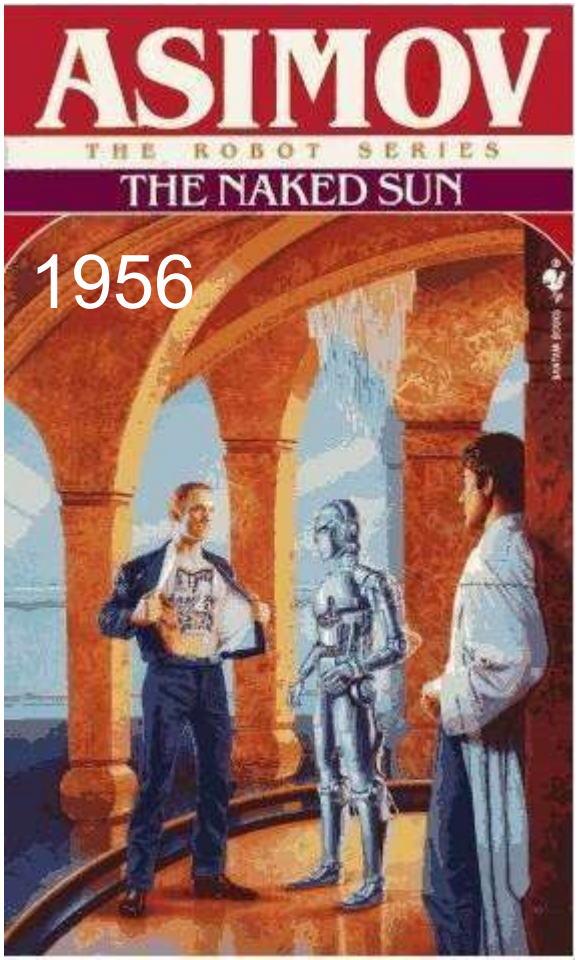
Calit2: Experiments in Living in the Virtual/Physical World

Pat Ledden Memorial Luncheon
Faculty Luncheon Seminar
UC San Diego Faculty Club
February 24, 2011

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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Over Fifty Years Ago, Asimov Described a World of Telepresence



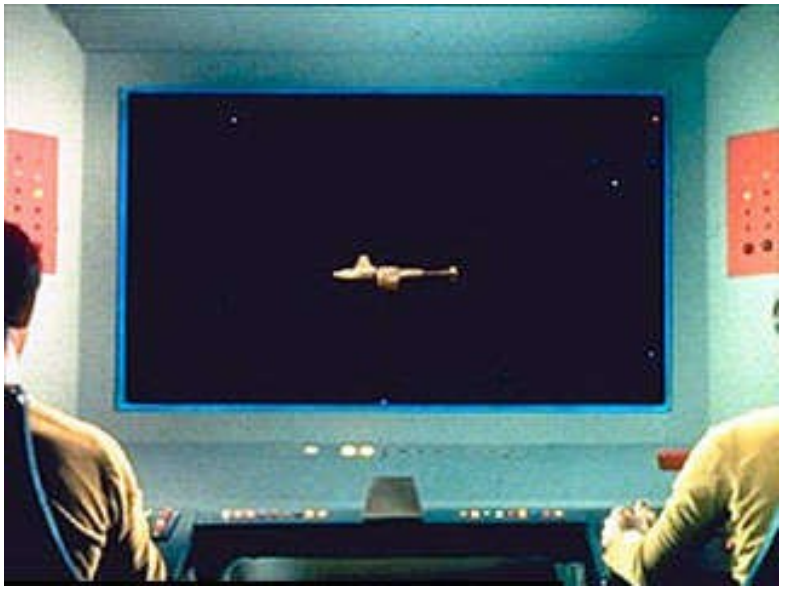
A policeman from Earth, where the population all lives underground in close quarters, is called in to investigate a murder on a distant world. This world is populated by very few humans, rarely if ever, coming into physical proximity of each other. Instead the people "View" each other with trimensional “holographic” images.

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TV and Movies of 40 Years Ago Envisioned Telepresence Displays









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Source: Star Trek 1966-68; Barbarella 1968

it²

The Beginnings of Commercialization: PicturePhone Introduced 40 Years Ago

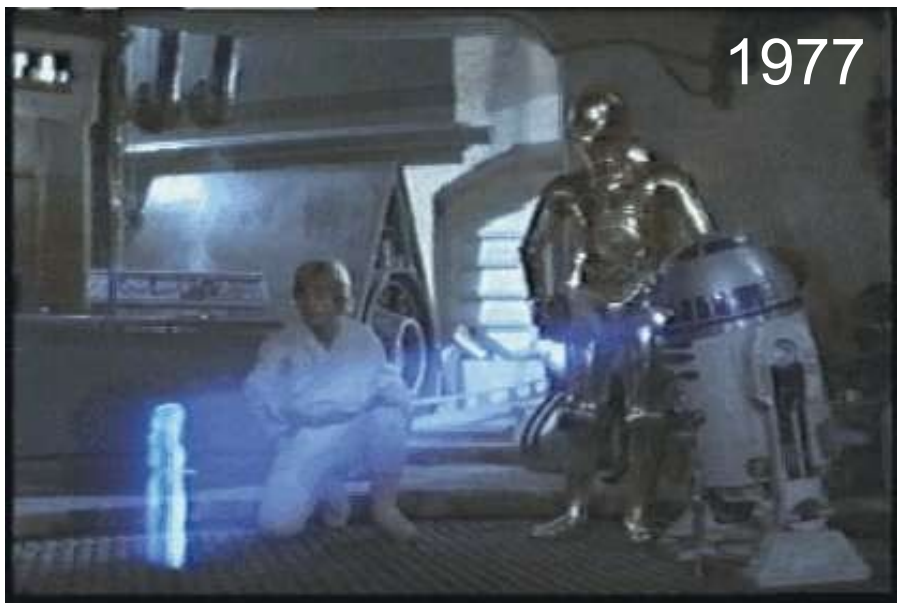


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www.bellsystemmemorial.com/telephones-picturephone.html

it²

Holographic Collaboration Coming Soon?
Science Fiction to Commercialization





Over the Sixty Years from Asimov to IBM
Real Progress Has Been Made in Eliminating Distance
For Complex Human Interactions

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The Bellcore VideoWindow -- A Working Telepresence Experiment



(1989)

"Imagine sitting in your work place lounge having coffee with some colleagues. Now imagine that you and your colleagues are still in the same room, but are separated by a large sheet of glass that does not interfere with your ability to carry on a clear, two-way conversation. Finally, imagine that you have split the room into two parts and moved one part 50 miles down the road, without impairing the quality of your interaction with your friends."

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Source: Fish, Kraut, and Chalfonte-CSCW 1990 Proceedings

it²

A Simulation of Telepresence

Using Analog Communications to Prototype the Digital Future

"What we really have to do is eliminate distance between individuals who want to interact with other people and with other computers."
— Larry Smarr, Director, NCSA

- **Televisualization:**
  - **Telepresence**
  - **Remote Interactive Visual Supercomputing**
  - **Multi-disciplinary Scientific Visualization**







"We're using satellite technology…to demo what It might be like to have high-speed fiber-optic links between advanced computers in two different geographic locations."

