The Emergence of the Grid
Implications for Mass Storage

- **The TeraGrid**
- **Wireless Sources of Data**
- **The Planetary Computer**

"The all optical fibersphere in the center finds its complement in the wireless ethersphere on the edge of the network."

– George Gilder

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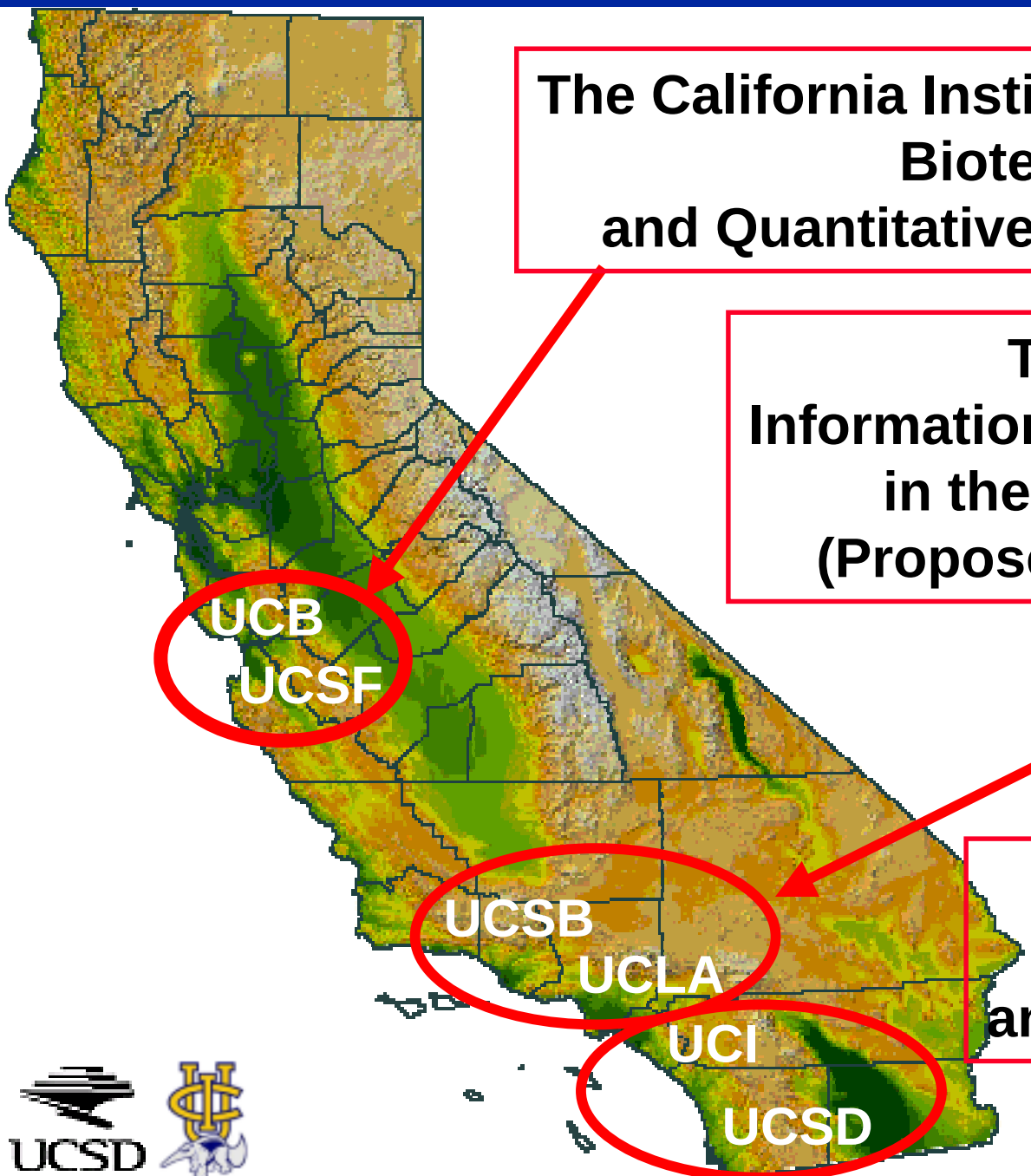
Governor Davis Created New Institutes for Science, Innovation, and Tech Transfer



The California Institute for Bioengineering, Biotechnology, and Quantitative Biomedical Research

The Center for Information Technology Research in the Interest of Society (Proposed-UCB, UCSC, UCM)

