CineGrid: An Innovative High End Digital Media Collaboration

Presentation

Sixth Meeting of the University-Industry Demonstration Partnership (UIDP):

The Changing Face of Innovation

Arnold and Mabel Beckman Conference Center of the National Academies

Irvine, California

July 1, 2008

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

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Abstract

I will discuss an innovative university-industry partnership, CineGrid, which was established to promote research, development and deployment of ultra-high performance digital media over high-speed photonic networks. It is a non-profit organization which currently has eleven corporate members, fifteen university members and twelve network organizations. It makes available 10 gigabit/sec bandwidth between cities for member experiments, enabling the production, use, and exchange of very high-quality digital media. CineGrid members work together to explore the feasibility of different networking approaches for emerging applications of media-rich forms of art, entertainment, distance learning, scientific visualization, remote collaboration and international cultural exchange.

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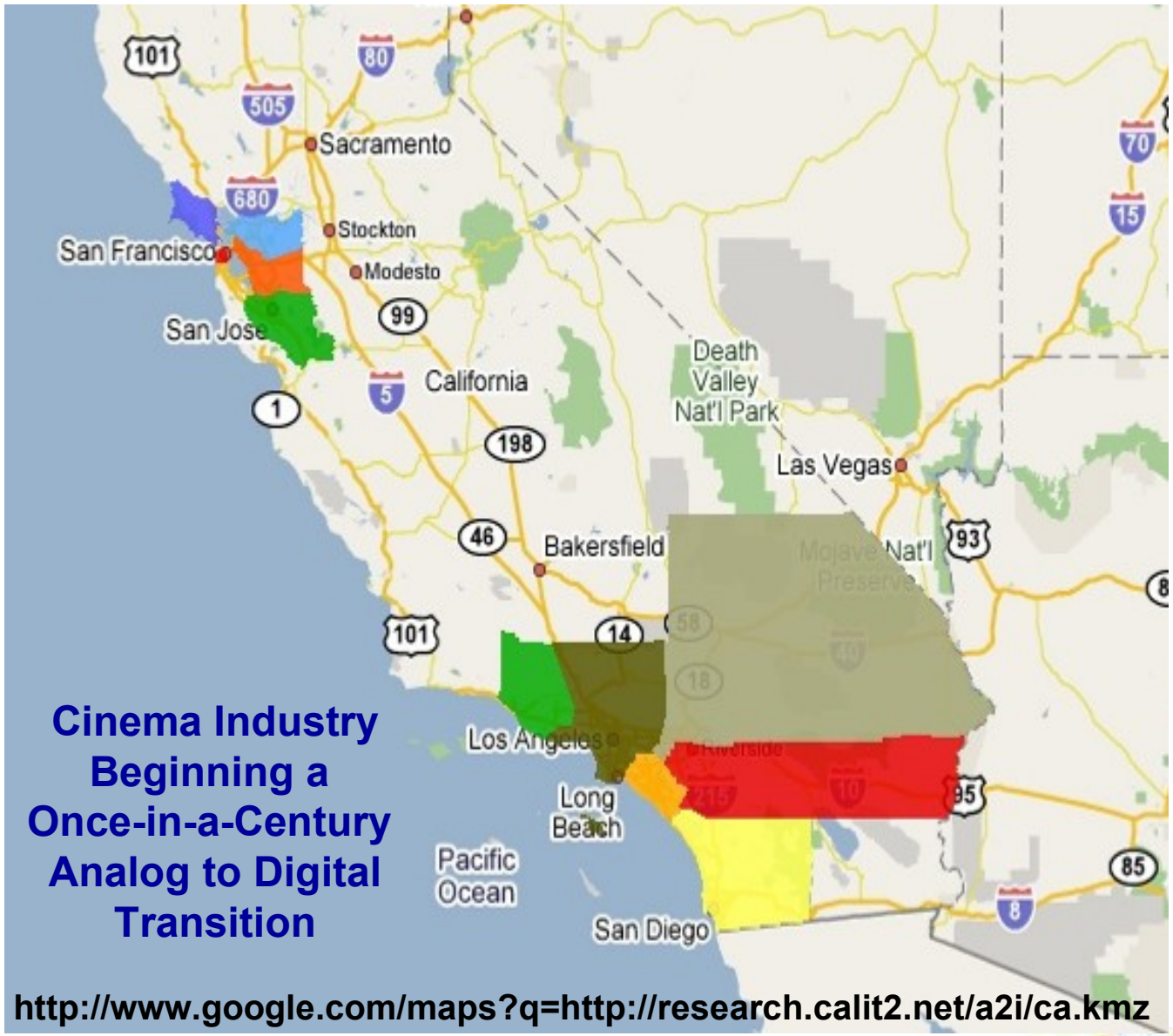
Economic Impact of Cinema in California

Major Employment from Movie Industry in California by County

In 2005, movie production provided employment for over 245,000 Californians, with an associated payroll of more than $17 billion

A 2-hour movie digitally scanned and compressed at 500Mb/s takes 450 GBytes

Hollywood alone makes 250 movies a year

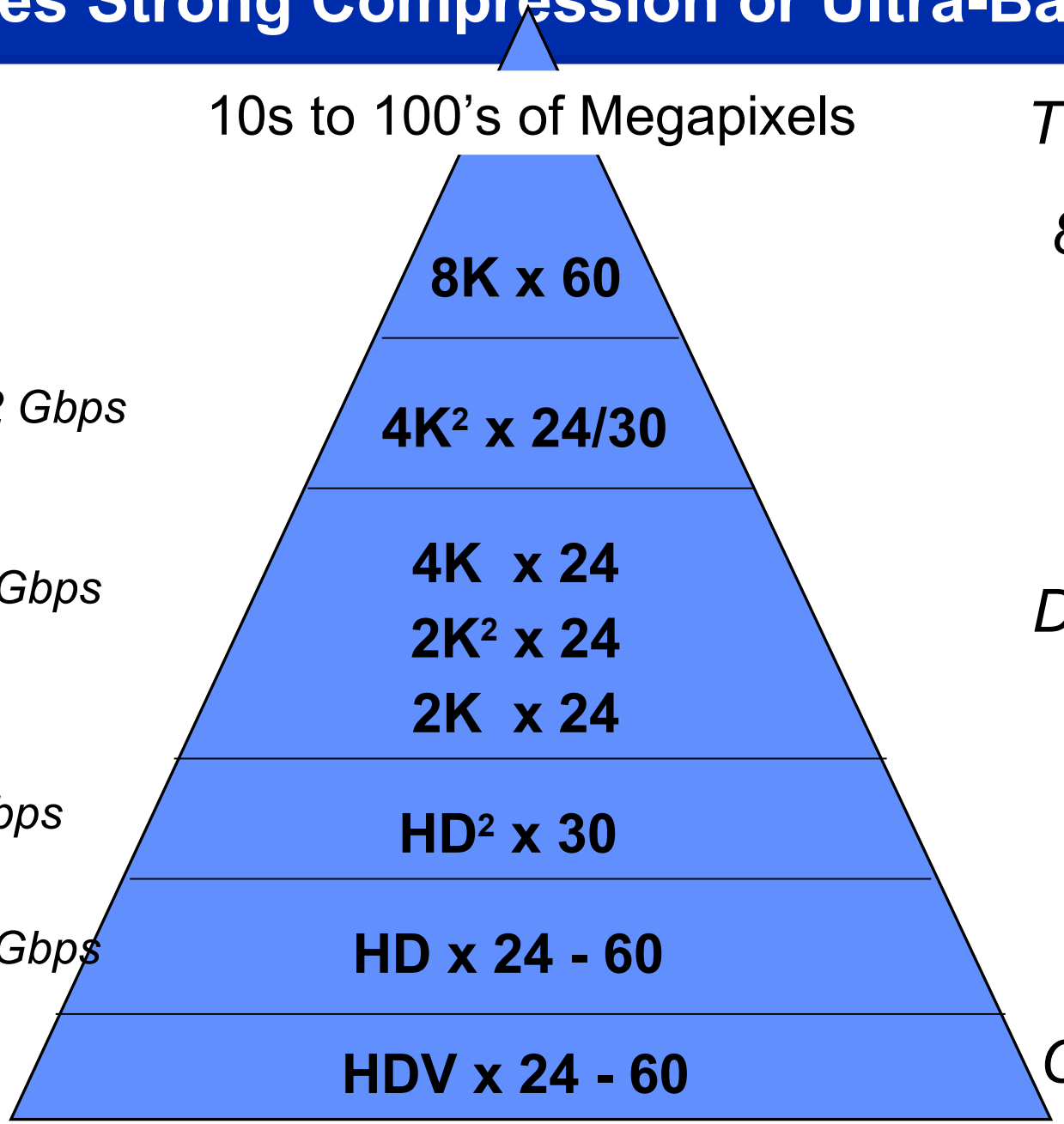


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Source: Laurin Herr and Jerry Sheehan