— Al Gore, Senator
Chair, US Senate Subcommittee on Science, Technology and Space

ATT & Sun

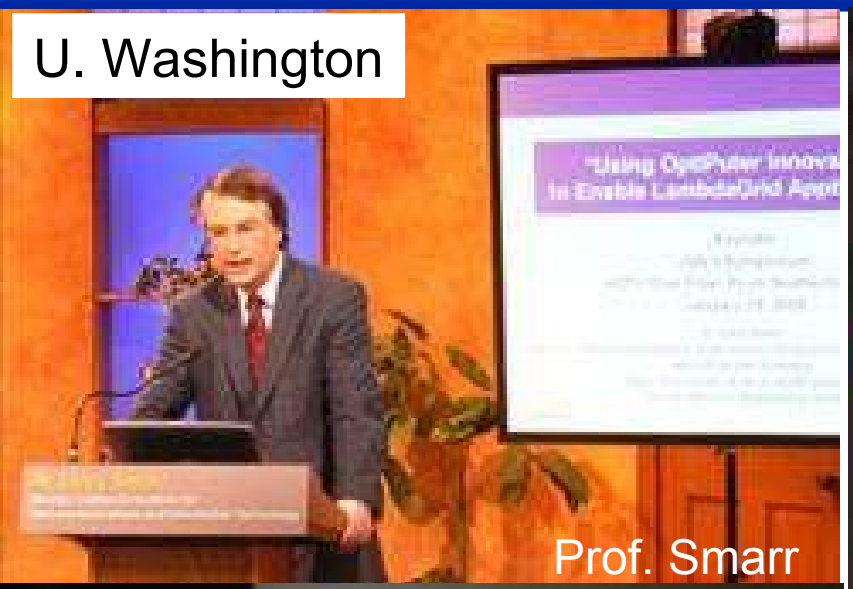
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SIGGRAPH 1989

NCSA

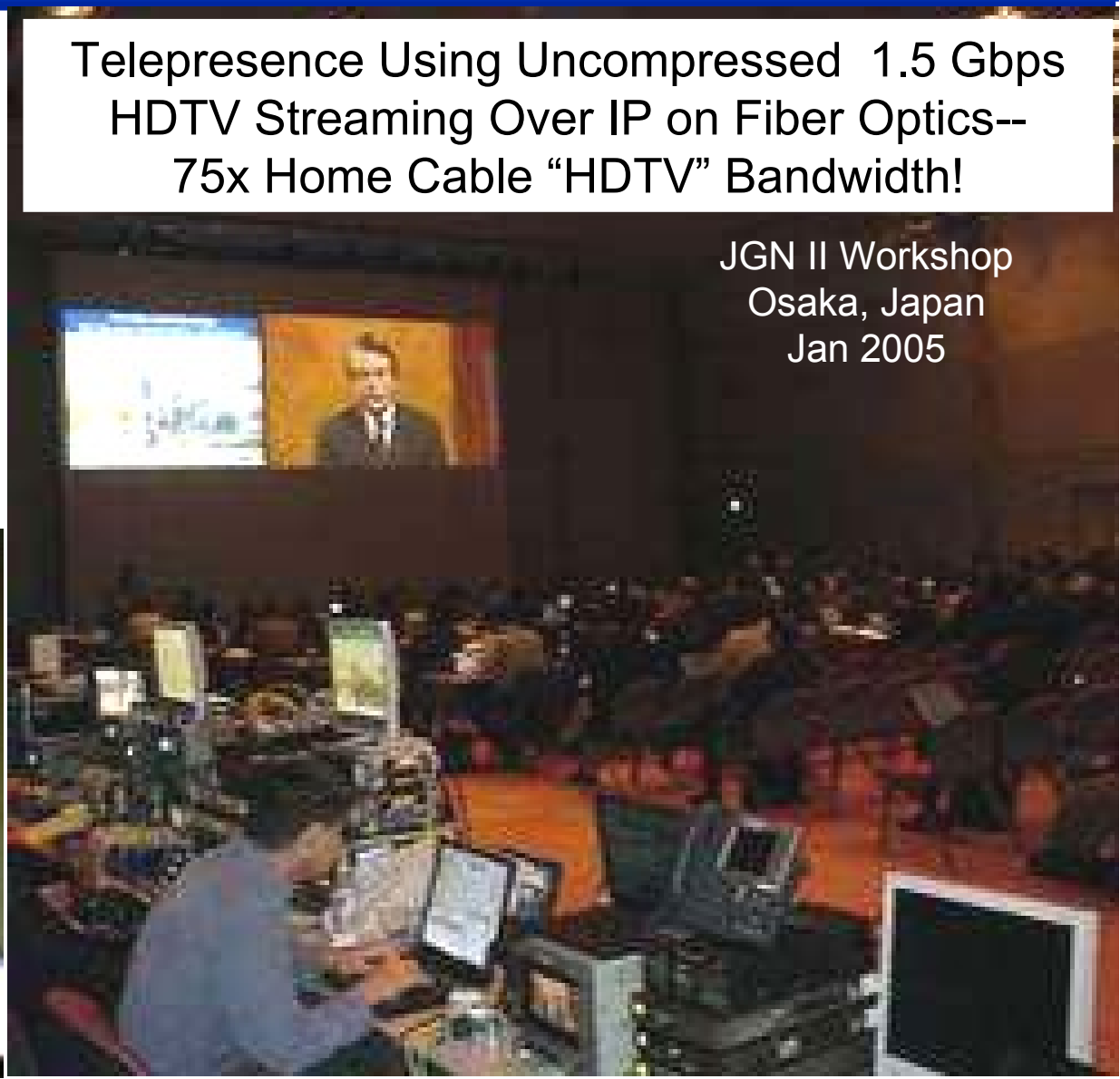
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15 Years Later, the Dream of Fiber Optic Globally Linked Telepresence Is Reality





Telepresence Using Uncompressed 1.5 Gbps HDTV Streaming Over IP on Fiber Optics-- 75x Home Cable "HDTV" Bandwidth!



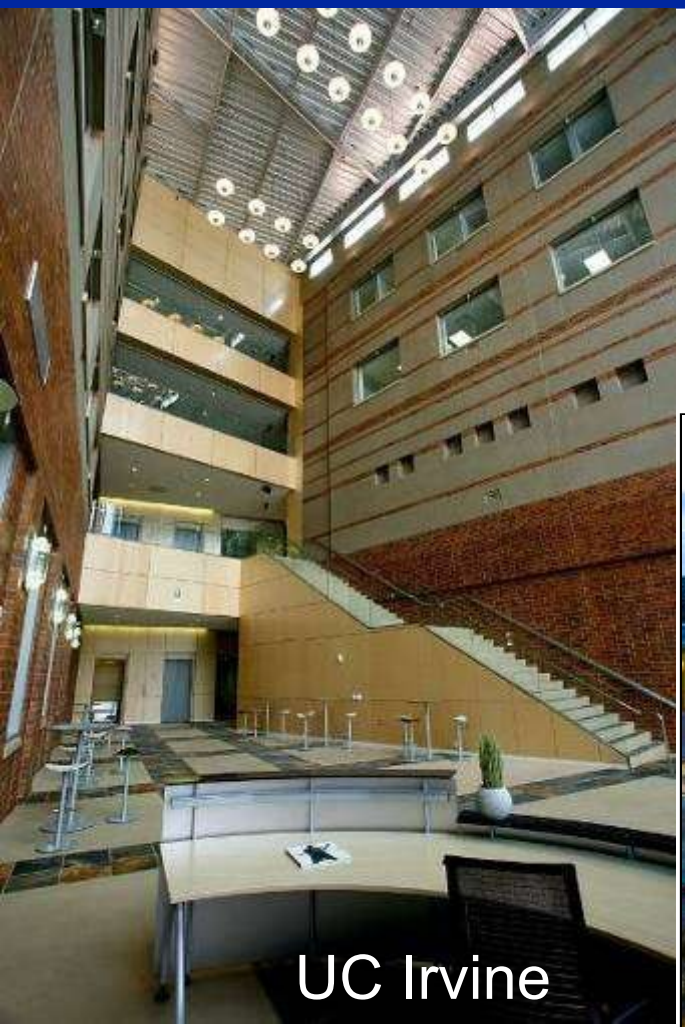
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"I can see every hair on your head!"—Prof. Aoyama

