“OptIPuter Year Five: From Research to Adoption"

OptIPuter All Hands Meeting
Calit2@UCSD
La Jolla, CA
January 22, 2007

Dr. Larry Smarr
Director, California Institute for Telecommunications and Information Technology;
Harry E. Gruber Professor,
Dept. of Computer Science and Engineering
Jacobs School of Engineering, UCSD

Last Year of OptIPuter Research Grant -- First Year of Broad Adoption of OptIPuter Results

- OptIPuter has Stimulated Global Interest in Using Lambdas
- 2D OptIPortals are Being Installed to Support e-Science
- 3D OptIPortals Under Development (CAVEs, Varrier)
- UC Campuses Adopting OptIPuter (UCSD, UCI, UCD, …)
- Both National and International Collaborations
- Parallel Lambdas For Single User in 2007 (UCSD, NU)
- Major Outreach at SC06
- Success in OptIPuter Support of Brain Imaging / Earth Sciences
- New Disciplinary Adoptions (Talks Tomorrow):
  - Digital Cinema (CineGrid)
  - Microbial Metagenomics (CAMERA)
  - Ocean Observatories (LOOKING, NEPTUNE, ORION)
  - Telescience

OptIPuter

it²

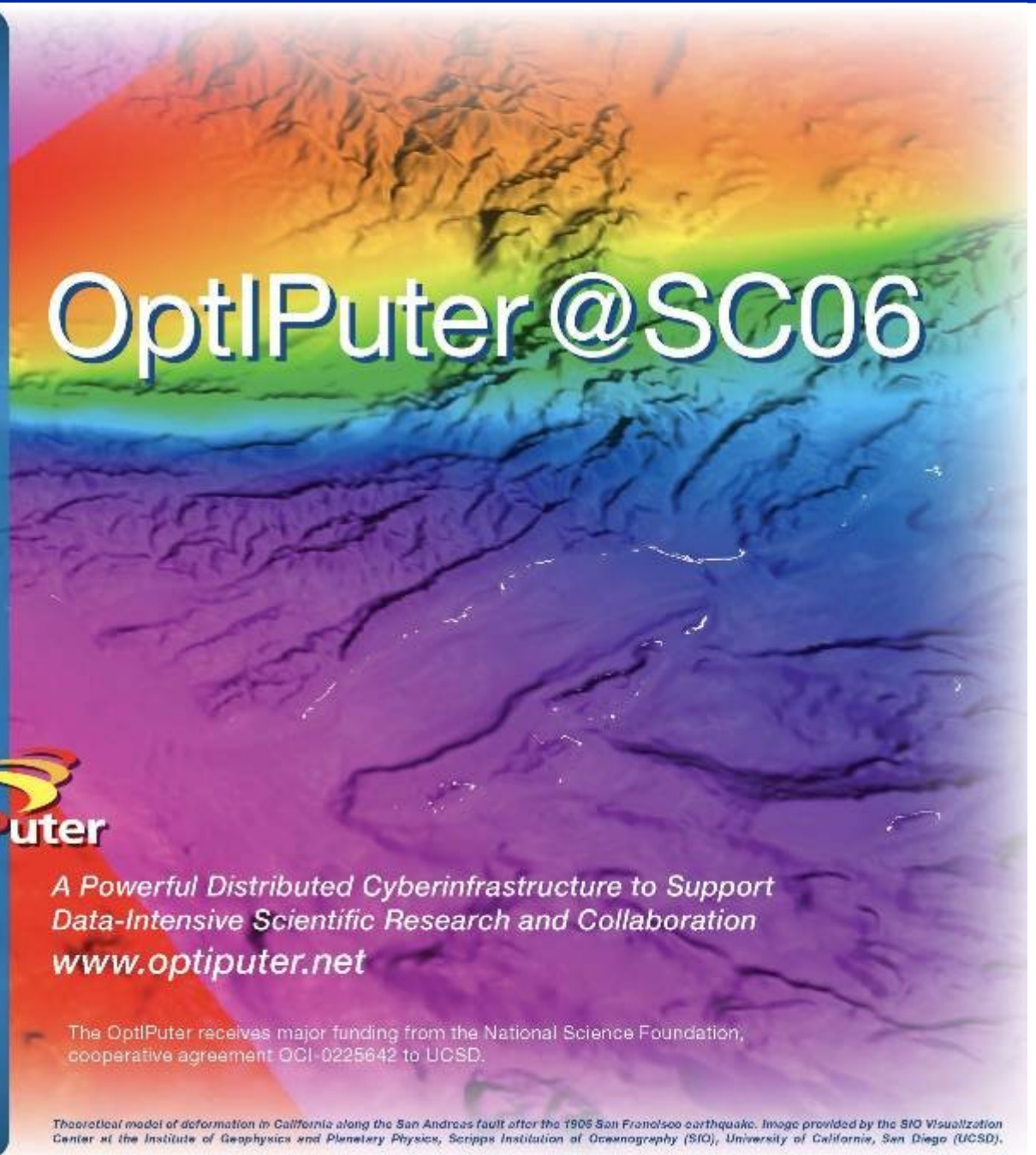
OptIPuter @ SC'06

ACADEMIC PARTNERS
Calit2 (California Institute for Telecommunications and Information Technology): University of California, San Diego and University of California, Irvine
Northwestern University
San Diego State University
Texas A&M University
University of Southern California, Information Sciences Institute
University of Illinois at Chicago
University of Illinois at Urbana-Champaign, National Center for Supercomputing Applications

AFFILIATE PARTNERS
AIST (National Institute of Advanced Industrial Science and Technology), Japan
CANARIE, Canada
Communications Research Centre Canada (CRC), Canada
KISTI (Korea Institute of Science and Technology Information), Korea
NASA
Purdue University
SARA Computing and Networking Services, The Netherlands
United States Geological Survey, National Center for Earth Resources Observation and Science