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Digital Video Streams: Requires Strong Compression or Ultra-Bandwidth



10 - 100's Gbps	*Tiled Displays*
1 - 24 Gbps	*8K (projector)*
500 Mbps - 15.2 Gbps	*Stereo 4K*
250 Mbps - 7.6 Gbps	*Digital Cinema*
200 Mbps - 3 Gbps	*Stereo HD*
100 Mbps - 1.5 Gbps	*HDTV*
25 Mbps	*Consumer HD*

Source: Laurin Herr

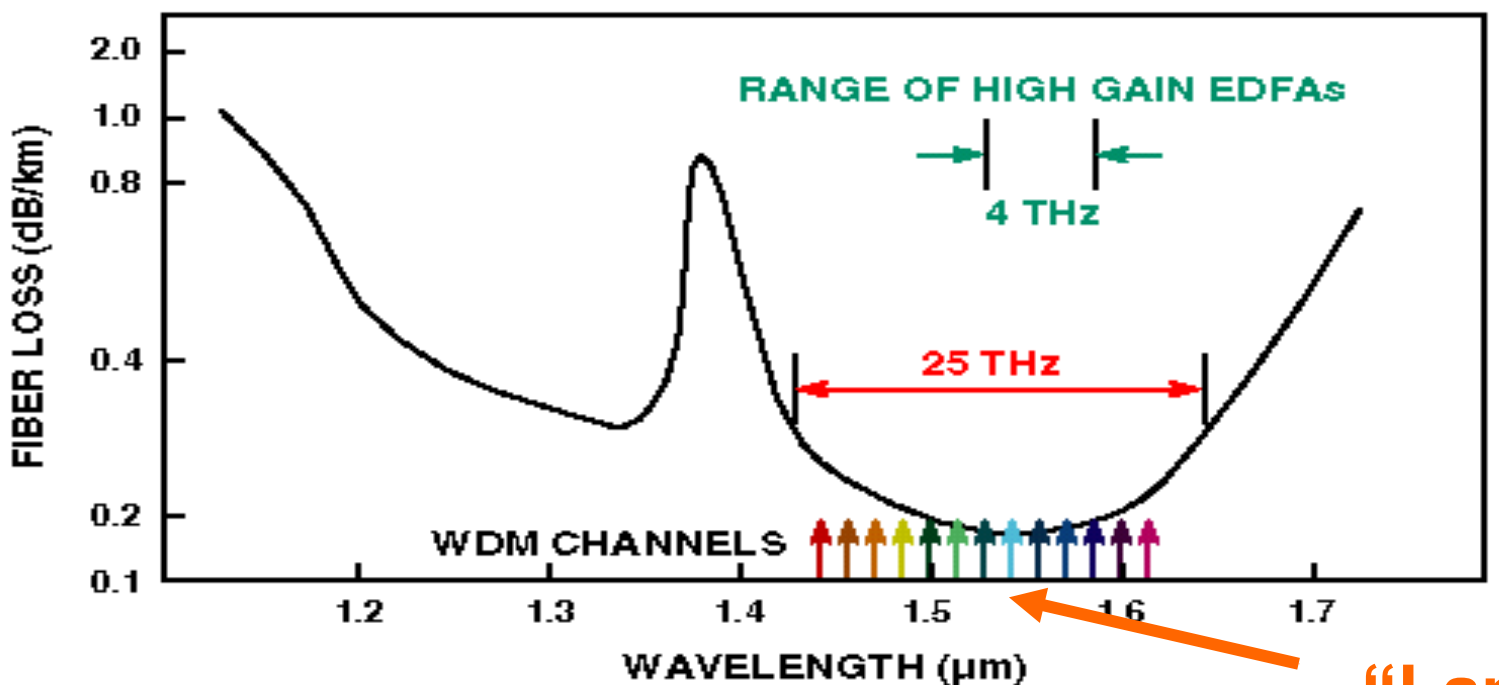
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Dedicated Optical Fiber Channels Makes High Performance Digital Cinema Streaming Possible

WAVELENGTH DIVISION MULTIPLEXING (WDM)

10 Gbps per User ~ 500x Shared Internet Throughput

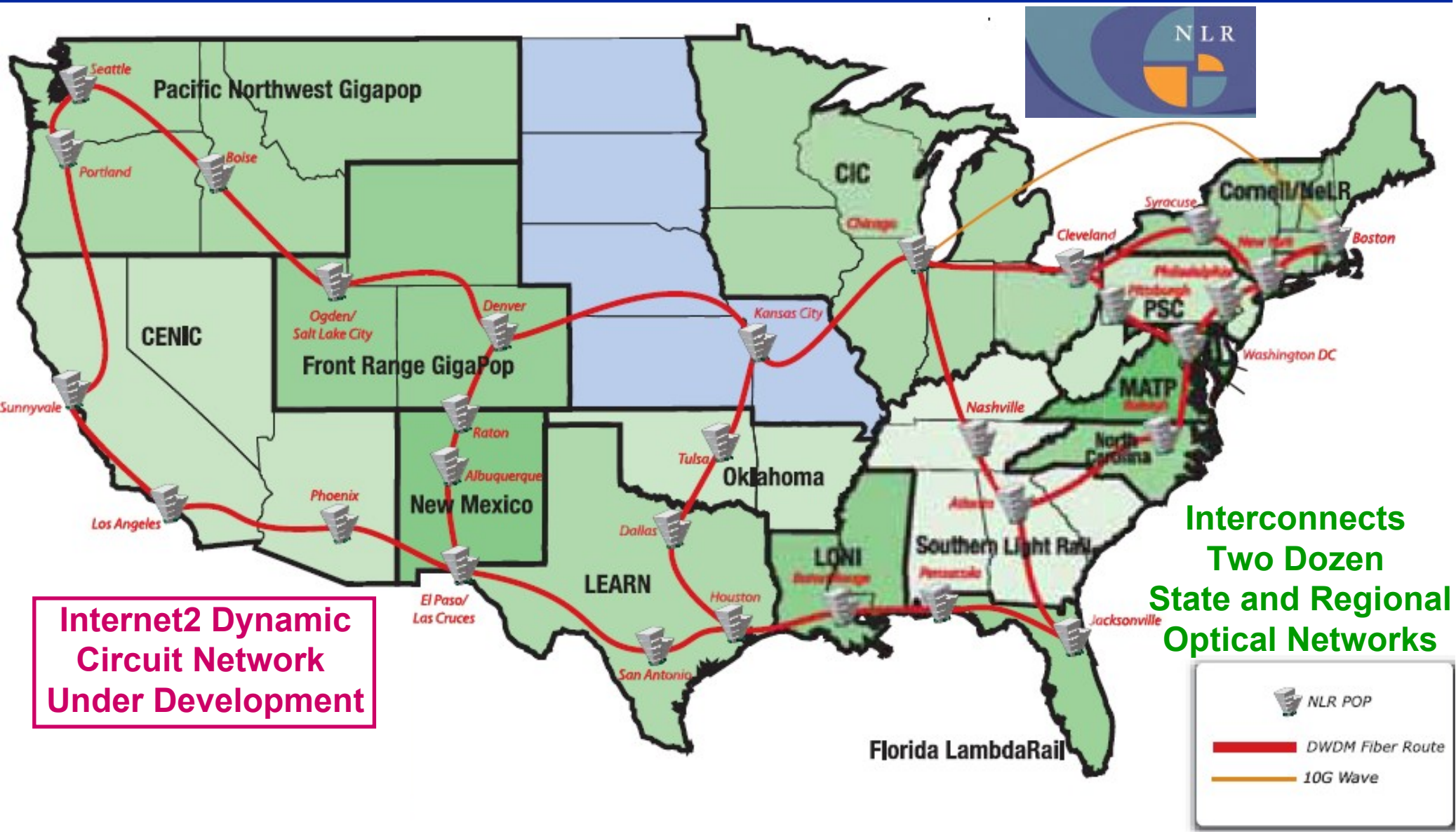
- EXPLOITS
  - ENORMOUS BANDWIDTH OF SILICA FIBER
  - HIGH-GAIN WIDEBAND OPTICAL AMPLIFIERS



"Lambdas"

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National Lambda Rail (NLR) Provides Cyberinfrastructure Backbone for U.S. Campuses

