Calit2 Projects in Cyberinfrastructure

Welcome Talk to
the Minority-Serving Institutions Cyberinfrastructure Institute
Calit2@UCSD
June 28, 2006

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

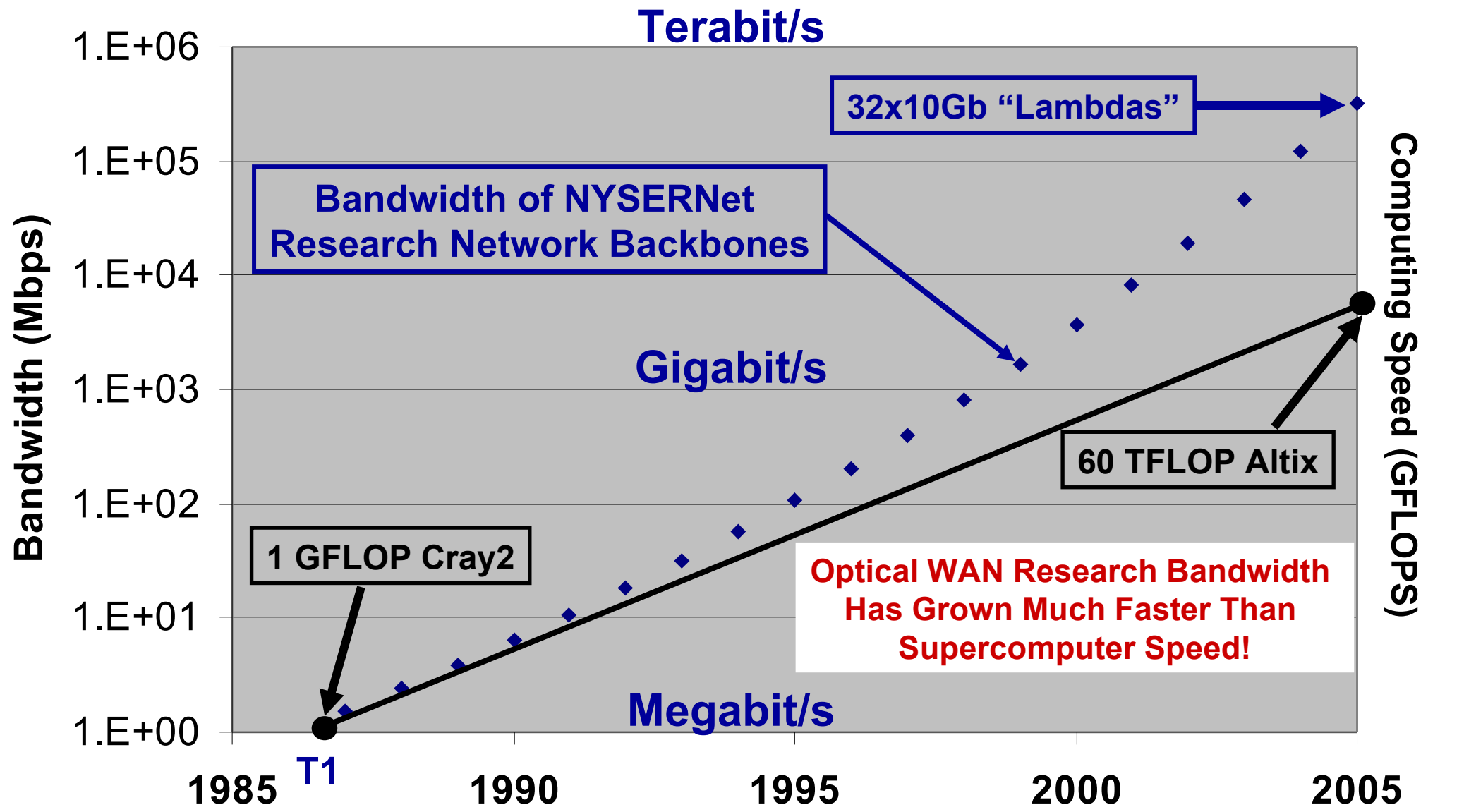
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Agenda for Morning

9:00	9:30	Cyberinfrastructure @Calit2	Larry Smarr
9:30	9:45	Education@Calit2	Jerry Sheehan
9:45	10:00	The Digital Village Project	Sukumar Srinivas
10:00	10:30	Digital Cinema and Super High Definition Visualization	Larry Smarr
10:30	11:00	Calit2 Immersive Visualization Environments	Jerry Sheehan and Calit2 Staff
11:00	11:30	Calit2 Building Tour	Jerry Sheehan

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From "Supercomputer–Centric" to "Supernetwork-Centric" Cyberinfrastructure



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Network Data Source: Timothy Lance, President, NYSERNet

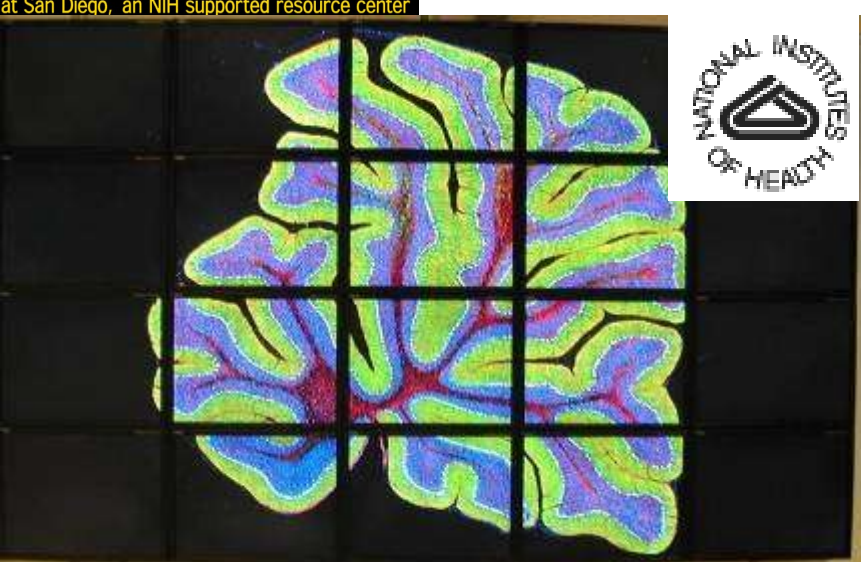
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The OptIPuter Project – Creating High Resolution Portals Over Dedicated Optical Channels to Global Science Data

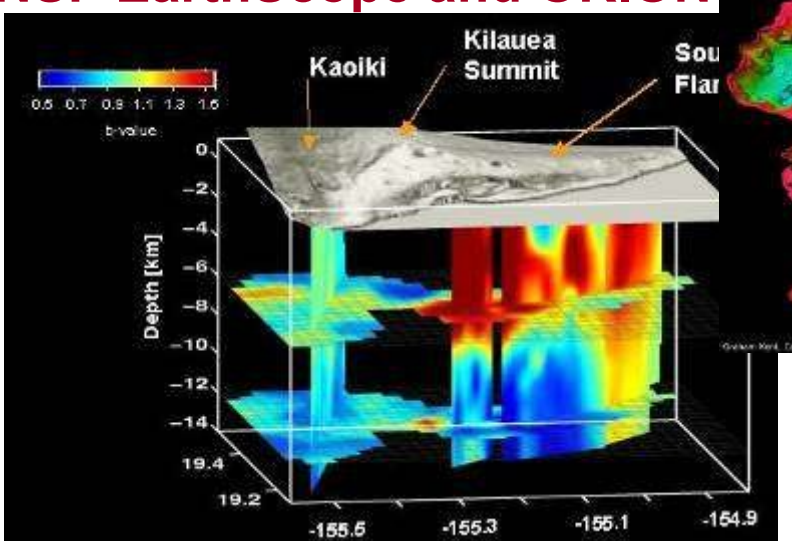
- **NSF Large Information Technology Research Proposal**
  - Calit2 (UCSD, UCI) and UIC Lead Campuses—Larry Smarr PI
  - Partnering Campuses: SDSC, USC, SDSU, NCSA, NW, TA&M, UvA, SARA, NASA Goddard, KISTI, AIST, CRC(Canada), CICESE (Mexico)
- **Industrial Partners**
  - IBM, Sun, Telcordia, Chiaro, Calient, Glimmerglass, Lucent
- **$13.5 Million Over Five Years—Now In the Fourth Year**

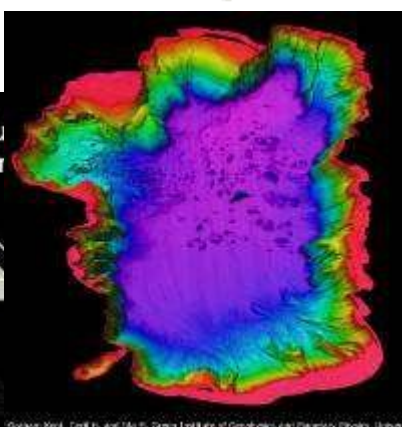
NIH Biomedical Informatics Research Network

NCMIR NATIONAL CENTER for MICROSCOPY and IMAGING RESEARCH at San Diego, an NIH supported resource center