The California NanoSystems Institute

The California Institute for Telecommunications and Information Technologies

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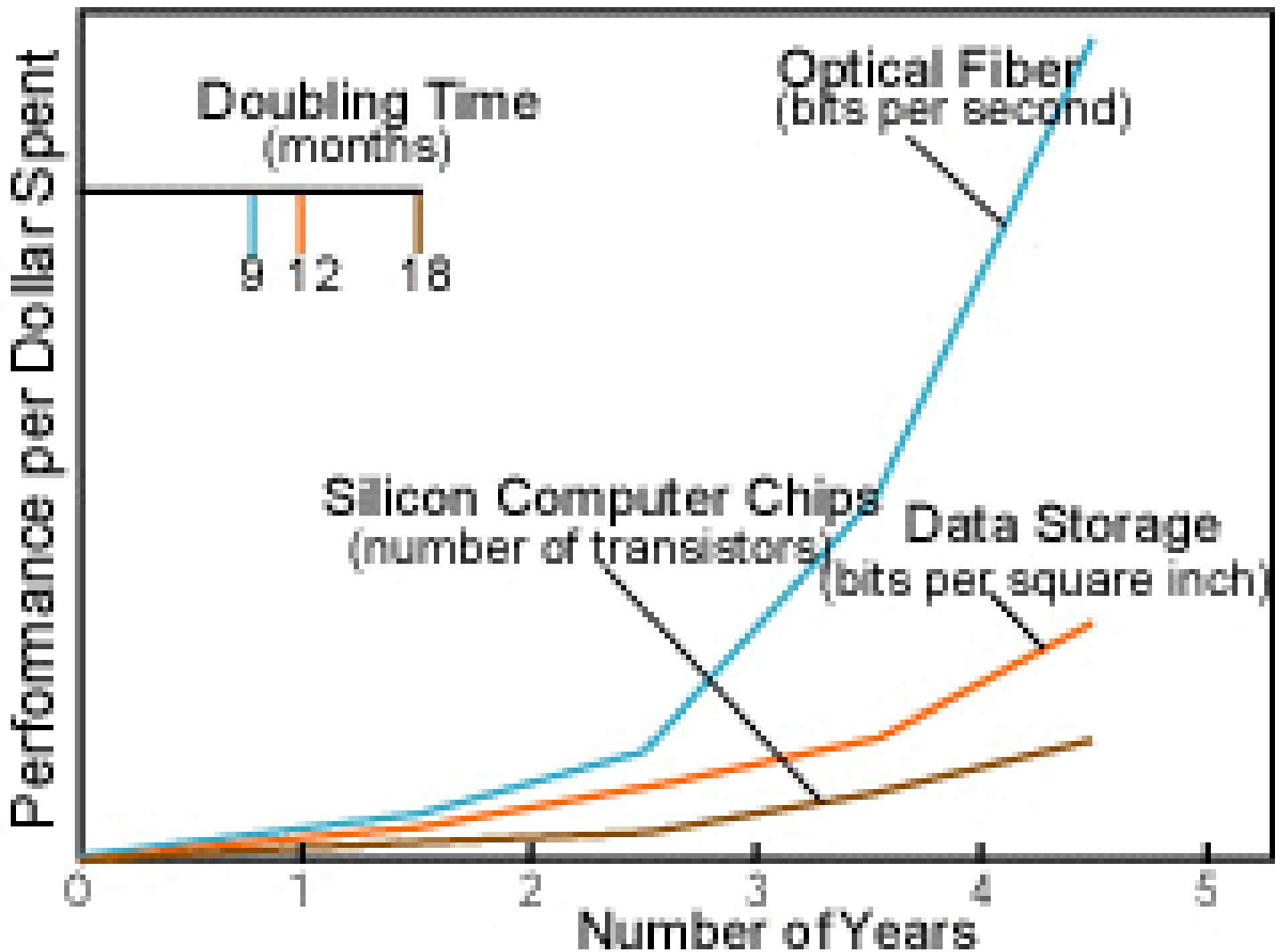
Why the Grid is the Future



Scientific American, January 2001

Near Term Goal: Build an International LambdaGrid

- **Establish PACI High Performance Network**
  - SDSC to NCSA LambdaNet
- **Link to:**
  - State Dark Fiber
  - Metropolitan Optical Switched Networks
  - Campus Optical Grids
  - International Optical Research Networks
- **Distribute Storage Over the LambdaGrid**
  - Large Central Sites
  - Cached Intermediate Sites
  - Large Local Analysis Facilities

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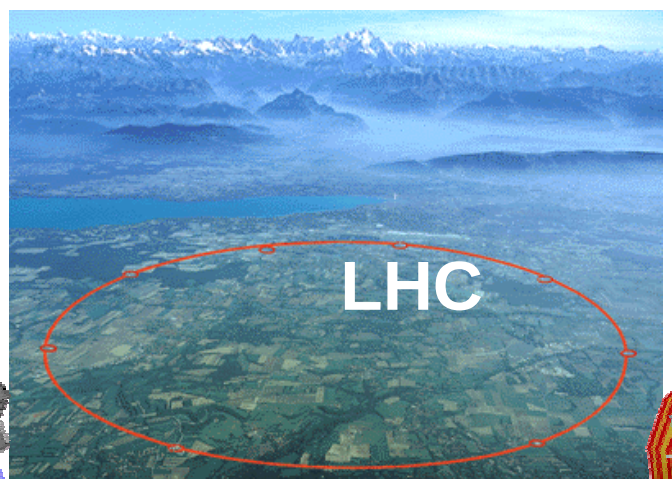
The Grid Physics Network
Petabyte-Scale Data Intensive Science

