“Creating High Performance Lambda Collaboratories"

ONR Briefing
ACCESS DC
Arlington, VA
March 25, 2005

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

Chair, NASA Earth System Science and Applications Advisory Committee

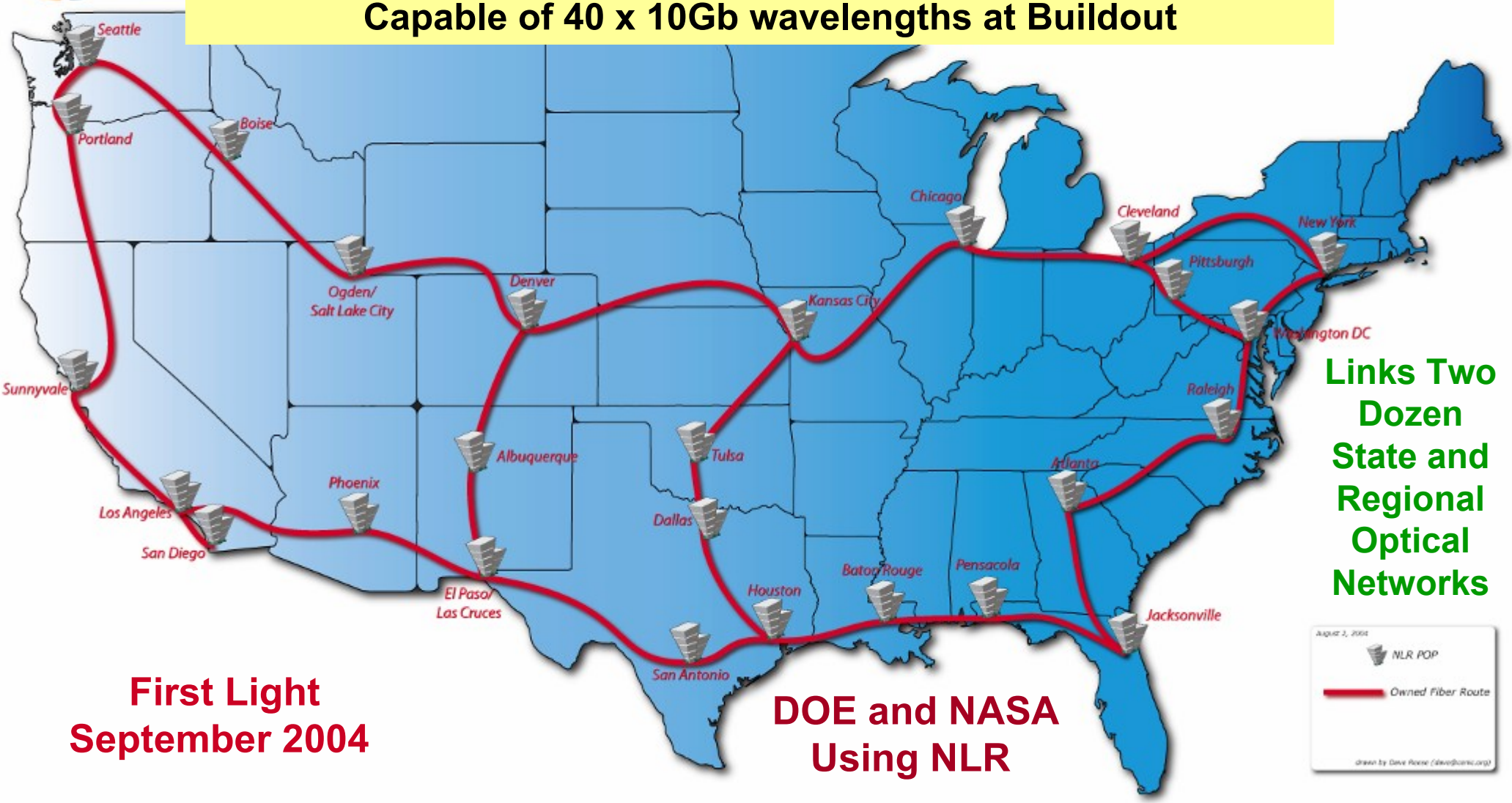




Cyberinfrastructure Breakthrough—NLR Provides Dedicated Optical Paths Between User and Data

"National LambdaRail" Partnership

Serves Very High-End Experimental and Research Applications
4 x 10Gb Wavelengths Initially
Capable of 40 x 10Gb wavelengths at Buildout



