Education in a Globally Connected World

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

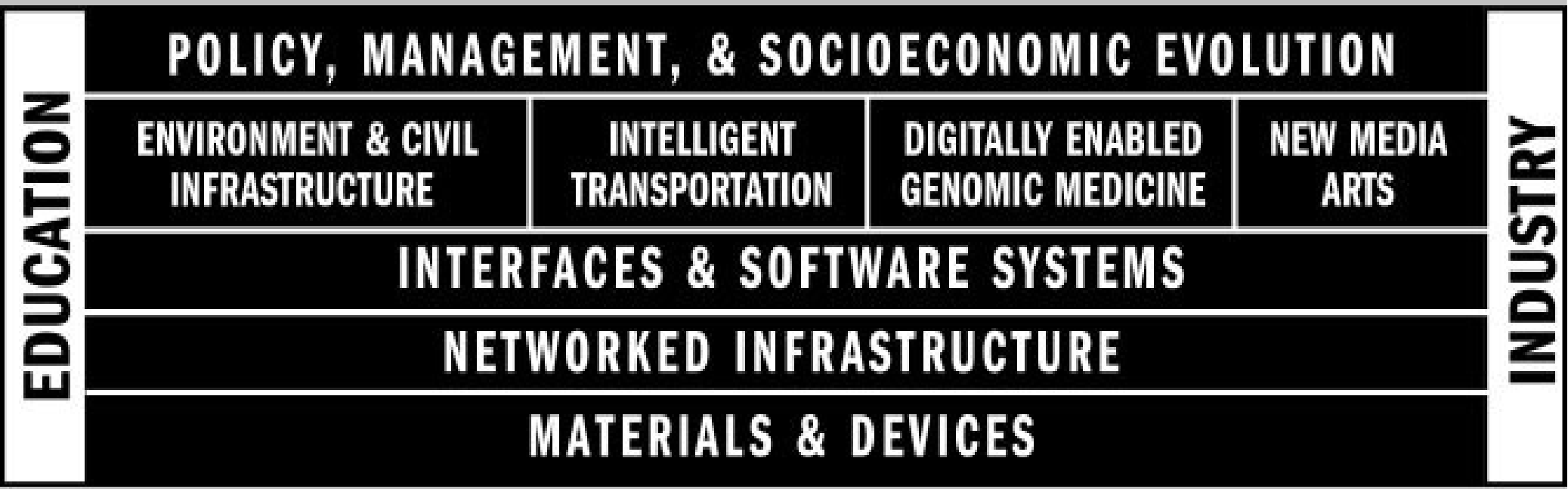
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www.calit2.net

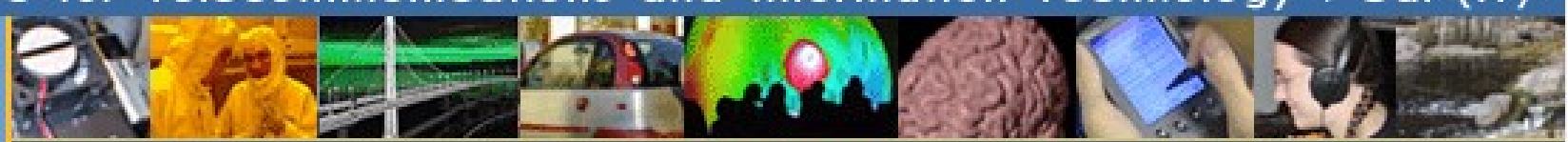
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Calit2 -- Research and Living Laboratories on the Future of the Internet

UC San Diego & UC Irvine Faculty Working in Multidisciplinary Teams With Students, Industry, and the Community



www.calit2.net



Two New Calit2 Buildings Will Provide Major New Laboratories to Their Campuses



- Over 1000 Researchers in Two Buildings
  - Linked via Dedicated Optical Networks

Richard C. Atkinson Hall Dedication Oct. 28, 2005



www.calit2.net

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Preparing for an World in Which Distance Has Been Eliminated…

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How Can We Make Scientific Discovery as Engaging as Video Games?



Geography



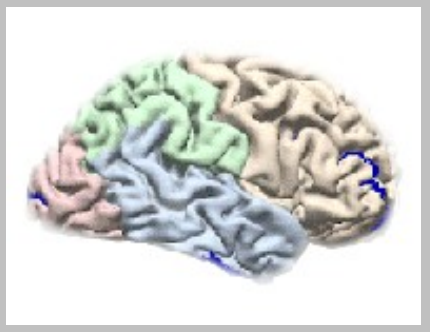
Earth Sciences



Anatomy



Neurosciences



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The Preuss School UCSD

SDSC

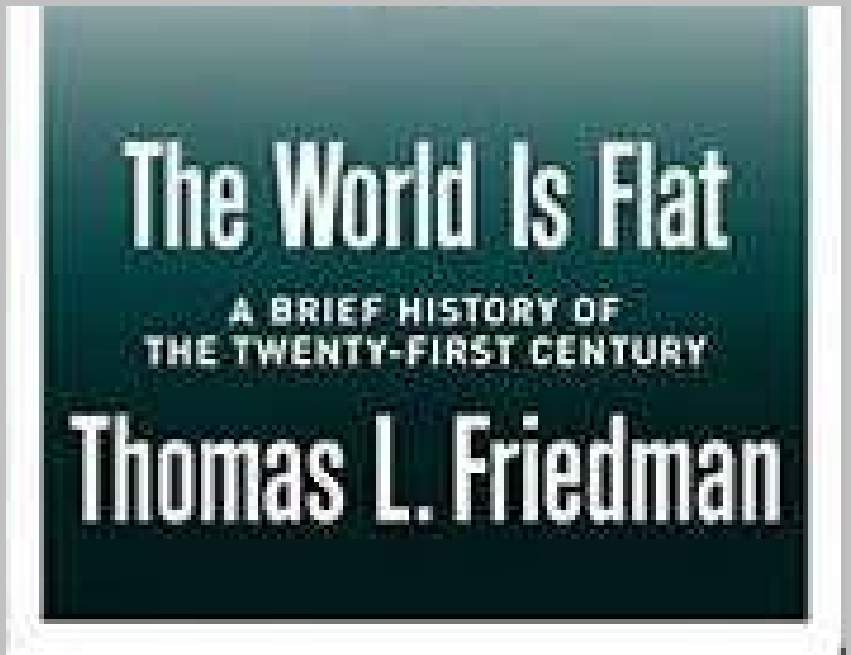
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We Are Living In A Fundamental Global Change—How Can We Glimpse the Future?

