Beyond Telepresence

Opening Talk

Cisco Day at the Center for Networked Systems

UC San Diego

January 19, 2010

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

Twitter: lsmarr

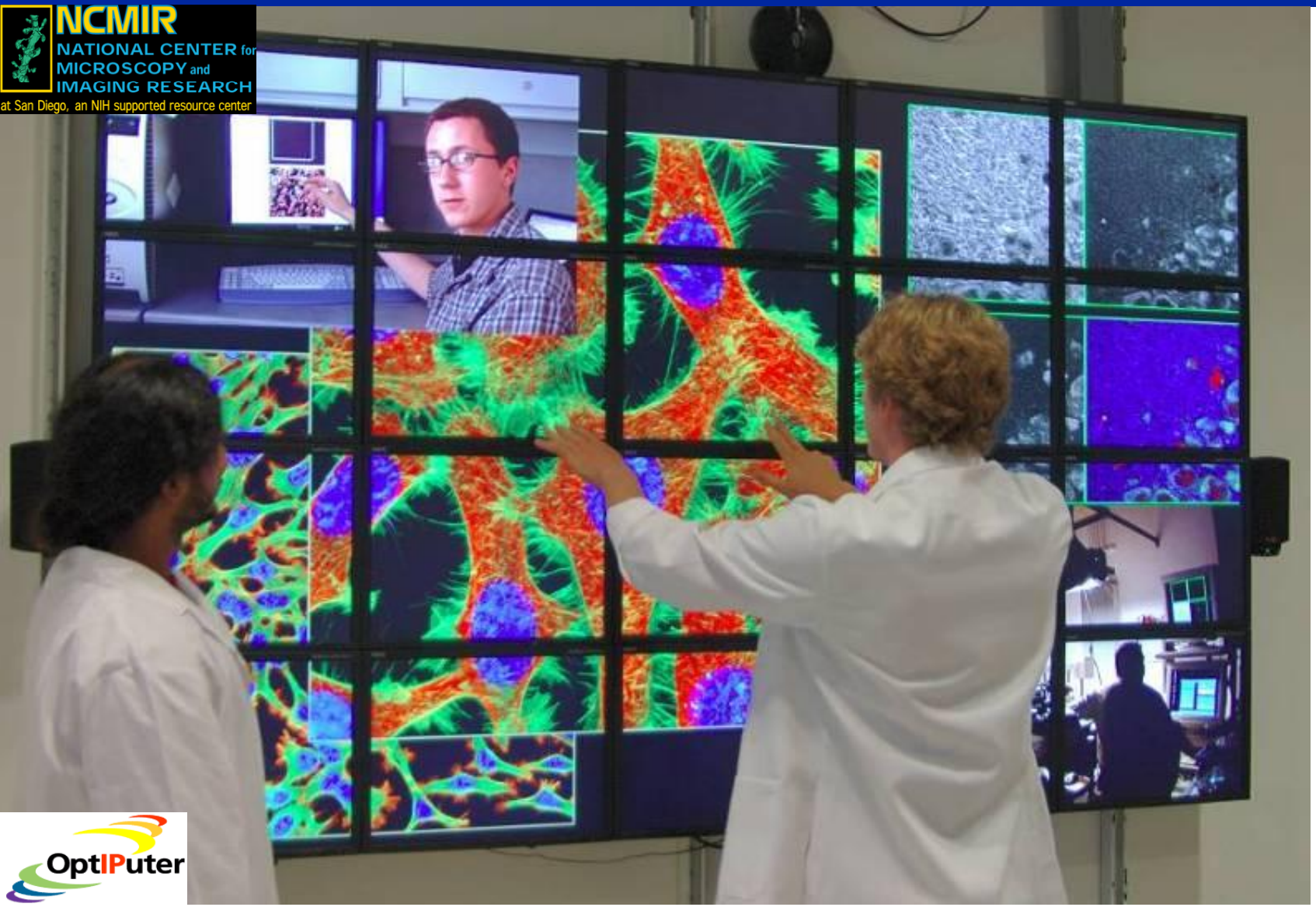
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The OptIPuter Project: Creating High Resolution Portals Over Dedicated Optical Channels to Global Science Data

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



Scalable Adaptive Graphics Environment (SAGE)