Links Two Dozen State and Regional Optical Networks

First Light September 2004

DOE and NASA Using NLR

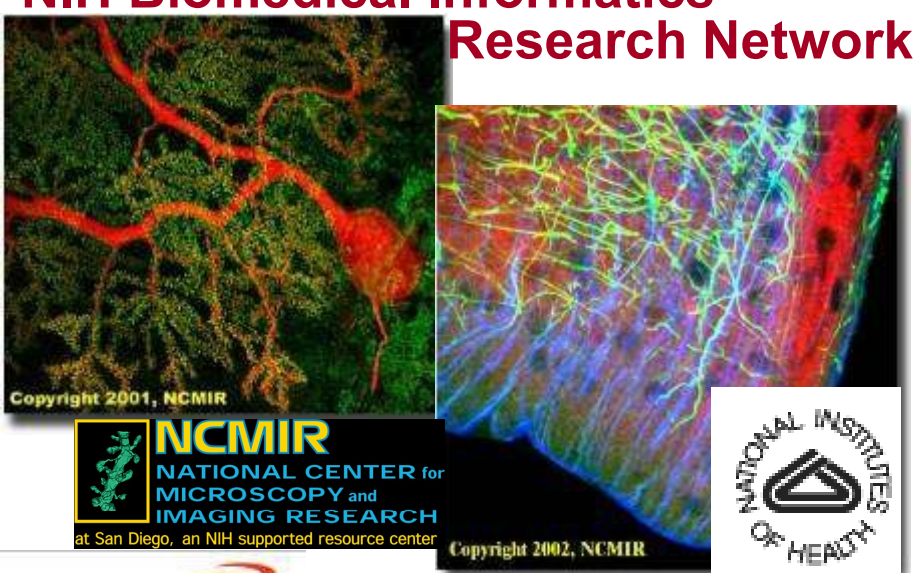
For more information regarding NLR see http://www.nlr.net or contact info@nlr.net

The OptIPuter Project –

Creating a LambdaGrid "Web" for Gigabyte Data Objects

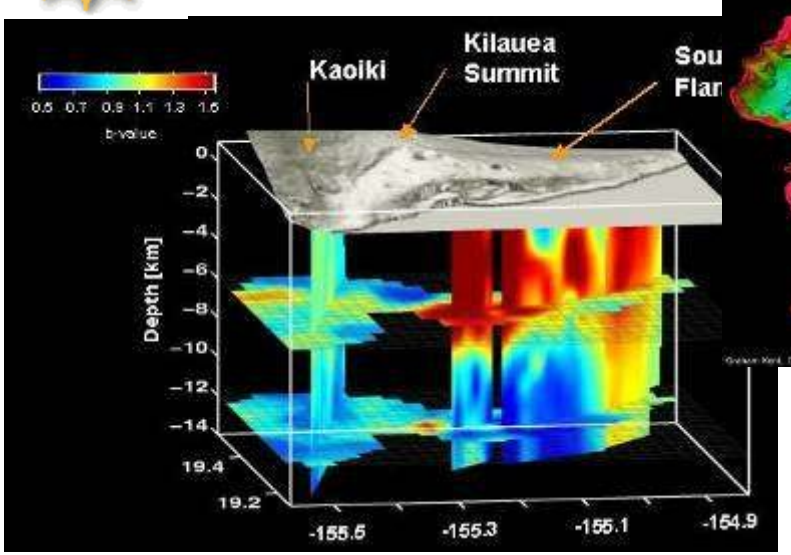
- **NSF Large Information Technology Research Proposal**
  - Calit2 (UCSD, UCI) and UIC Lead Campuses—Larry Smarr PI
  - Partnering Campuses: USC, SDSU, NW, TA&M, UIUC, UvA, SARA
- **Industrial Partners**
  - IBM, Sun, Telcordia, Chiaro, Calient, Glimmerglass, Lucent
- **$13.5 Million Over Five Years**
- **Linking Global Scale Science Projects to User's Linux Clusters**

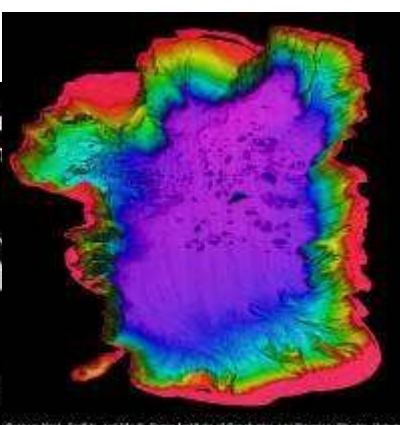
NIH Biomedical Informatics Research Network