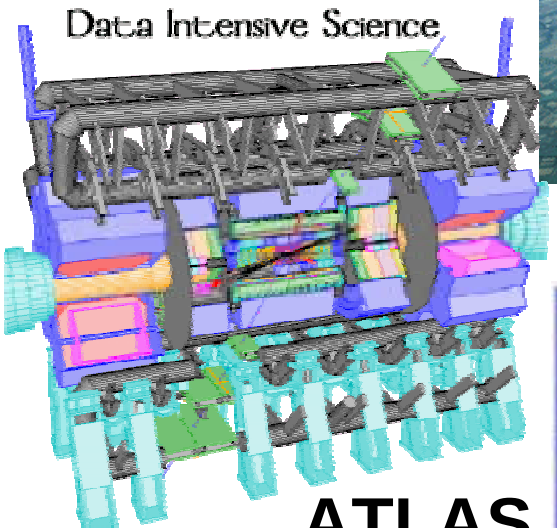
- **Paul Avery (Univ. of Florida) and Ian Foster (U. Chicago and ANL), Lead PIs**
  - **Largest NSF Information Technology Research Grant**
  - **20 Institutions Involved**
  - **Enabled by the LambdaGrid and Internet2**

GriPhyN

Data Intensive Science



Sloan Digital Sky Survey



ATLAS

CMS

LIGO

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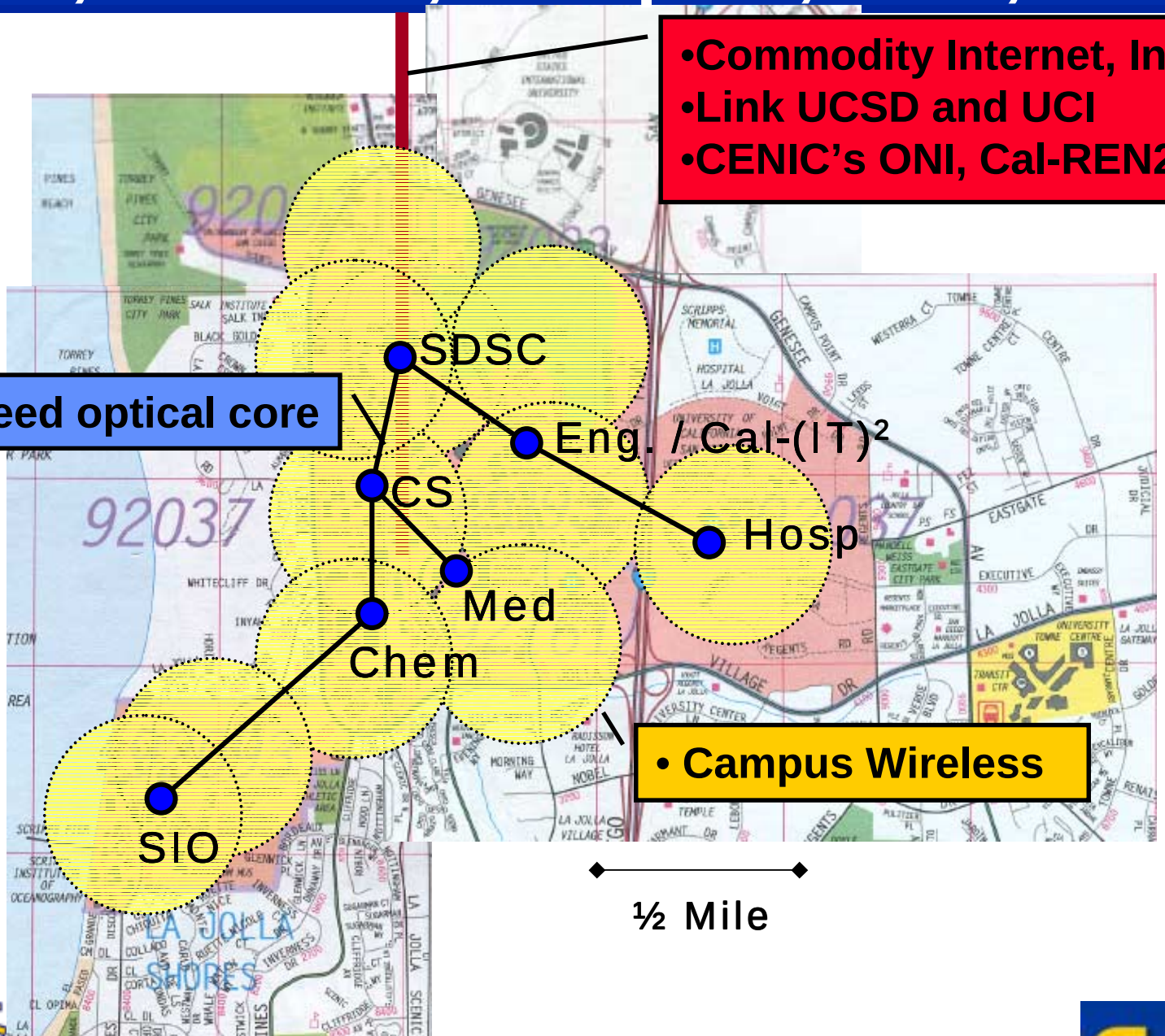
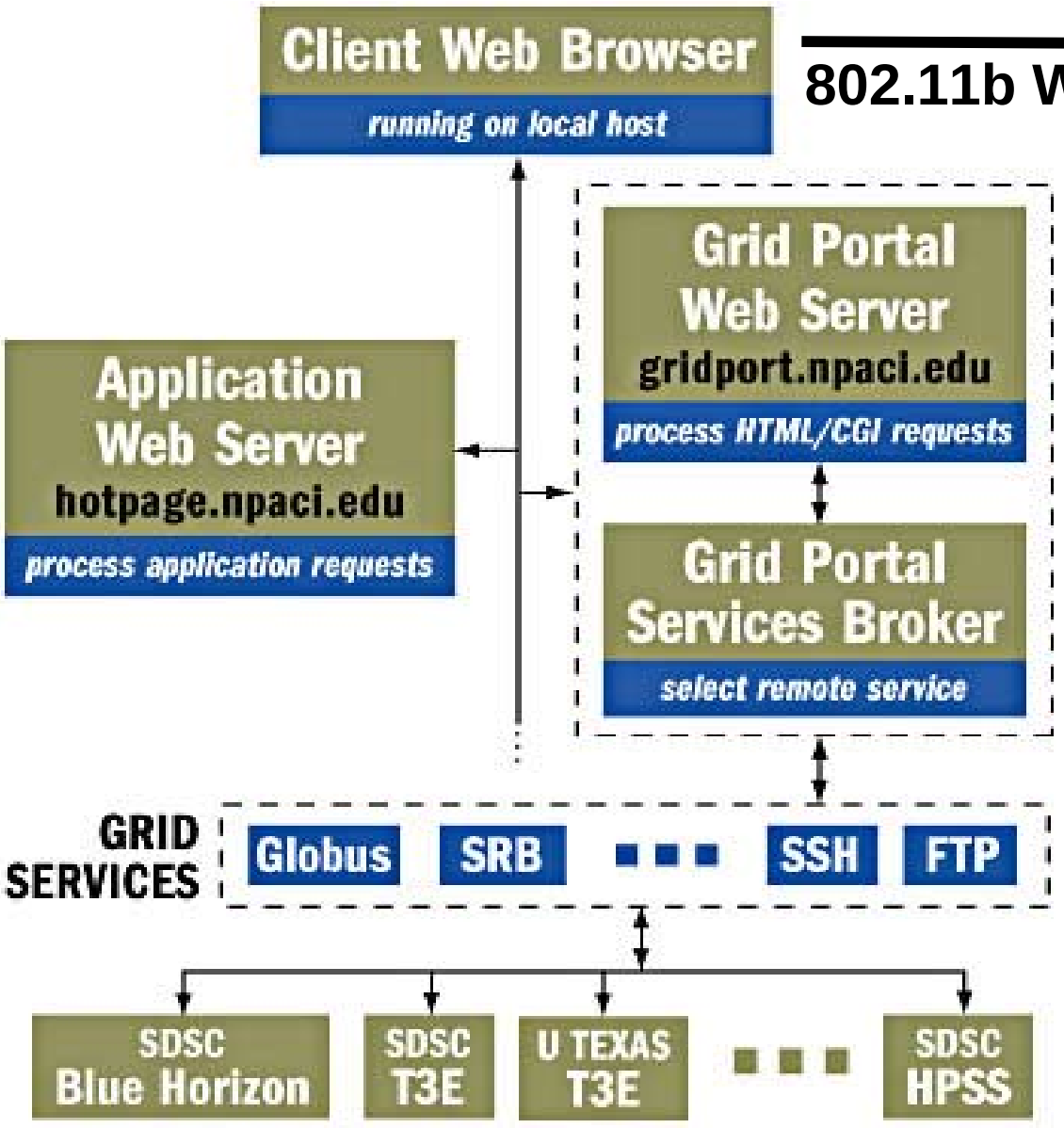
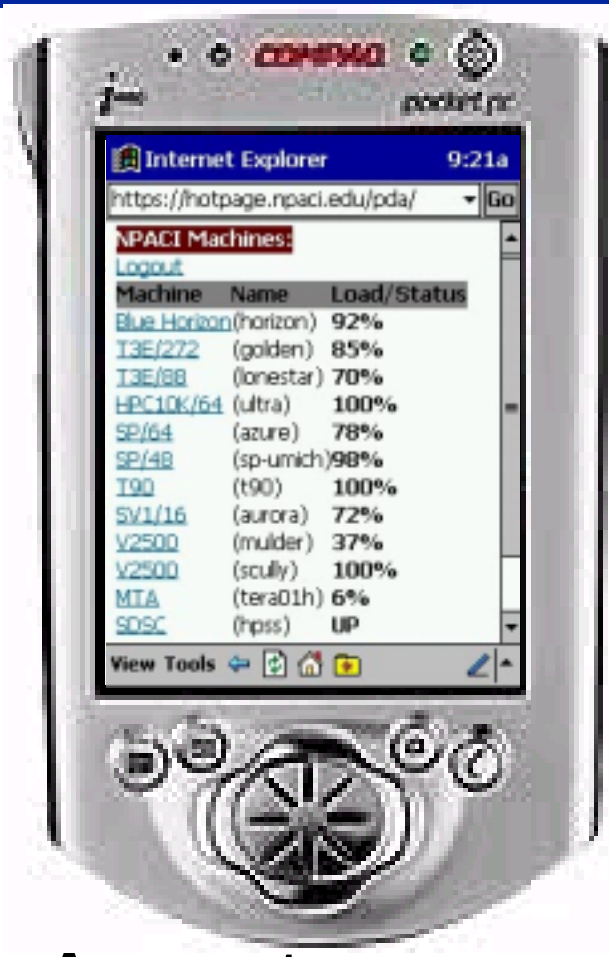
The UCSD "Living Grid Laboratory"— Fiber, Wireless, Compute, Data, Software