Source: U Washington Research Channel

it²

In 2005, the Two Calit2 Buildings Are Occupied-- Creating Laboratories for "Living in the Future"



- **Over 1000 Researchers in Two Buildings**
  - **Linked via Dedicated Optical Networks**
  - **International Conferences and Testbeds**
- **New Laboratories**
  - **Nanotechnology**
  - **Virtual Reality, Digital Cinema**

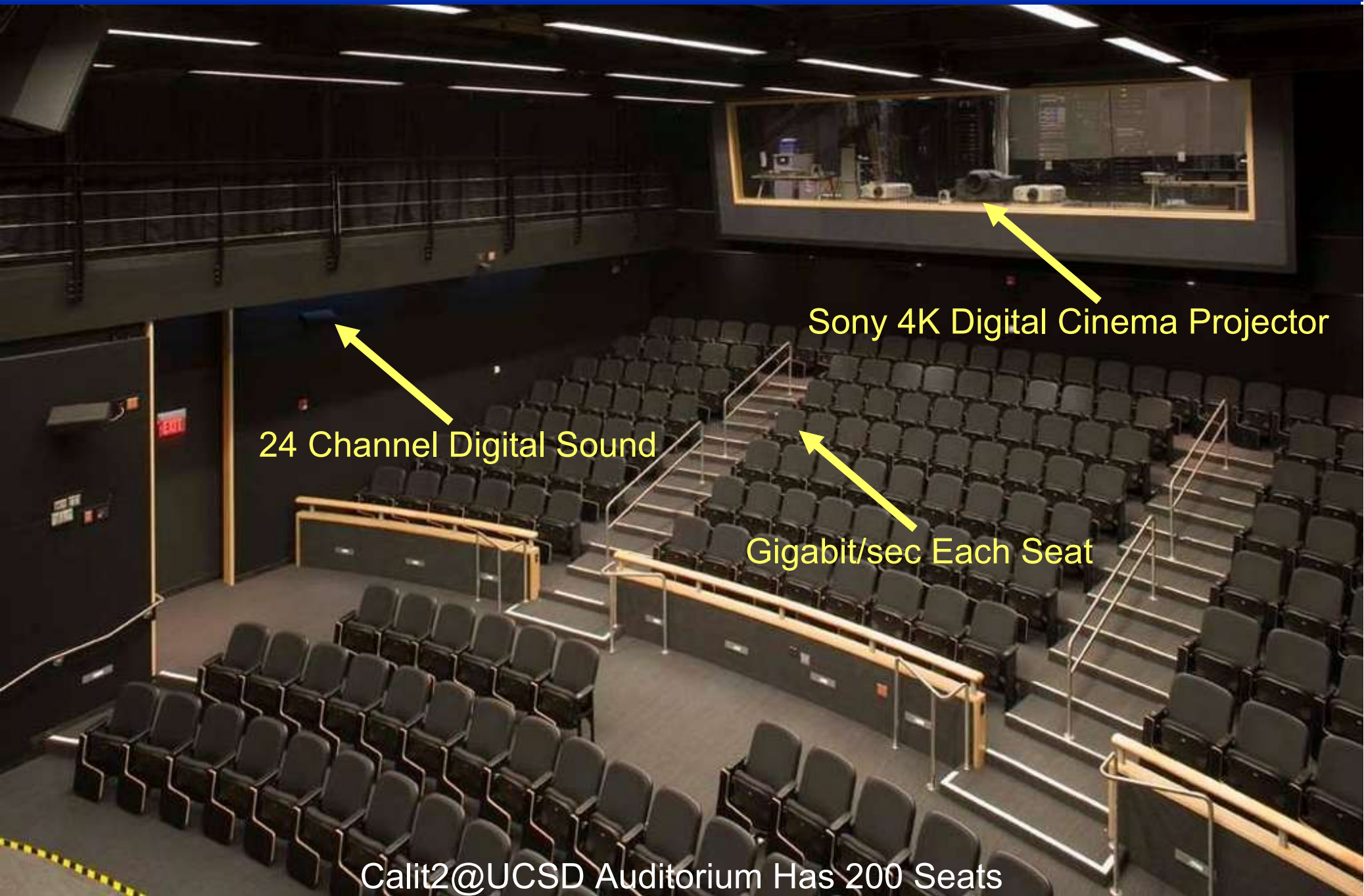


www.calit2.net

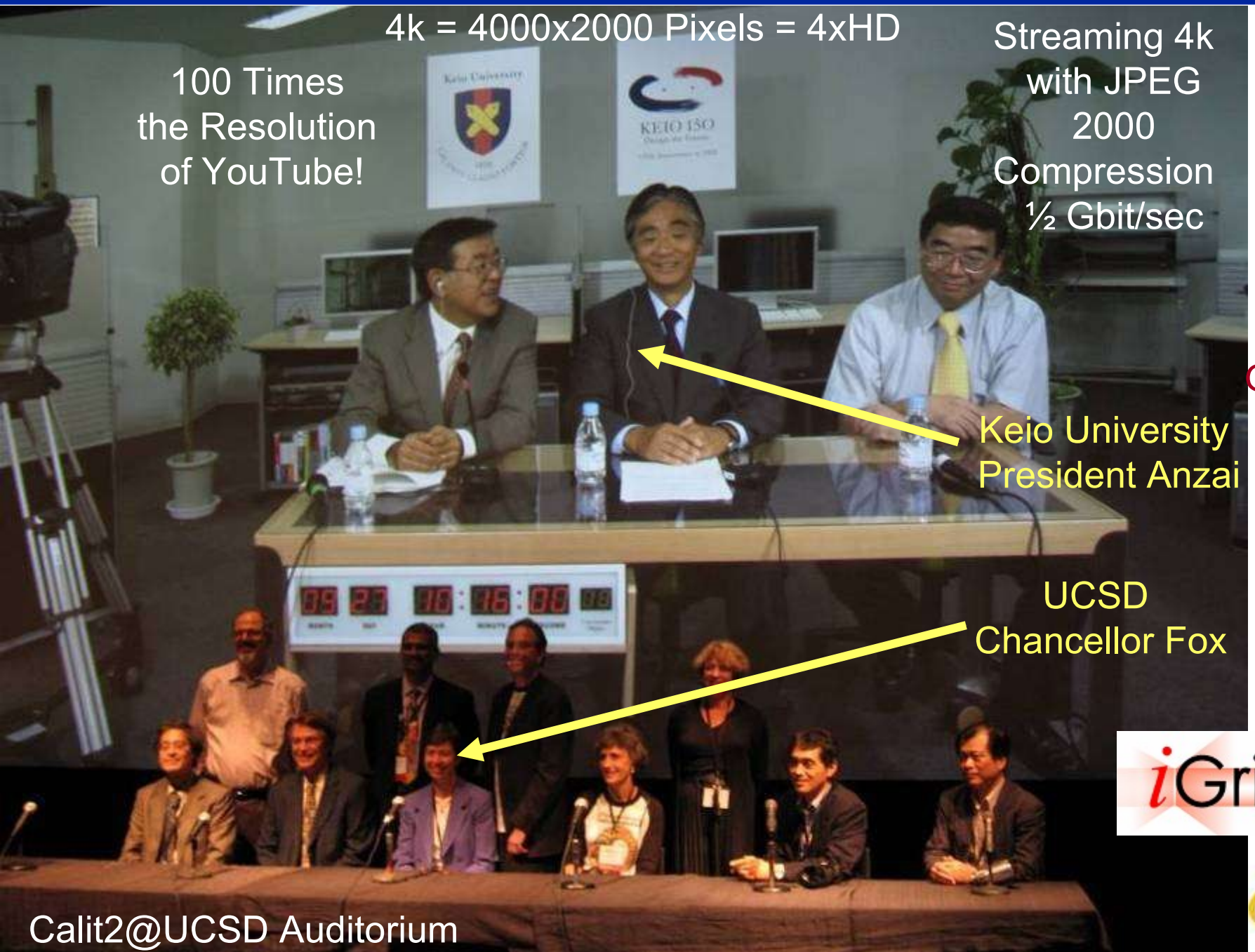
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Preparing for a World in Which Distance is Eliminated…