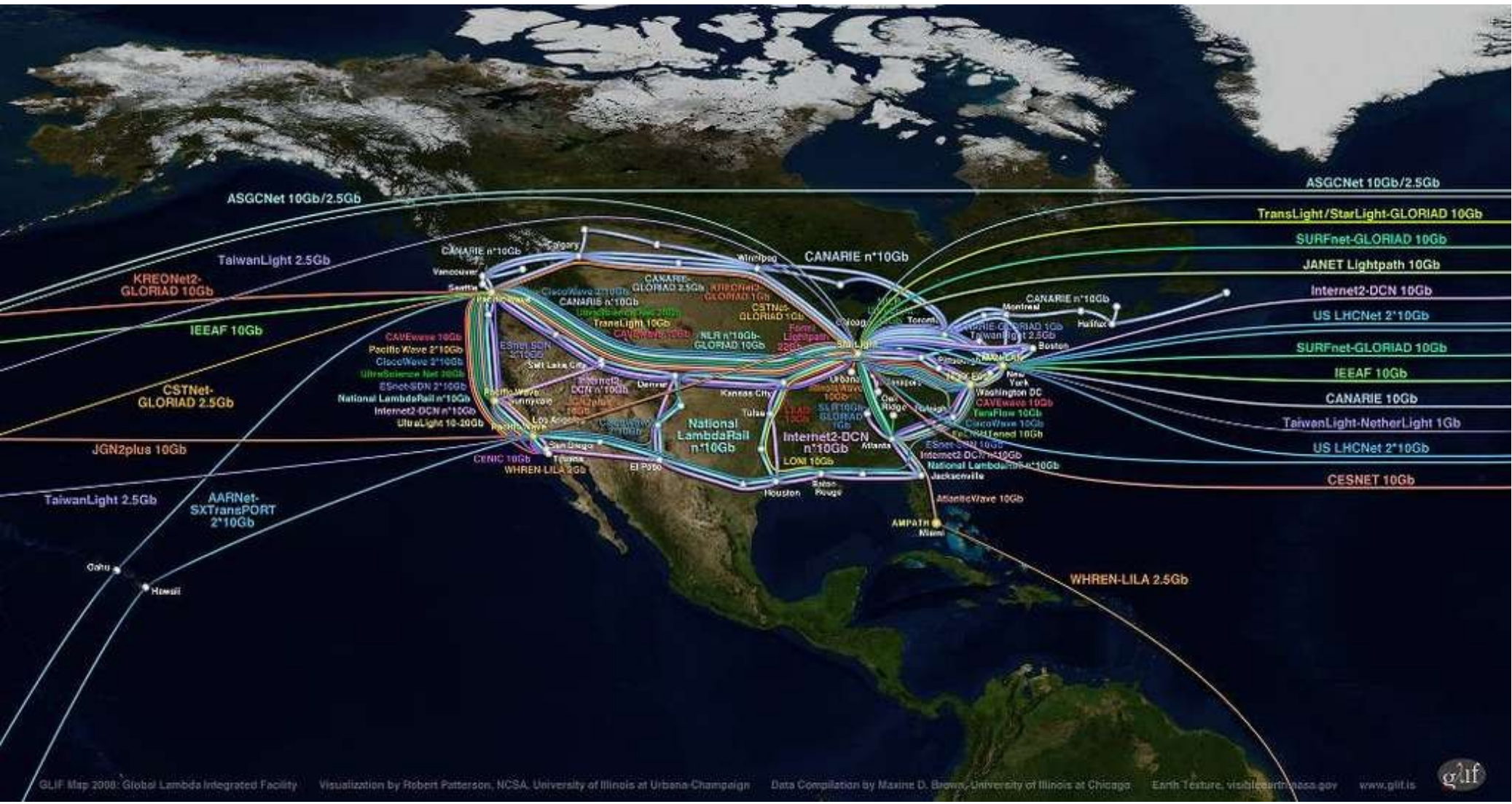


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NLR 40 x 10Gb Wavelengths
Expanding with Darkstrand to 80

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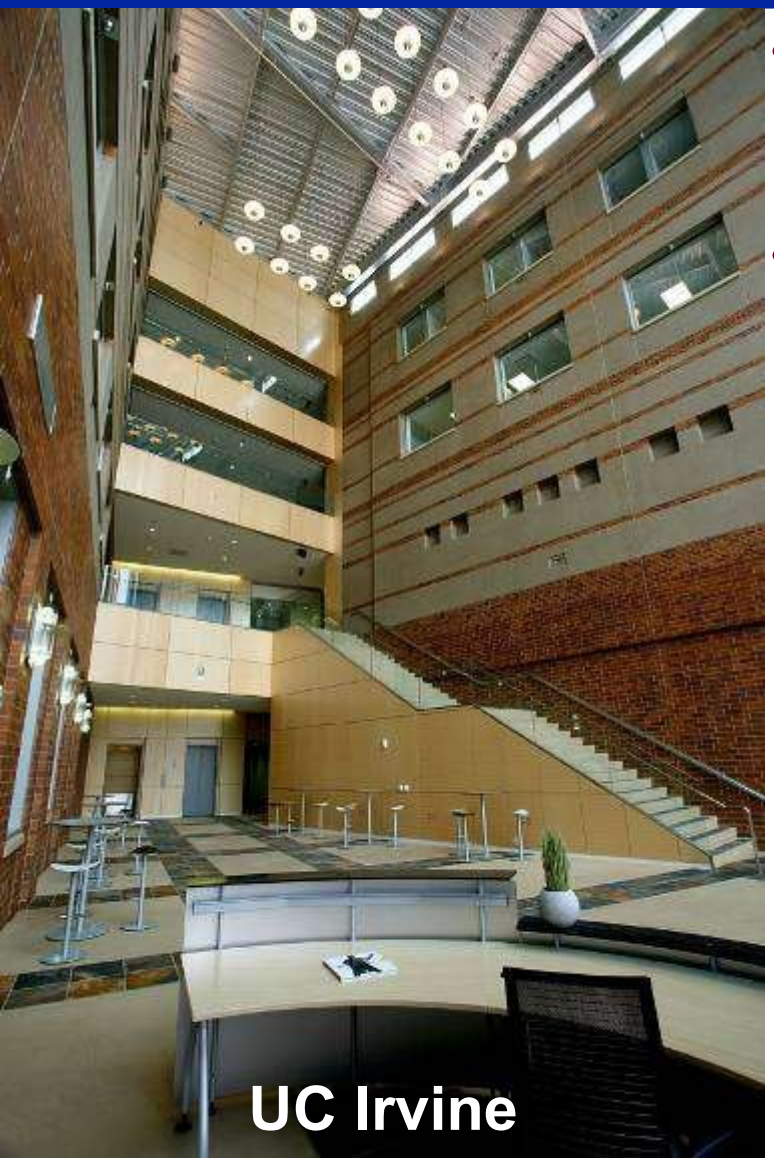
NLR/I2 is Connected Internationally via Global Lambda Integrated Facility