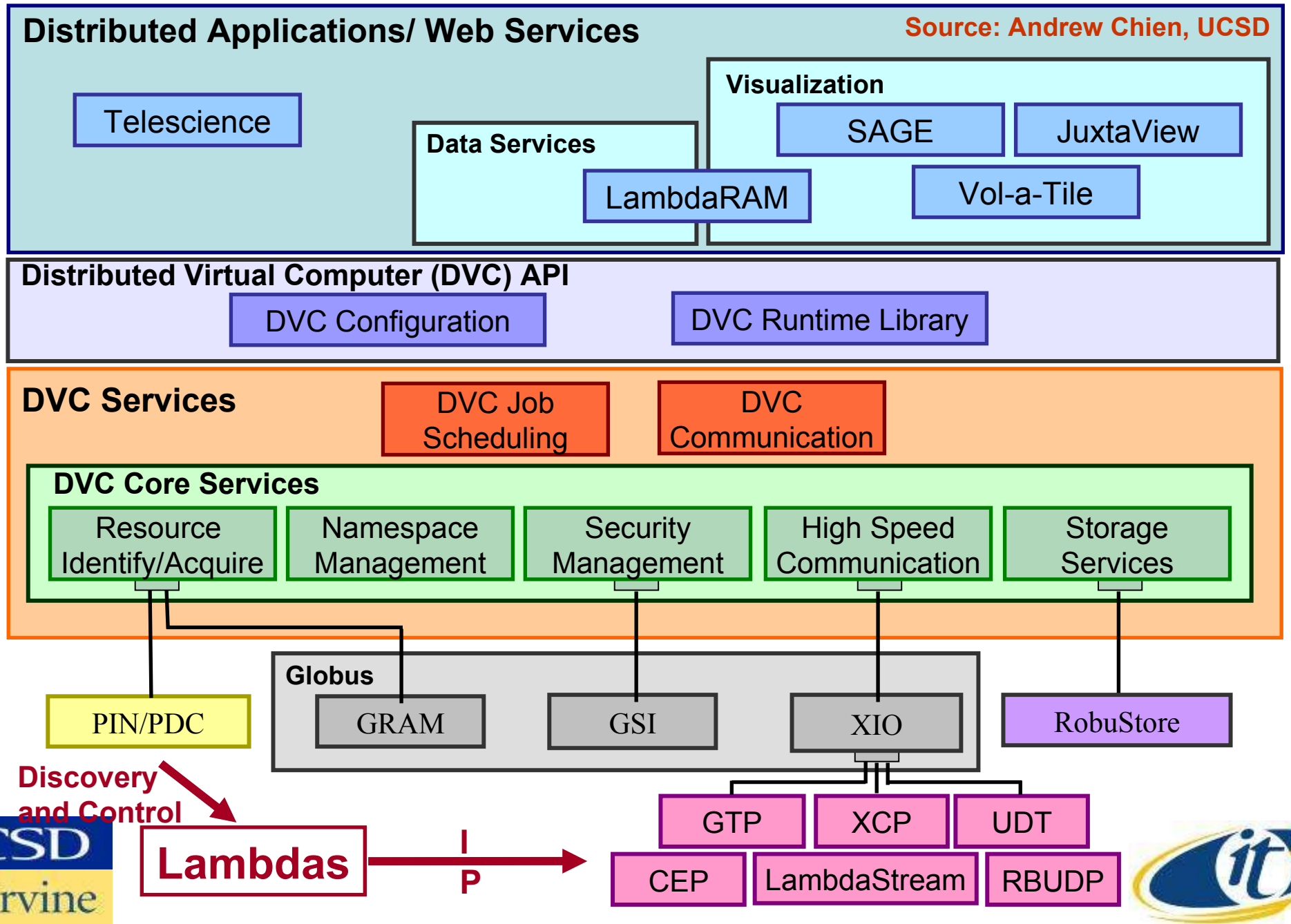
NSF EarthScope and ORION





SCRIPPS INSTITUTION OF OCEANOGRAPHY

OptIPuter Software Architecture--a Service-Oriented Architecture Integrating Lambdas Into the Grid



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OptIPortal–
Termination Device for the OptIPuter Global Backplane

- 20 Dual CPU Nodes, 20 24” Monitors, ~$50,000
- 1/4 Teraflop, 5 Terabyte Storage, 45 Mega Pixels--Nice PC!
- Scalable Adaptive Graphics Environment (SAGE) Jason Leigh, EVL-UIC





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Powered by Rocks

ROCKS

Source: Phil Papadopoulos SDSC, Calit2

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The New Optical Core of the UCSD Campus-Scale Testbed: Evaluating Packet Routing versus Lambda Switching

Goals by 2007:

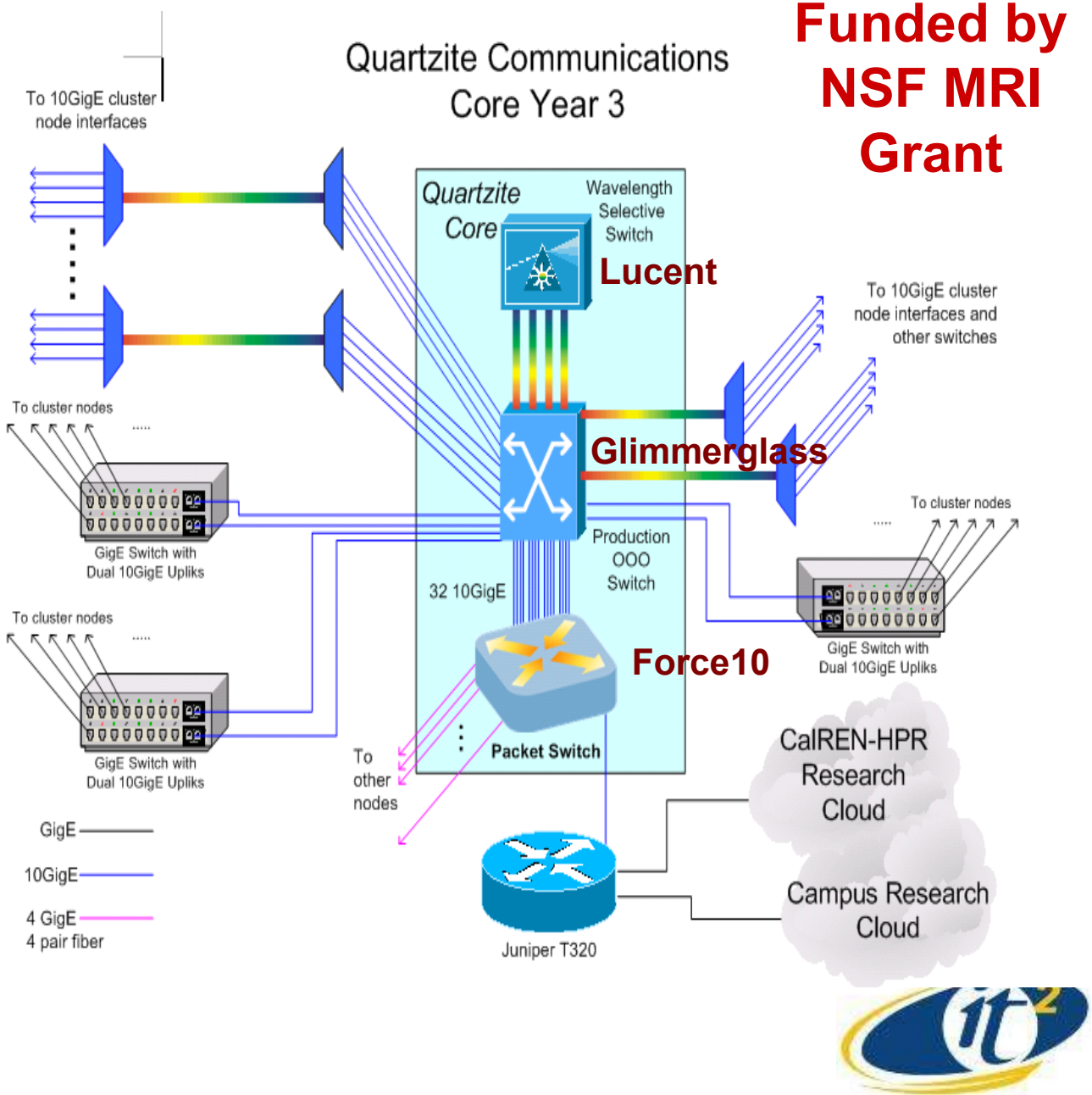
>= 50 endpoints at 10 GigE

>= 32 Packet switched

>= 32 Switched wavelengths

>= 300 Connected endpoints

Approximately 0.5 TBit/s Arrive at the "Optical" Center of Campus
Switching will be a Hybrid Combination of:
Packet, Lambda, Circuit -- OOO and Packet Switches Already in Place



Funded by NSF MRI Grant

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NSF is Launching a New Cyberinfrastructure Initiative

"Research is being stalled by 'information overload,' Mr. Bement said, because data from digital instruments are piling up far faster than researchers can study. In particular, he said, campus networks need to be improved. High-speed data lines crossing the nation are the equivalent of six-lane superhighways, he said. But networks at colleges and universities are not so capable. "Those massive conduits are reduced to two-lane roads at most college and university campuses," he said. Improving cyberinfrastructure, he said, "will transform the capabilities of campus-based scientists."