The Calit2@UCSD Digital Auditorium: Designed to Create a Global Collaboratorium



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



CineGrid

Lays Technical Basis for Global Digita Cinema

Sony
NTT
SGI

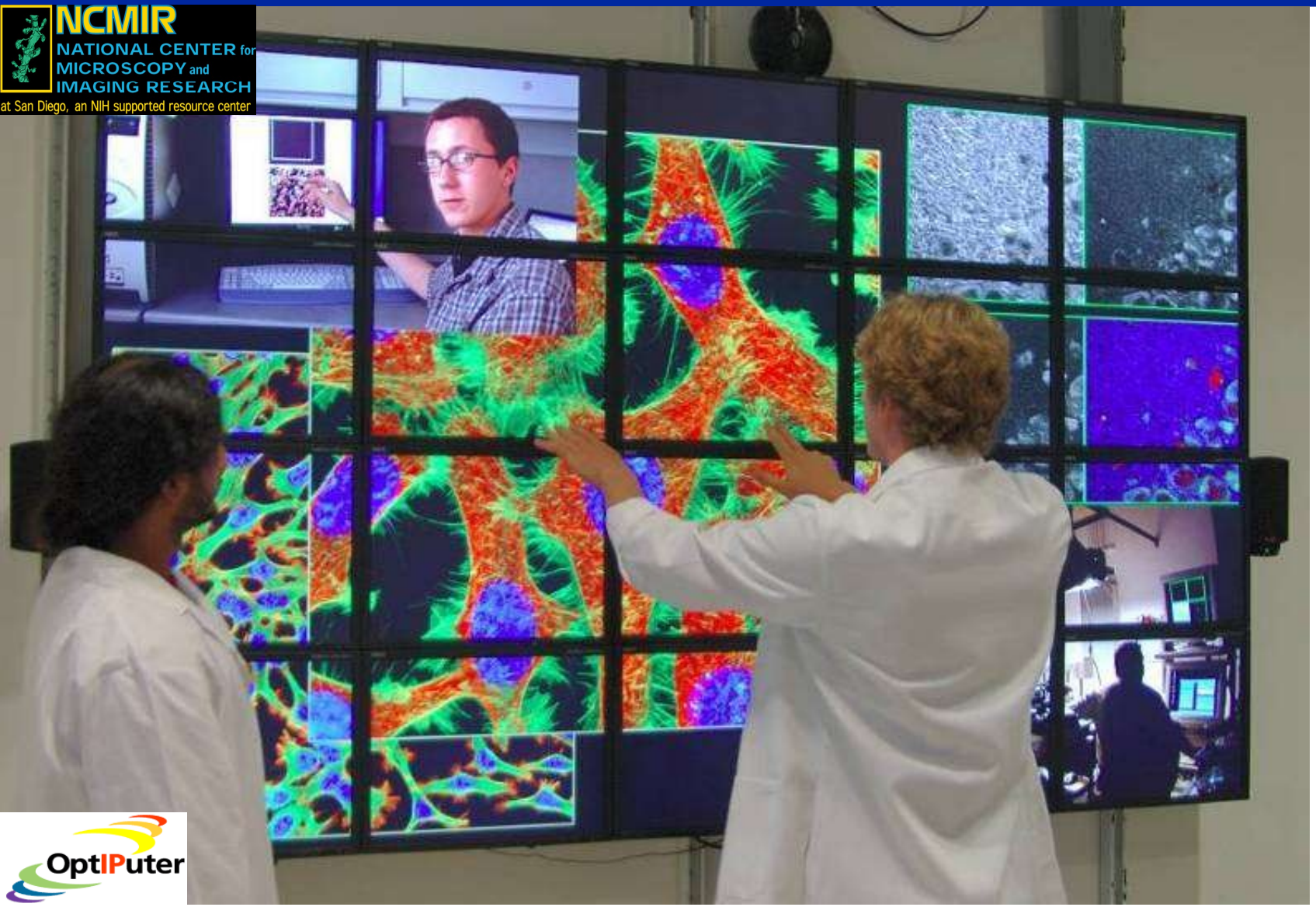
Sept 2005

iGrid 2005

it²

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

it2

OptIPuter Persistent Infrastructure Enables Calit2 and U Washington CAMERA Collaboratory