Source: Phil Papadopoulos, SDSC

Web Interface to Grid Computing
The NPACI GridPort Architecture





Interactive Access to:

- **State of Computer**
- **Job Status**
- **Application Codes**

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NPACI

GRIDPORT

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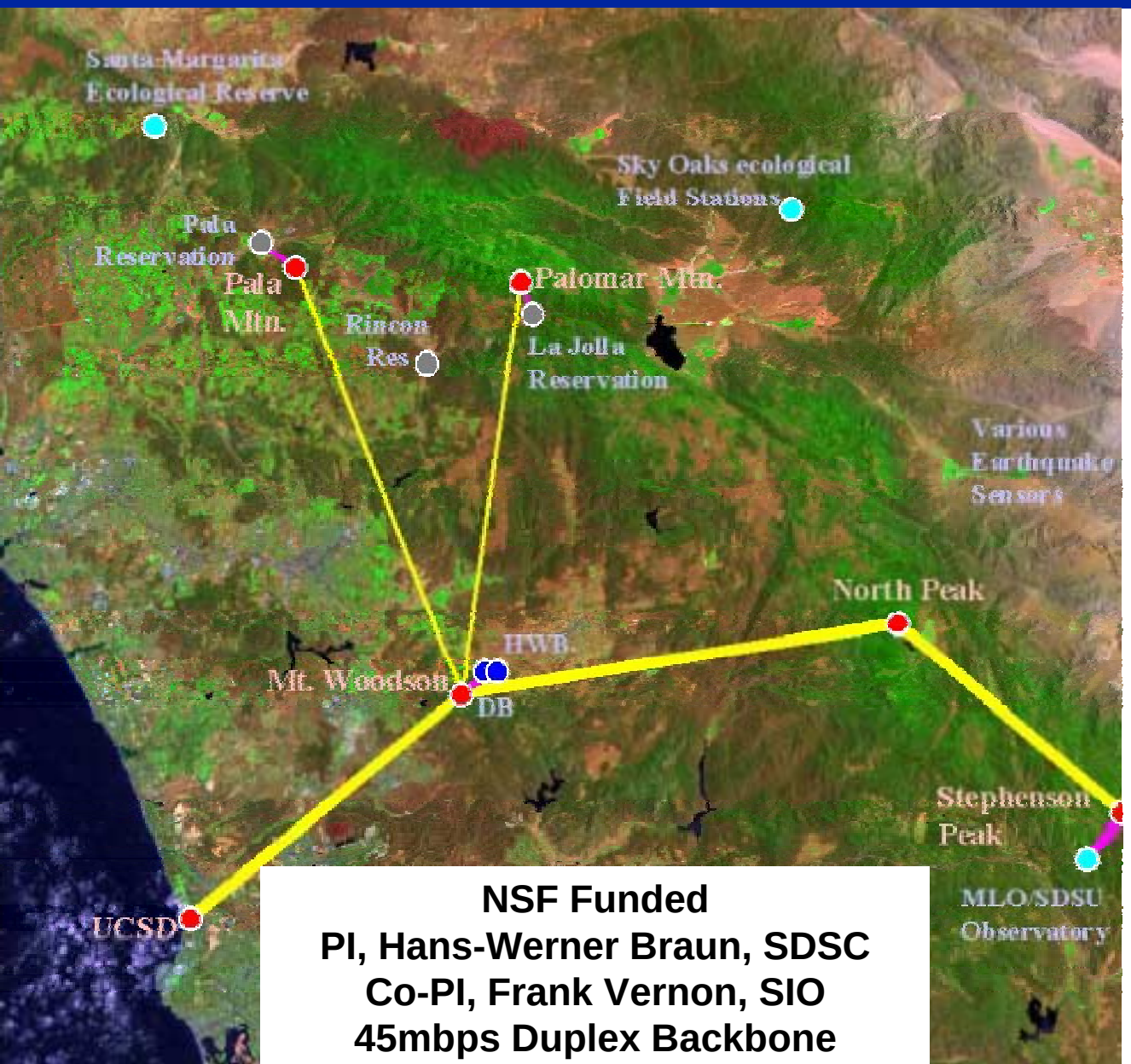
The High Performance Wireless Research and Education Network



NSF Funded
PI, Hans-Werner Braun, SDSC
Co-PI, Frank Vernon, SIO
45mbps Duplex Backbone

- **Cal-(IT)2 Will Build on This Pioneering Experiment**
- **Add New Science Sensor Arrays**
- **Instrument Civil Infrastructure**
- **Try Out New Wireless Technologies**
- **Data Analysis**
- **Outreach and Education**

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The Wireless Internet Will Improve the Safety of California's 25,000 Bridges

New Bay Bridge Tower with Lateral Shear Links

Cal-(IT)^2 Will Develop and Install Wireless Sensor Arrays Linked to Crisis Management Control Rooms

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Source: UCSD Structural Engineering Dept.