evl electronic visualization laboratory

NSF

$13.5M Over Five Years

Picture Source: Mark Ellisman, David Lee, Jason Leigh

OptIPuter

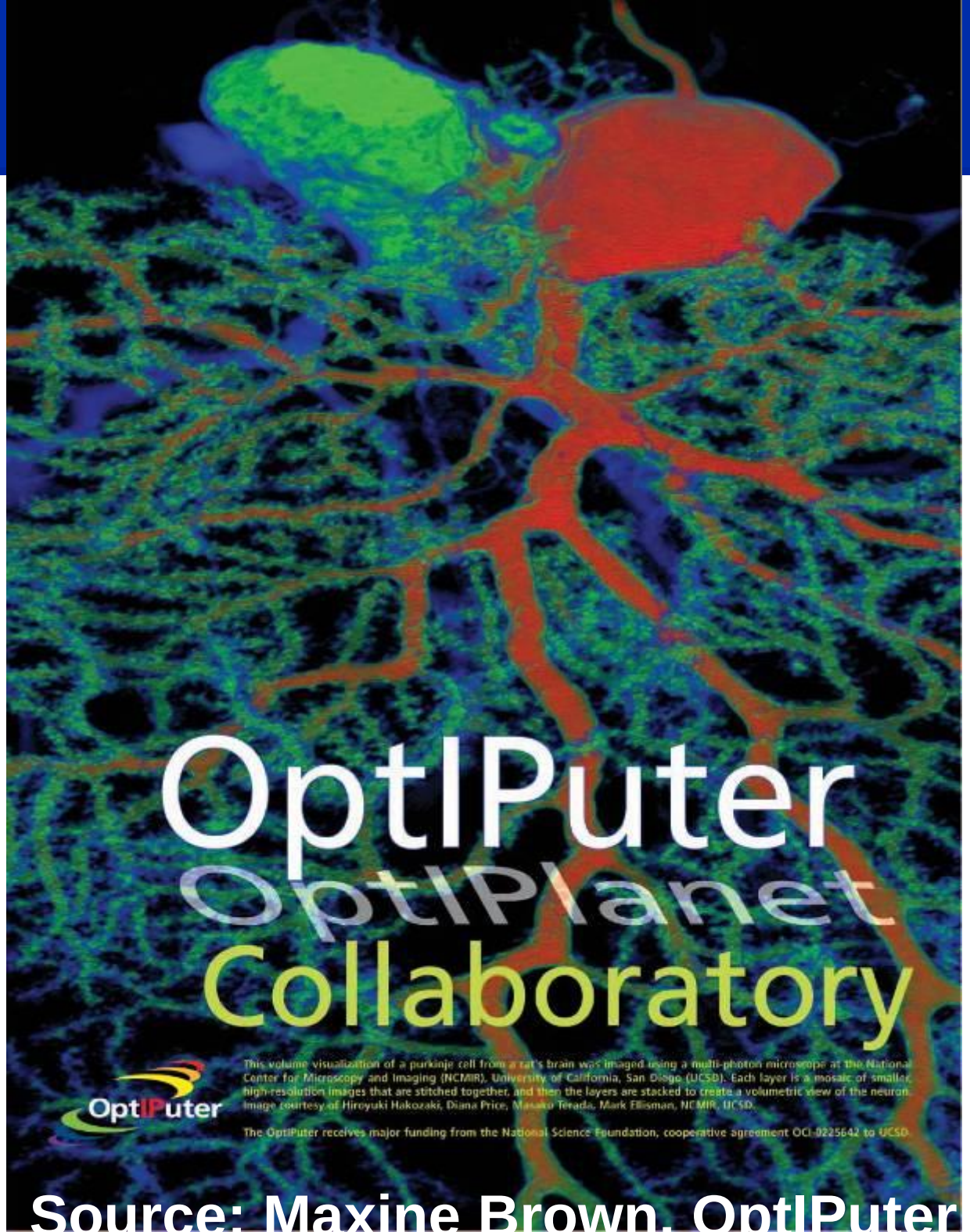
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Calit2 (UCSD, UCI) and UIC Lead Campuses—Larry Smarr PI

Univ. Partners: SDSC, USC, SDSU, NW, TA&M, UvA, SARA, KISTI, AIST

Industry: IBM, Sun, Telcordia, Chiaro, Calient, Glimmerglass, Lucent

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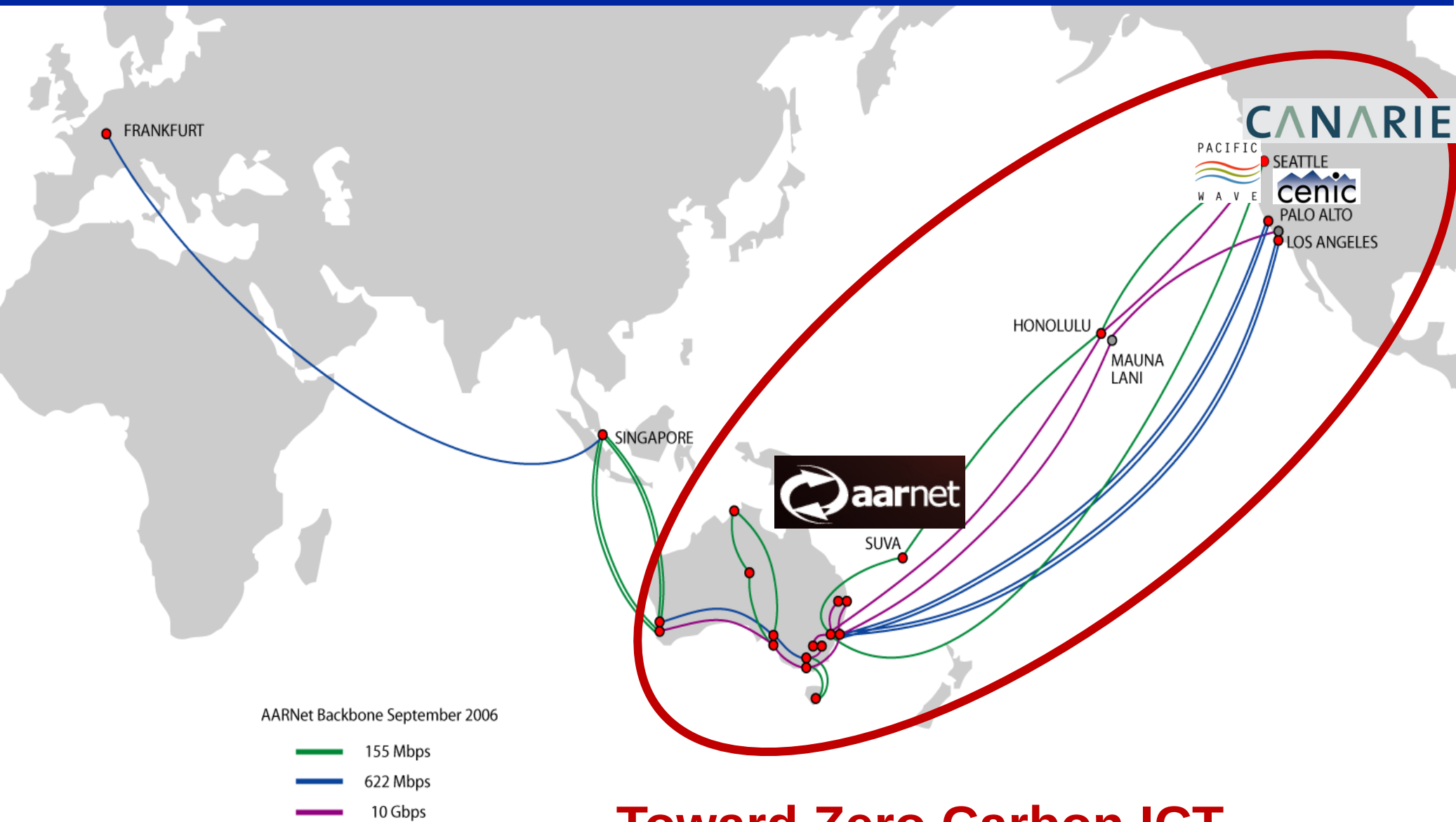
Source: Maxine Brown, OptIPuter