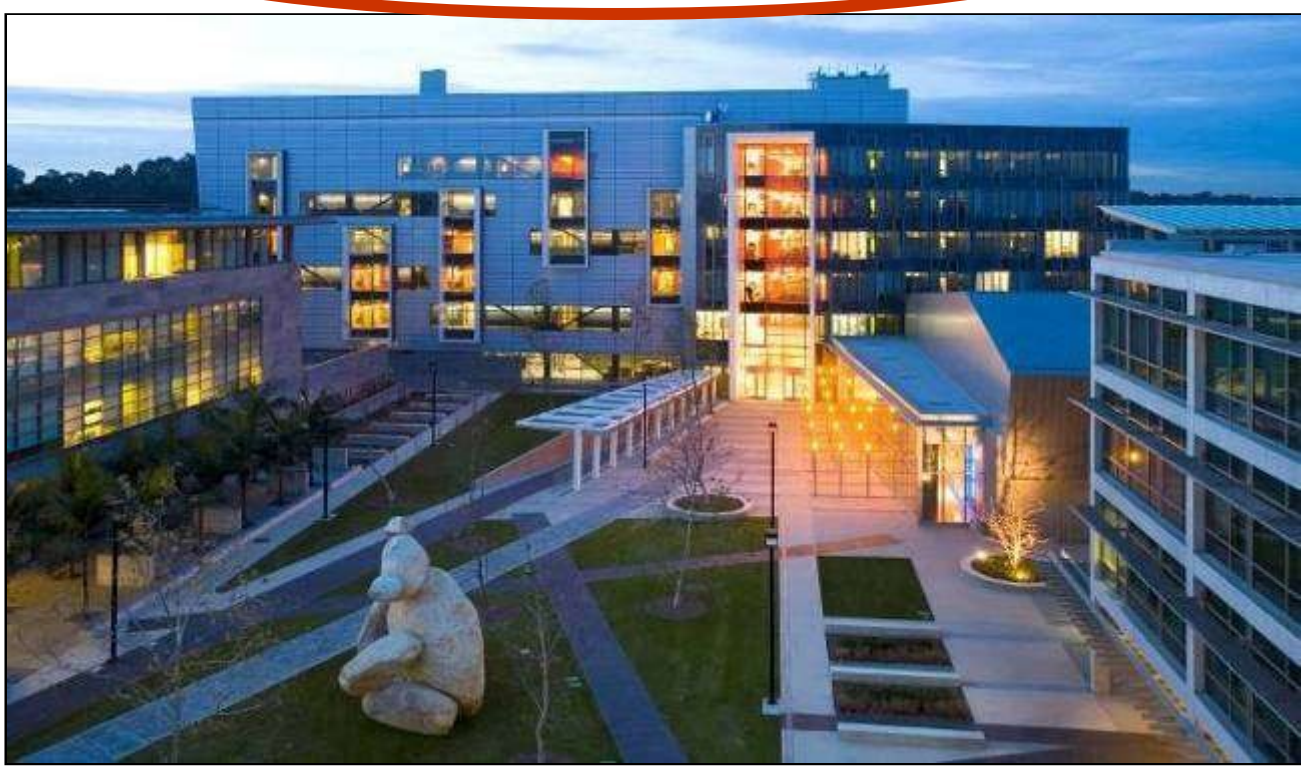
Global Testbed for Data Intensive Applications

Source: Maxine Brown, UIC and Robert Patterson, NCSA

Two New Calit2 Buildings Provide New Laboratories for "Living in the Future"



- "Convergence" Laboratory Facilities
  - Nanotech, BioMEMS, Chips, Radio, Photonics
  - Virtual Reality, Digital Cinema, HDTV, Gaming
- Over 1000 Researchers in Two Buildings
  - Linked via Dedicated Optical Networks

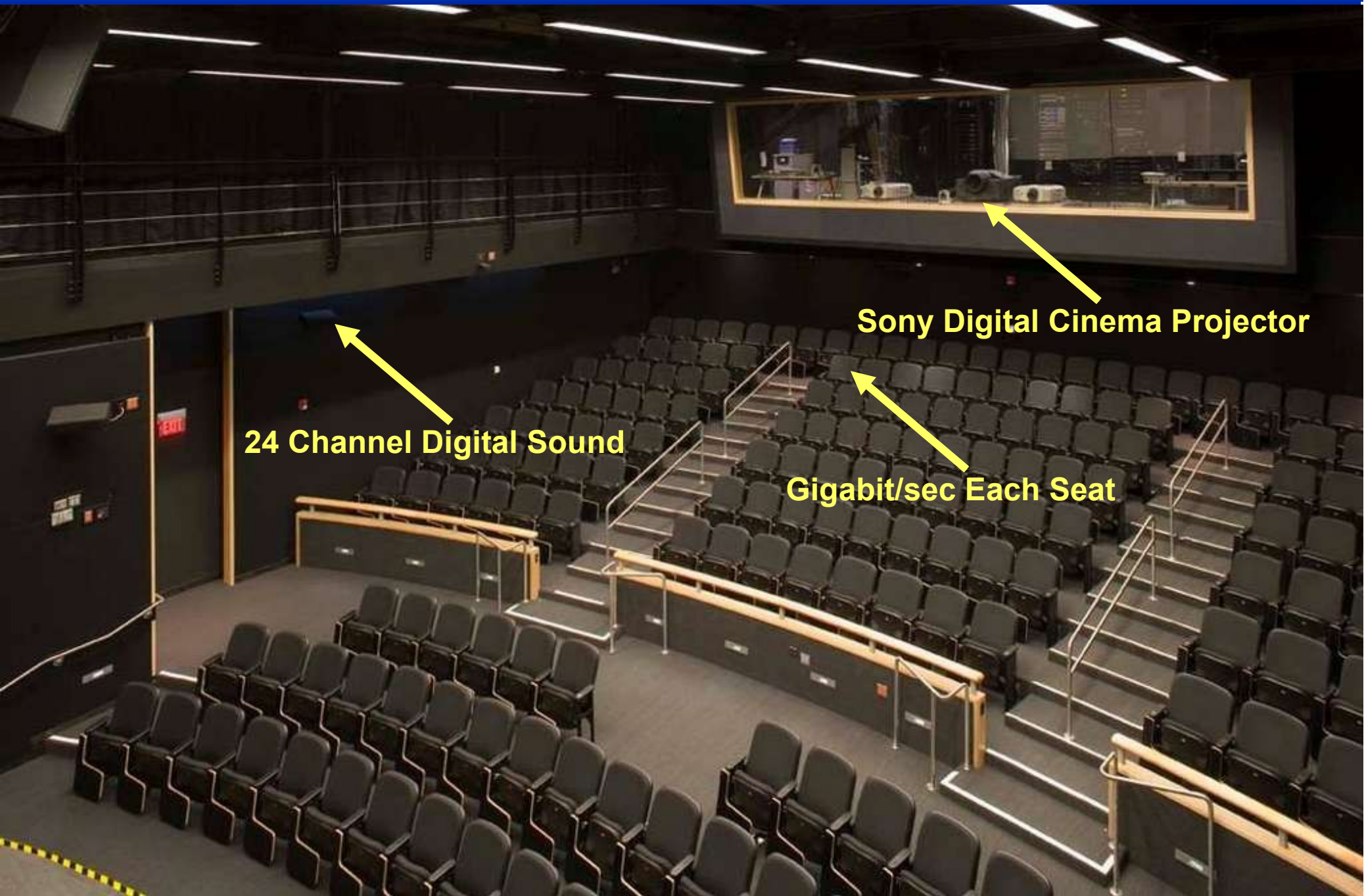


www.calit2.net

Collaborations with Over 100 Companies
Over 300 Federal Grants

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Calit2@UCSD Auditorium
Built for Global Distributed Digital Cinema



Calit2 3D Immersive StarCAVE: Enables Exploration of High Resolution Virtual Worlds