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High Resolution Data Analysis Facility Linked by Optical Networks to PACI TeraGrid

Planned for Fall 2001 at SIO
Support from SDSC and SDSU
Linked to Clusters and AI Data Mining

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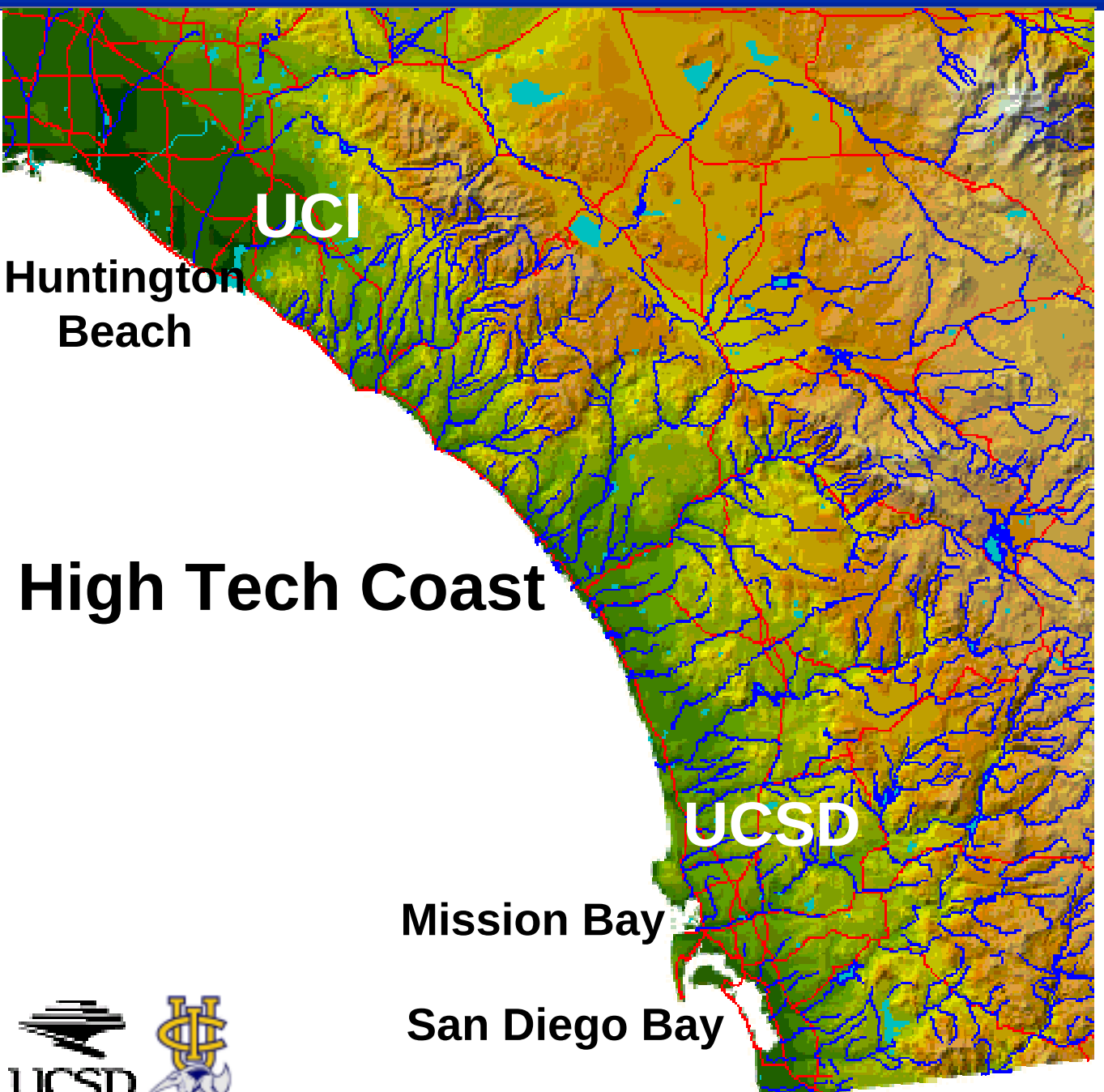
Can Use of These Technologies Help Us Avoid the Downsides of Prolonged Growth?



- Add Wireless Sensor Array
- Build GIS Data
- Focus on:
  - Pollution
  - Water Cycle
  - Earthquakes
  - Bridges
  - Traffic
  - Policy
- Work with the Community to Adapt to Growth

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Establish National Federated Repositories of Disciplinary Datasets

Proposal-Form a National Scale Testbed for Federating Multi-scale Brain Databases Using NIH High Field NMR Centers

Stanford

U. Of MN

Harvard

Cal Tech

NCRR Imaging and Computing Resources UCSD

SDSC

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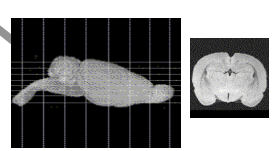
Surface Web