[The Internet] has created a [global] platform where intellectual work, intellectual capital, could be delivered from anywhere. It could be disaggregated, delivered, distributed, produced, and put back together again…

The playing field is being leveled."

--Nandan Nilekani, CEO Infosys (Bangalore, India)

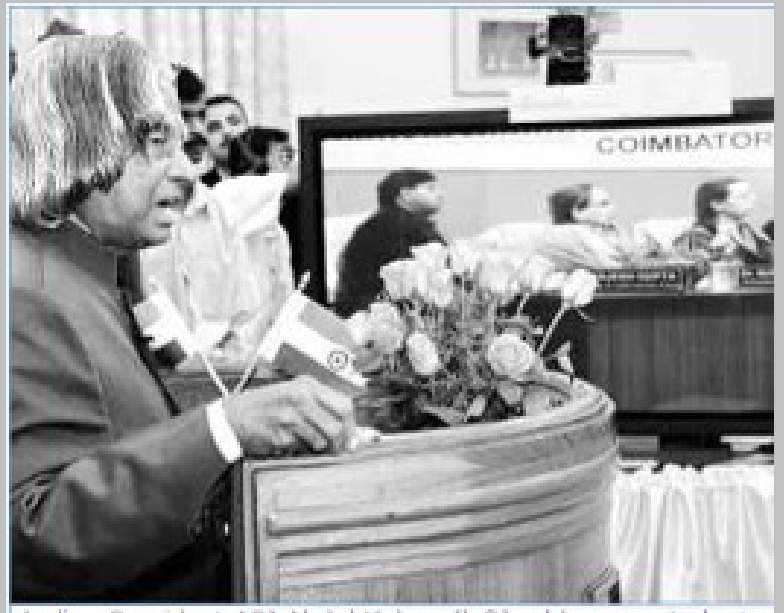


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India Partners with US Universities to Establish Satellite e-Learning Collaboration

- **Industry Partners**
  - QUALCOMM, Microsoft and Cadence Design
  - Pay for U.S. Professors to Spend Part of their Sabbaticals Teaching at the E-Learning Facility
  - Their Lectures will be Beamed via Edusat, India's First Satellite Devoted to Educational Programming
  - Lectures will Eventually Reach Classrooms on 100 Indian Campuses