http://ncmir.ucsd.edu/gallery.html

NSF EarthScope and ORION





siovizcenter.ucsd.edu/library/gallery/shoot1/index.shtml

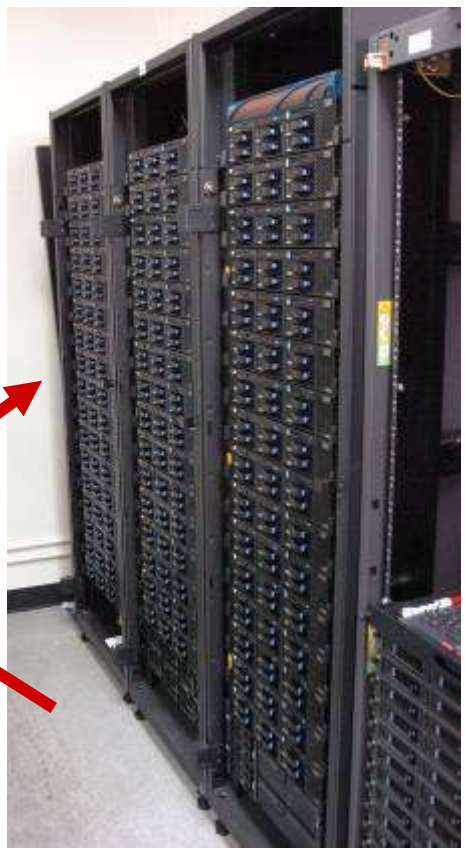
OptIPuter SDSC

Enabling Scientists to Analyze Large Data Objects: UCSD Campus LambdaStore Architecture