University of Michigan
University of Amsterdam, The Netherlands

INDUSTRIAL PARTNERS
Big Bandwidth
Calient Networks
Chiaro Networks
Glimmerglass Networks
IBM
Lucent Technologies
Rincon Research Corporation
Sun Microsystems
Telcordia Technologies

COLLABORATORS
CENIC (Corporation for Education Network Initiatives in California)
CICESE (Centro de Investigación Científica y de Educación Superior de Ensenada), Mexico
CommNexus San Diego
National LambdaRail



OptIPuter @ SC'06

Exhibition: Academic Partners

APPLE COMPUTER — BOOTH #1834

SAGE/OptIPuter Demonstration
University of Illinois at Chicago (UIC), Electronic Visualization Laboratory (EVL) • University of California, San Diego (UCSD), Calit2, CEOA and Scripps Institution of Oceanography (SIO) • Contact: Atul Nayak <anayak@ucsd.edu>

CALIT2/CEOA — BOOTH #1847

California Institute of Telecommunications and Information Technology (Calit2) and Center for Earth Observation Applications (CEOA) at UCSD

SAGE and Visualcasting Create a Virtual Distributed Laboratory
UIC EVL • with OptIPuter partners and research partners on the show floor – Calit2/CEOA • Purdue • NBCR/Osaka • SARA (Dutch Consortium) • University of Michigan – and remote participation by UIC EVL (Chicago) and possibly Chinese Academy of Sciences' Computer Network Information Center • Contact: Maxine Brown <maxine@uic.edu>

Studies of Gaviota Slide Offshore Southern California and EM Modeling
UCSD SIO • British Petroleum America • Contact: Atul Nayak <anayak@ucsd.edu>

Cyberinfrastructure for Ocean Observing Systems: Laboratory for the Ocean Observatory Knowledge Integration Grid (LOOKING) and the Southern California Coastal Ocean Observing System (SCCOOS)
UCSD Calit2 • UCSD CEOA • Contacts: Matthew Arrott <marrott@ucsd.edu>, Atul Nayak <anayak@ucsd.edu>

3D Interactive Visualization of Heterogeneous Earth Science Datasets
SIO Visualization Center, UCSD SIO • Contact: Debi Kilb <dkilb@ucsd.edu>