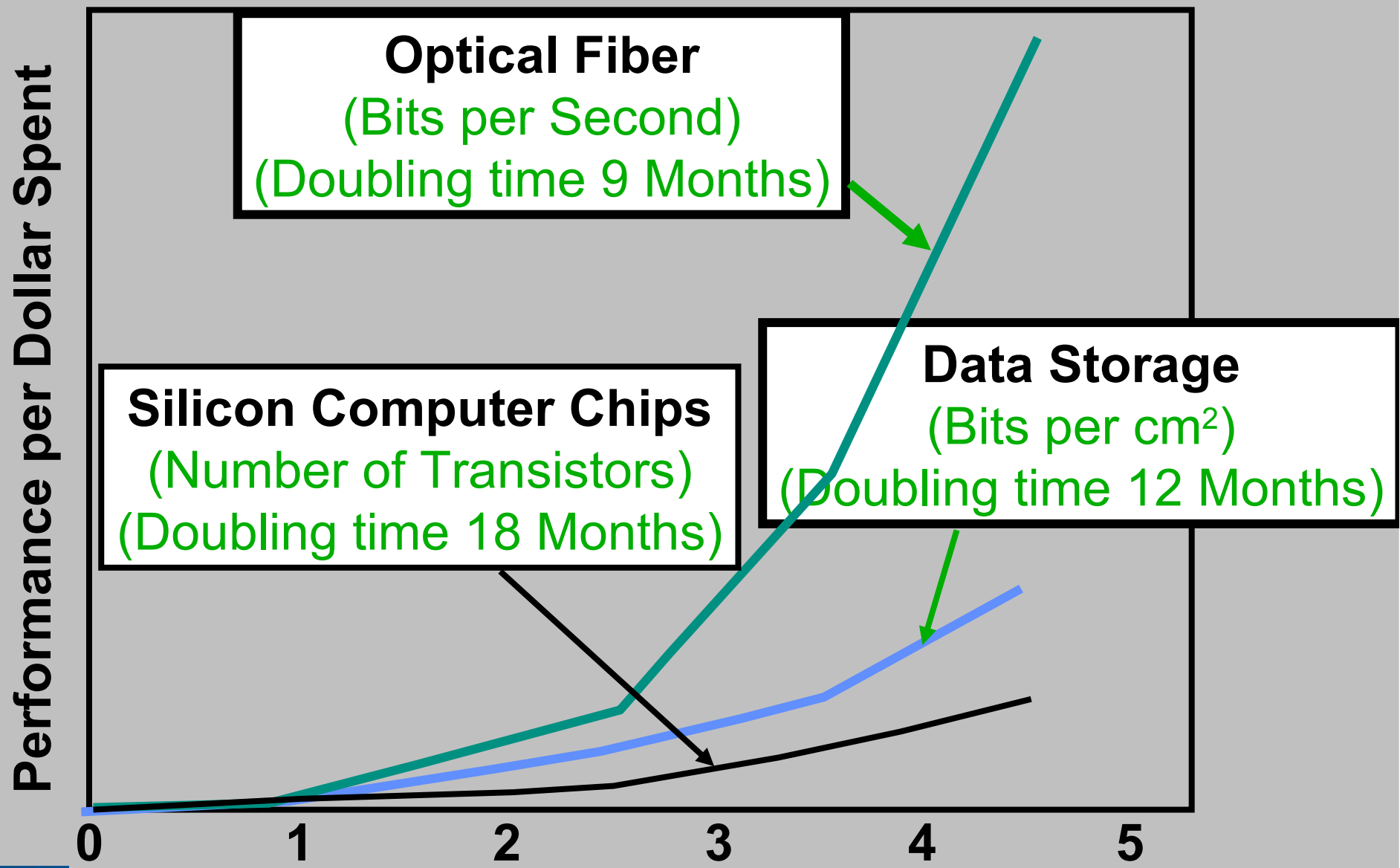


Indian President APJ Abdul Kalam (left) addresses students

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Why Optical Networks Is Becoming the 21st Century Driver

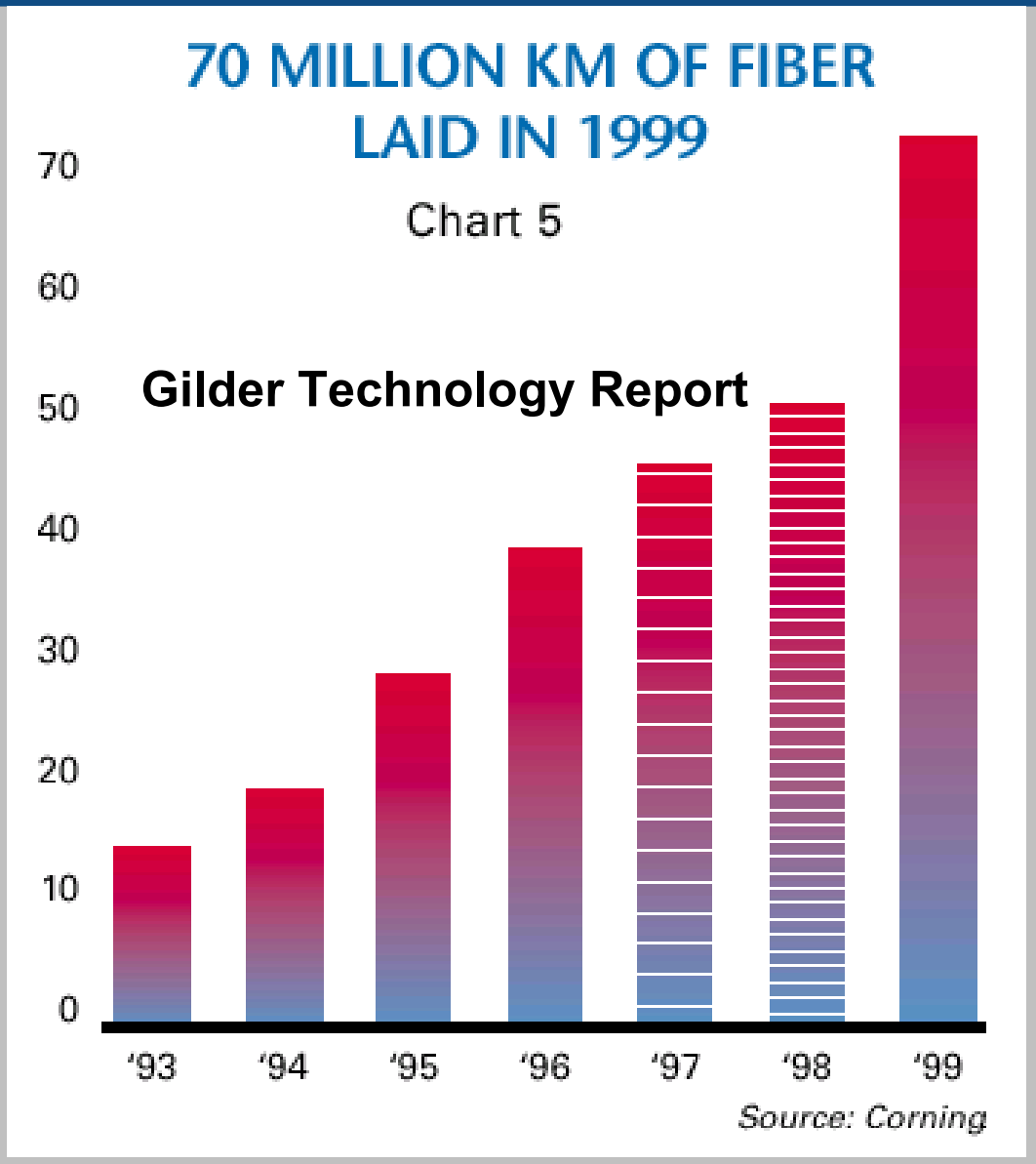


Scientific American, January 2001

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Worldwide Deployment of Fiber Up 42% in 1999