Wireless "Pad" Web Interface

Deep Web

UCLA



Duke

UCSD

Source: Mark Ellisman, UCSD

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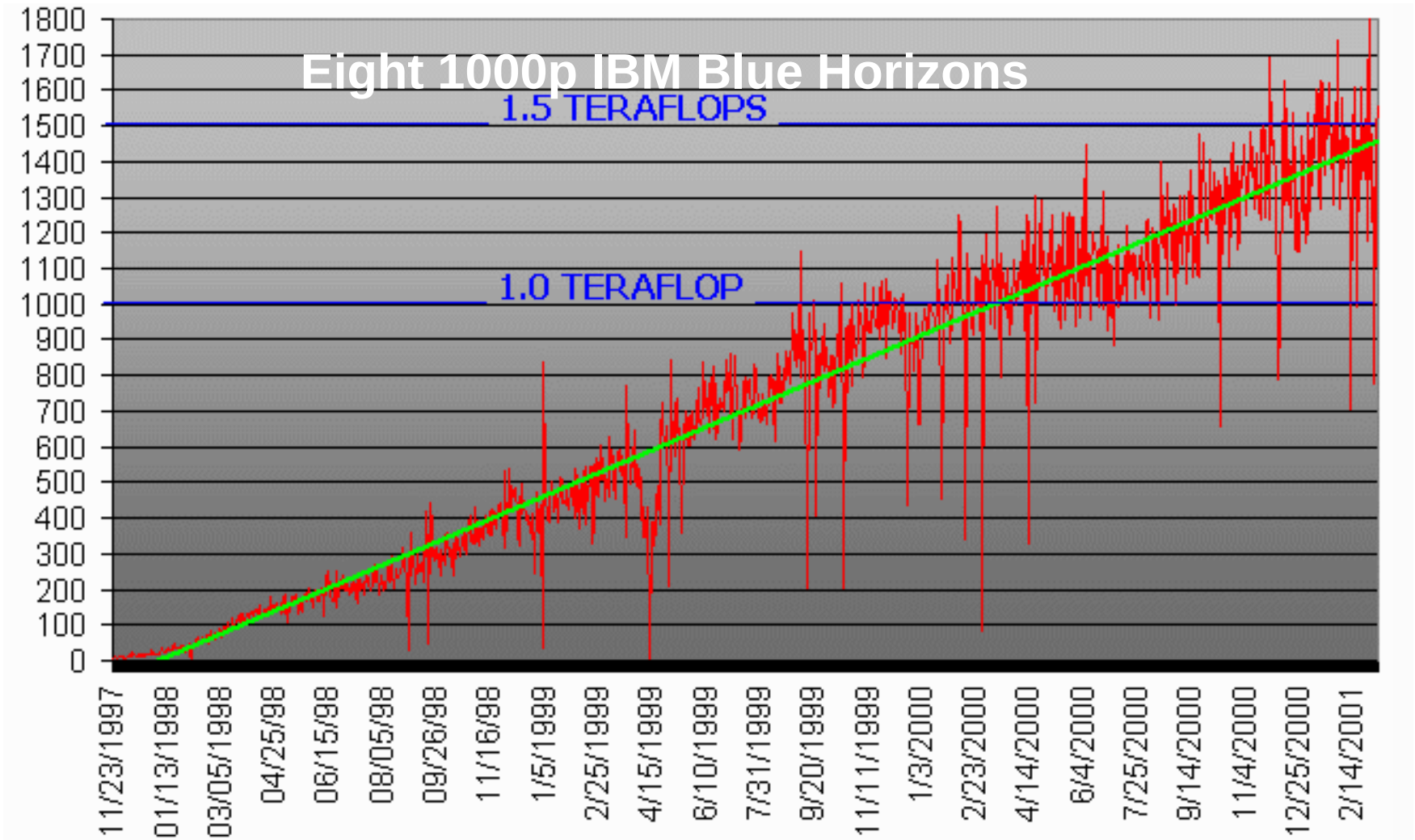
Entropia's Planetary Computer Grew to a Teraflop in Only Two Years

The Great Mersenne Prime (2^P-1) Search (GIMPS) Found the First Million Digit Prime



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Deployed in Over 80 Countries

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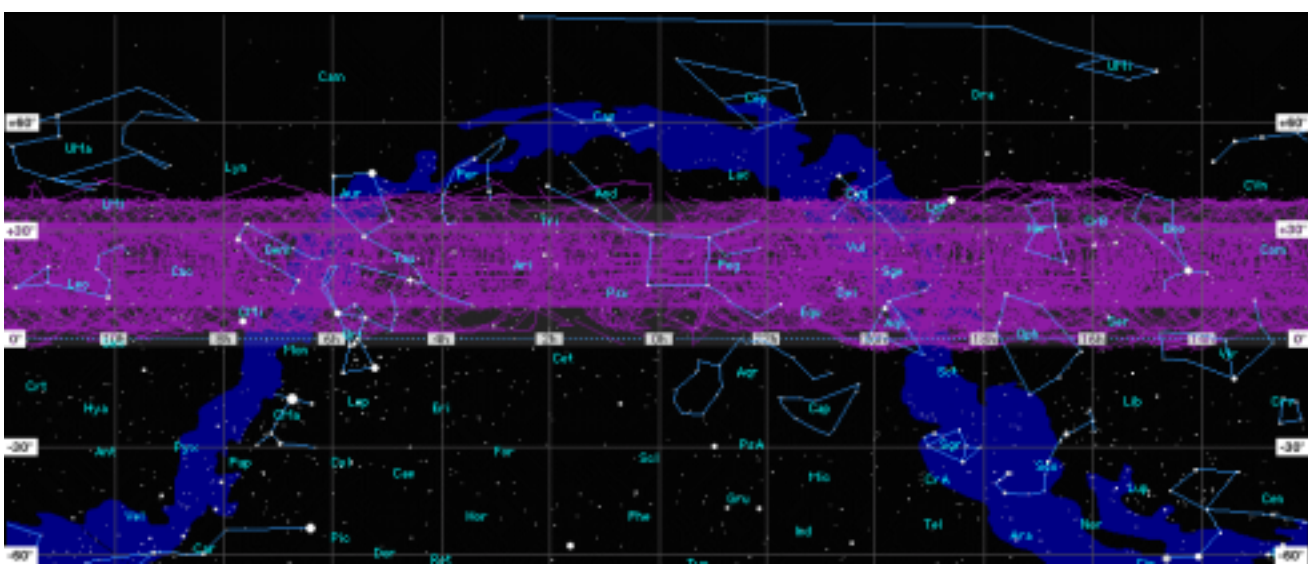
SETI@home Demonstrated that PC Internet Computing Could Grow to Megacomputers