Visualizing and Interacting with Protein Data
UCSD Calit2 • Burnham Institute for Medical Research • Contact: Jurgen Schulze <jschulze@ucsd.edu>

Beyond Networks: Integrated Collaborative Cyberinfrastructure
UCSD National Center for Microscopy and Imaging Research (NCMIR) • Contact: Rajvikram Singh <raj@ncmir.ucsd.edu>

The NCMIR Multiscale Imaging Portal
UCSD NCMIR • Contact: Rajvikram Singh <raj@ncmir.ucsd.edu>

GULF COAST ACADEMIC SUPERCOMPUTING — BOOTH #1825

Gulf Coast Academic Supercomputing is an alliance of Rice University, Texas A&M University (TAMU), and University of Houston

Prophesy (poster)
Texas A&M University (TAMU) • Contact: Xingfu Wu <wuxf@cs.tamu.edu>

Processor Partitioning-based Performance Analysis and Optimization Framework (poster)
TAMU • Contact: Xingfu Wu <wuxf@cs.tamu.edu>

Performance Analysis, Modeling and Prediction of a Parallel Lattice Boltzmann Application Using Prophesy (poster)
TAMU • Contact: Xingfu Wu <wuxf@cs.tamu.edu>

NATIONAL CENTER FOR DATA MINING — BOOTH #1428

Transporting Sloan Digital Sky Survey (SDSS) Data using SECTOR
UIC National Center for Data Mining (NCDM) • Northwestern University (NU) International Center for Advanced Internet Research (iCAIR) • Johns Hopkins University • JGN2 • KISTI/GLORIAD • SARA • SURFnet • StarLight • NASA Goddard Space Flight Center (GSFC) • Caltech • Contact: Robert Grossman <grossman@uic.edu>

NATIONAL LAMBDARAIL — BOOTH #1951

OptIPuter Technologies Enable Genomic and Oceanographic Research
(presentation) • Larry Smarr, UCSD Calit2

Global Lambda Visualization Facility and SAGE Visualcasting
(presentation) • Jason Leigh, UIC EVL <spiff@uic.edu>

TransLight and GLIF (presentation) • Maxine Brown, UIC EVL <maxine@uic.edu>

NORTEL — BOOTH #1843

International Dynamic Optical Multicast
NU iCAIR • Nortel • Louisiana State University • Masaryk University (Czech Republic) • Louisiana Optical Network Initiative (LONI) • CESnet • MCNC • SURFnet • CANARIE 4 • StarLight • National LambdaRail • Atlantic Wave • Contact: Joe Mambretti <j-mambretti@northwestern.edu>

Exhibition: Affiliate Partners and Friends

AIST — BOOTH #325

G-lambda Project: Inter-Domain Advance Reservation of Bandwidth and Computing Resources
AIST (National Institute of Advanced Industrial Science and Technology), Grid Technology Research Center (GTRC) • Contact: Tomohiro Kudoh <t-kudoh@aist.go.jp>

GEO Grid: Motivations and Opportunities for Earth Observation Grids
(presentation) – *Demonstration in the NBCR-Osaka booths #439-443*
AIST GTRC • Contact: Ryousuke Nakamura <r-nakamura@aist.go.jp>

DUTCH RESEARCH CONSORTIUM — BOOTH #1805

Visualizing a 50-Terabyte Climate Study using the OptIPuter
SARA High Performance Networking & Insight Services Group • University of Utrecht • Contact: Paul Wielinga <wielinga@sara.nl>

Token-based GMPLS: Path Authorization and Resource Management by extending RSVP-TE with Tokens
Universiteit van Amsterdam (UvA), Advanced Internet Research Group • UvA System and Network Engineering Research (SNER) Group • Contact: Cees de Laat <delaat@science.uva.nl>

Using the RDF-based Network Description Language to Describe Network Resources in the GLIF for Pathfinding
UvA SNER • SARA • Contact: Cees de Laat <delaat@science.uva.nl>

StarPlane: Enable Applications to Dynamically Manage and Control Photonic Networks
UvA SNER • Vrije Universiteit Amsterdam • Contact: Cees de Laat <delaat@science.uva.nl>