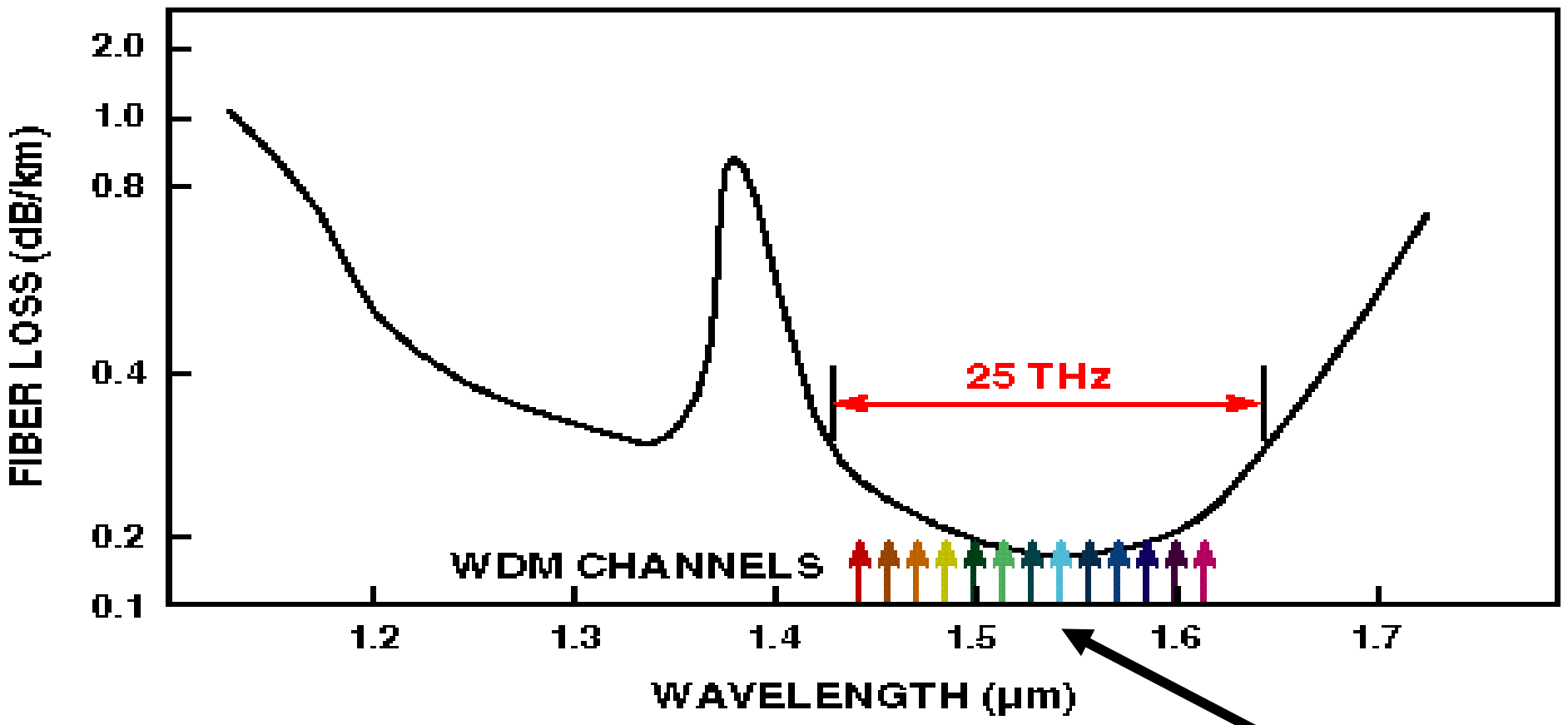
That's Laying Fiber at the Rate of Nearly 10,000 km/hour!!

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From Smarr Talk (2000)

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Each Optical Fiber Can Now Carry Many Parallel Light Paths or "Lambdas"



"Lambdas"

Source: Steve Wallach, Chiaro Networks

"The Broad Overinvestment in Fiber Cable is a Gift That Keeps on Giving."

"When these fiber cables were originally laid, the optical switches could not take full advantage of the fiber's full capacity. But every year since then, the optical switches at the end of that fiber cable have gotten better and better, meaning that more and more voices and data can be transmitted down each fiber.