Green Initiative:

Can Optical Fiber Replace Airline Travel for Continuing Collaborations ?

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Coupling AARNet - CENIC/PW - CANARIE Optical Nets: An Australian-U.S.-Canada Green Cloud Testbed



Toward Zero Carbon ICT

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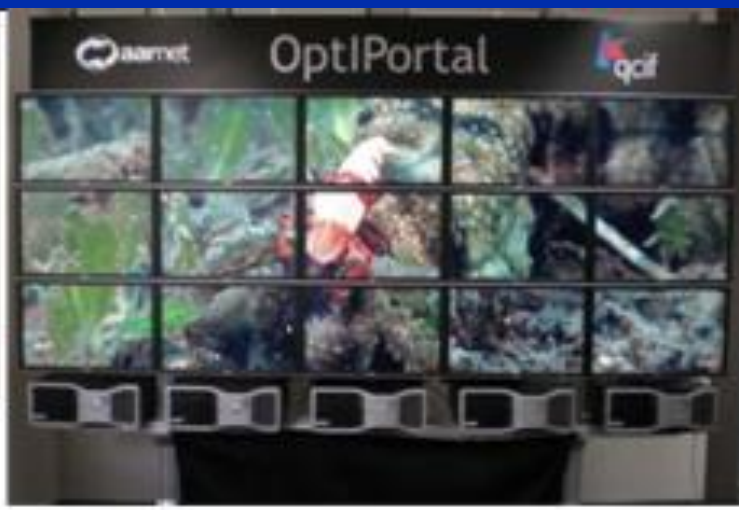
Launch of the 100 Megapixel OzIPortal Kicked Off a Rapid Build Out of Australian OptIPortals



ANU



U Queensland



AARNet



CSIRO



Monash U-Caufield



Monash U-Clayton



U Wellington, NZ

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HD Talk to Australia's Monash University from Calit2: Reducing International Travel