IBM — BOOTH #1205

Participatory Design Studio
Communications Research Centre Canada (CRC) • Carleton University Interactive Multimedia Studio (CIMS), Canada • National Research Council (NRC) of Canada • Contact: Michel Savoie <michel.savoie@crc.ca>

UCLP Graphical User Interface
CRC • CIMS • NRC • Contact: Michel Savoie <michel.savoie@crc.ca>

KISTI — BOOTH #1242

Streaming HDTV
KISTI (Korea Institute of Science and Technology Information) Supercomputing Center • Contact: Minsun Lee <mleech@kisti.re.kr>

NASA — BOOTH #917

Uncompressed Real-Time High-Definition Streaming
NASA GSFC • DRAGON Project (Mid-Atlantic Crossroads, USC Information Sciences Institute East, George Mason University) • with SC06 Xnet, AOVA Networks, Internet2, and NICT/Osaka University • Contact: Pat Gary <Pat.Gary@nasa.gov>

NBCR-UCSD/OSAKA UNIVERSITY — BOOTH #439-443

UCSD National Biomedical Computation Resource (NBCR) and the CyberMedia Center at Osaka University, Japan, showcasing PRAGMA and MR NRCC demonstrations

GEO Grid: Global Earth Observation Grid
AIST GTRC • Contact: Nadaka Yamamoto <nadaka@ni.aist.go.jp>

NCHC Bioimaging and Environmental Observatories
National Center for High-Performance Computing (NCHC), Taiwan • Contact: Fang-Pang Lin <c00fpl00@nchc.org.tw>

Beyond Networks: Integrated Collaborative Cyberinfrastructure
UCSD NCMIR • Contact: Rajvikram Singh <raj@ncmir.ucsd.edu>

The NCMIR Multiscale Imaging Portal
UCSD NCMIR • Contact: Rajvikram Singh <raj@ncmir.ucsd.edu>

Python-based Molecular Viewing, Visual Programming, and Scalable Computing Environment
UCSD NBCR • Contact: Peter Arzberger <parzberg@ucsd.edu>

Rocks Based Tile Display Wall (TDW) and OptIPortal
UCSD San Diego Supercomputer Center (SDSC) • UCSD Calit2 • Contact: Phil Papadopoulos <phil@sdsc.edu>

BioGrid Project and BioGrid Kansai NPO
Osaka University • Contact: Shinji Shimojo <shimojo@cmc.osaka-u.ac.jp>

Status Report of JGN2 R&D and Future Direction
JGN2-Osaka • Contact: Shinji Shimojo <shimojo@cmc.osaka-u.ac.jp>

PRIUS and PRIME Joint Presentations
Osaka University • UCSD • Contacts: Susumu Date <date@ais.cmc.osaka-u.ac.jp>, Peter Arzberger <parzberg@ucsd.edu>

PACIFIC NORTHWEST GIGAPOP & RESEARCHCHANNEL — BOOTH #236

SAGE/OptIPuter Demonstration
University of Michigan, School of Info. • Contact: Erik Hofer <erhofer@umich.edu>

PURDUE UNIVERSITY — BOOTH #2214

SAGE/OptIPuter Demonstration
Purdue University, Envision Center for Data Perceptualization and Rosen Center for Advanced Computing • Contact: Laura Arns <larns@purdue.edu>

Technical Papers

High-Performance Dynamic Graphics Streaming for SAGE
Byungil Jeong, Luc Renambot, Ratko Jagodic, Rajvikram Singh, Julieta Aguilera, Andrew Johnson, Jason Leigh • UIC EVL • Contact: Byungil Jeong <bjeong@evl.uic.edu>

Posters

Semantics for Hybrid Networks Using the Network Description Language
Jeroen van der Ham, Paola Grosso, Freek Dijkstra, Cees de Laat, Ronald van der Pol, Andree Toonk • UvA SNER • SARA • Contact: Cees de Laat <delaat@science.uva.nl>

BOFs

Rocks Clusters
Steve Jones, Greg Bruno, Tim Mattoni • UCSD SDSC • Contact: Phil Papadopoulos <phil@sdsc.edu>