-- Arden Bement, the director of the National Science Foundation



www.ctwatch.org

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Calit2/SDSC Proposal to Create a UC Cyberinfrastructure of OptIPuter "On-Ramps" to TeraGrid Resources



OptIPuter + CalREN-XD + TeraGrid = "OptiGrid"

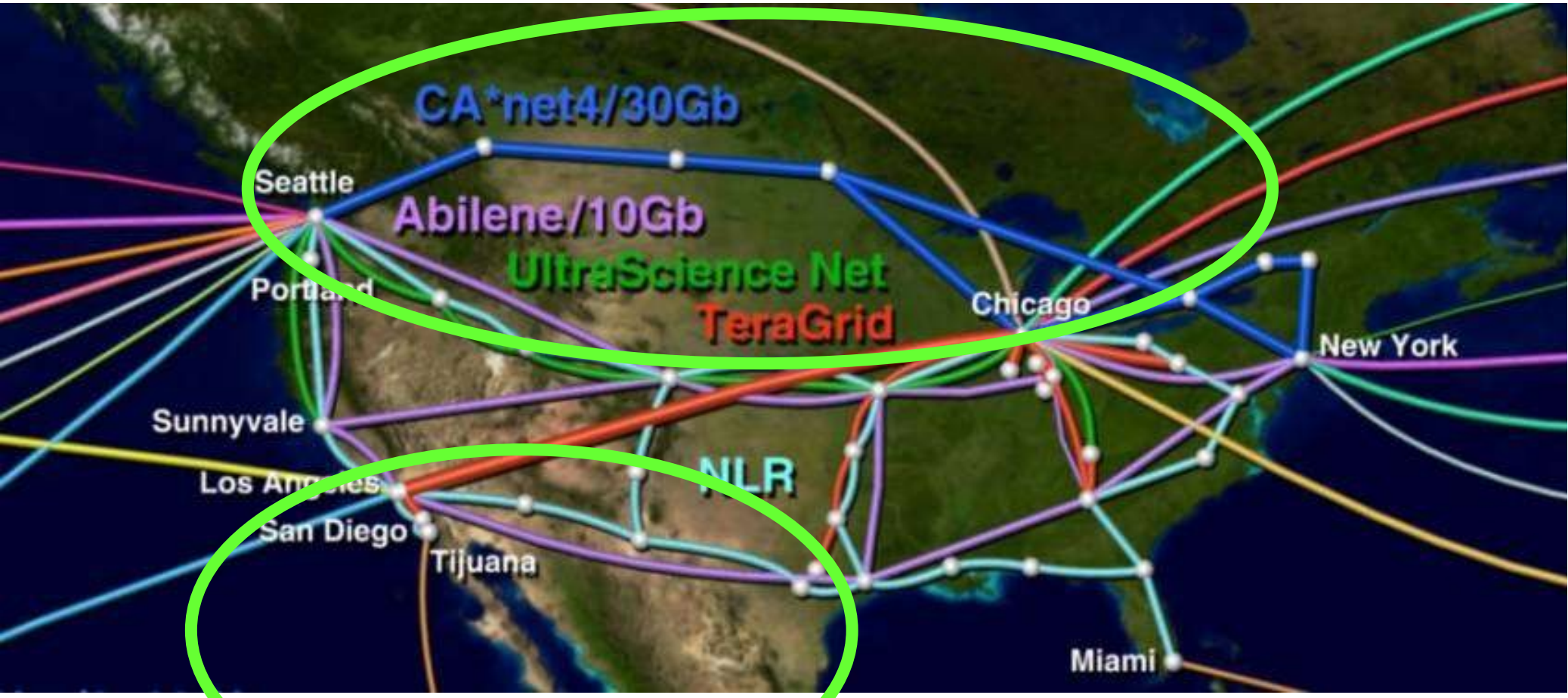


Creating a Critical Mass of End Users on a Secure LambdaGrid

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Source: Fran Berman, SDSC , Larry Smarr, Calit2

Creating a North American Superhighway for High Performance Collaboration

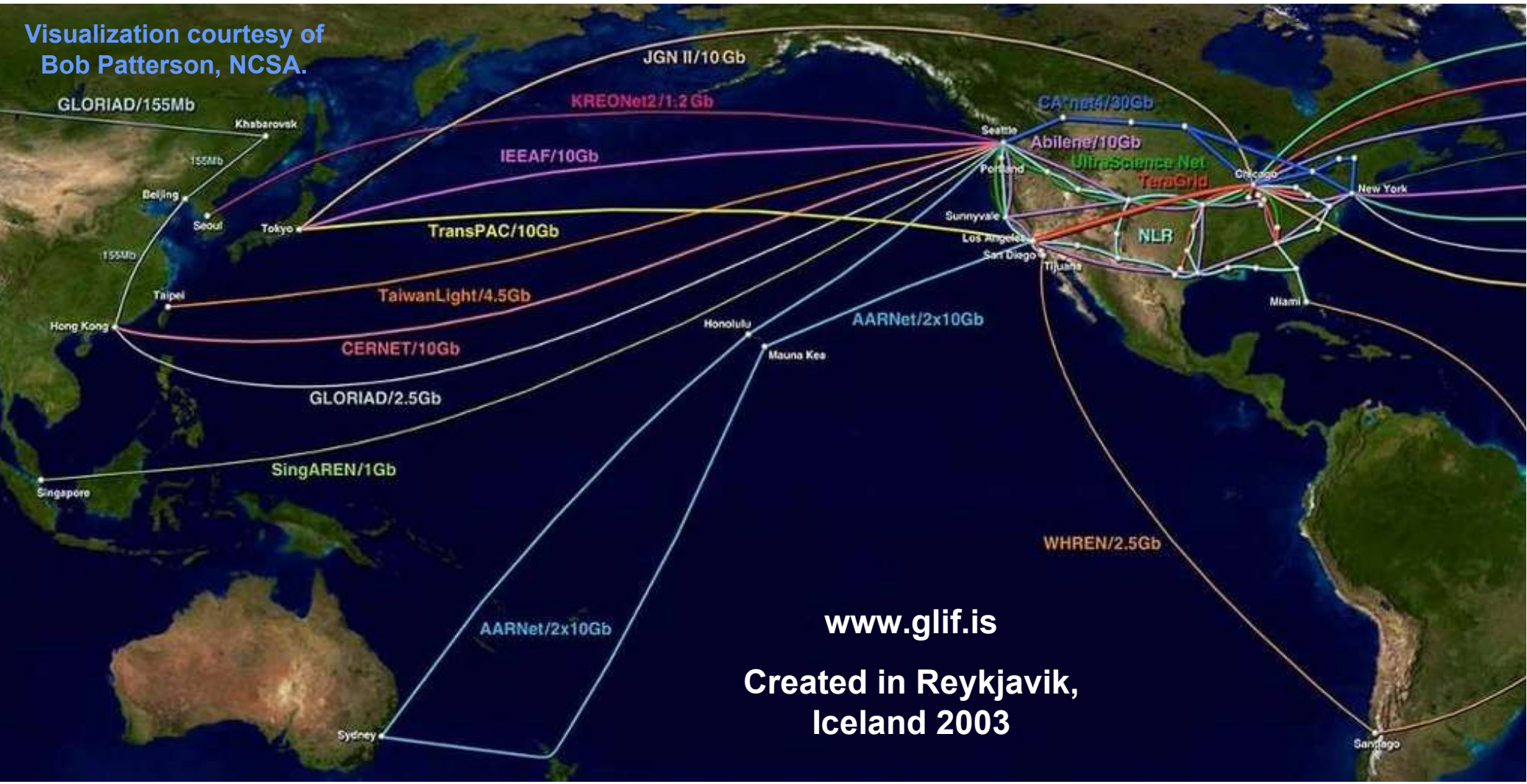


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Next Step: Adding Mexico to Canada's CANARIE and the U.S. National Lambda Rail

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Countries are Aggressively Creating Gigabit Services: Interactive Access to CAMERA Data System



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New OptIPuter Driver: Gigabit Fibers on the Ocean Floor -- Controlling Sensors and HDTV Cameras Remotely



LOOKING is Driven By NEPTUNE CI Requirements

- **National Science Foundation Is Planning a New Generation of Ocean Observatories**
  - **Ocean Research Interactive Observatory Networks (ORION)**
- **Fibered Observatories Linked to Land Fiber Infrastructure**
- **Laboratory for the Ocean Observatory Knowledge Integration Grid (LOOKING)**
  - **Building a Prototype Based on OptIPuter Technologies Plus Web/ Grid Services**
  - **HDTV Streams Over IP Will be a Major Driver**

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(Funded by NSF ITR- John Delaney, UWash, PI)

Making Management of Gigabit Flows Routine

First Remote Interactive High Definition Video Exploration of Deep Sea Vents



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Source John Delaney & Deborah Kelley, UWash

A Near Future Metagenomics Fiber Optic-Enabled Data Generator



Source John Delaney, UWash

CAMERA: Community Cyberinfrastructure for Advanced Marine Microbial Ecology Research and Analysis

National LambdaRail
Direct Connect
Computation and Storage Complex

Funded by: Gordon and Betty Moore Foundation

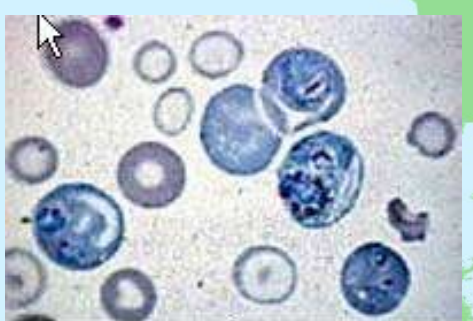
Joint Partnership of:

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PI Larry Smarr

Marine Genome Sequencing Project
Measuring the Genetic Diversity of Ocean Microbes





Canada
United States
Mexico
Puerto Rico
Honduras
Costa Rica
Panama
Galapagos Islands
x 10 samples
French Polynesia
Cook Islands
Tonga
Fiji
Vanuatu
x 17 samples
Australia
New Caledonia
x 8 samples
Cocos-Keeling Is.
Tanzania/ Zanzibar
x 7 samples
Seychelles
Madagascar
South Africa