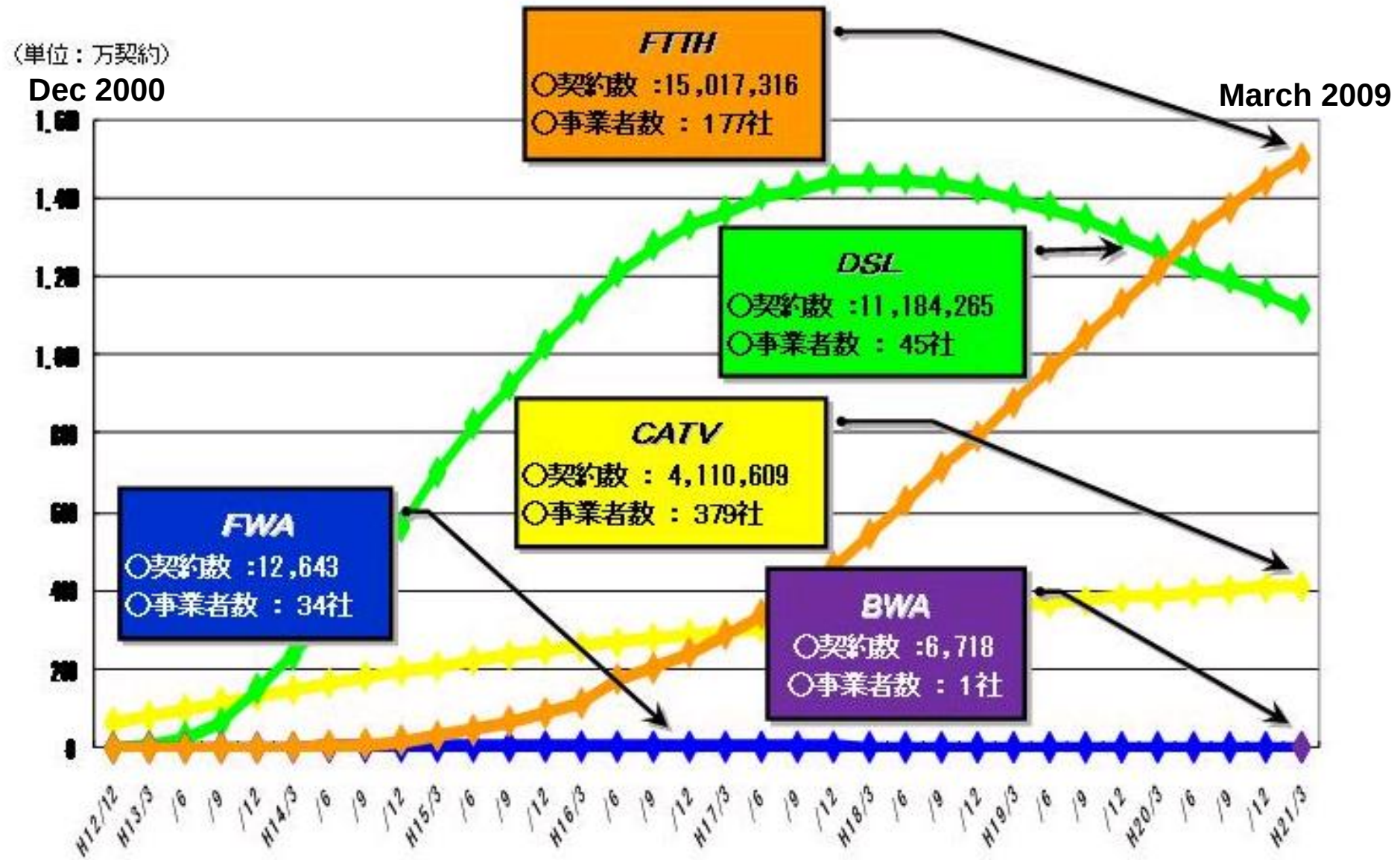
Qvidium Compressed HD ~140 mbps

Source: David Abramson, Monash Univ

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In Japan, FTTH Has Become the Dominant Broadband--Subscribers to "Slow" 40 Mbps ADSL Are Decreasing!



Source: Japan's Ministry of Internal Affairs and Communications
Add url

Australia's National Broadband Network (NBN) Will Create the World's Most Ubiquitous Broadband

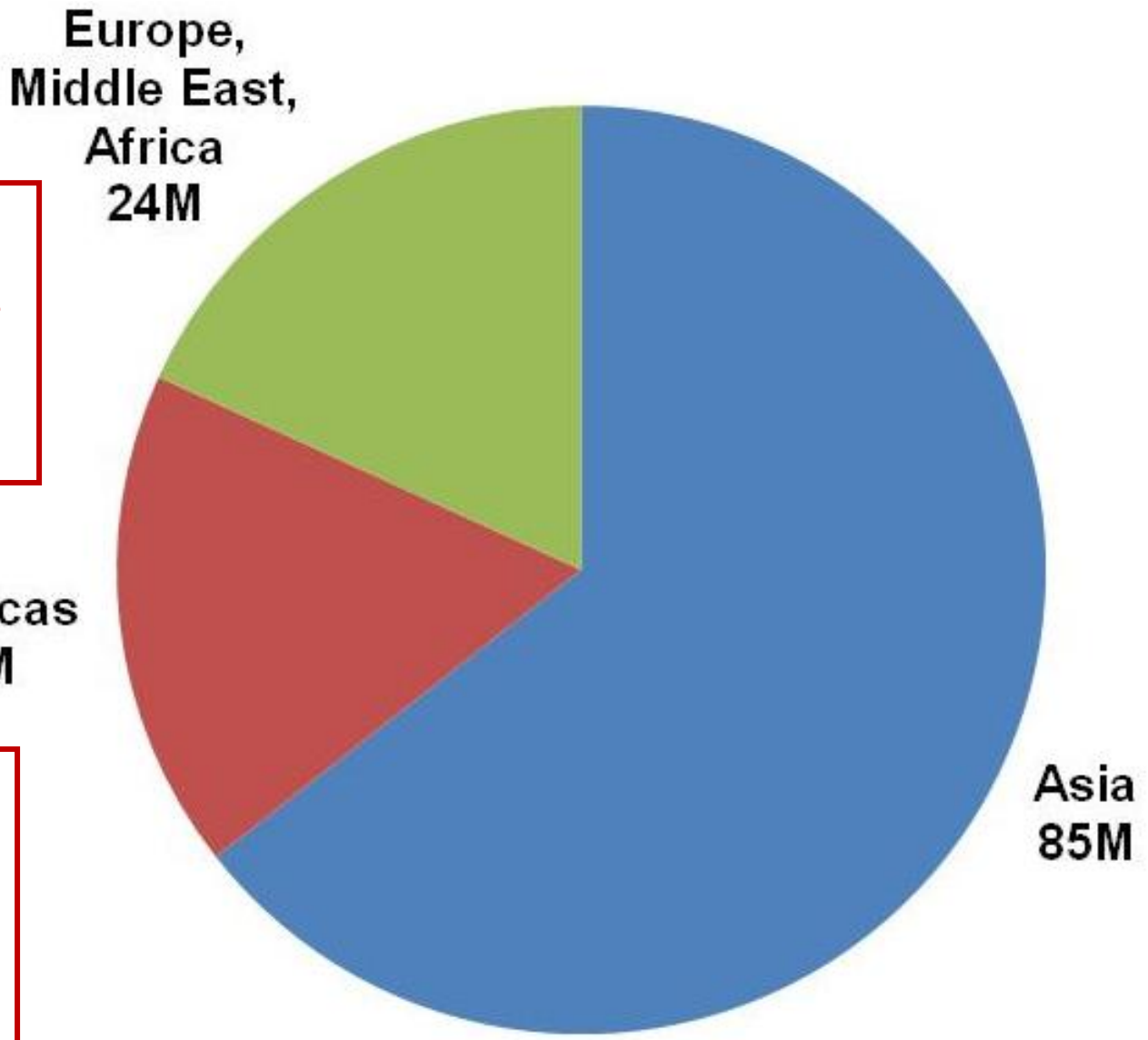
- **NBN Goals**
  - Connect 90% of Households with Fiber in Eight Years
  - Remaining 10% by Satellite or Wireless
  - 100 Mbit/s Broadband Per House
  - Driven by Consumer Internet, Telephone, Video
    - "Triple Play", eHealth, eCommerce…
- **Video Conferencing to Avoid Transportation**
- **"Smart" Electric Grid**
  - Reduce Household and Building Energy Usage
  - Avoid Peak Loading
  - Plug-In Hybrid with Renewable Electricity Generation
- **Cloud Computing and Storage at Renewable Sites**