SIO Ocean Supercomputer

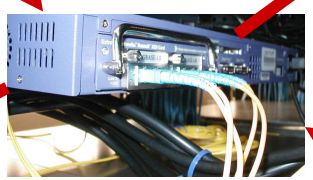


IBM Storage Cluster



Streaming Microscope









Extreme Switch with 2 Ten Gbps Uplinks



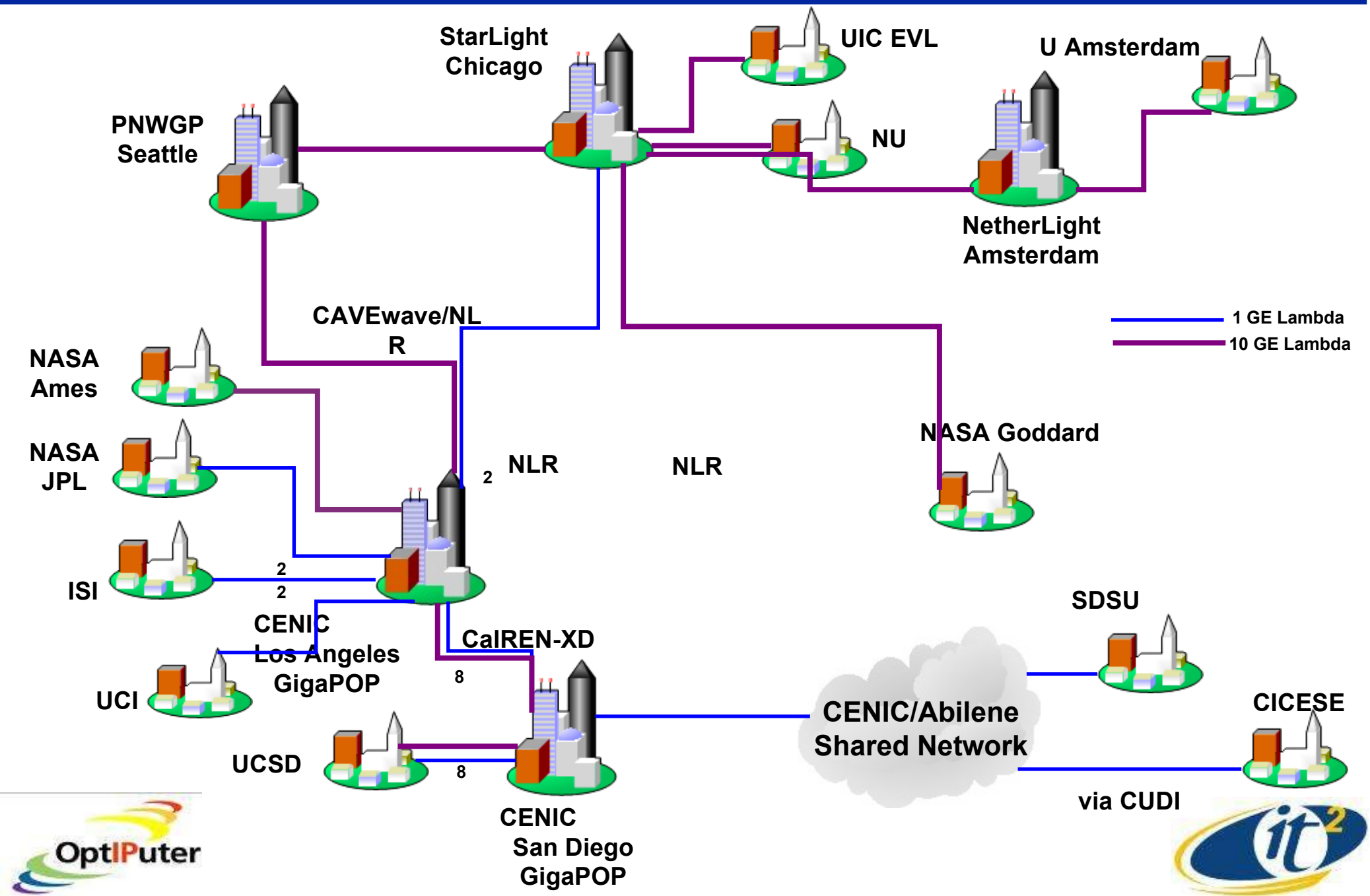


Source: Phil Papadopoulos, SDSC, Calit2

OptIPuter

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Expanding the OptIPuter LambdaGrid Over CENIC, NLR, and Starlight



Coupling to Interactive Remote Data & Visualization Services



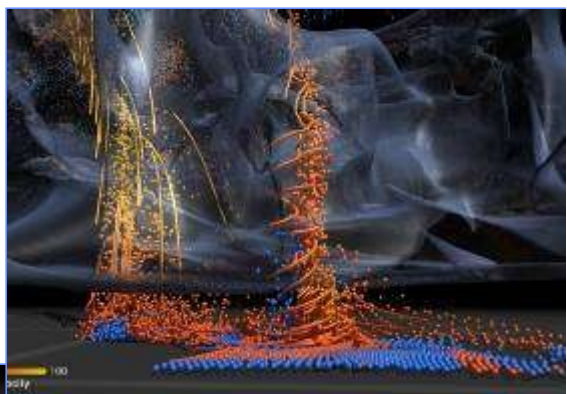
- Multiple Scalable Displays
- Hardware Pixel Streaming
- Distributed Collaboration

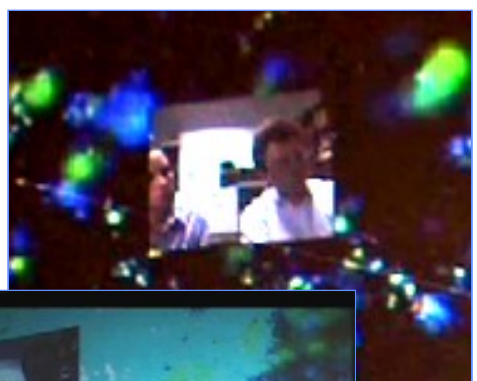
NCSA

- Scientific-Info Visualization
- AMR Volume Visualization
- Glyph and Feature Vis
- Visualization Services

NCSA Altix Data and Vis Server



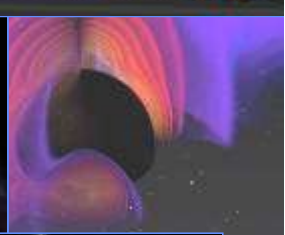


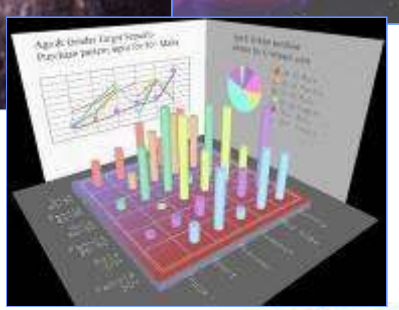












Linking to OptIPuter Over I-WIRE

- Data Mining for Areas of Interest
- Analysis and Feature Extraction
- Data Mining Services