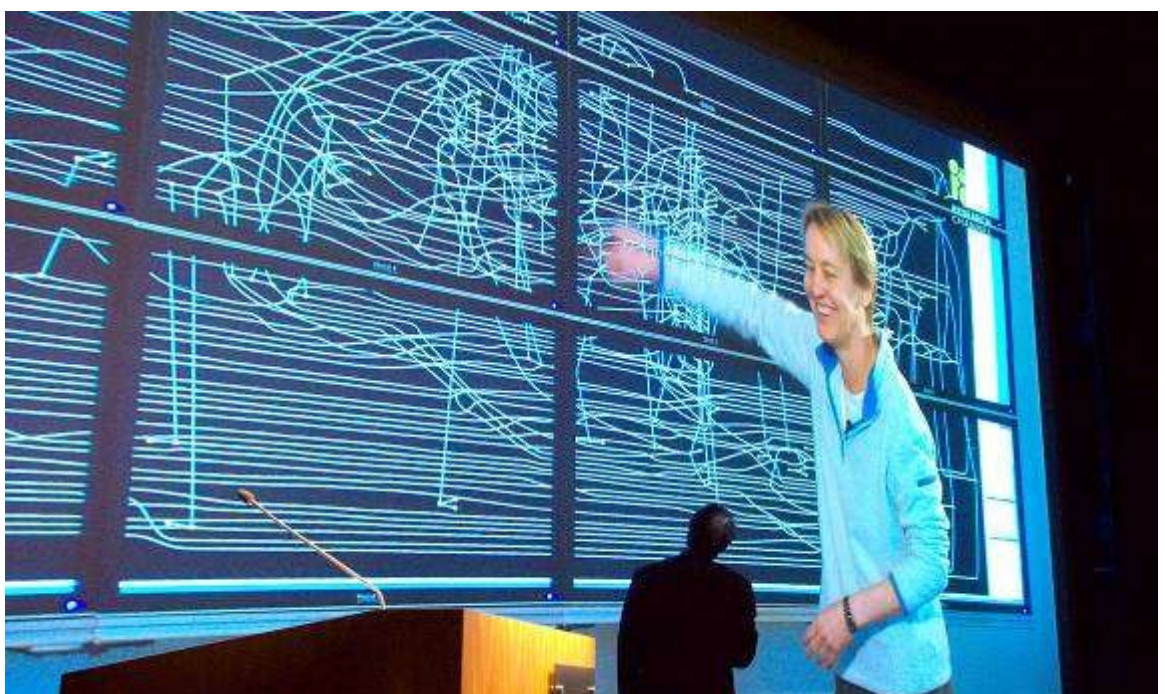
OptIPuter

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

ROCKS



MOORE FOUNDATION



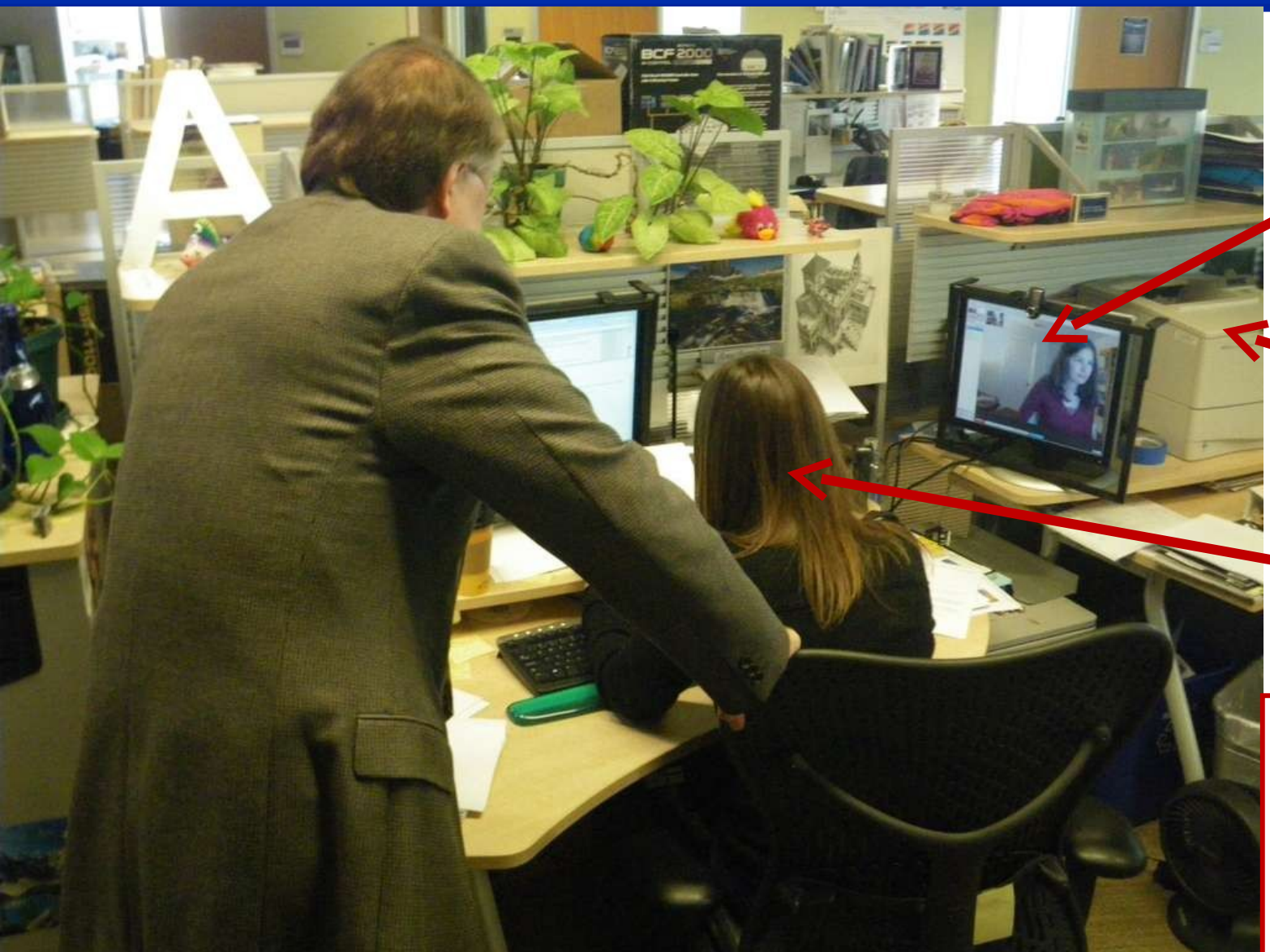
camera
Marine Microbial Ecology

NSF

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Calit2 is Learning How to Work in the Virtual/Physical World



We Run Video Sykpe Continuously During Office Hours

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Using High Definition to Enable Virtual Meetings: Living Greener

Calit2 Directors Office Meeting



une 2, 2008

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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

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Calit2 10th Anniversary Class Photo
UCSD/UCI Partnership



CineGrid 4K Remote Microscopy Collaboratory: USC to Calit2



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Richard Weinberg, USC

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eMedia Studio: Interactive Telepresence Dance/Media Performances