● Analyzed ● Sampled, but not Analyzed

camera
Marine Microbial Ecology

MARINE MICROBIOLOGY INITIATIVE

Gordon and Betty MOORE FOUNDATION

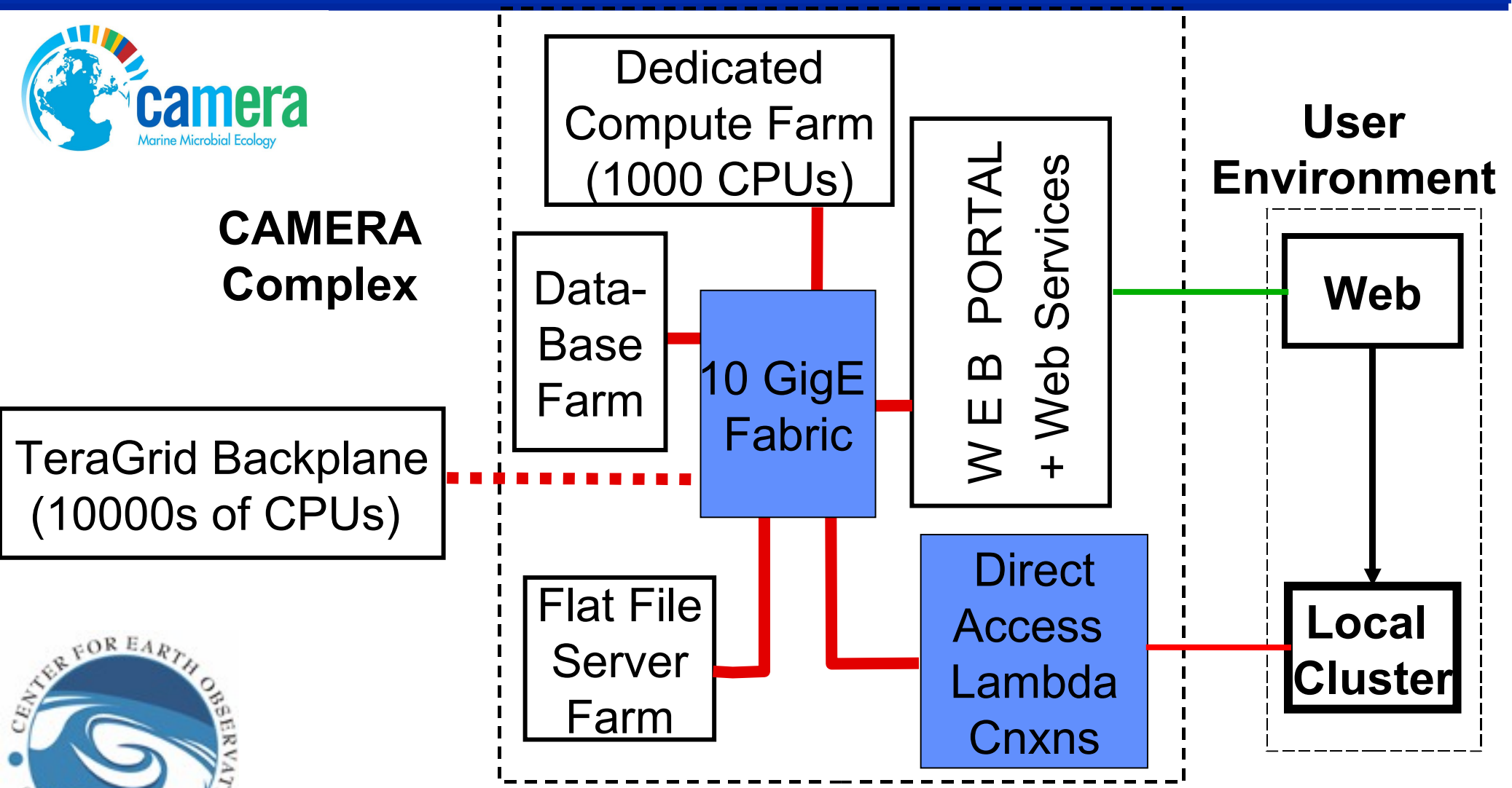
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CAMERA will include
All Sorcerer II Metagenomic Data

J. Craig Venter INSTITUTE

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Calit2's Direct Access Core Architecture Will Create Next Generation Metagenomics Server

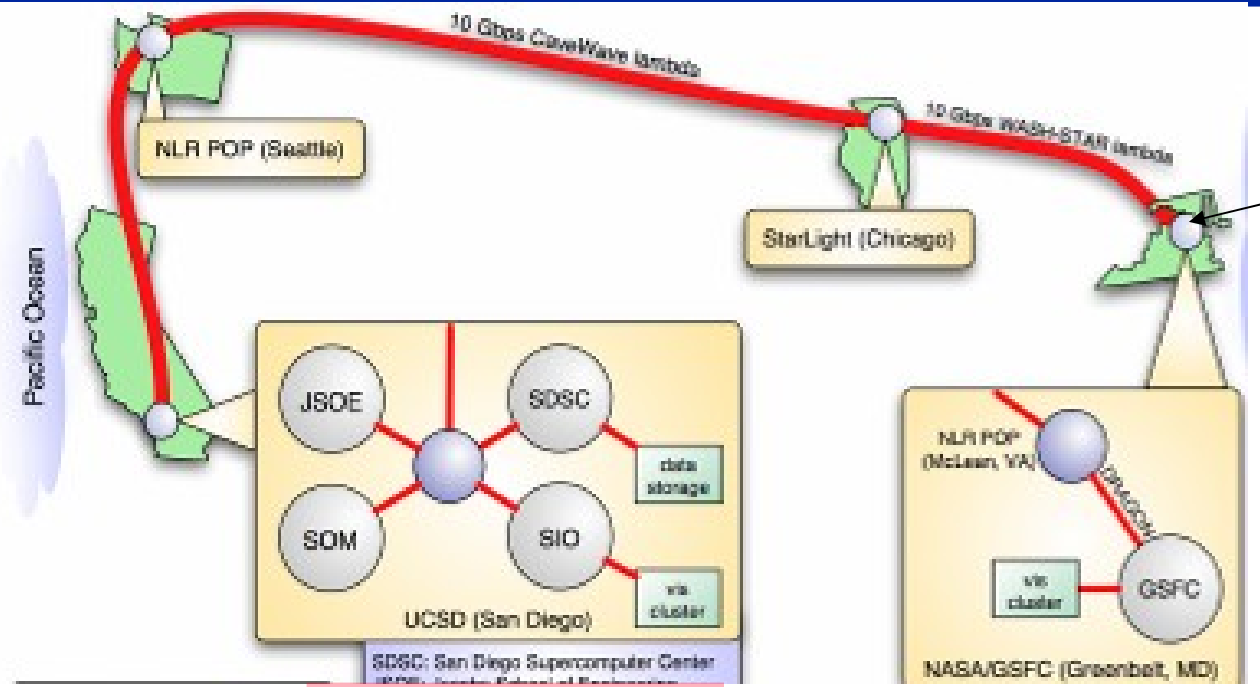


Source: Phil Papadopoulos, SDSC, Calit2

Calit2 and the Venter Institute Will Combine Telepresence with Remote Interactive Analysis

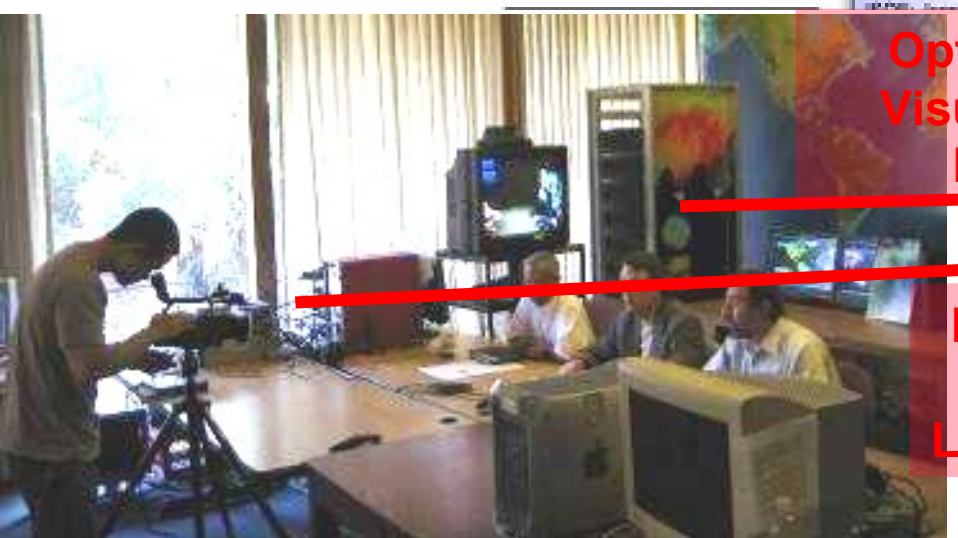
Live Demonstration

of 21st Century National-Scale Team Science



25 Miles

Venter Institute



OptIPuter Visualized Data

HDTV Over Lambda



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Calit2 is Developing High Definition Streaming Internationally



Photo: Courtesy of Harry Ammons

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Studio on 4th Floor of Calit2@UCSD Building
Two Talks to Australia in March 2006

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Collaboration Goals from President Kalam of India

- Interactive Knowledge System
- Convergence of Info- Nano - Bio
- Make the Bandwidth Available with No Limits
- PURA--Societal Grid With Electronic Connection of a Billion People