MeyerSound-Calit2 Partnership

StarCAVE Audio Installation & Calibration













Calit2 Has Become a Global Hub for Optical Connections

Between University Research Centers at 10Gbps

Maxine Brown, Tom DeFanti, Co-Chairs

iGrid 2005

THE GLOBAL LAMBDA INTEGRATED FACILITY

www.igrid2005.org

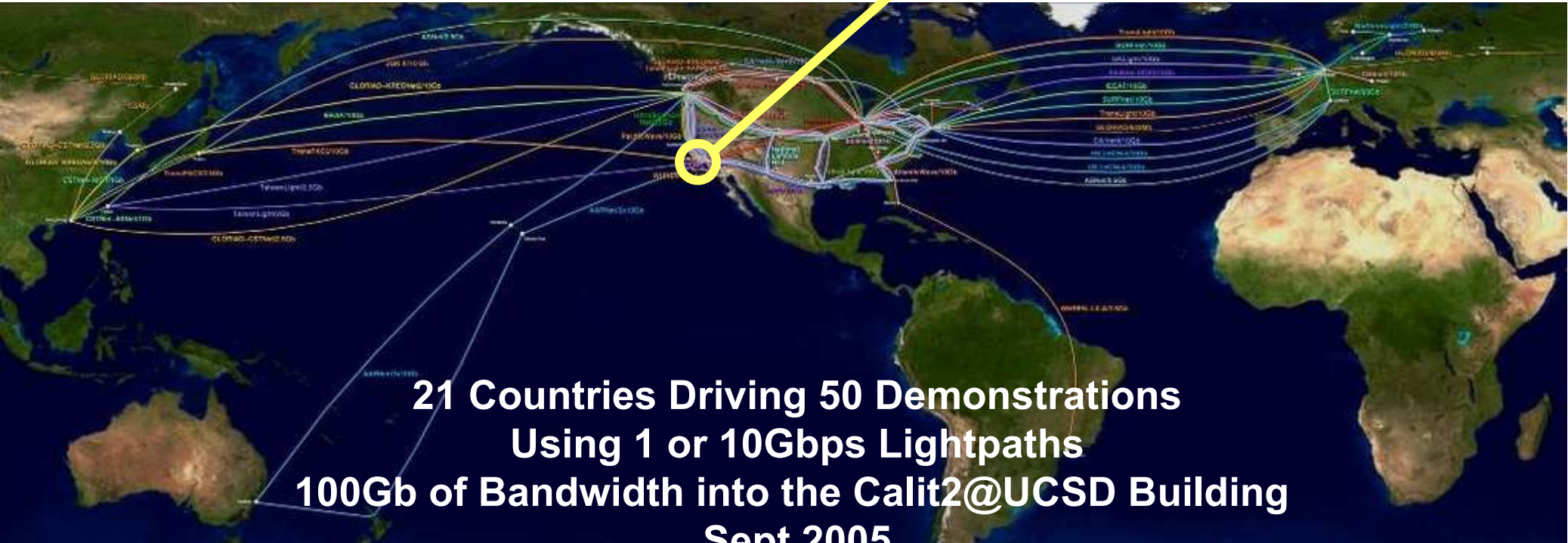


the UC Discovery Grant

September 26-30, 2005

Calit2 @ University of California, San Diego

California Institute for Telecommunications and Information Technology



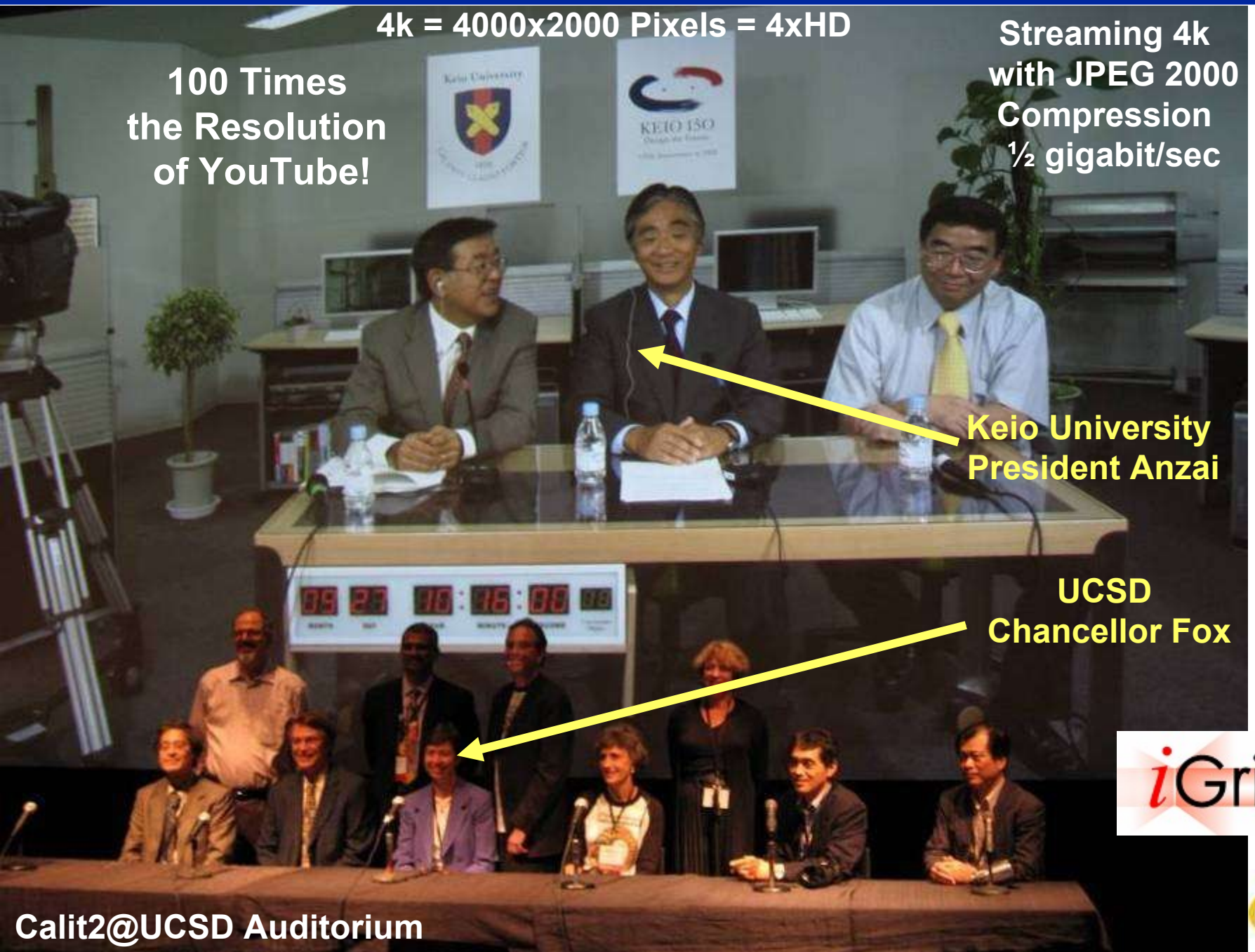
21 Countries Driving 50 Demonstrations

Using 1 or 10Gbps Lightpaths

100Gb of Bandwidth into the Calit2@UCSD Building

Sept 2005

First Trans-Pacific Super High Definition Telepresence Meeting Using Digital Cinema 4k Streams



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Lays Technical Basis for Global Digital Cinema

Sony
NTT
SGI

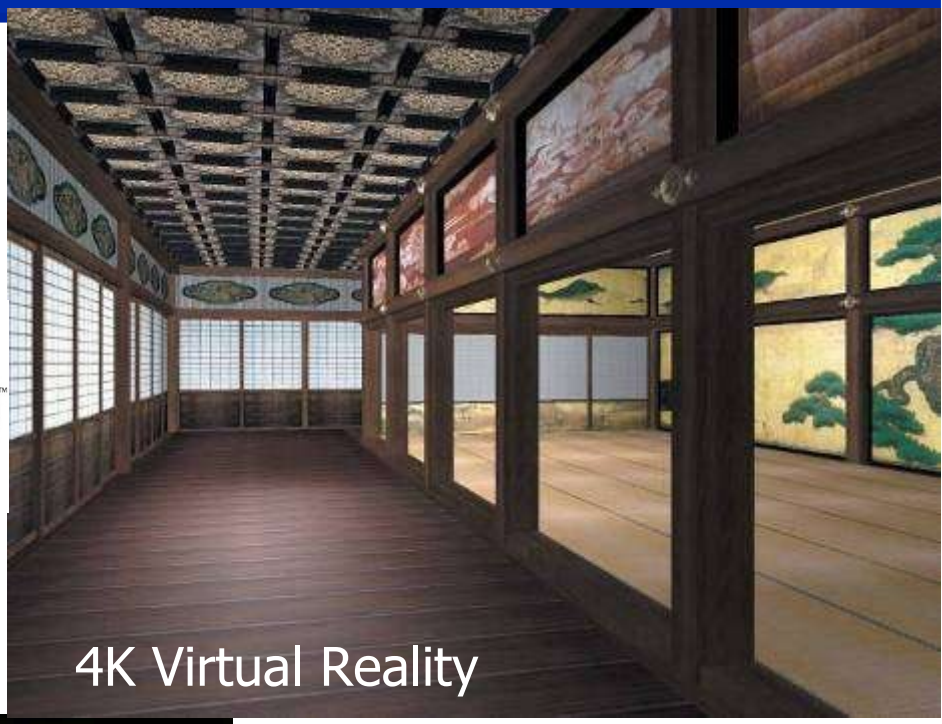
iGrid 2005

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CineGrid @ iGrid2005:
Six Hours of 4K Projected in Calit2 Auditorium

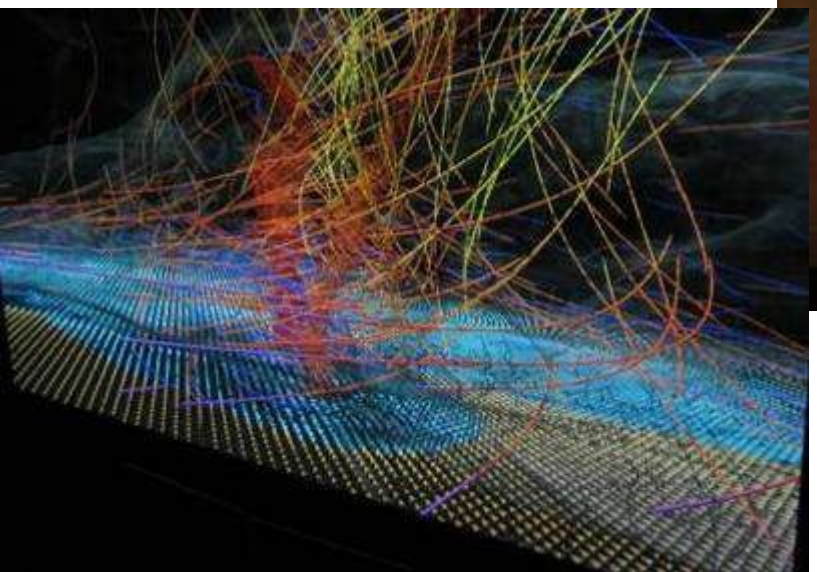
4K Distance Learning





4K Virtual Reality

4K Scientific Visualization





4K Digital Cinema

4K *Anime*



Source: Laurin Herr

What is CineGrid?