OptIPuter @ SC06
Check SC06 conference schedule and individual booth schedules for presentation times

OptIPuter @ SC'06
Calit2 Booth



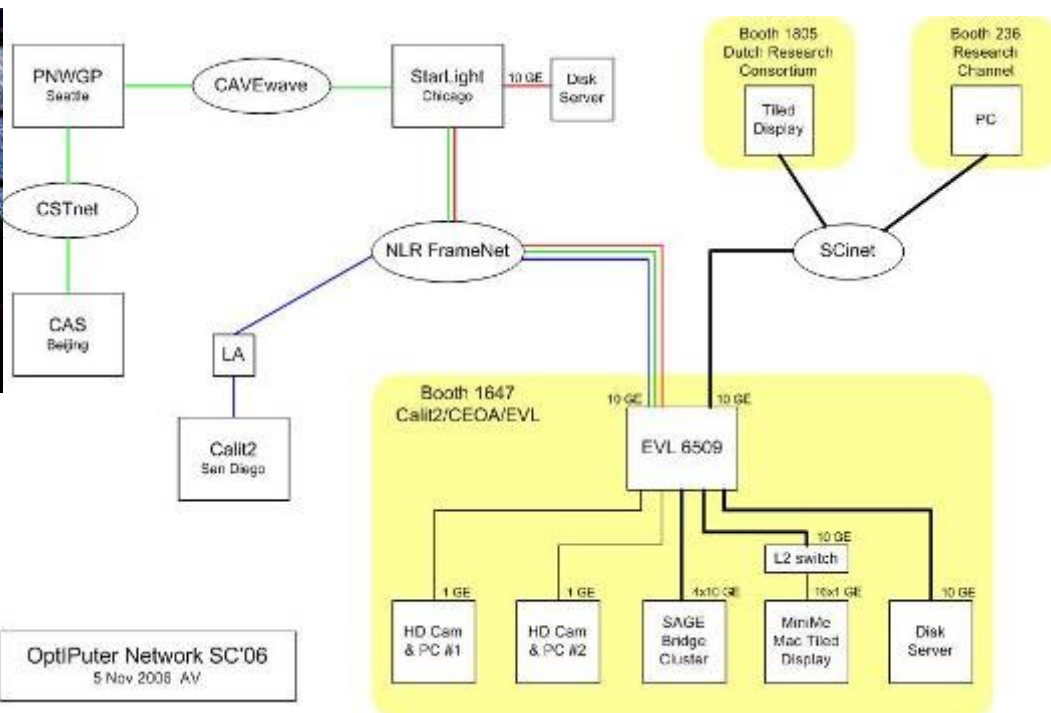














OptIPuter

it2

Verify the Timelines in the FY2006 Annual Progress Report

Network and Hardware Infrastructure Timeline	
Year 4 (Oct '05-'06)	**Year 5 (Oct '06-'07)**
UCSD Campus Testbed (and SoCal OptIPuter sites) (UCSD)	
• Added Intel AMD 64-bit nodes with PCI-express interfaces • Deployed full bisection networks to NCMIR (20Gbps), SDSC (10Gbps), Calit2 Viz walls(30Gbps) • Demonstrated 10Gbps sustained storage read and/or write across campus • Deployed first DWDM on campus (Quartzite) • Striped 10Gbps to most campus sites • Automated discovery and mapping of OptIPuter network configuration • Extended CAVEwave to McLean VA with other funding • Built three OptIPortals with other funding • Tested several HD video strategies	• Retire some IA-32 clusters; many are still useful for testing • Refine packaging of OptIPuter hardware and software, including Gold, Base, Visualization, and Storage personalities • Complete deployment of DWDM infrastructure (Quartzite and OptIPuter) • Continue evolution of automated network discovery tools • Stripe 10Gbps to all sites with more than 32 nodes. • Connect to additional NLR and PacificWave 10GEs, get ready for Internet2 waves • Incorporate best HD video strategies for collaboration with OptIPortals
Metro Chicago Testbed (NU)	
• Add additional 64-bit clusters. • Evaluate/refine storewidth physical model	• Retire IA-32 clusters • Package know-how to build storewidth endpoints
National Testbed via CAVEwave (UIC)	
• Use CAVEwave with OptIPuter national-scale applications	• Integrate CAVEwave with GLIF • Replicate CAVEwave as needed