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Globally Fiber to the Premise is Growing Rapidly, Mostly in Asia

FTTP Connections Growing at ~30%/year



130 Million Households with FTTH in 2013

Source: Heavy Reading (www.heavyreading.com), the market research division of Light Reading (www.lightreading.com).

Cisco is the Lead Industrial Partner for Australia's New Broadband Institute



Sponsors

Melbourne Uni opens 'NBN Institute'

Victoria
The Place To Be

Platinum Sponsor

CISCO

Gold Sponsors

Empowered by Innovation NEC

Telstra

Test-bed partner

NICTA

Connectivity partner

aarnet

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Rod Tucker, Director
www.broadband.unimelb.edu.au/

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CineGrid Founding Members

- Cisco Systems
- Keio University DMC
- Lucasfilm Ltd.
- NTT Network Innovation Laboratories
- Pacific Interface Inc.
- Ryerson University/Rogers Communications Centre
- San Francisco State University/INGI
- Sony Electronics America
- University of Amsterdam
- University of California San Diego/Calit2/CRCA
- University of Illinois Chicago/EVL
- University of Illinois at Urbana-Champaign/NCSA
- University of Southern California/School of Cinematic Arts
- University of Washington/Research Channel



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The Founding Members of CineGrid are an extraordinary mix of media arts schools, research universities, and scientific laboratories connected by 1GE and 10GE networks used for research & education



CineGrid 4K Digital Cinema Projects: "Learning by Doing"