OptIPuter

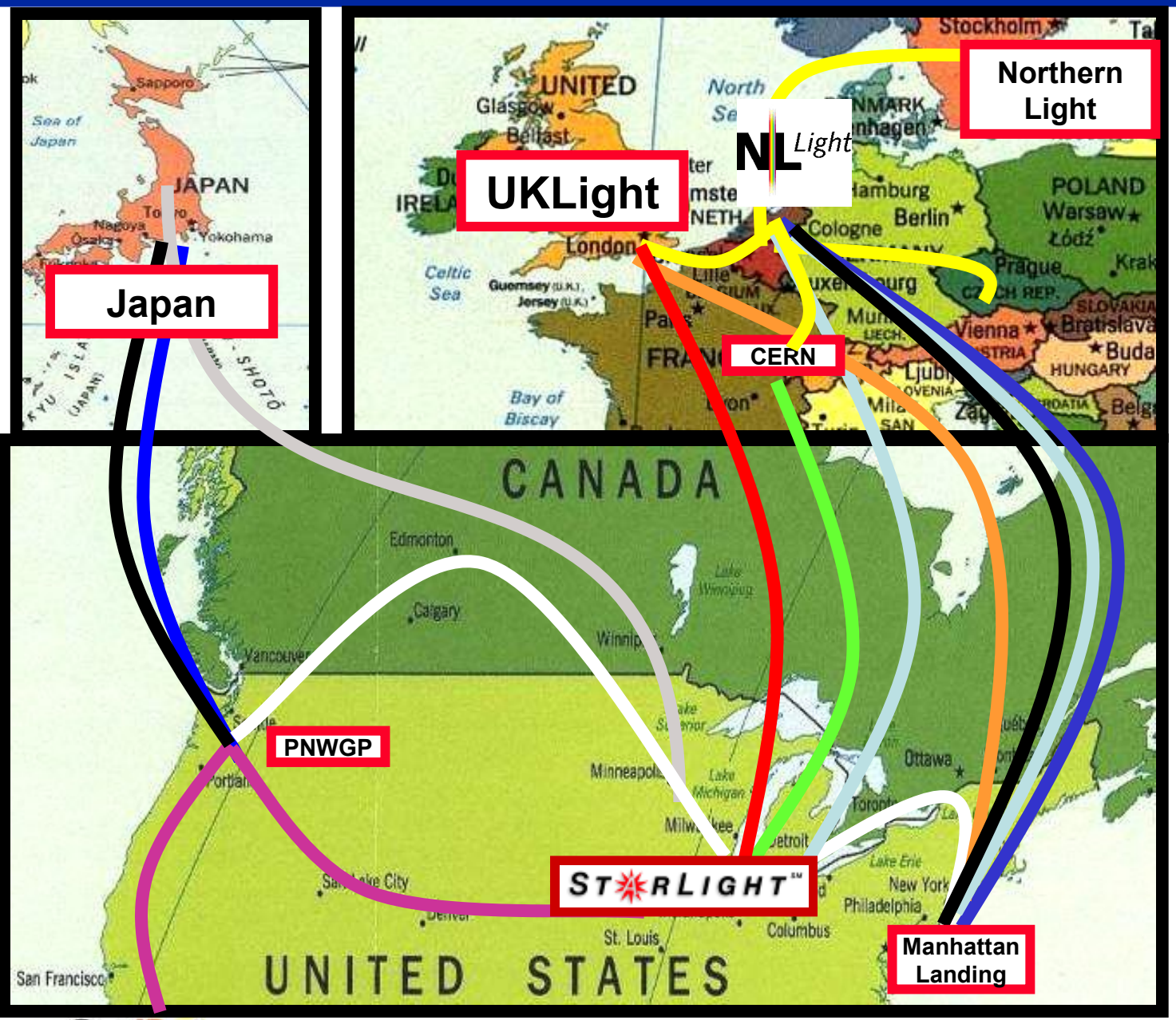
Source: Donna Cox, Bob Patterson, Michael Welge, NCSA

National Laboratory for Advanced Data Research

An SDSC/NCSA Data Collaboration

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Optical Circuits to the Pacific Rim and Europe Already Exist and Link to U.S.



US IRNC (black)
–20Gb NYC—Amsterdam
–10Gb LA—Tokyo
GEANT/I2 (orange)
–30Gb London, etc.—NYC
UK to US (red)
–10Gb London—Chicago
SURFnet to US (light blue)
–10Gb Amsterdam—NYC
–10Gb Amsterdam—Chicago
Canadian CA*net4 to US (white)
–30Gb Chicago-Canada-NYC
–30Gb Chicago-Canada-Seattle
Japan JGN II to US (grey)
–10Gb Chicago—Tokyo
European (not GEANT) (yellow)
–10Gb Amsterdam—CERN
–10Gb Prague—Amsterdam
–2.5Gb Stockholm—Amsterdam
–10Gb London—Amsterdam
IEEAF lambdas (dark blue)
–10Gb NYC—Amsterdam
–10Gb Seattle—Tokyo
CAVEwave/PacificWave (purple)
–10Gb Chicago—Seattle—SD
–10Gb Seattle—LA—SD

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Multiple HD Streams Over Lambdas Will Radically Transform Campus Collaboration







OptIPuter

Source: U Washington Research Channel

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Two New Calit2 Buildings Will Provide Persistent Collaboration Testbed



- Will Create New Laboratory Facilities
- International Conferences and Testbeds
- Over 1000 Researchers in Two Buildings
- High Performance Lambda Collaboratories



In 2005 Calit2 Will Link its Two Buildings via CENIC-XD Dedicated Fiber Using OptIPuter Architecture to Create a Distributed Collaboration Laboratory

Goal—Upgrade Access Grid to HD Streams Over IP on Dedicated Lambdas



SC Global Keynote at Supercomputing 04: Access Grid Talk with 35 Locations on 5 Continents