FY 2006 Annual Progress Report
p 17, 21, 23, 27, 31-32

OptIPuter Timelines in the FY2006 Annual Progress Report

- Network and Hardware Infrastructure
- Optical Signaling, Control and Management
- Software Architecture Research
- Data, Visualization and Collaboration Research
- Applications and Education

Each Breakout Group Should Review Appropriate Timelines and Prepare Accomplishments/Activities Presentations

Review Carefully the Milestones and Activities Contained in the FY2007 Program Plan

6. OptIPuter FY2007 Program Plan (October 1, 2006 – September 30, 2007)

Year 5 timelines for the OptIPuter teams are included in their respective sections in Section 2.A.

6.A. Year 5 Milestone

MILESTONE: By Year 5, enhanced data acquisition and collaborative capabilities afforded by the emerging OptIPuter technologies will be demonstrated in national-scale geoscience and bioscience projects. New application scientists outside the initial cohort of project investigators will use the OptIPuter. OptIPuter partner sites will document and deploy the OptIPuter's design to the broader e-Science community.

6.B. Network and Hardware Infrastructure Activities

UCSD and UIC will complete benchmarks and evaluations of the OptIPuter "Mod 3" system design. By the conclusion of this award, the goal is to transport traffic over multiple user planes using a variable switching model, bring lambdas to endpoints, and achieve a 1:1 national bisection bandwidth ratio.

6.B.1. UCSD Campus Testbed (includes SoCal OptIPuter sites)

UCSD (Phil Papadopoulos, Greg Hidley) will add networking capacity to include additional optical paths (over DWDM) and higher network throughput, standardized compute, storage and visualization clusters, and additional connectivity to national and international partners.

See Page 68-73 of FY2006 Annual Progress Report

OptIPuter

it2

OptIPuter Year 5 Team Milestones and Goals

Monday, January 22

- **Infrastructure (Tom DeFanti, Phil Papadopoulos)**
  - **Goal is to transport traffic over multiple user planes using a variable switching model, bring lambdas to endpoints, and achieve a 1:1 national bisection bandwidth ratio.**
- **Software (Nut Taesombut -- for Andrew Chien)**
  - **Monitor and tune OptIPuter DVC-enabled applications and demonstrate an integrated capability for applications to access OptIPuter's unique capabilities through DVC**
- **Data, Visualization and Collaboration (Jason Leigh)**
  - **SAGE-enabled visual-casting will be demonstrated; new data middleware and data services will be integrated with the application; lessons learned from monitoring and tuning OptIPuter applications will help improve data, visualization and collaboration technologies**
- **Applications (Mark Ellisman/Raj Singh; John Orcutt/Graham Kent; Atul Nayak)**
  - **UCSD/NCMIR/BIRN and UCSD/SIO will continue to port application codes to advanced cluster architectures, integrate codes with DVC, and help transfer OptIPuter technologies to new user communities; outreach activities**

OptIPuter

it²

OptIPuter Year 5--Critique Team Reports

Monday, January 22 (Afternoon)

- What were the highlights of SC'06?
- Can we quantitatively assess for national-scale geoscience and bioscience projects the OptIPuter data acquisition and collaboration capabilities?
- Do we have "5-layer" application solutions (control planes, protocols, middleware, toolkits, applications)?
- Are we deploying and documenting the OptIPuter's design for the broader e-Science community?
  - What application scientists outside the initial cohort of project investigators are using the OptIPuter?
- Define OptIPortal & Gold Standard OptIPuter Implementations
  - What is the necessary hardware and software?
  - What technology transfer efforts are needed to deploy OptIPortals now and after the OptIPuter award is over at the end of Year 5?
- How are we moving to parallel lambdas?