- Running on 500,000 PCs, ~1000 CPU Years per Day
  - Over Half a Million CPU Years so far!
  - 22 Teraflops sustained 24x7
- Sophisticated Data & Signal Processing Analysis
- Distributes Datasets from Arecibo Radio Telescope



Arecibo
Radio Telescope

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Extending the Grid to Planetary Dimensions Using Distributed Computing and Storage

fightAIDS@home

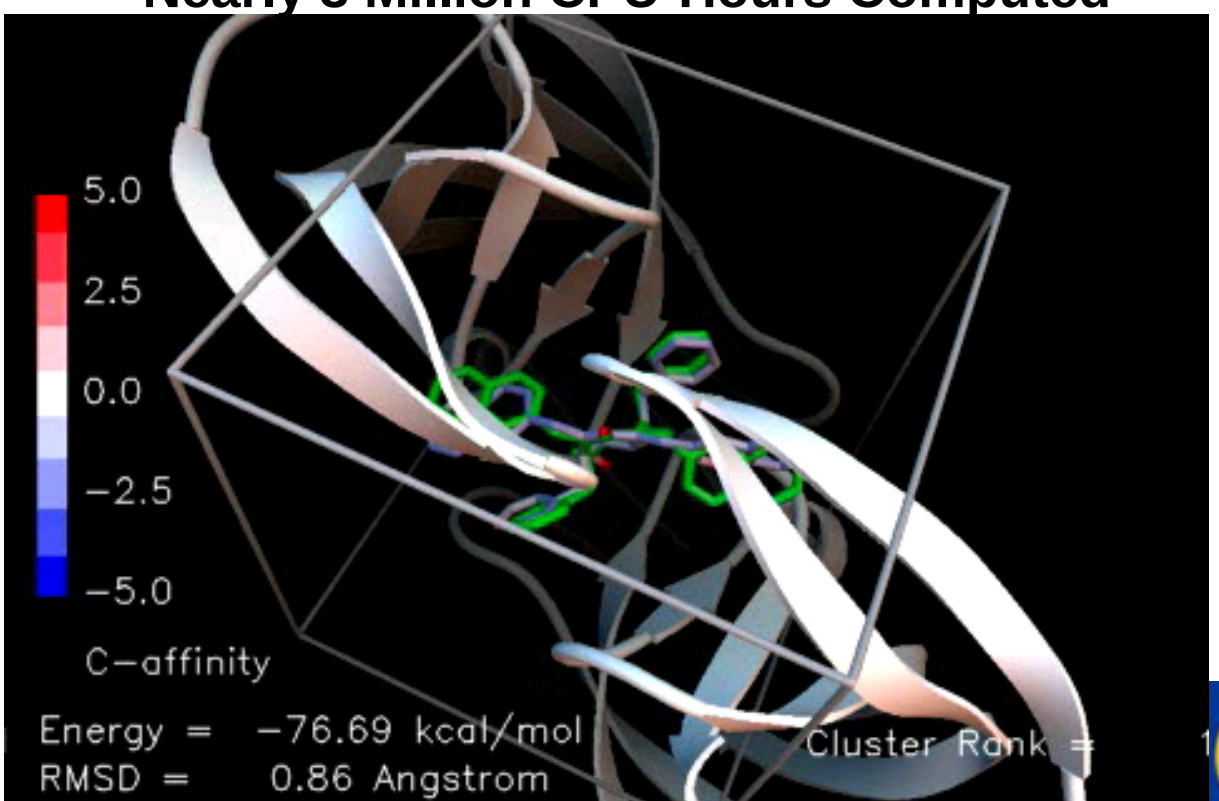
computing toward a cure

the Olson laboratory at The Scripps Research Institute

powered by entropia

AutoDock Application Software Has Been Downloaded to Over 20,000 PCs
Nearly 3 Million CPU-Hours Computed

***In Silico* Drug Design**



Art Olson, TSRI

UCSD

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A Megacomputer as Mass Storage

- **Napster Meets Seti@Home**
  - **Distributed Computing and Storage**
- **Assume Ten Million PCs in Five Years**
  - **Average Speed Ten Gigaflop**
  - **Average Free Storage 100 GB**
- **Planetary Computer Capacity**
  - **100 Petaflop Speed**
  - **1 Exabyte Storage**