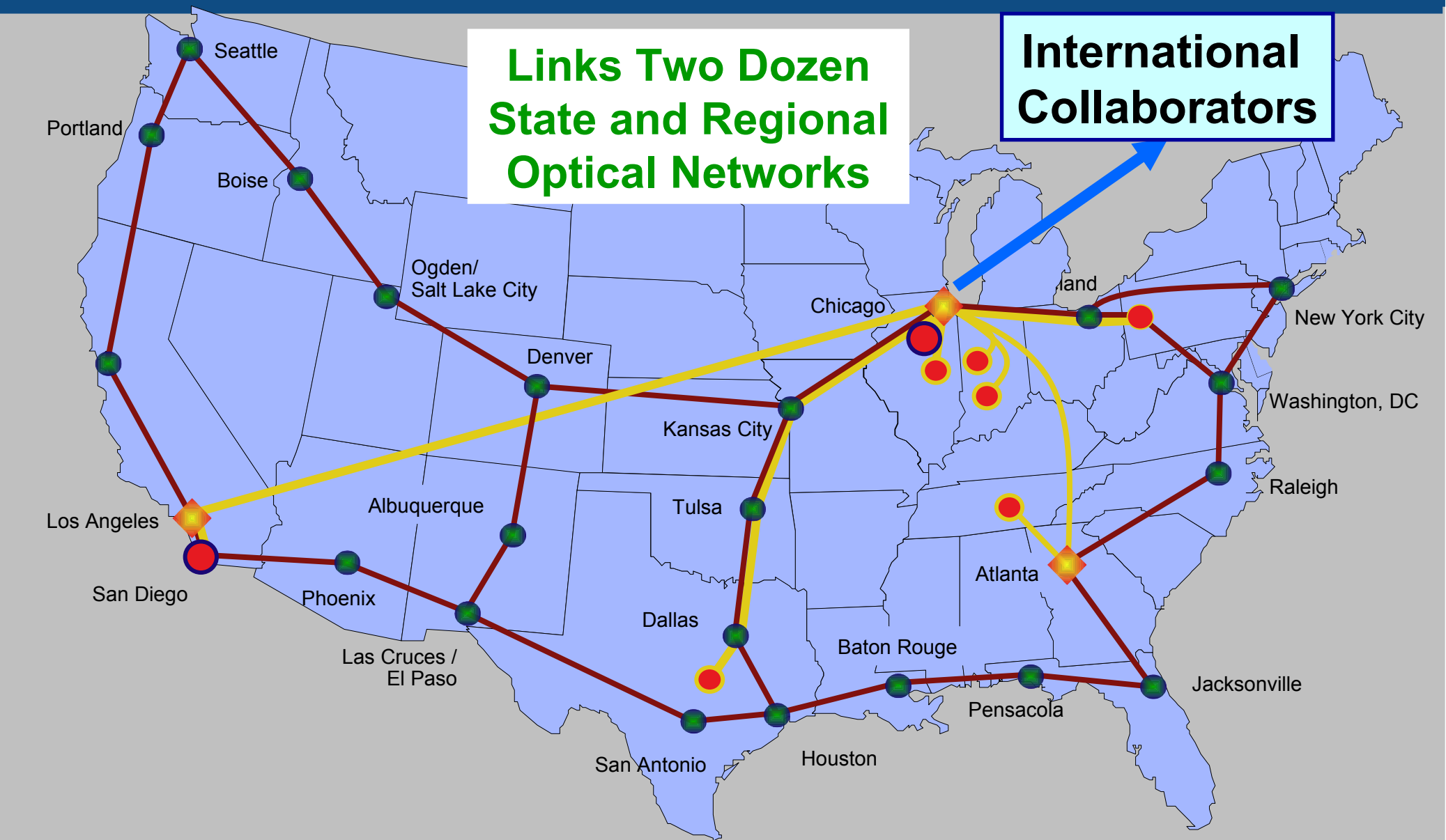
So, as the switches kept improving, the capacity of all the already installed fiber cables just kept on growing, making it cheaper and easier to transmit voices and data to any part of the world."

--Thomas Friedman, The World is Flat (2005)

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National Lambda Rail (NLR) Provides Cyberinfrastructure Backbone for Researchers



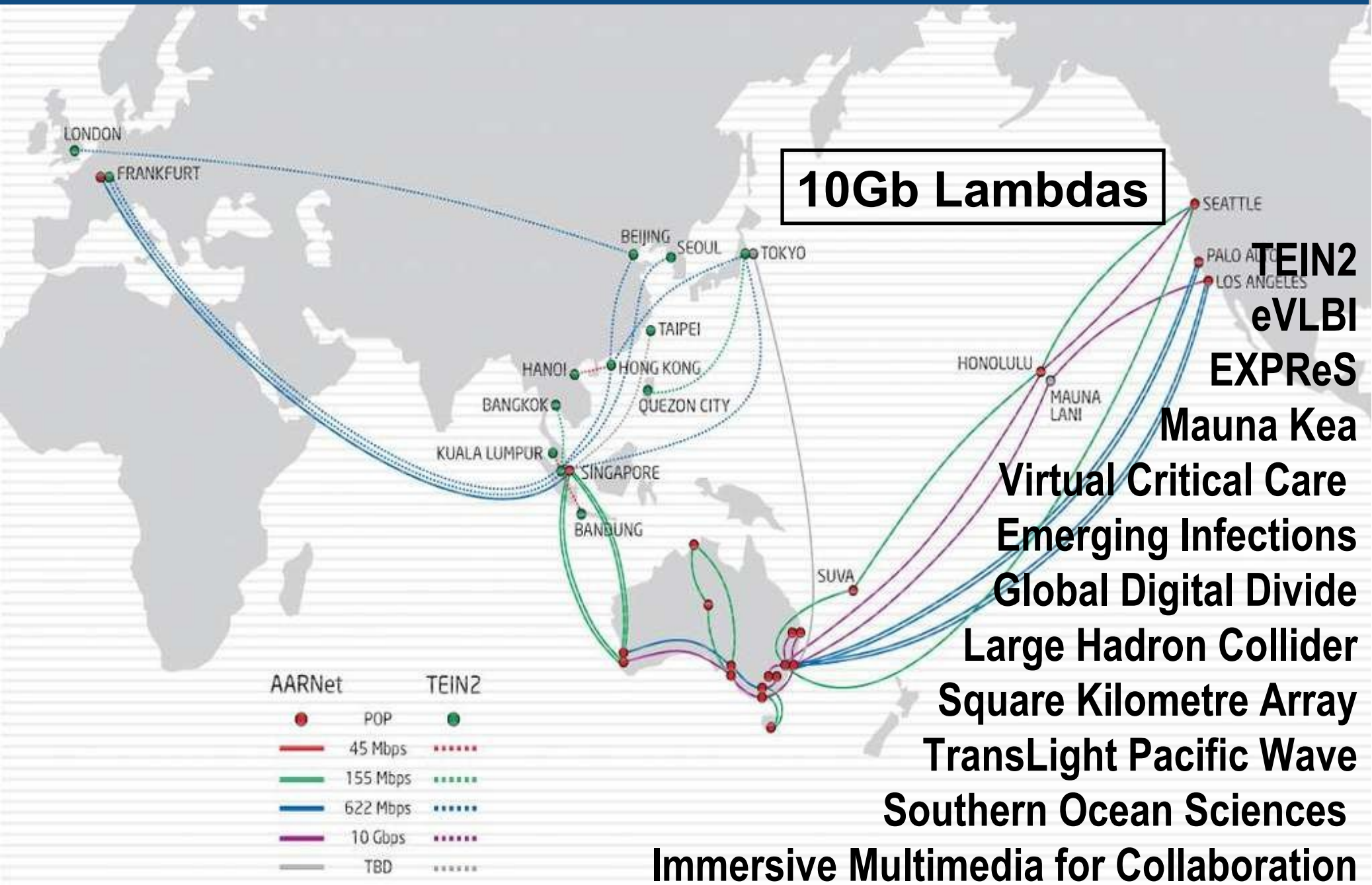
NLR 4 x 10Gb Lambdas Initially Capable of 40 x 10Gb Wavelengths at Buildout