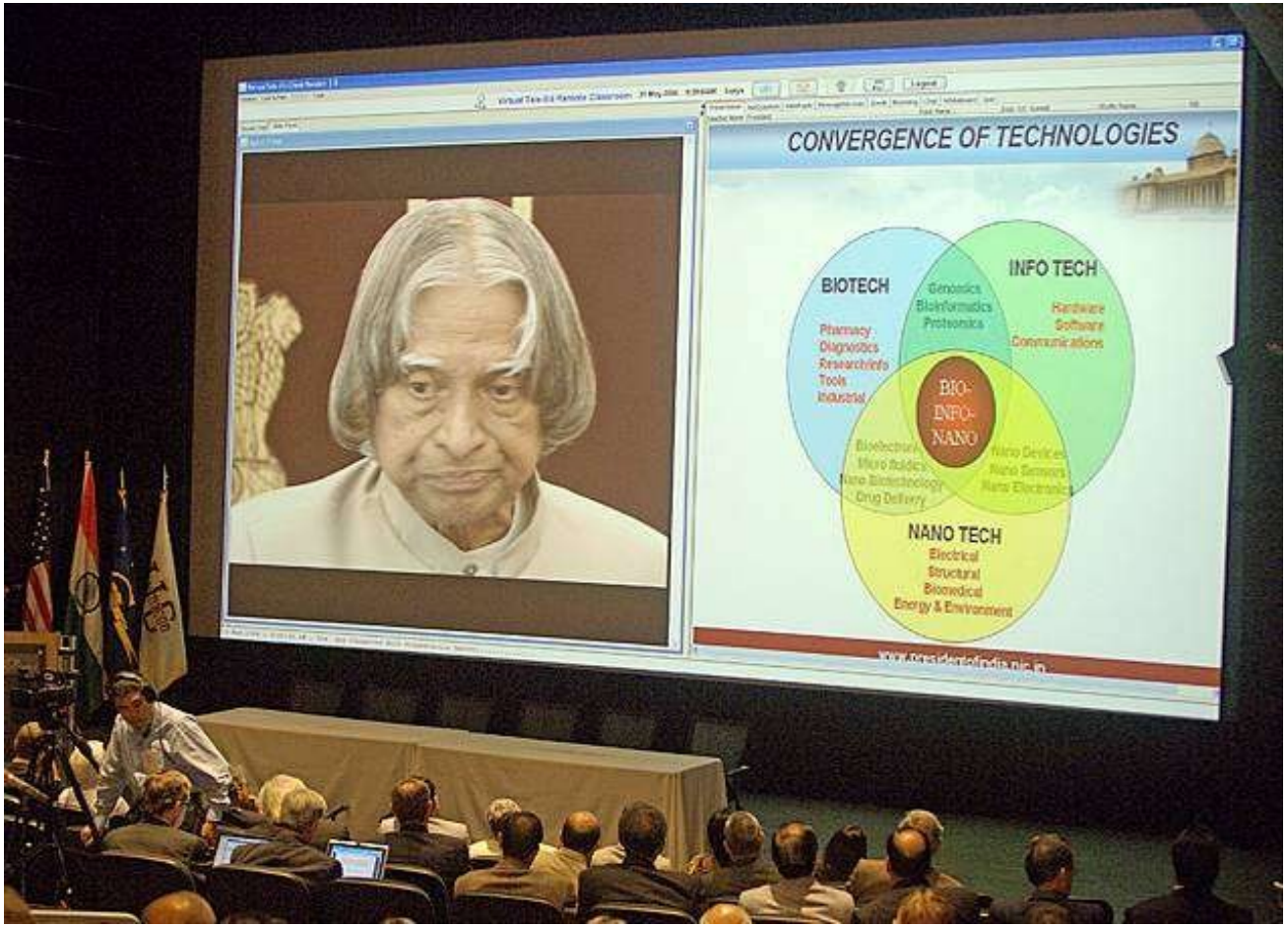
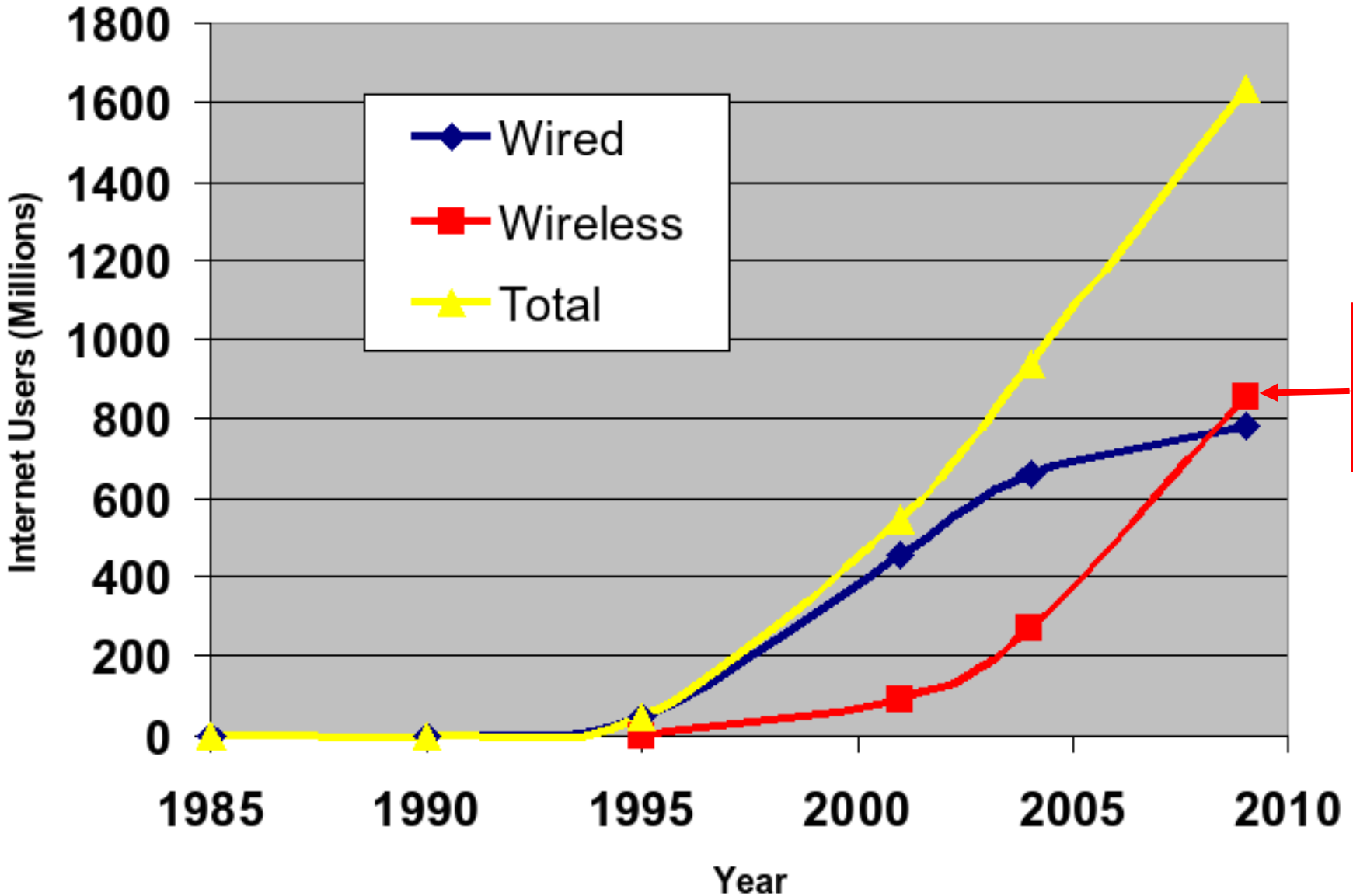


Photo: Alan Decker, UCSD

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Transitioning to the "Always-On" Mobile Internet



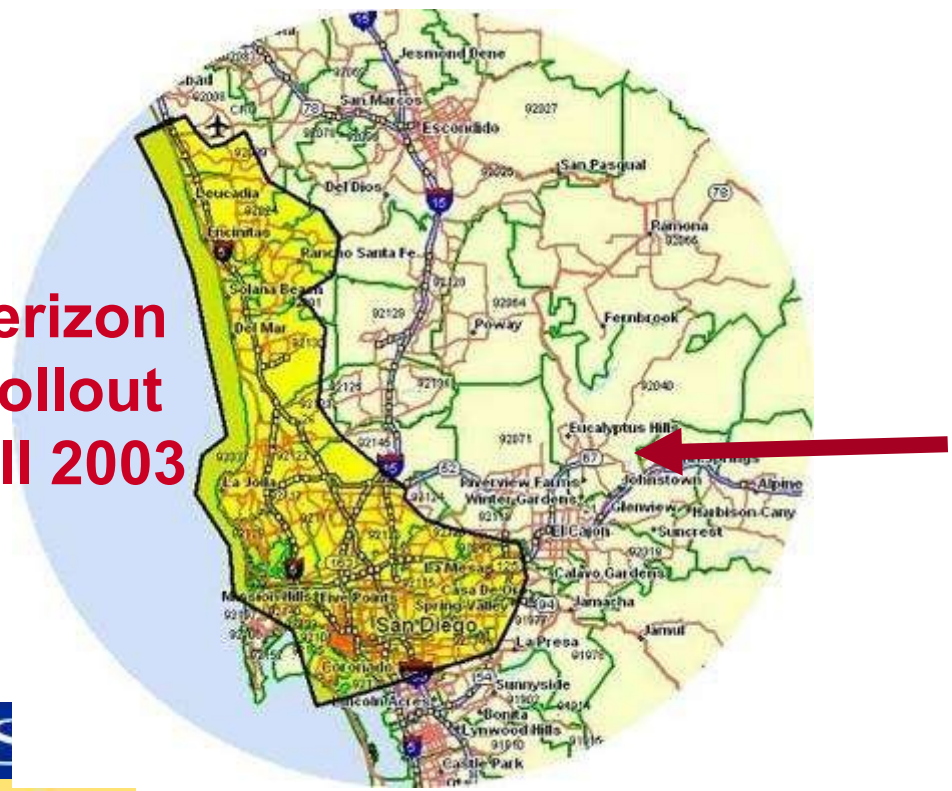
http://www.etforecasts.com/products/ES_intusersv2.htm

Only Three Years From Research to Market New Broadband Cellular Internet Technology

- First US Taste of 3G Cellular Internet
  - UCSD Jacobs School Antenna
    - Three Years Before Commercial Rollout
- Linking to WiFi Mobile "Bubble"
  - Tested on Campus CyberShuttle
- Verizon Introduces in San Diego