http://embodied.uci.edu



Calit2@UCI

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



LifeSize HD

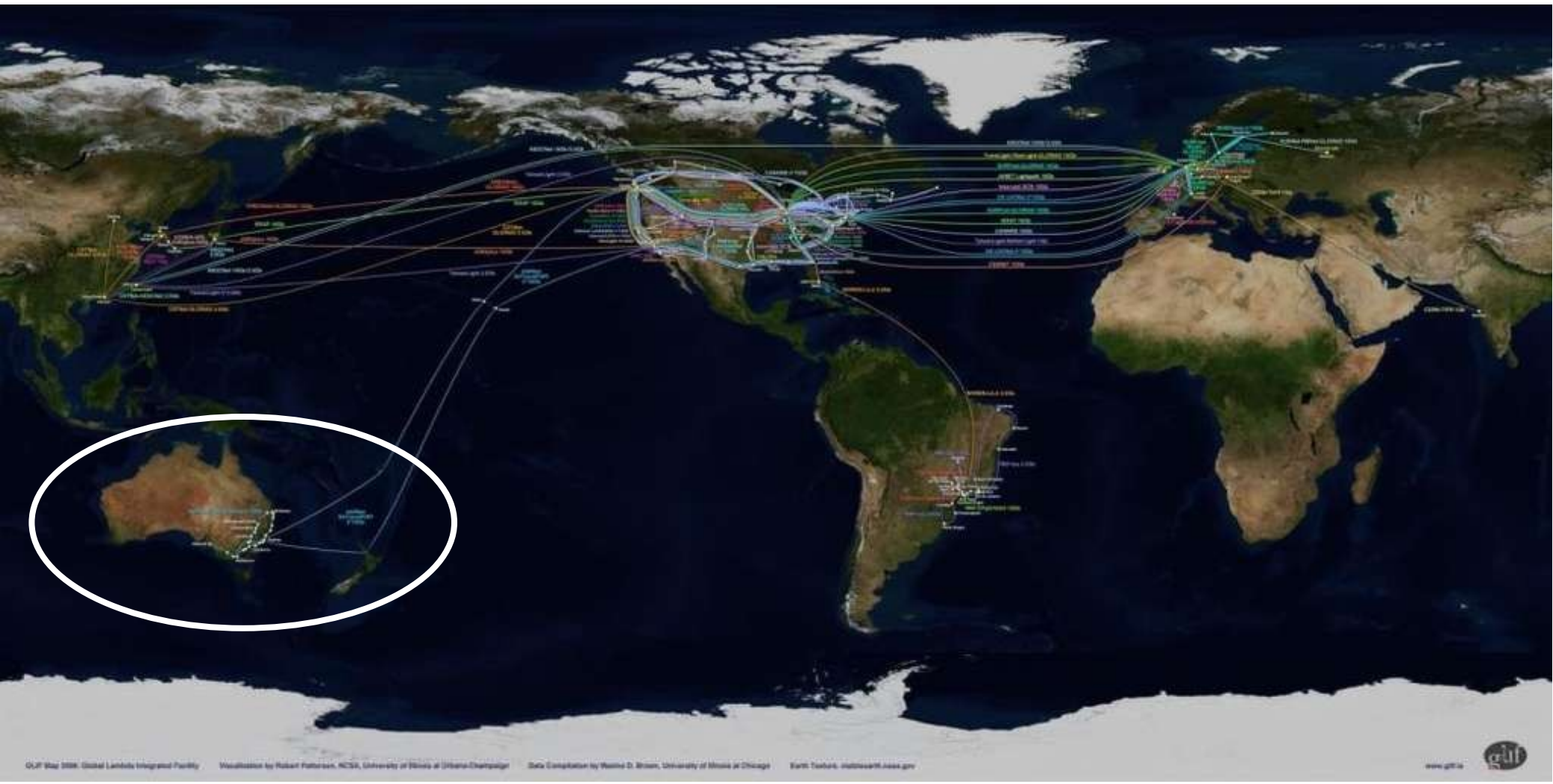
NASA Ames
Lunar Science Institute
Mountain View, CA

NASA Interest
in Supporting
Virtual Institutes

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

Global Innovation Centers are Being Connected with 10,000 Megabits/sec Clear Channel Lightpaths

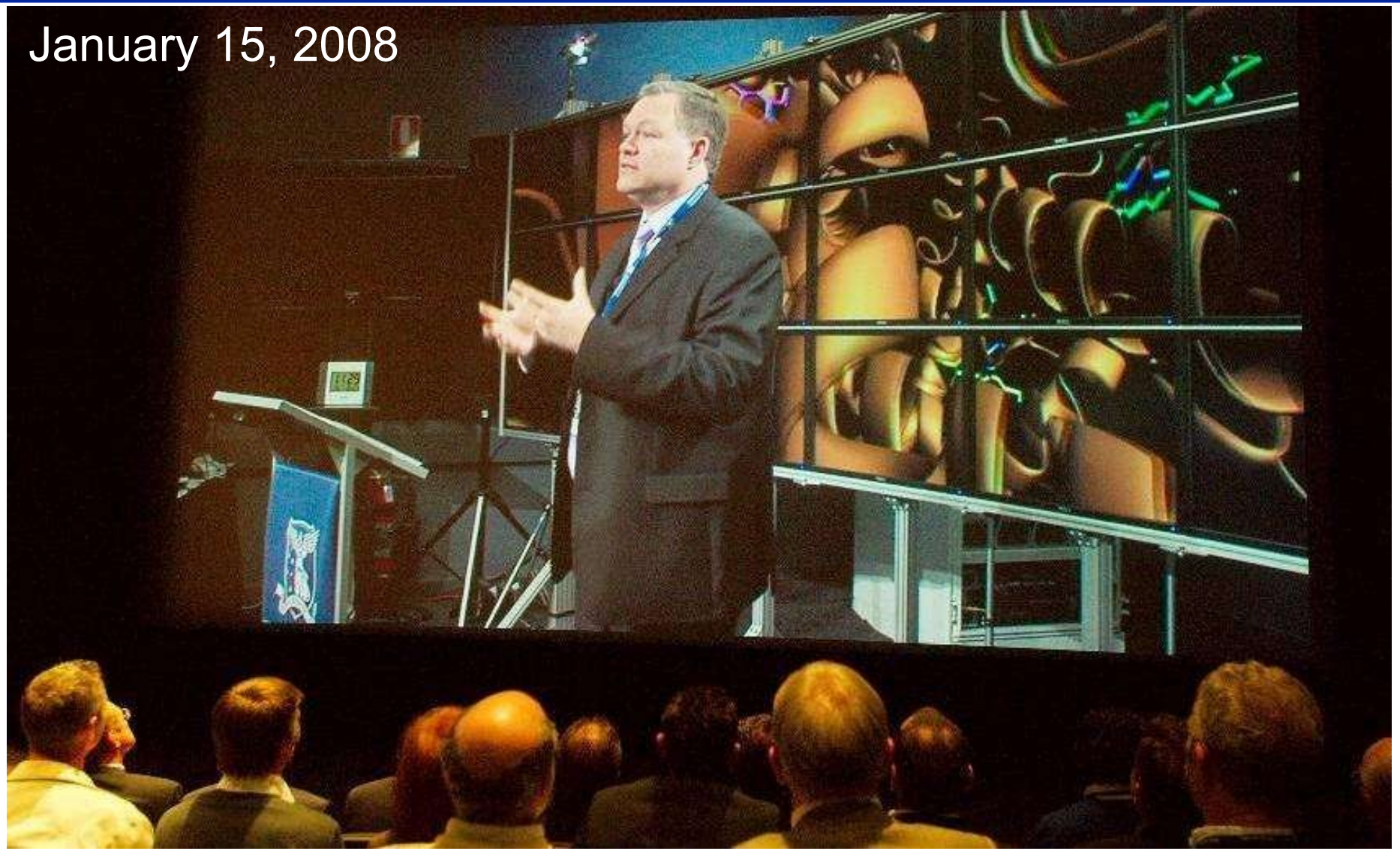


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Research on 100 Gbps and 1 Tbps

Source: Maxine Brown, UIC and Robert Patterson, NCSA

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



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

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Covise, Phil Weber, Jurgen Schulze, Calit2
CGLX, Kai-Uwe Doerr , Calit2
http://www.calit2.net/newsroom/release.php?id=1421

Victoria Premier and Australian Deputy Prime Minister Asking Questions



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

University of Melbourne Vice Chancellor Glyn Davis in Calit2 Replies to Question from Australia