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Fiber Optics Position Australia for Global Collaboration

AARNet



10Gb Lambdas

TEIN2

eVLBI

EXPReS

Mauna Kea

Virtual Critical Care

Emerging Infections

Global Digital Divide

Large Hadron Collider

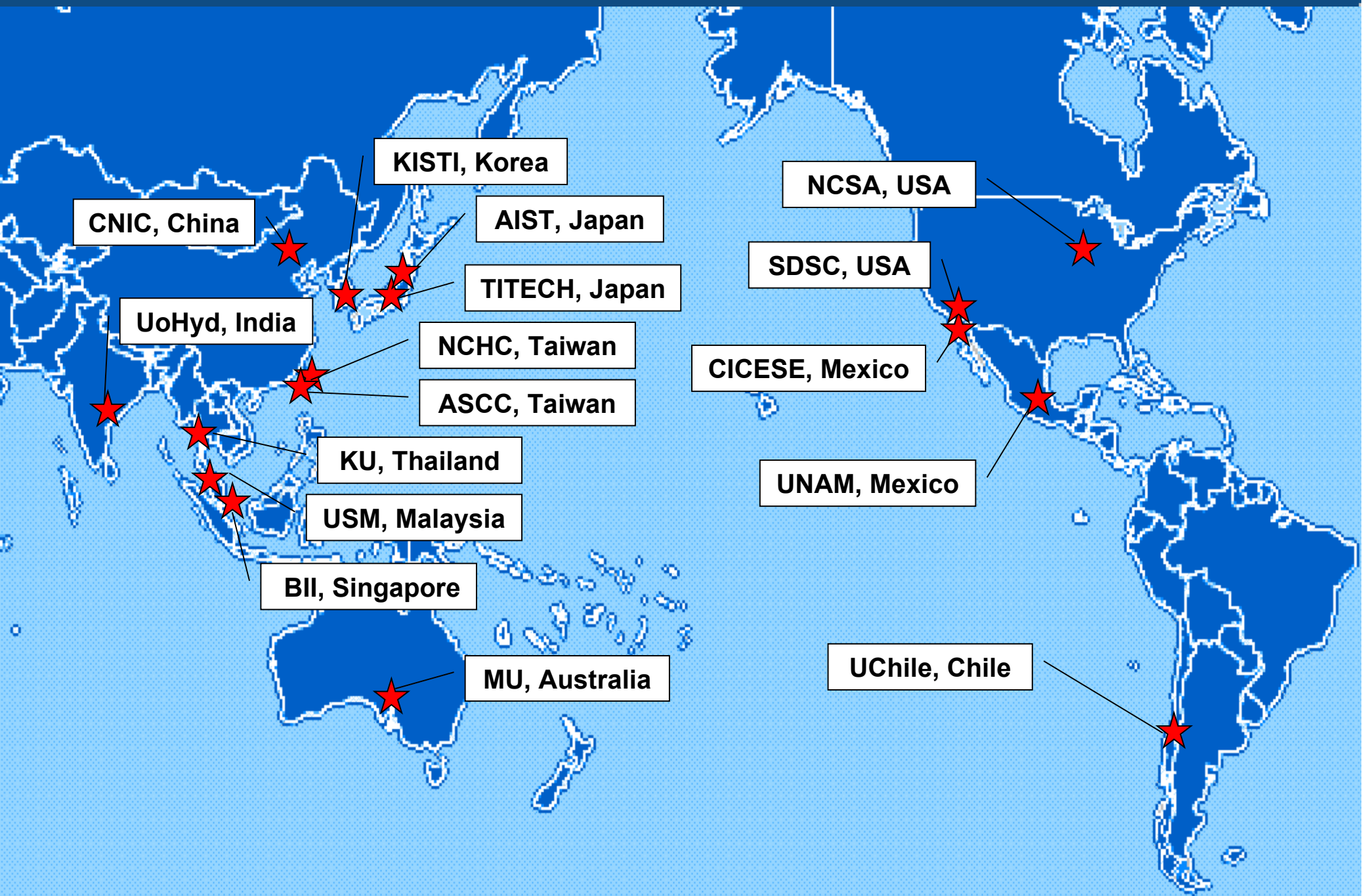
Square Kilometre Array

TransLight Pacific Wave

Southern Ocean Sciences

Immersive Multimedia for Collaboration

PRAGMA International Grid Testbed



Accelerator: Global Connections Between University Research Centers at 10Gbps

Maxine Brown, Tom DeFanti, Co-Chairs

iGrid 2005

THE GLOBAL LAMBDA INTEGRATED FACILITY

www.igrid2005.org



September 26-30, 2005

Calit2 @ University of California, San Diego

California Institute for Telecommunications and Information Technology



21 Countries Driving
50 Demonstrations
1 or 10Gbps to Calit2@UCSD

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



iGrid 2005

Goal – From Expedition to Cable Observatories with Streaming HDTV Robotic Cameras