CineGrid @ iGrid 2005



CineGrid @ AES 2006





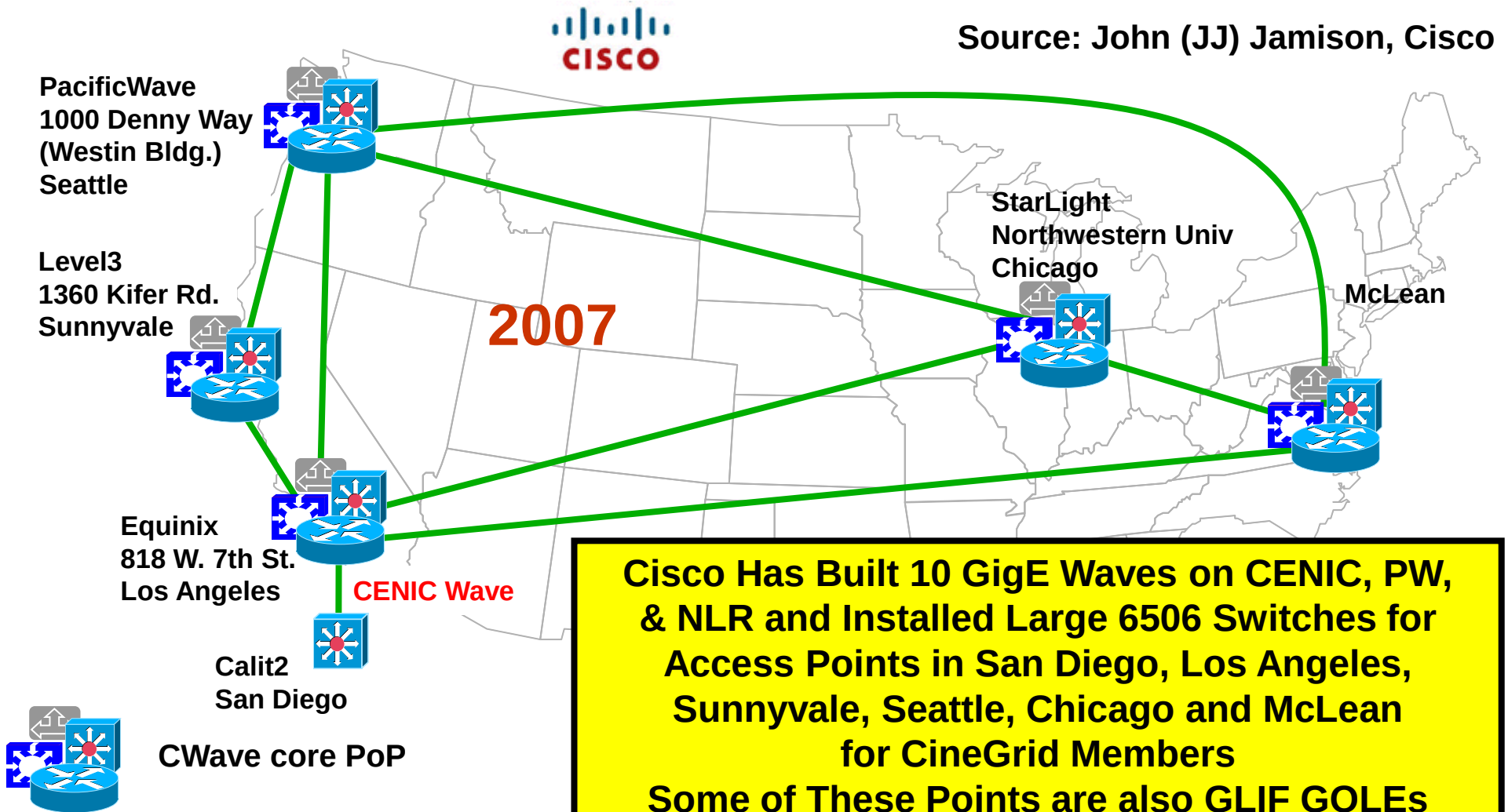
CineGrid @ Holland Festival 2007



CineGrid @ GLIF 2007

Cisco CWave for CineGrid: A New Cyberinfrastructure for High Resolution Media Streaming*

Source: John (JJ) Jamison, Cisco



Cisco Has Built 10 GigE Waves on CENIC, PW, & NLR and Installed Large 6506 Switches for Access Points in San Diego, Los Angeles, Sunnyvale, Seattle, Chicago and McLean for CineGrid Members
Some of These Points are also GLIF GOLEs

First Tri-Continental Premier of a Streamed 4K Feature Film With Global HD Discussion



CRCA

CISCO
C-wave
CineGrid

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4K Transmission Over 10Gbps--
4 HD Projections from One 4K Projector

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Linking the Calit2 Auditoriums at UCSD and UCI with LifeSize HD for Shared Seminars



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Photo by Erik Jepsen, UC San Diego

OptIPlanet Collaboratory Persistent Infrastructure Between Calit2 and U Washington



OptIPuter

Ginger Armbrust's Diatoms: Micrographs, Chromosomes, Genetic Assembly

ROCKS





iHDTV: 1500 Mbits/sec Calit2 to UW Research Channel Over 10,000 Mbps Pacific Wave/CENIC Dedicated Optical Fiber

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Multi-User Global Workspace: San Diego, Chicago, Saudi Arabia



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Source: Tom DeFanti, KAUST Project, Calit2

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High Definition Video Connected OptIPortals: Virtual Working Spaces for Data Intensive Research