- **CineGrid is a non-profit international membership organization.**

- **CineGrid's mission is to build an interdisciplinary community focused on the research, development, and demonstration of networked collaborative tools to enable the production, use and exchange of very high-quality digital media over high-speed photonic networks.**

- **Members of CineGrid are a mix of media arts schools, research universities, scientific laboratories, post-production facilities and hardware/software developers around the world connected by 1 Gigabit Ethernet and 10 Gigabit Ethernet networks used for research and education.**

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www.cinegrid.org

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CineGrid – a Public/Private Global Partnership Founding Members

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

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CineGrid
Institutional Members

- California Academy of Sciences
- Cinepost, ACE Prague
- Dark Strand
- i2CAT
- JVC America
- Korea Advanced Institute of Science and Technology (KAIST)
- Louisiana State University, Center for Com and Tech
- Mechdyne Corporation
- Meyer Sound Laboratories
- Nortel Networks
- Renaissance Computing Initiative (RENCI)
- SARA
- Sharp Corporation Japan
- Sharp Labs USA
- Swedish Royal Institute of Technology
- Tohoku University/Kawamata Lab
- Waag Society

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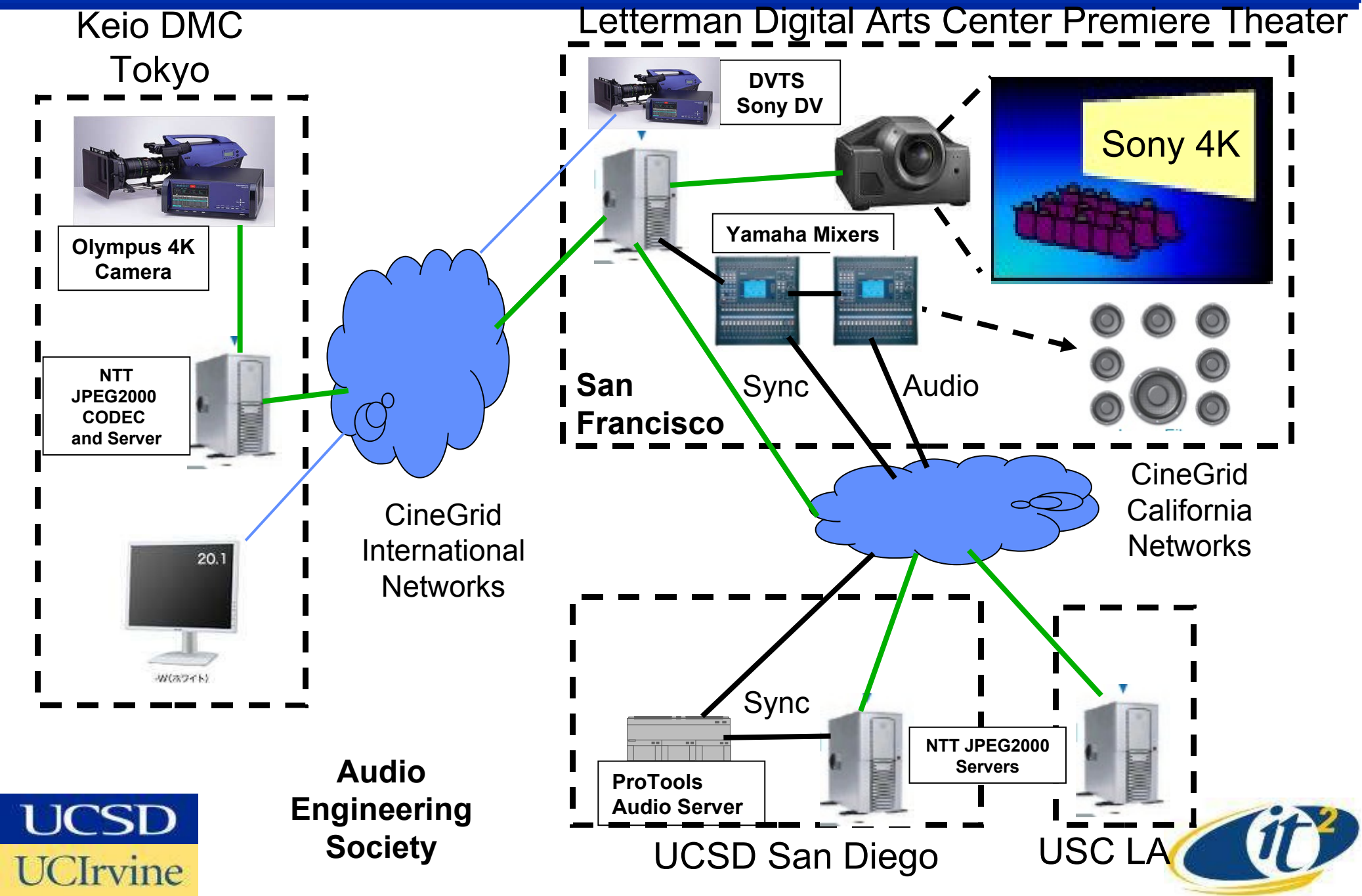
CineGrid
Network/Exchange Members

- CANARIE
- CENIC
- CESNET
- CzechLight
- Internet 2
- JANET
- Japan Gigabit Network 2
- National LambdaRail
- NetherLight
- Pacific Wave
- Pacific North West GigaPOP
- StarLight
- SURFnet
- WIDE

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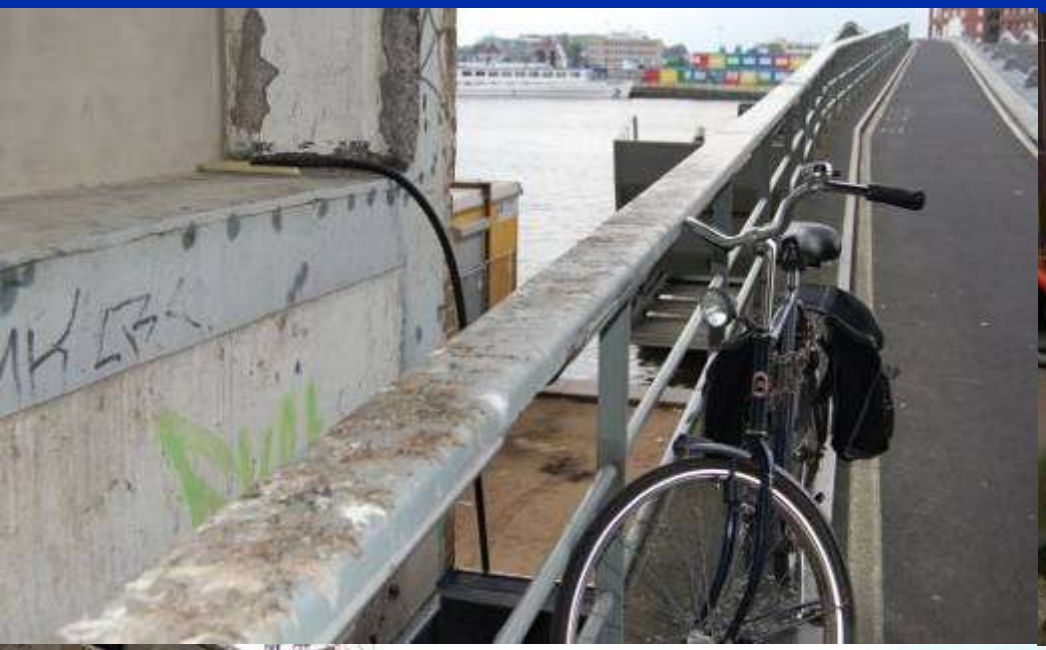
Cinegrid Extreme Audio Networking With 4k Demo at Audio Engineering Society Meeting at LucasFilm's LDAC



CineGrid @ AES 2006
Keio Wagner Society String Ensemble



Swimming Fiber the Last 500m to the Muziekgebouw: CineGrid @ Holland Festival 2007









CineGrid @ Holland Festival 2007
As Seen In the Calit2@UCSD Auditorium



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Era la Notte, June 20-21, 2007 (Live!)