Rooftop Qualcomm 1xEV Access Point





CyberShuttle March 2002

www.calit2.net/news/2002/4-2-bbus.html

Quickly Re-Establishing Communications: Calit2 Mesh Network R & D



Disaster site

Hospital

Ground Zero



Incident command center

Deploy Portable Relay Nodes



responsphere

rescue

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Wireless Video Transmission Capability
Major Improvement for Hazmat and Medical Units





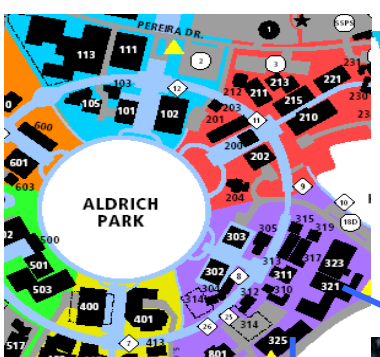


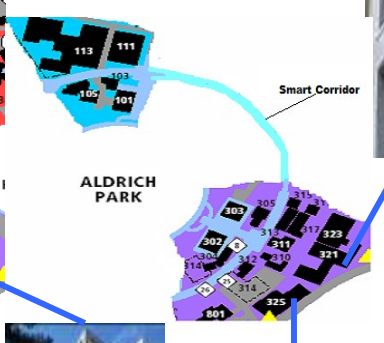
NSF-Funded ResponSphere Establishes Calit2 Project Rescue Testbeds in Irvine and in San Diego

- **Localized Site-Specific Disasters Via Crisis Response Drills**
- **Explore Privacy vs. Public Safety Issues**
- **GLQ (*Gaslamp Quarter*, San Diego/UCSD)**
  - **Ubiquitous Wireless Coverage in Downtown San Diego**
  - **Test Network Architecture Enhancement and New Applications**
- **CAMAS (*Crisis Assessment, Mitigation, And Analysis*) – UCI Campus**
  - **Field-Test and Refine Research on Information Collection, Analysis, Sharing, and Dissemination in Controlled yet Realistic Settings**

















PI: Magda El Zarki, ICS, UCI
www.responsphere.org

Calit2 Provides Real Time Personalized Commute Information



http://traffic.calit2.net/index.jsp

Calit2, SDSC, and SIO are Building Environmental Observatory Control Rooms



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Opportunity to Partner with Australia On-Line Coral Reef Monitoring

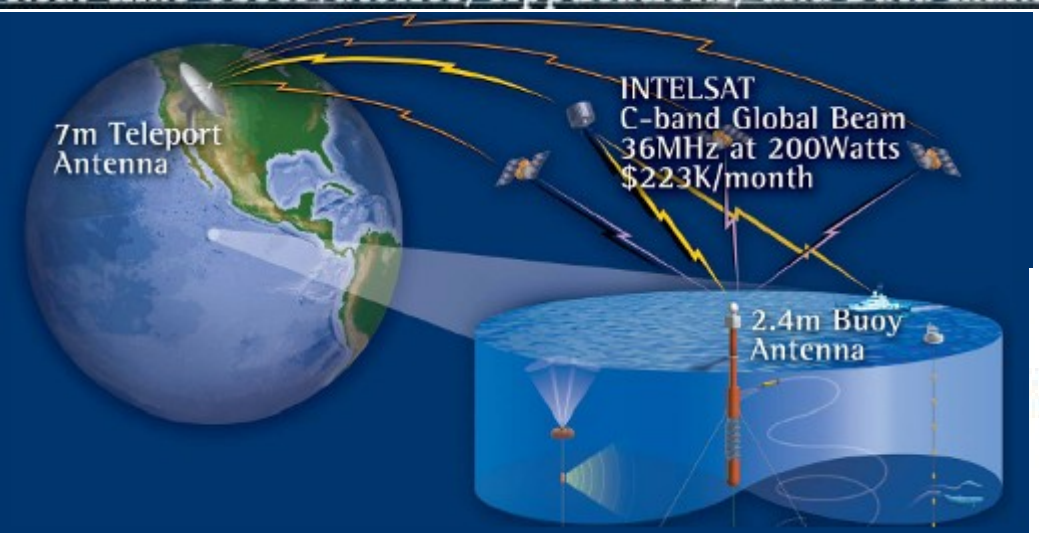
it²

ROADnet and HiSeasNet are Prototypes of the Future of *In Situ* Earth Observing Systems

BRINGING THE INFORMATION SUPERHIGHWAY TO THE DIRT ROAD AND THE HIGH SEAS

http://roadnet.ucsd.edu

Real-time Observatories, Applications, and Data management Network ROADNet



Office of Naval Research

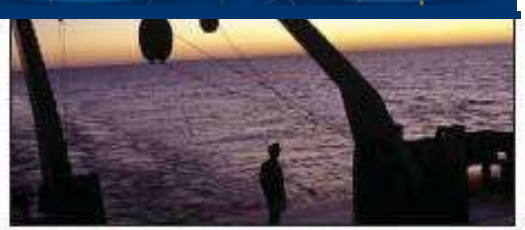
NSF

SDSU

SDSC
SAN DIEGO SUPERCOMPUTER CENTER

IGPP









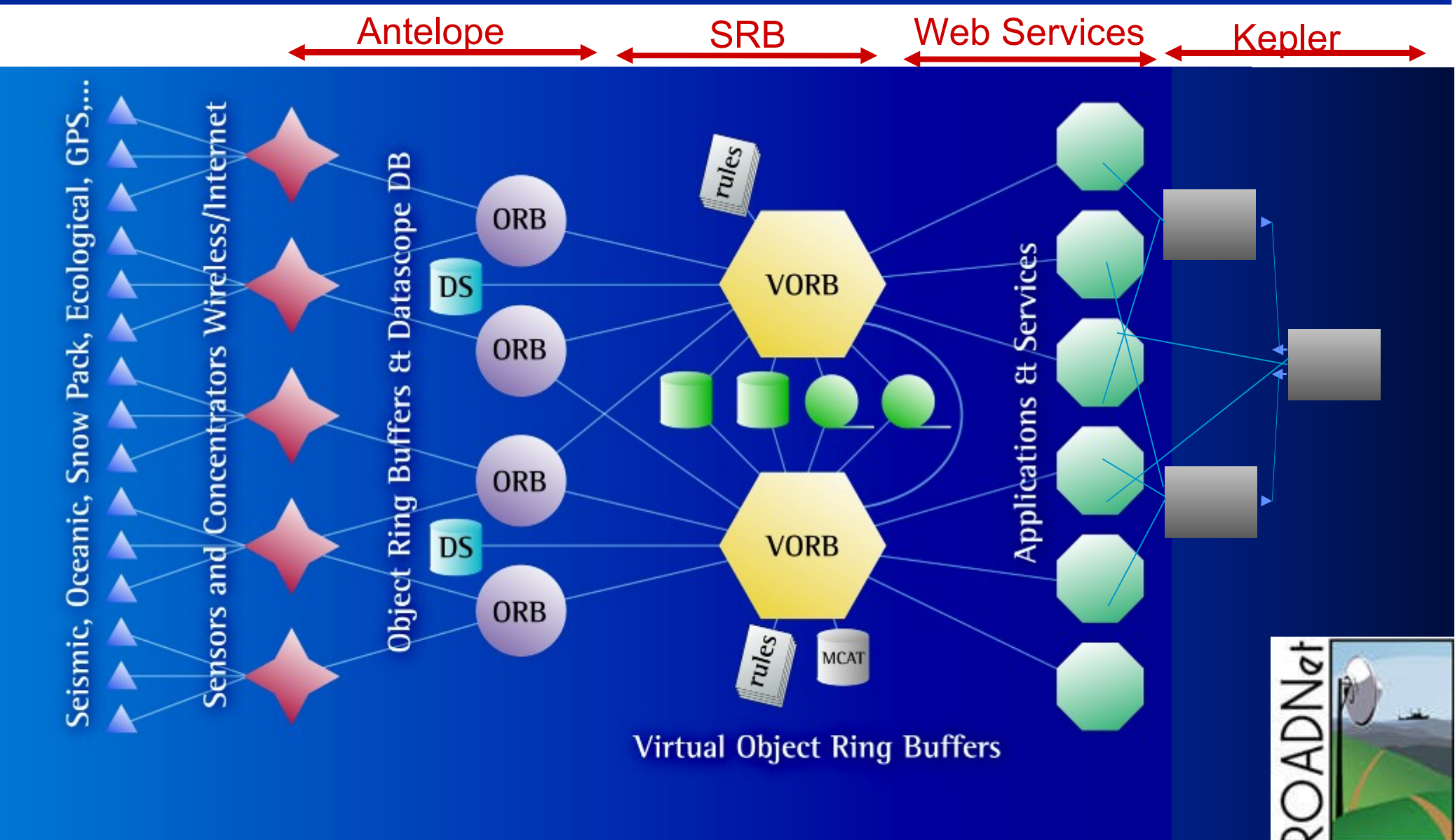
HiSeasNet

The Real-time Observatories, Applications and Data management Network is an interdisciplinary collaboration funded by the National Science Foundation and the Office of Naval Research. Participating institutions include Scripps Institution of Oceanography and the San Diego Supercomputer Center at the University of California, San Diego.