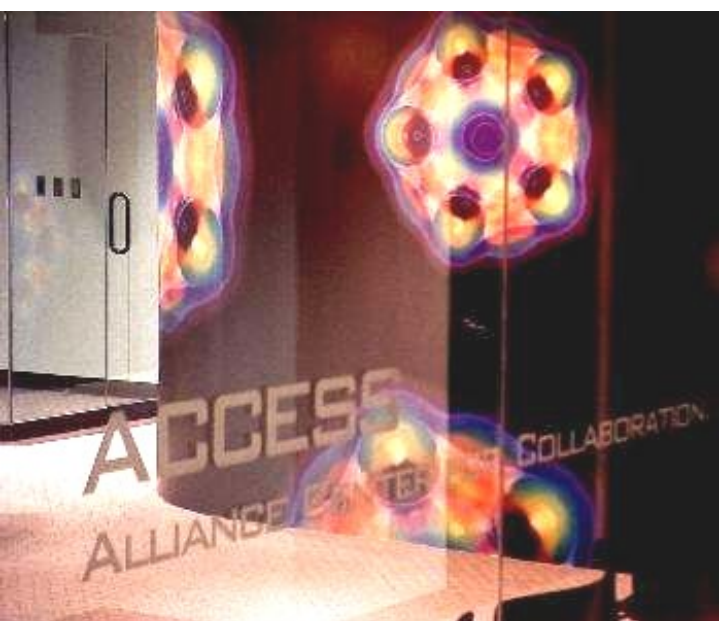
Extending High Performance Collaboratories over the NLR-- ACCESS DC and TRECC Chicago



TRECC







NCSA

Jason Leigh,
OptIPuter co-PI



www.trecc.org

The Networking Double Header of the Century Will Be Driven by LambdaGrid Applications

Maxine Brown, Tom DeFanti, Co-Organizers



iGrid 2005

THE GLOBAL LAMBDA INTEGRATED FACILITY

www.startap.net/igrid2005/

September 26-30, 2005

University of California, San Diego

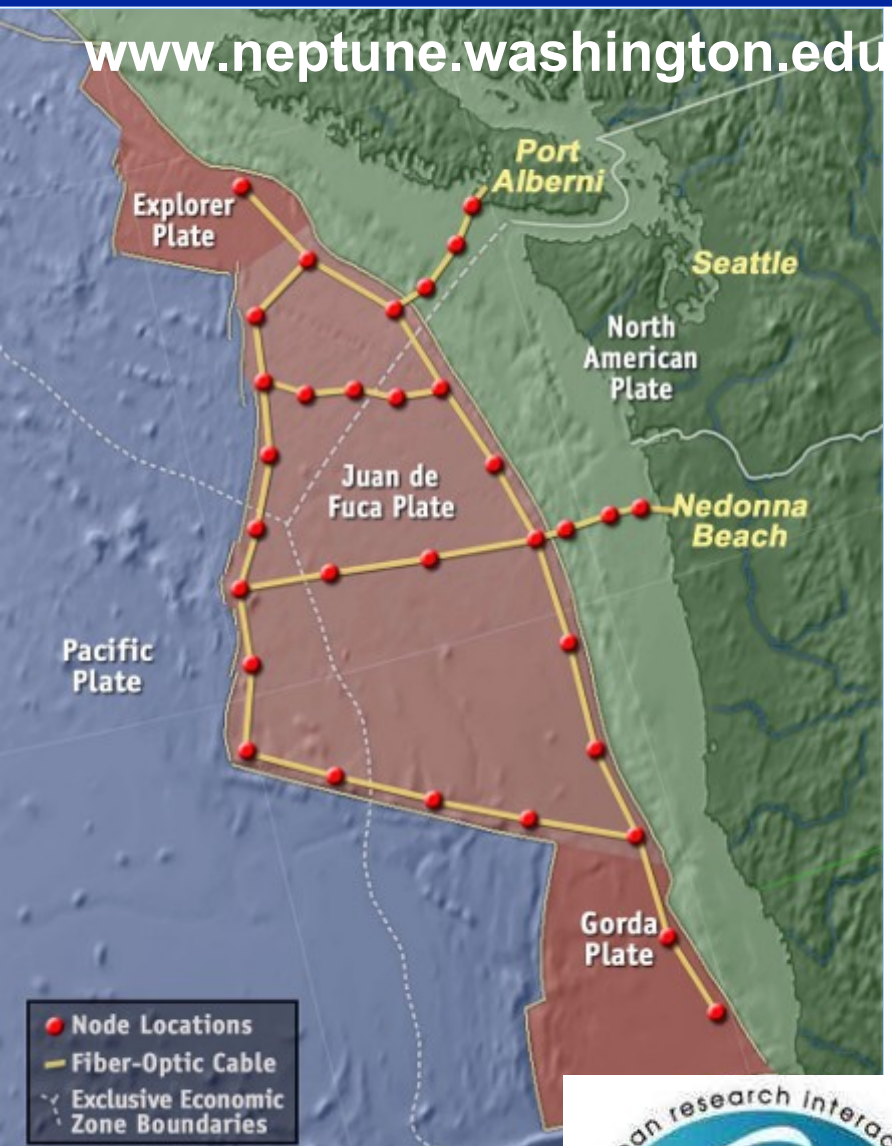
California Institute for Telecommunications and Information Technology