OptIPuter

it²

OptIPuter And Broader e-Science Community

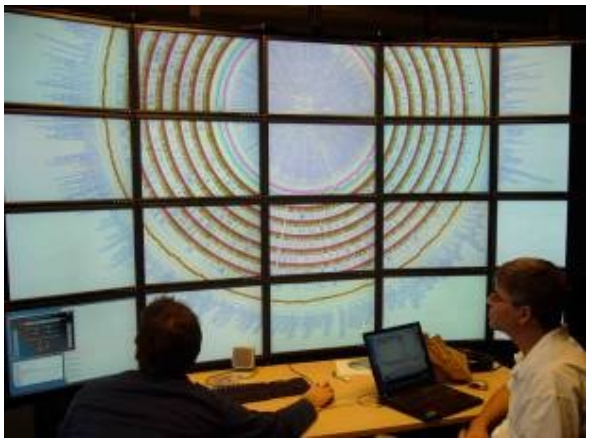
Some Examples (From PPP); More to be Discussed Tuesday Morning



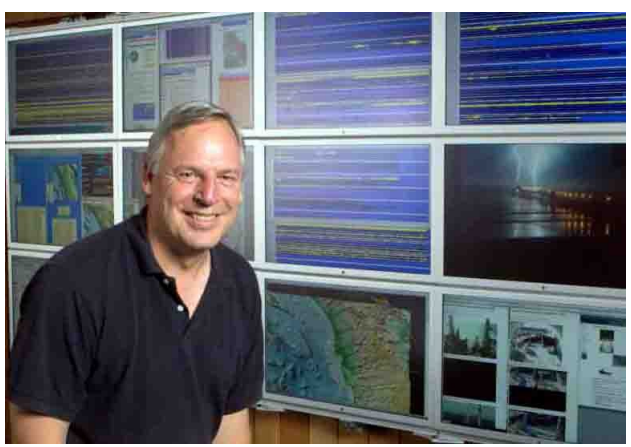
BIRN/
Telescience



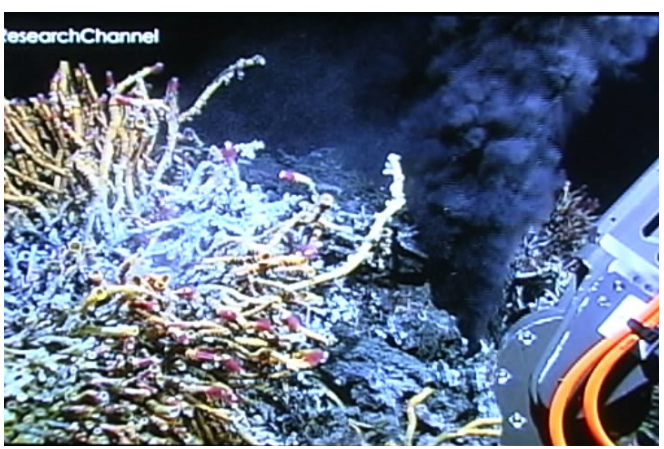
CineGrid



CAMERA



EarthScope



LOOKING/ORION

OptIPuter

it²

OptIPuter: The Road Ahead

Tuesday, January 23

- **Application Presentations**
  - Telescience – Mark Ellisman
  - Earthscope/RIDGE/RoadNet – Graham Kent
  - CAMERA – Paul Gilna
  - CineGrid – Tom DeFanti
  - LOOKING/ORION – Ron Johnson and Matt Arrott
  - North/Central American LambdaGrids – John Orcutt and Larry Smarr
  - Discussion – All
- **Technology Presentations**
  - OptIPortal Teleconferencing Audio/Video Research – Dan Sandin
  - Making Varrier an OptIPortal – Dan Sandin
  - SAGE Future Plans – Jason Leigh
  - Phosphorus/StarPlane – Cees de Laat
  - Optical Multicast – Joe Mambretti
  - Streaming Audio for CineGrid and GridJam – Peter Otto and Jack Ox
  - Discussion – All
- **International Collaborations (Panel) − Larry Smarr, Radha Nandkumar, Peter Arzberger, Cees de Laat, Tom DeFanti, Paul Gilna, Mark Ellisman**
- **General Discussion – All**

OptIPuter

it²