PROVIDING COMMUNICATIONS AND NETWORKING FOR THE ORION FLEET OF MOORED OCEAN OBSERVATORIES

ROADNet Architecture:

SensorNets, Storage Research Broker, Web Services, Work Flow



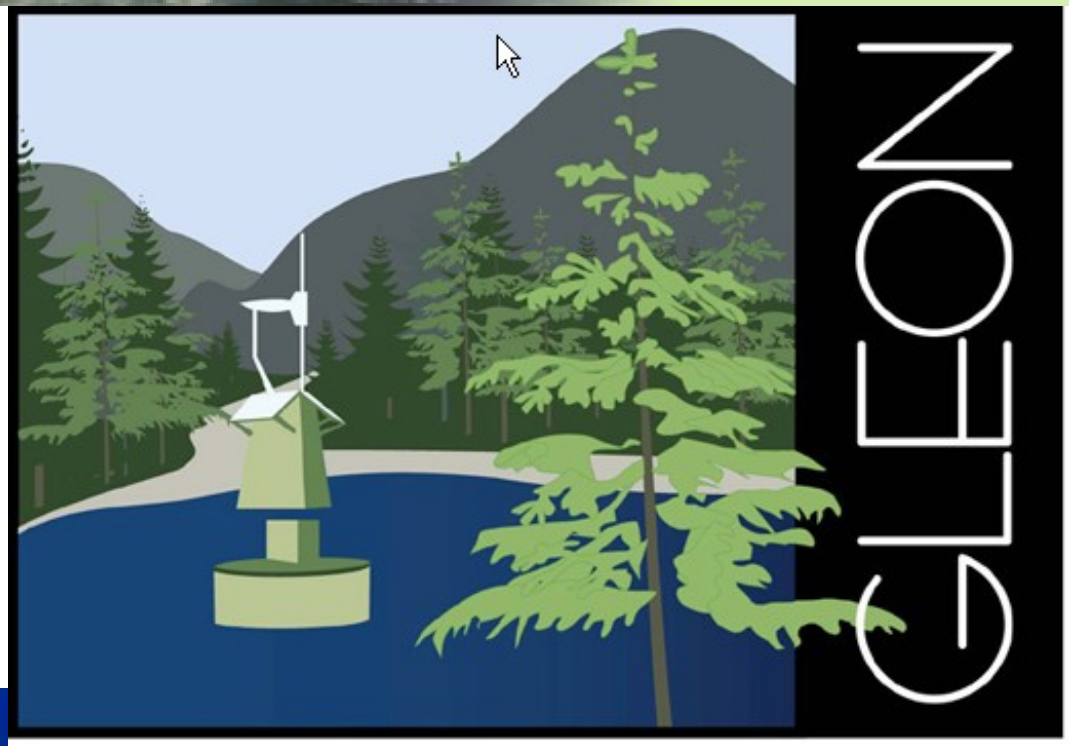
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Frank Vernon, SIO; Tony Fountain, Ilkay Altintas, SDSC

Schools Will Be Able to Monitor Remote Environments in Real Time



Coral Reef Environmental Observatory Network



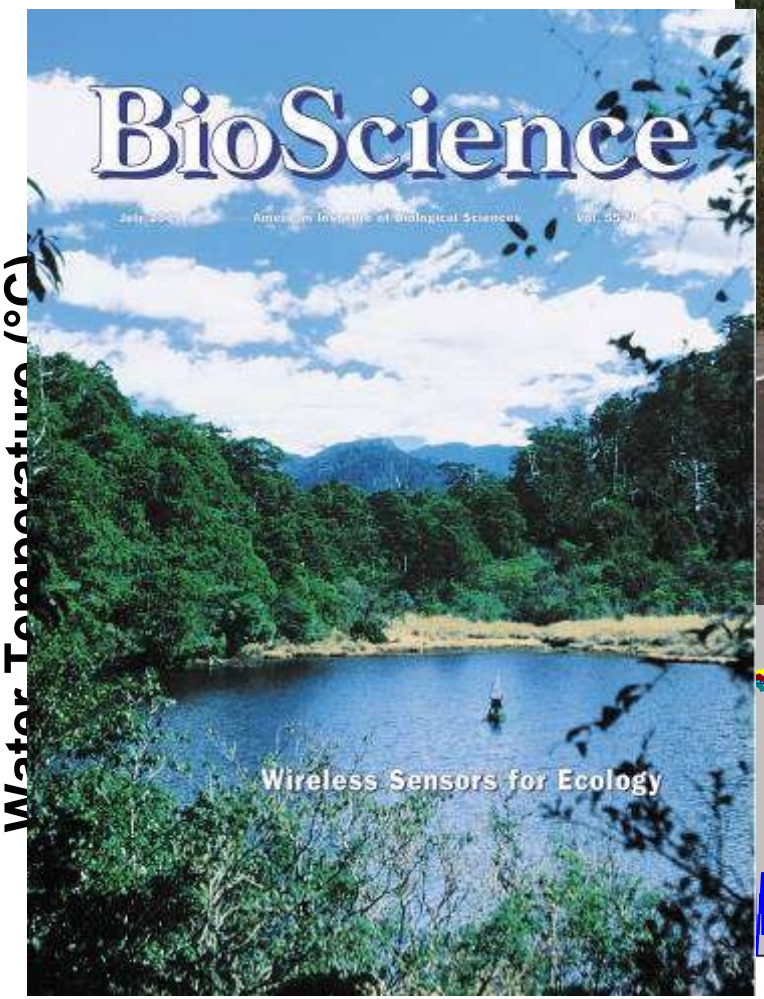
Workshop
29th to 31st March 2006
Townsville, Australia

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global lake ecological observatory network

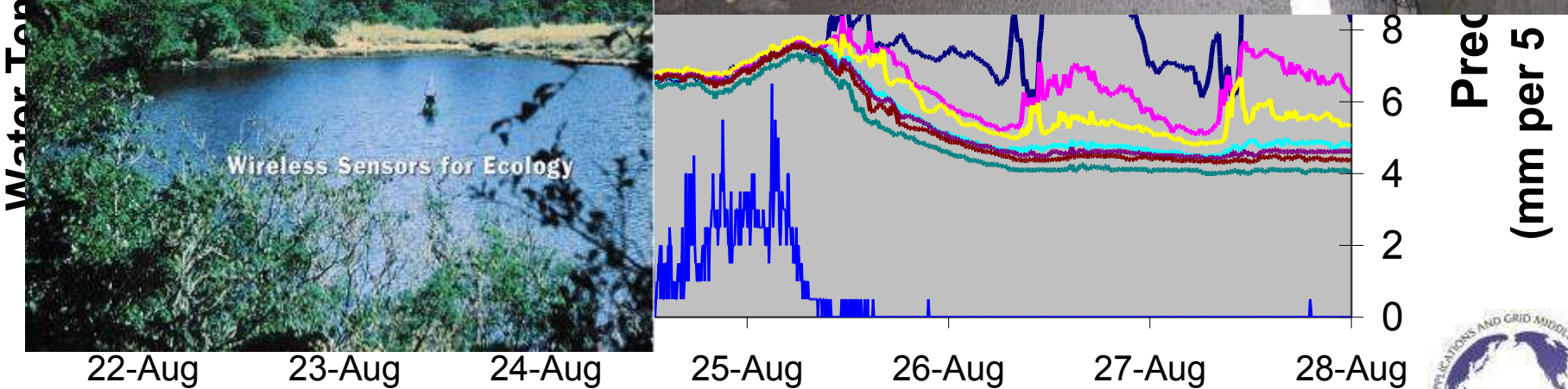
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Remote Observation of Episodic Events in Water-Based Ecological Systems

Used by NSF Director Feb 2005







Part of a growing global lake observatory network - http://lakemetabolism.org

Source: Tim Kratz

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PRAGMA

Supported by Moore Foundation

CineGrid Demonstrations

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Calit2 Works with CENIC to Provide the California Optical Core for CineGrid

Partnering with SFSU's Institute for Next Generation Internet

SFSU

UCB

Discussions with CITRIS

Digital Archive of Films

Prototype of CineGrid

Calit2's CineGrid Team is Working with Cinema Industry in LA and SF

In addition, 1Gb and 10Gb Connections to:

- Seattle, Asia, Australia, New Zealand
- Chicago, Europe, Russia, China
- Tijuana, Rosarita Beach, Ensenada