LifeSize HD

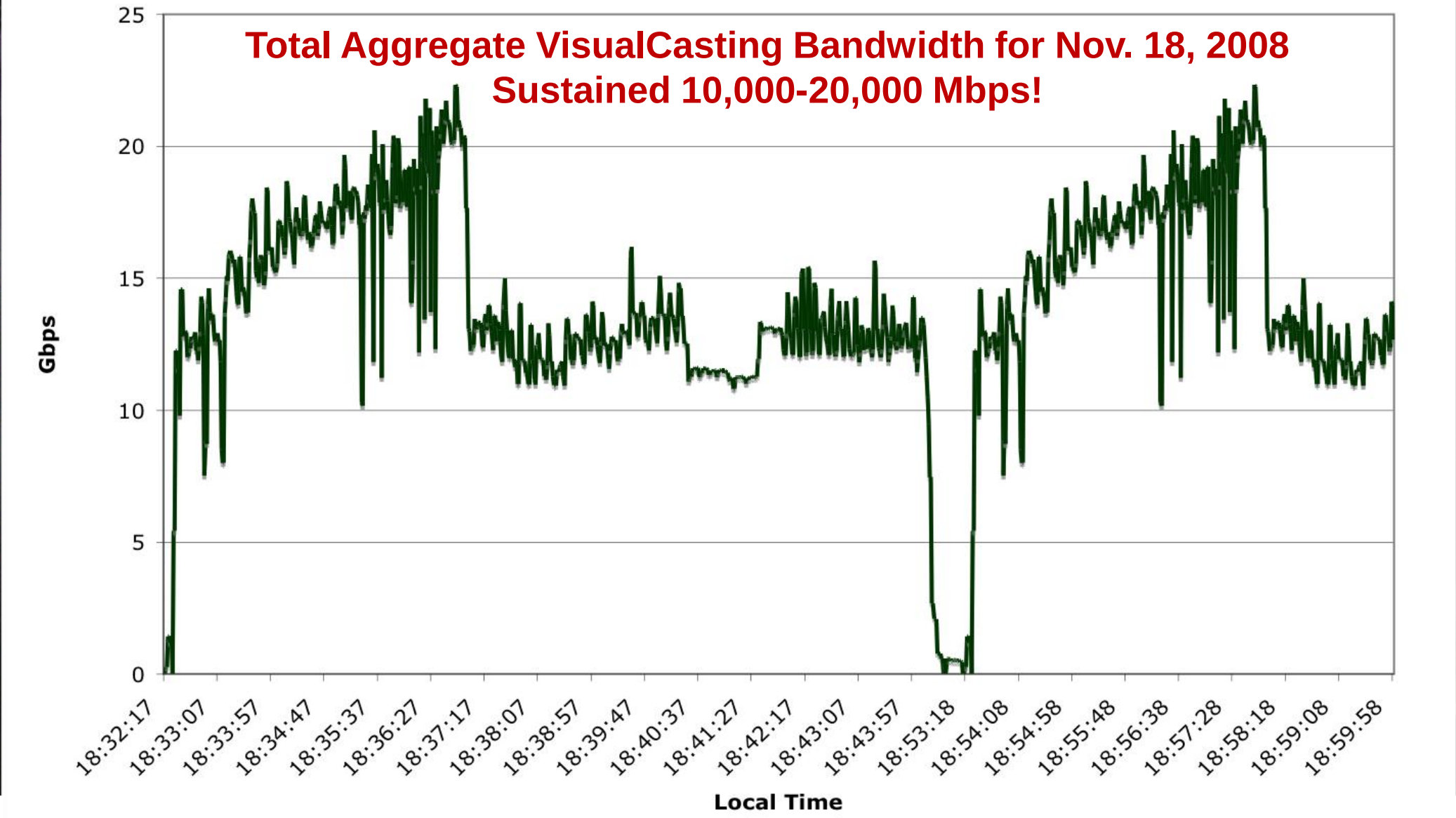
NASA Ames
Lunar Science Institute
Mountain View, CA

NASA Interest in Supporting Virtual Institutes

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Source: Falko Kuester, Kai Doerr Calit2; Michael Sims, NASA

