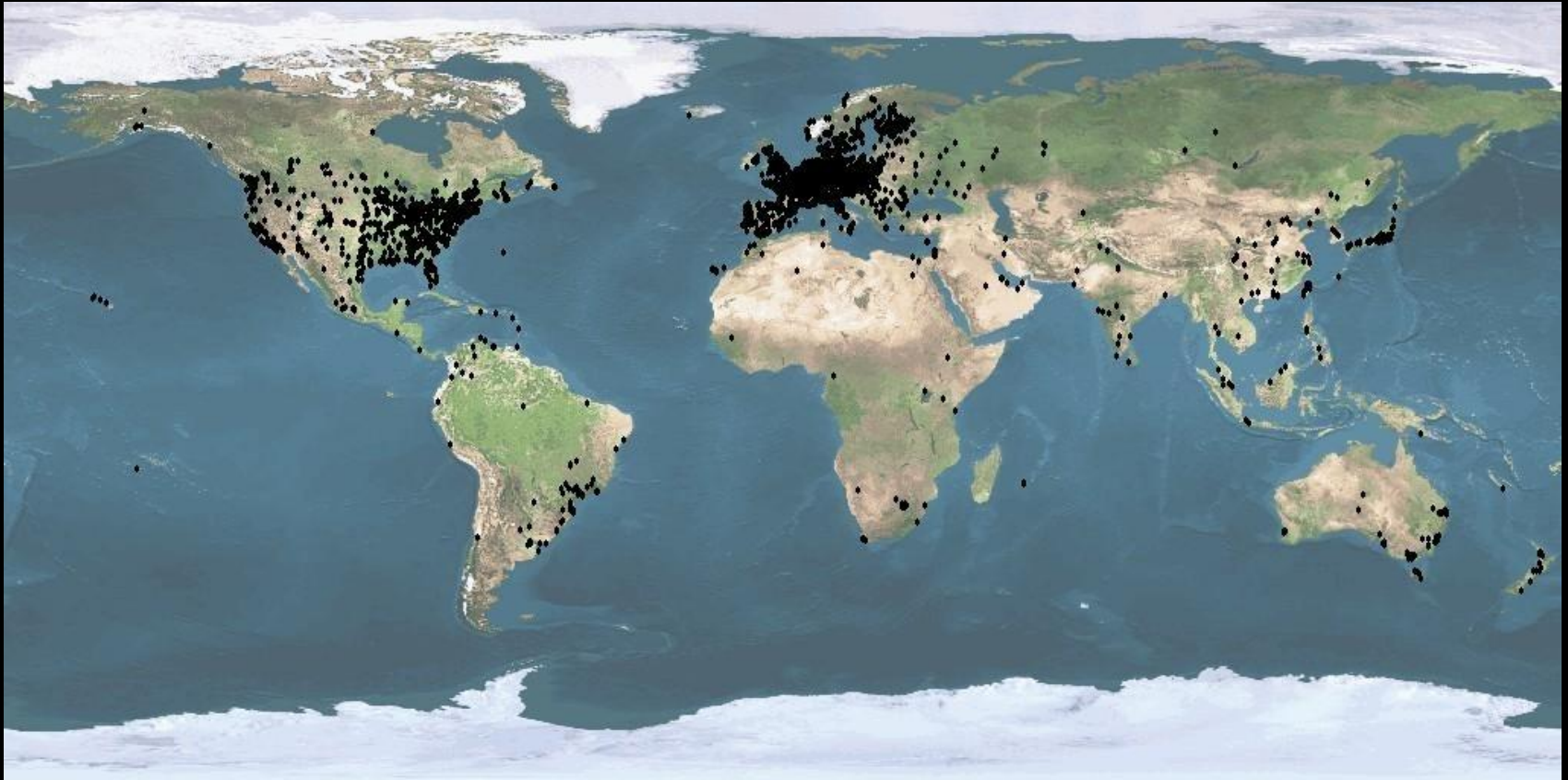
Africa: A chance to help



Asia: a huge potential



Typical volunteer distribution today



Scientific Opportunities in Asia



- 1) Fundamental science in Asia: increase awareness of Asian projects in astro- and particle physics.
- 2) Humanitarian research for Asia: focus on Asia-specific issues (SARS, bird-flu, regional weather phenomena...)
- 3) Asian digital history: digitalization and annotation of ancient manuscripts and images of artefacts



Taipei Workshop 16-17 April 2007 hosted by Academia Sinica
<http://event.twgrid.org/isgc2009/asiaathome/>

Beijing Seminar 20 April hosted by IHEP
<http://www.ihep.ac.cn/>

Both events featuring David Anderson, inventor of SETI@home and BOINC, and several other experts

A future volunteer?