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CineGrid International Workshop 2007
Calit2@UCSD in San Diego



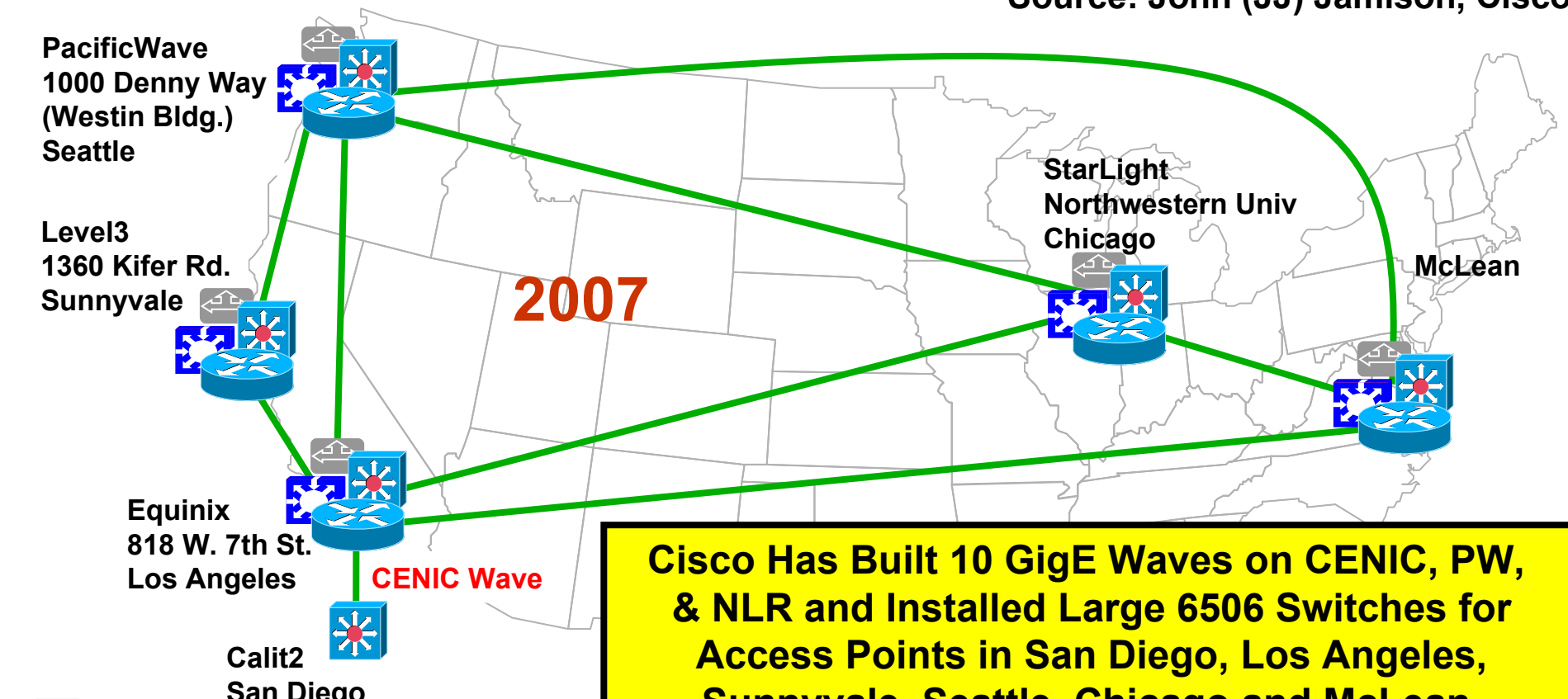
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Next CineGrid Workshop:
December 7-10, 2008

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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

CineGrid Exchange

- **CineGrid Exchange will Collect High Quality Digital Media Assets, Including (But not Limited to) 4K, 2K, HD, SD, Mono & Stereo, Still & Motion Pictures, Plus Audio with Various Channel Counts**

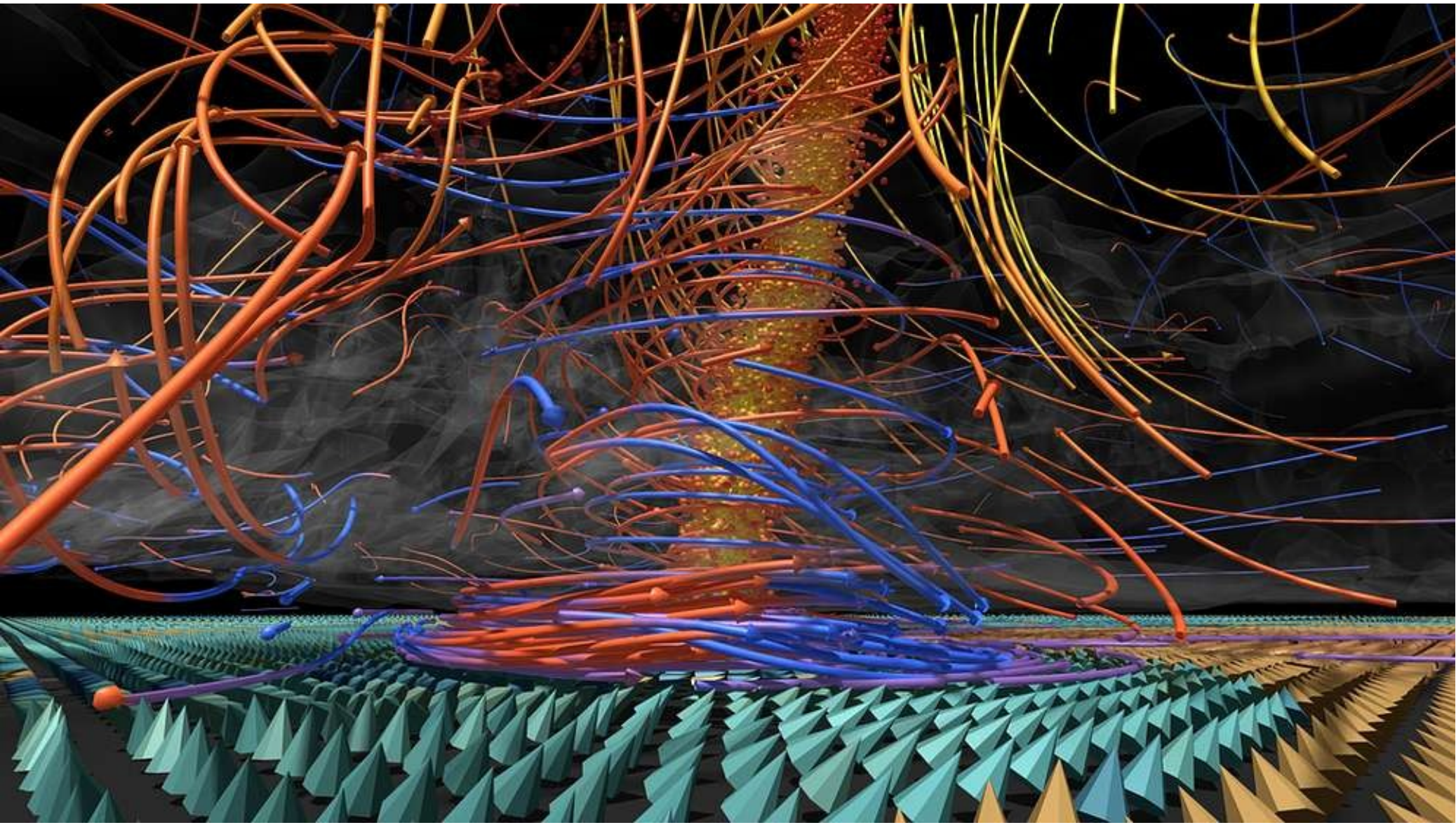
- **CineGrid Exchange Stores its Digital Media Assets at Multiple Sites Linked By Secure Fast Networks**
  - **Keio DMC (Tokyo)**
  - **UCSD/Calit2 (San Diego)**
  - **UvA/SARA (Amsterdam)**

- **CineGrid Exchange Assets will be Made Accessible to Cinegrid Members**

- **CineGrid Exchange will Support Member-Driven Testbeds for:**
  - **Networked Digital Media Asset Management,**
  - **Transcoding,**
  - **Distribution and Preservation Experiments**

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Rendering Supercomputer Data at Digital Cinema Resolution