SC|05 Gateway to Discovery

Washington State Convention and Trade Center Seattle, WA
November 12-18 2005

http://sc05.supercomp.org

Example of New Science Enabled by Lambdas: Interactive Ocean Observatories



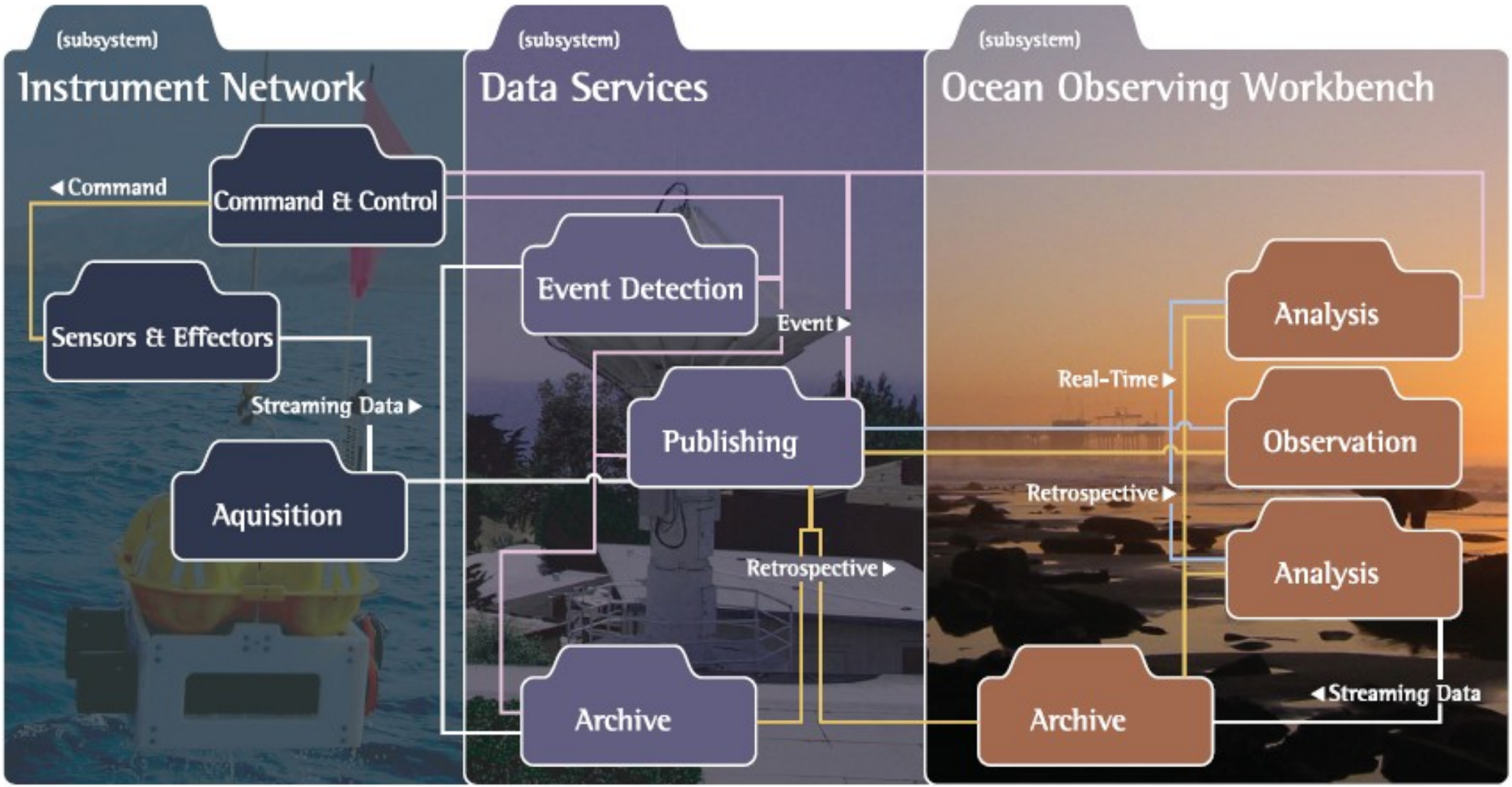
LOOKING:
(Laboratory for the Ocean Observatory Knowledge Integration Grid)