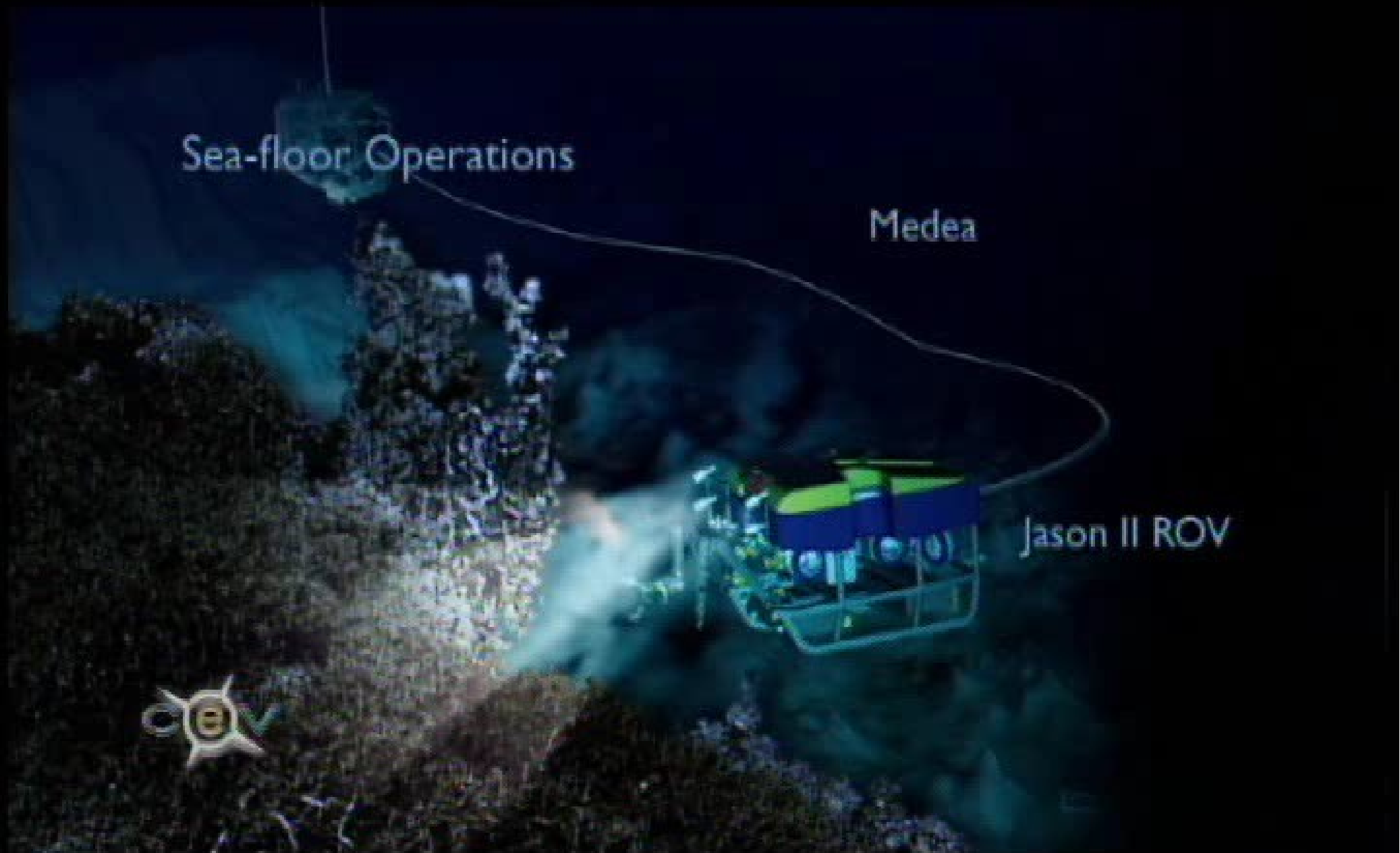


Scenes from The Aliens of the Deep, Directed by James Cameron & Steven Quale



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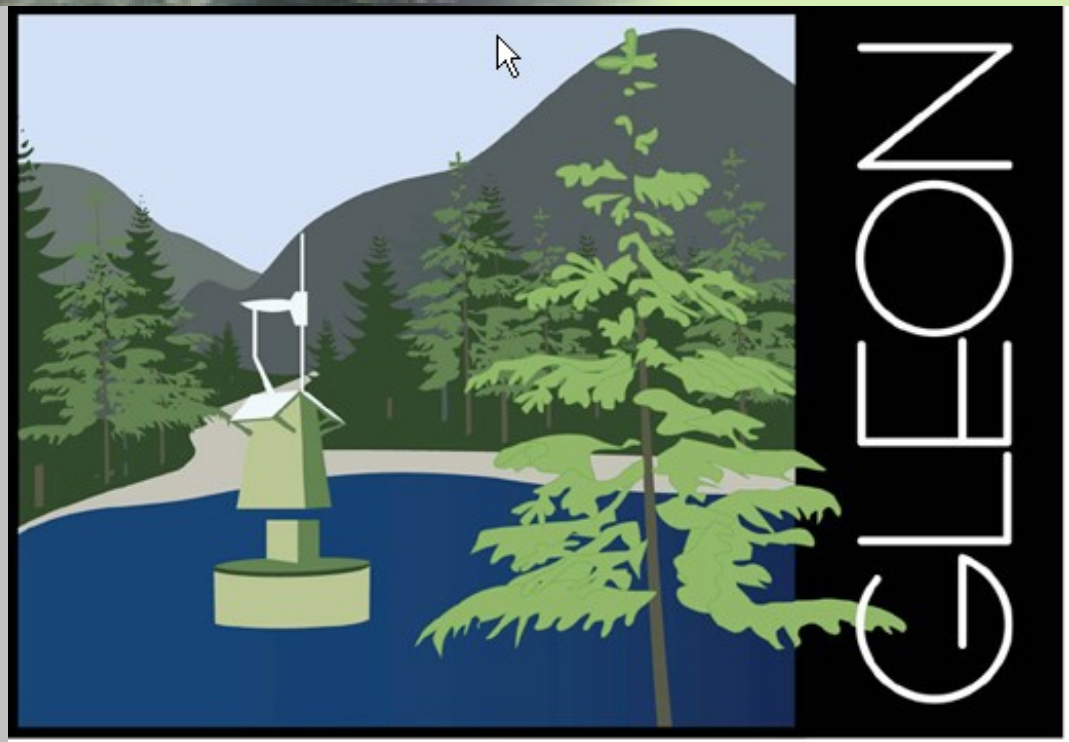
High Definition Video - 2.5 km Below the Ocean Surface