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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

it²

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

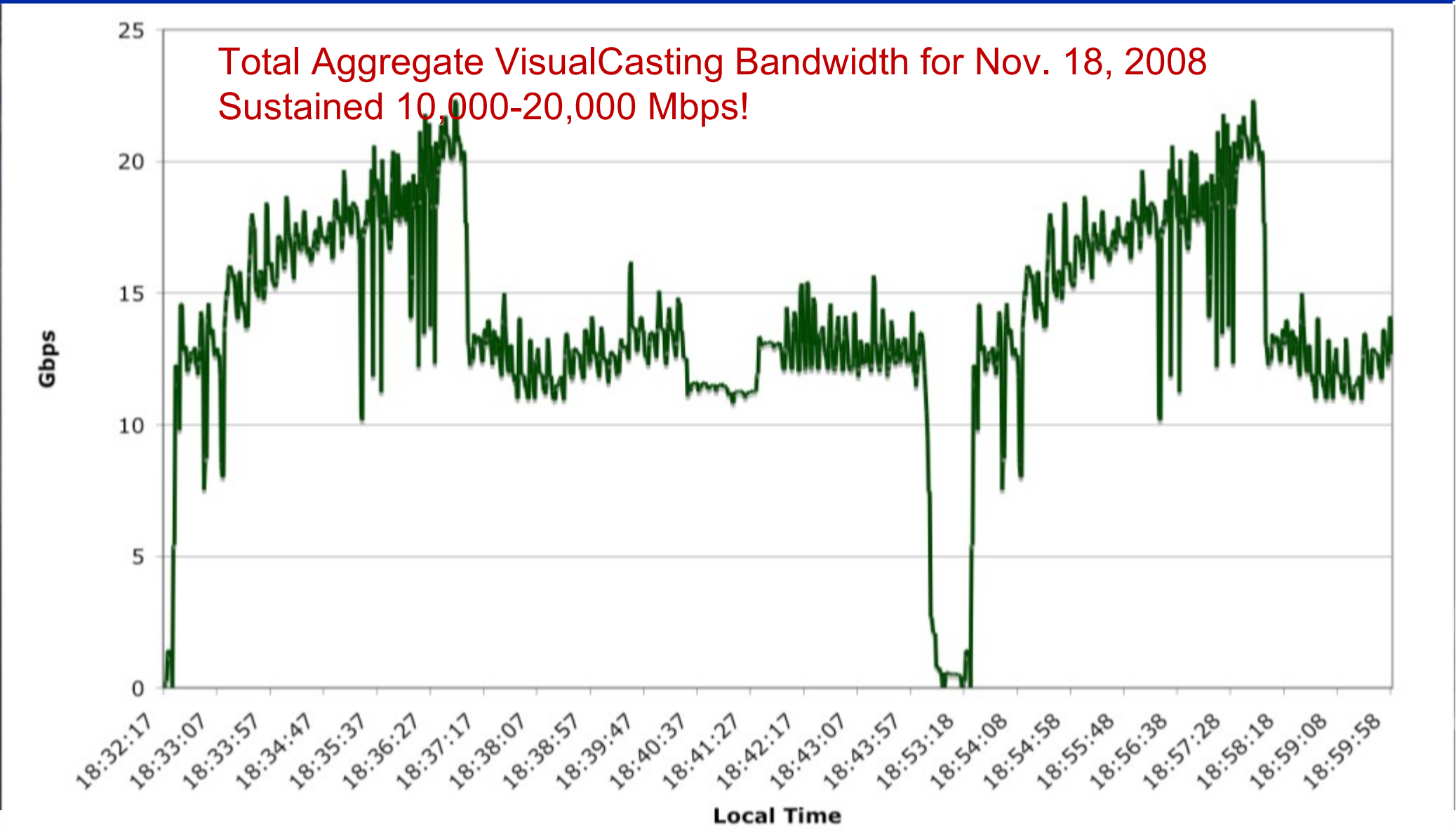


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Source: Tom DeFanti, KAUST Project, Calit2

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EVL's SAGE OptIPortal VisualCasting Multi-Site OptIPuter Collaboratory

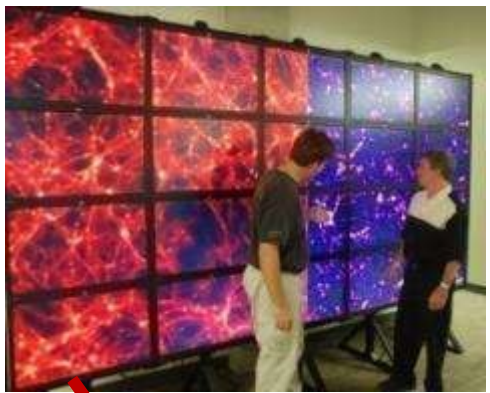


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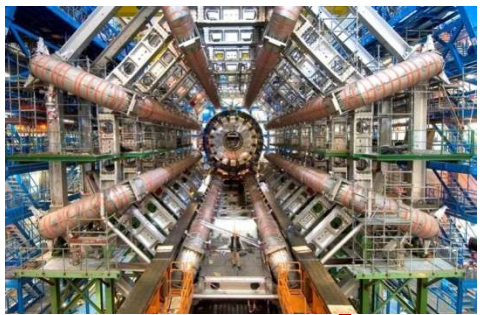
Source: Jason Leigh, Luc Renambot, EVL, UI Chicago

it²

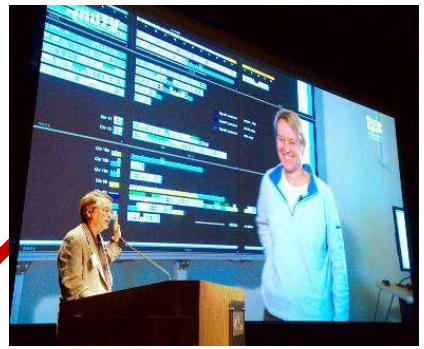
Academic Research OptIPlanet Collaboratory: A 10Gbps "End-to-End" Lightpath Cloud