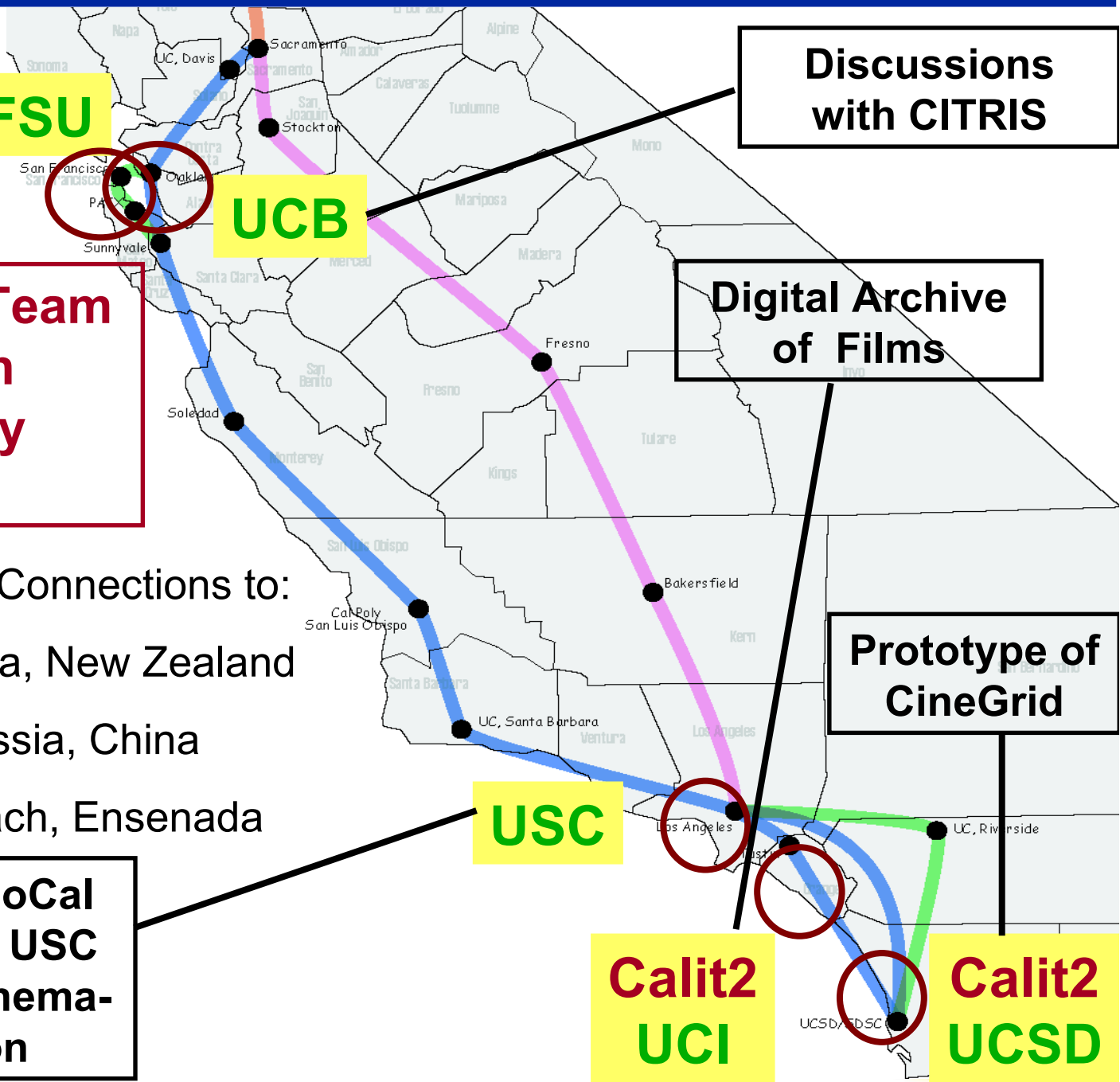
USC

Extending SoCal OptIPuter to USC School of Cinema-Television

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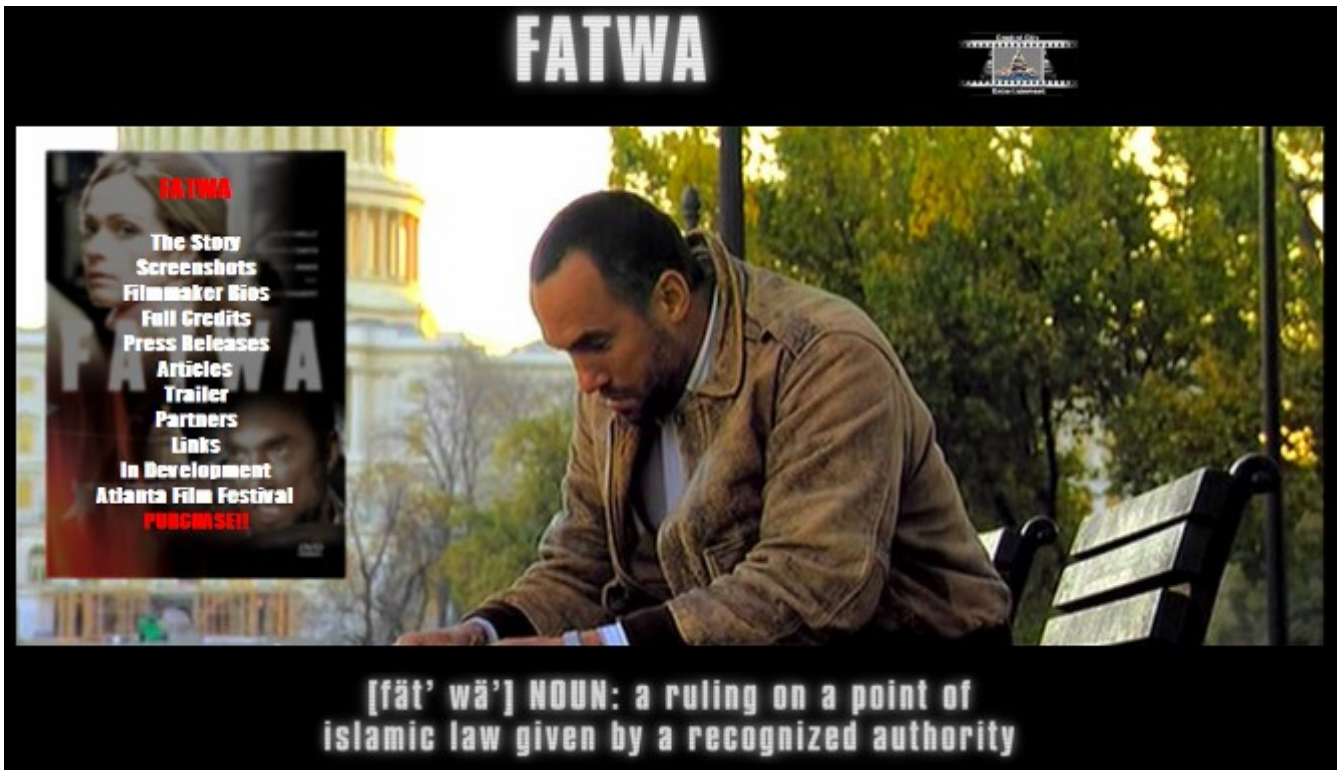
Calit2 UCSD



Independent Film Director Teams with Calit2 on 'CineGrid' Coast-to-Coast Screening of New HD Movie



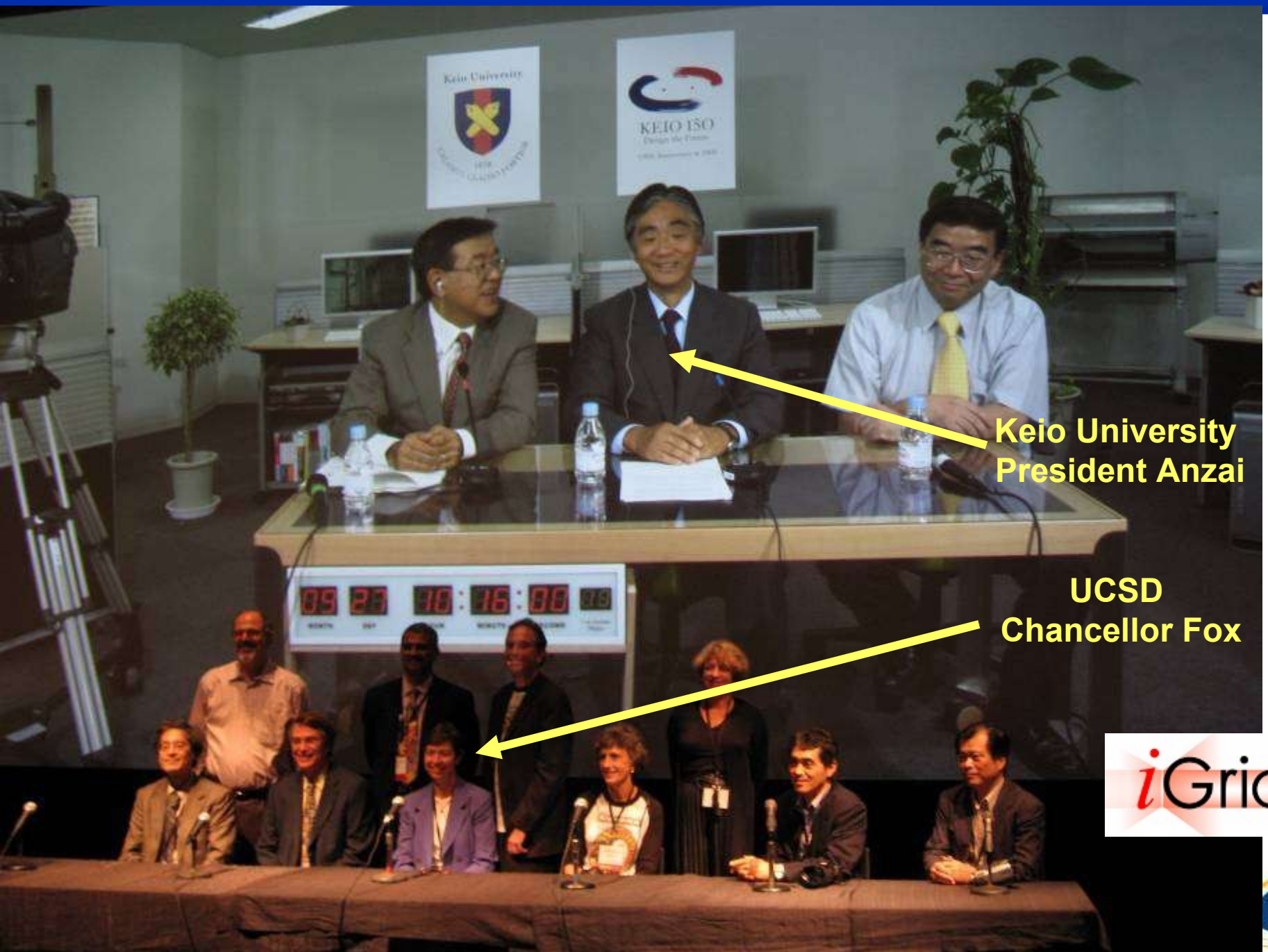
Movie director John Carter at the Venter Institute in Maryland talking with the Calit2 audience in California over the optical link before the screening.



CineGrid Experiment – HD Movie Shown at Calit2
From Venter Institute in Maryland

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First Trans-Pacific Super High Definition Telepresence Meeting in New Calit2 Digital Cinema Auditorium



Lays Technical Basis for Global Digital Cinema

Sony
NTT
SGI

iGrid 2005

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