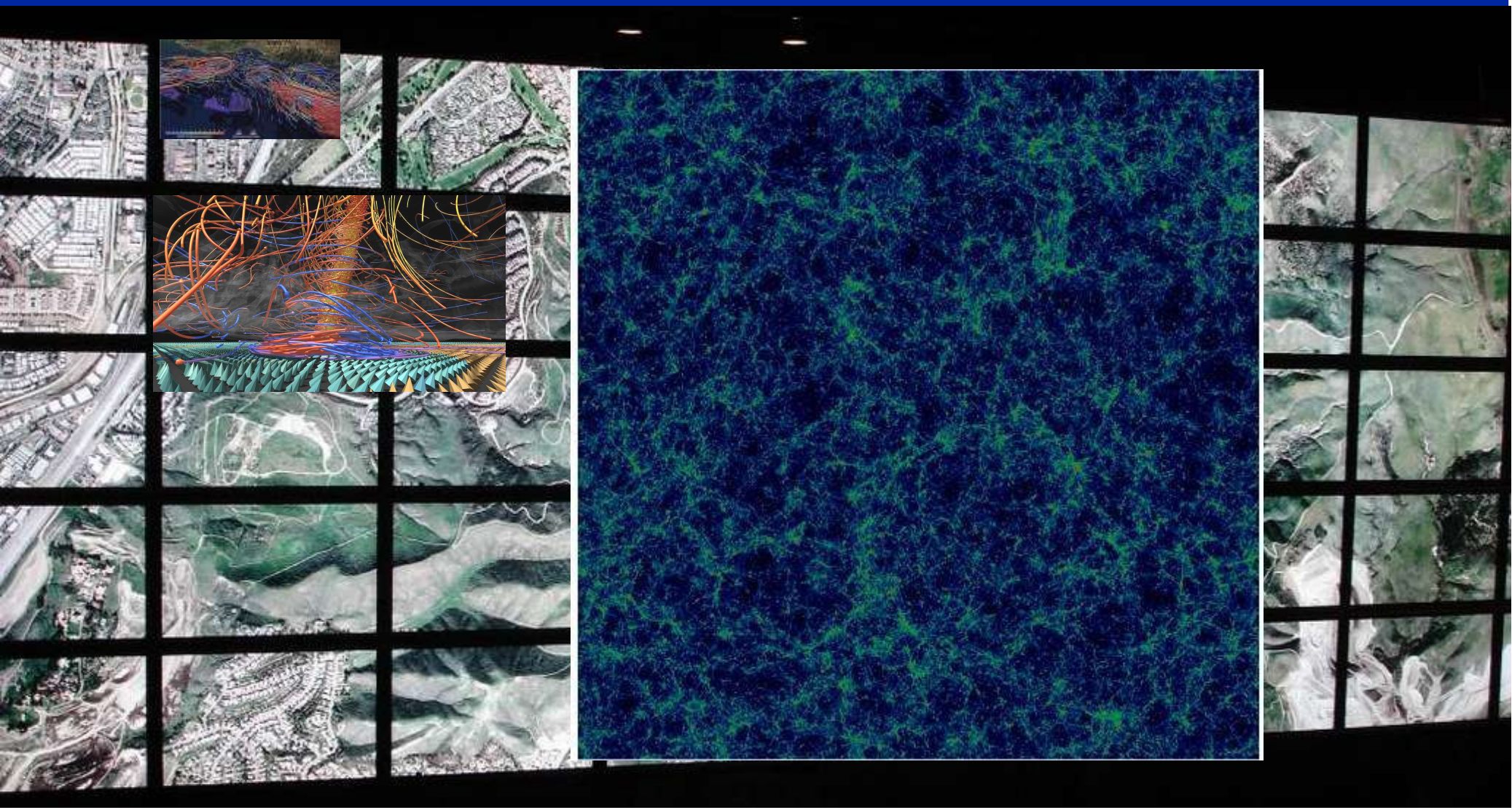


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Source: Donna Cox, Robert Patterson, Bob Wilhelmson, NCSA

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Beyond 4k-
OptIPortals Scaling to ¼ Billion Pixels

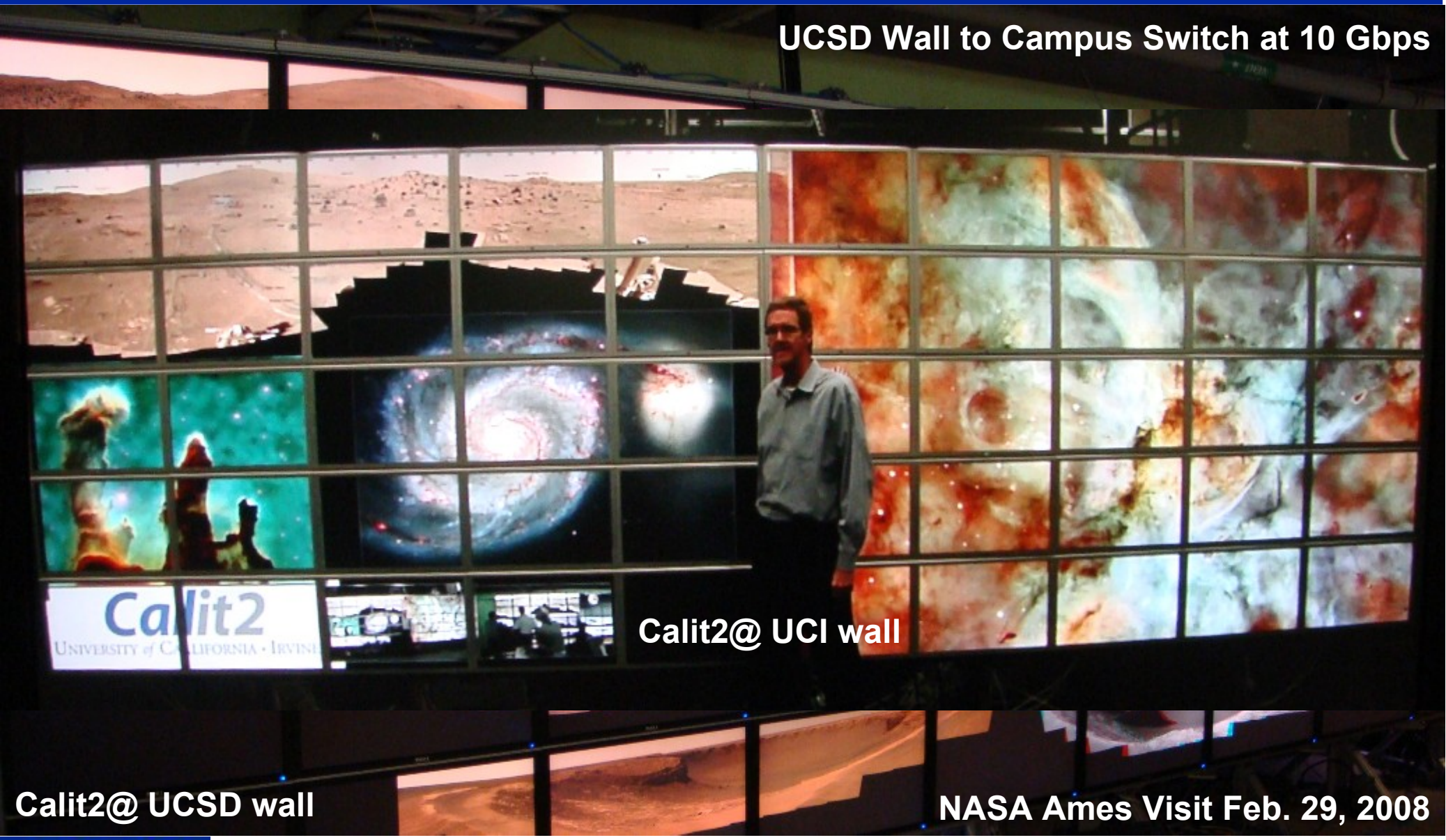


Goal: Link Norman's Lab OptIPortal
Over Quartzite, CENIC, NLR/TeraGrid to
Petascale Track 2 at Ranger@TACC and Kraken@NICS
by October 2008

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The Calit2 1/4 Gigapixel OptIPortals at UCSD and UCI Are Joined to Form a Gbit/s HD Collaboratory



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UCSD cluster: 15 x Quad core Dell XPS with Dual nVIDIA 5600s
UCI cluster: 25 x Dual Core Apple G5

Launch of the 100 Megapixel OzIPortal Over Qvidium Compressed HD on 1 Gbps CENIC/PW/AARNet Fiber



January 15, 2008

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No Calit2 Person Physically Flew to Australia to Bring This Up!

www.calit2.net/newsroom/release.php?id=1219

evl electronic visualization laboratory

SAGE Global Visualcasting to Europe September 2007