End User OptIPortal



Instruments



HD/4k Live Video

HPC





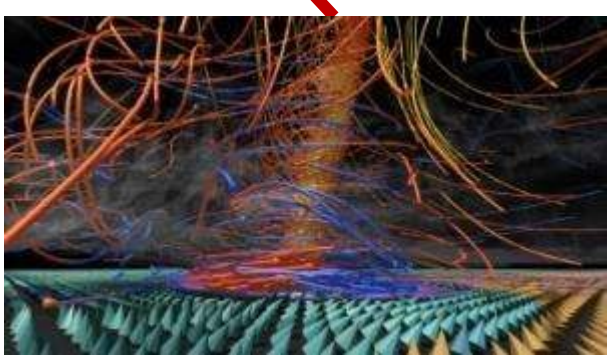
10G Lightpaths



Campus Optical Switch



Data Repositories & Clusters



HD/4k Video Repositories

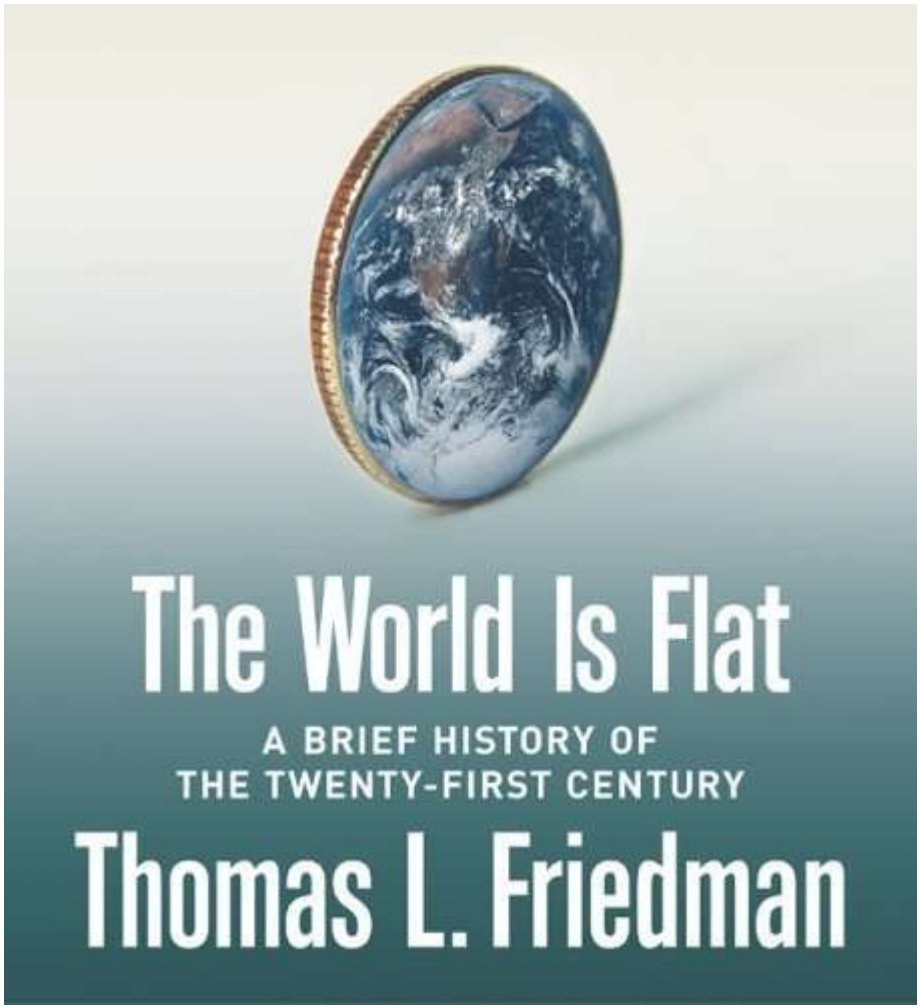


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Ten Years Old Technologies--the Shared Internet & the Web--Have Made the World "Flat"

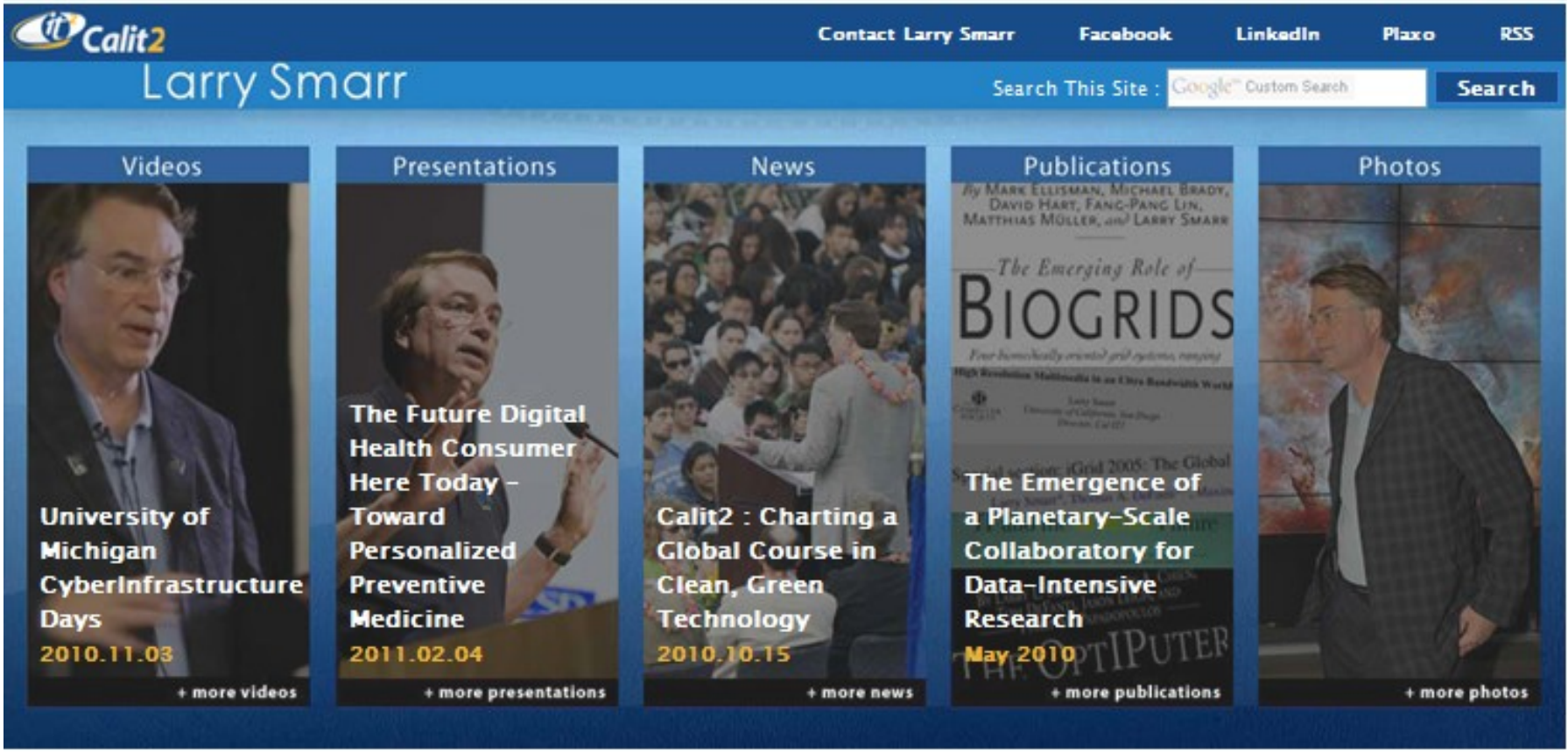
- But Today's Innovations
  - Dedicated Fiber Paths
  - Streaming HD TV
  - Large Display Systems
  - Massive Computing/Storage
- Are Reducing the World to a "Single Point"
  - How Will Our Society Reorganize Itself?



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You Can Download This Presentation at lsmarr.calit2.net



ABOUT LARRY SMARR

Larry Smarr is the founding Director of the California Institute for Telecommunications and Information Technology (Calit2), a UC San Diego/UC Irvine partnership, and holds the Harry E. Gruber professorship in Computer Science and Engineering (CSE) at UCSD's Jacobs School. At Calit2, Smarr has continued to drive major developments in information infrastructure-- including the Internet, Web, scientific

WHAT I'M READING

Complete List of Larry's Recommendations

Homo Britannicus: The Incredible Story of Human Life in Britain (2006)

American College and University Presidents' Climate Commitment

RECENT TWITTER POSTS

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Ismarr: SD is one of the leaders! RT@HealtheBay Surge in the # of plug-in electric vehicles on roadways through 2017 expected http://bit.ly/eHfKrR Wed, 23 Feb

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