- **LOOKING NSF ITR with PIs:**
  - **John Orcutt & Larry Smarr - UCSD**
  - **John Delaney & Ed Lazowska –UW**
  - **Mark Abbott – OSU**
- **Collaborators at:**
  - **MBARI, WHOI, NCSA, UIC, CalPoly, UVic, CANARIE, Microsoft, NEPTUNE-Canarie**
- **Reuse Telecom Cables on the Ocean Floor**

LOOKING--
Integrate Instruments & Sensors (Real Time Data Sources) Into a LambdaGrid Computing Environment With Web Services Interfaces

OptIPuter NSF ocean research interactive ORION observatory networks CENTER FOR EARTH OBSERVATIONS & APPLICATIONS it2

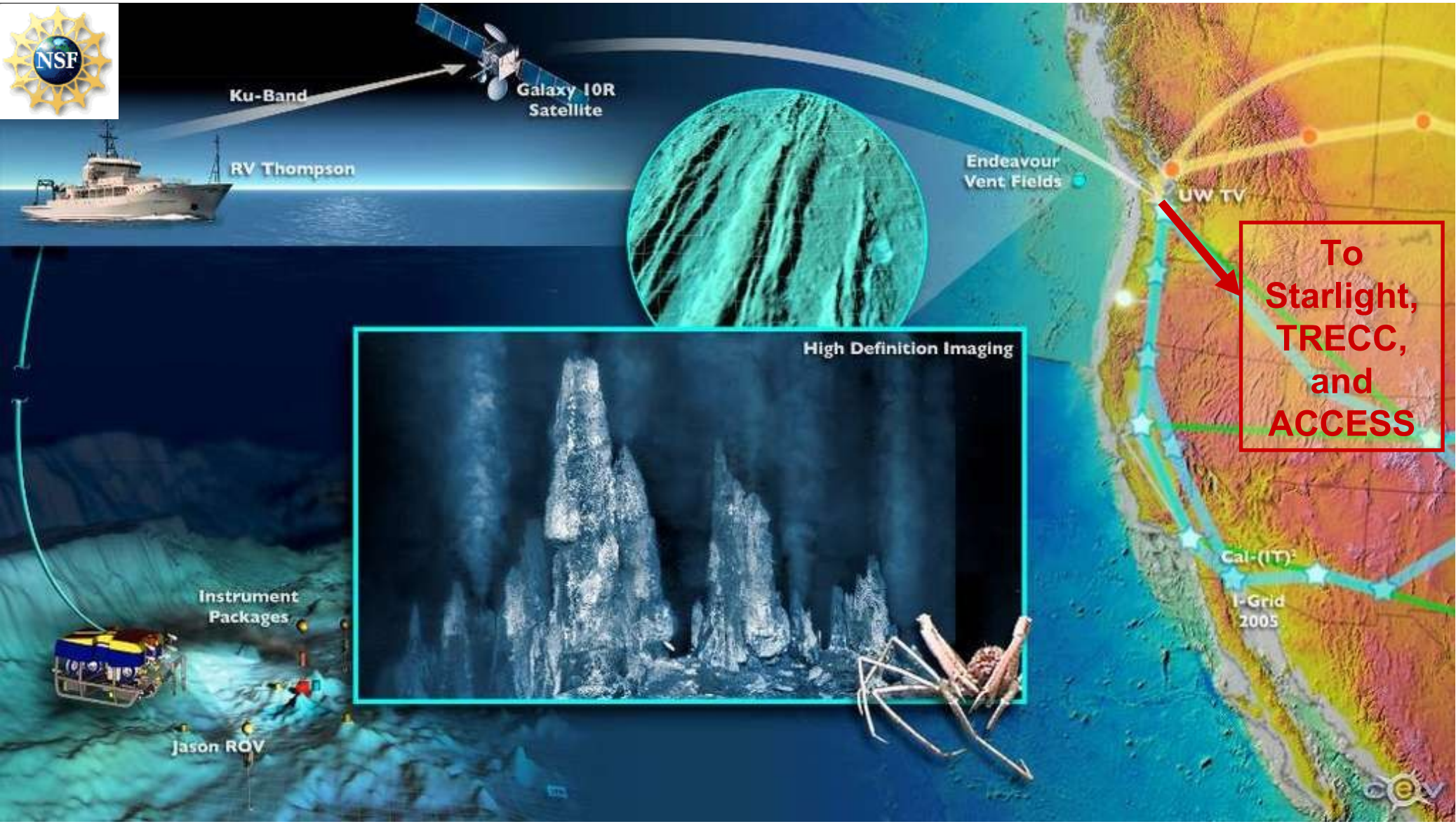
Looking High Level System Architecture



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Proposed Experiment for iGrid 2005 – Remote Interactive HD Imaging of Deep Sea Vent



OptIPuter NEPTUNE

Source John Delaney & Deborah Kelley, UWash

it²