EVL's SAGE OptIPortal VisualCasting Multi-Site OptIPuter Collaboratory

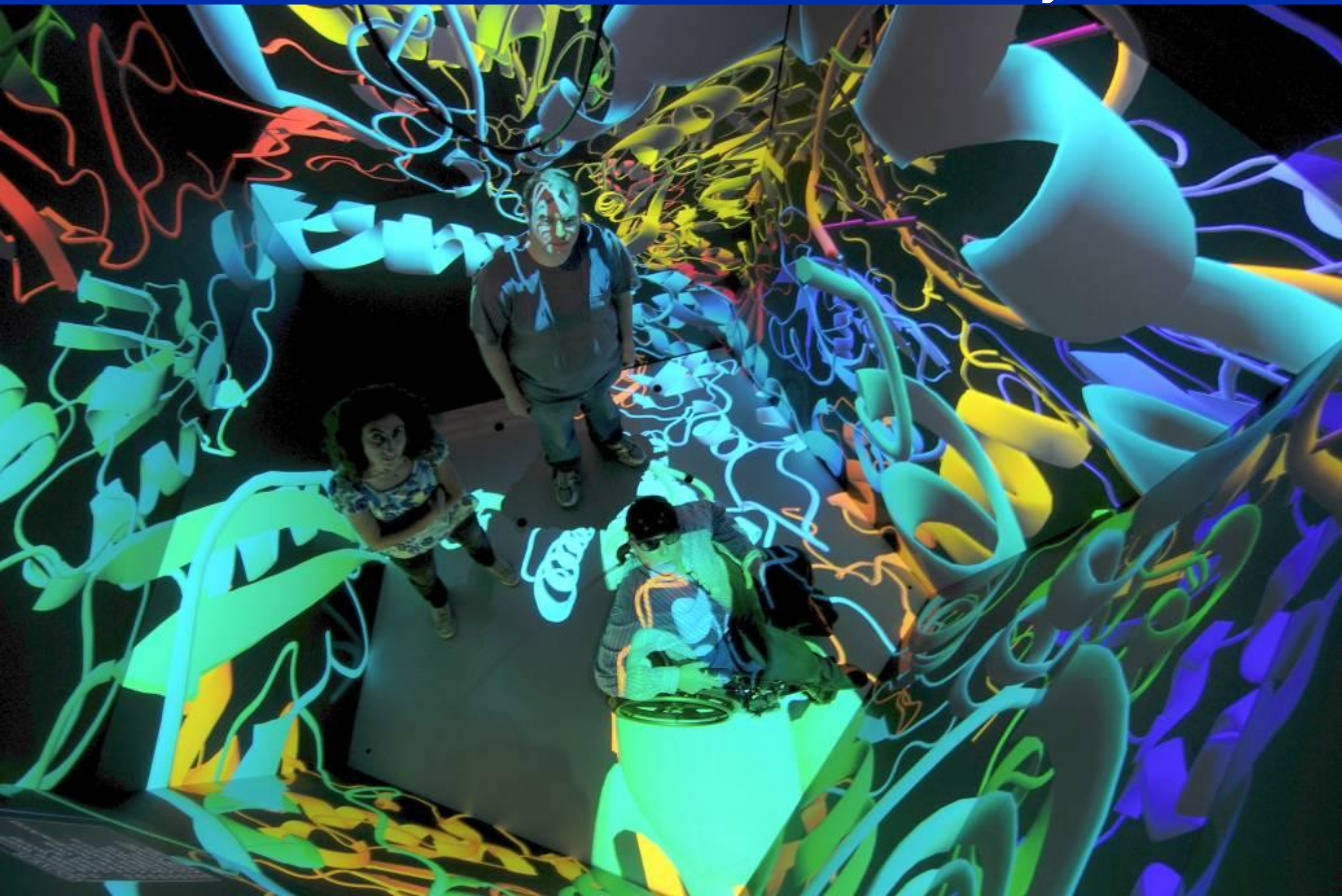


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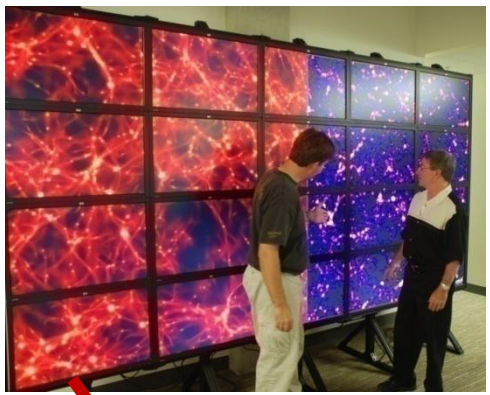
Source: Jason Leigh, Luc Renambot, EVL, UI Chicago

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Ultra Resolution Virtual Reality: Toward a 3D Global Collaboratory



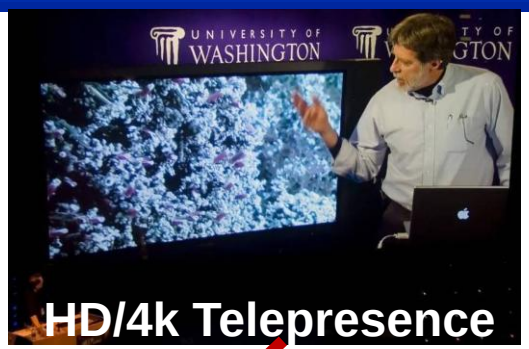
Academic Research "OptIPlatform" Cyberinfrastructure: A 10Gbps Lightpath Cloud



End User OptIPortal



Instruments

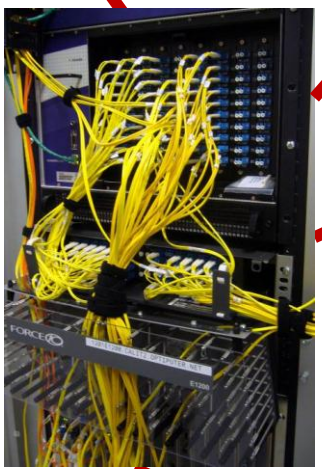


HD/4k Telepresence

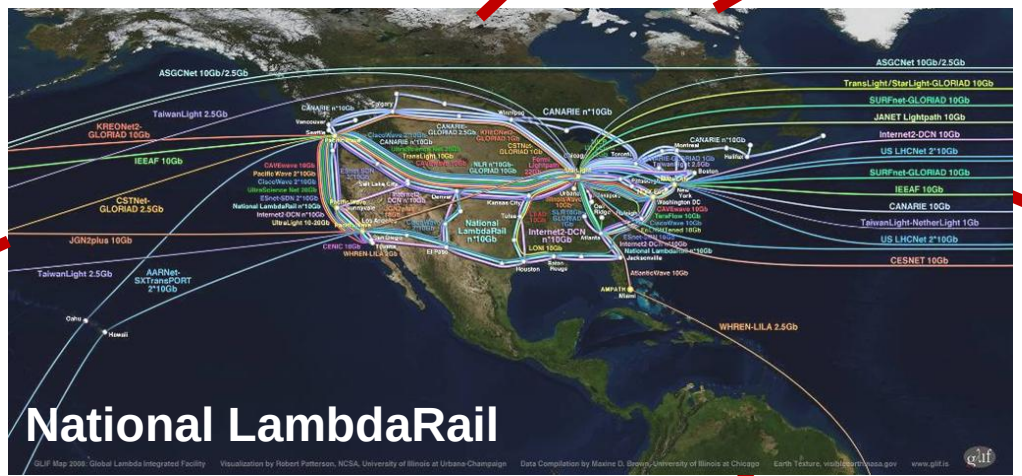


HD/4k Video Cams

HPC



10G Lightpaths



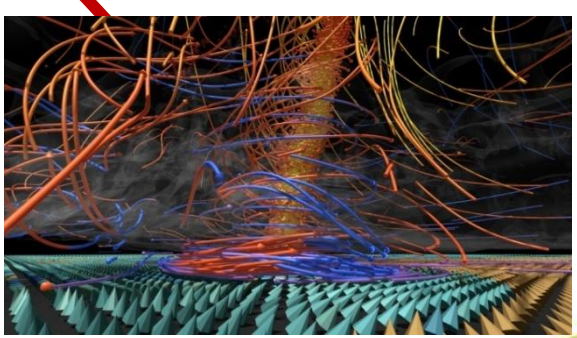
National LambdaRail

TeraGrid™

Campus Optical Switch



Data Repositories & Clusters



HD/4k Video Images

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