Schools Will Be Able to Monitor Remote Environments in Real Time



Coral Reef
Environmental
Observatory Network



global lake ecological observatory network

Workshop
29th to 31st
March 2006
Townsville,
Australia

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Marine Genome Sequencing Project
Measuring the Genetic Diversity of Ocean Microbes



Calit2's CAMERA will include
All Sorcerer II Metagenomic Data

MARINE MICROBIOLOGY INITIATIVE

Gordon and Betty MOORE FOUNDATION

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J. Craig Venter INSTITUTE

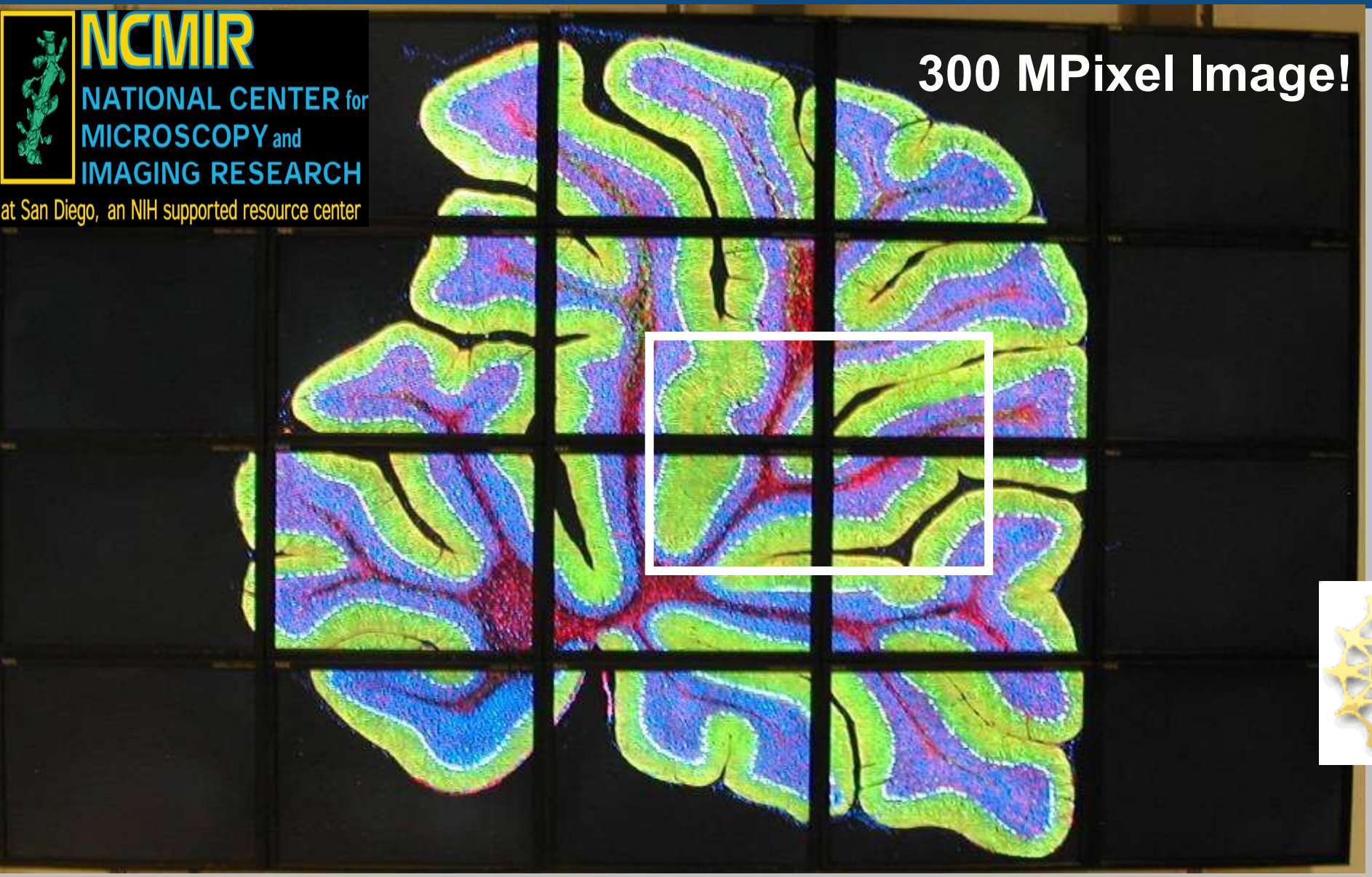
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Preparing Students for the Global Workplace of the 21st Century

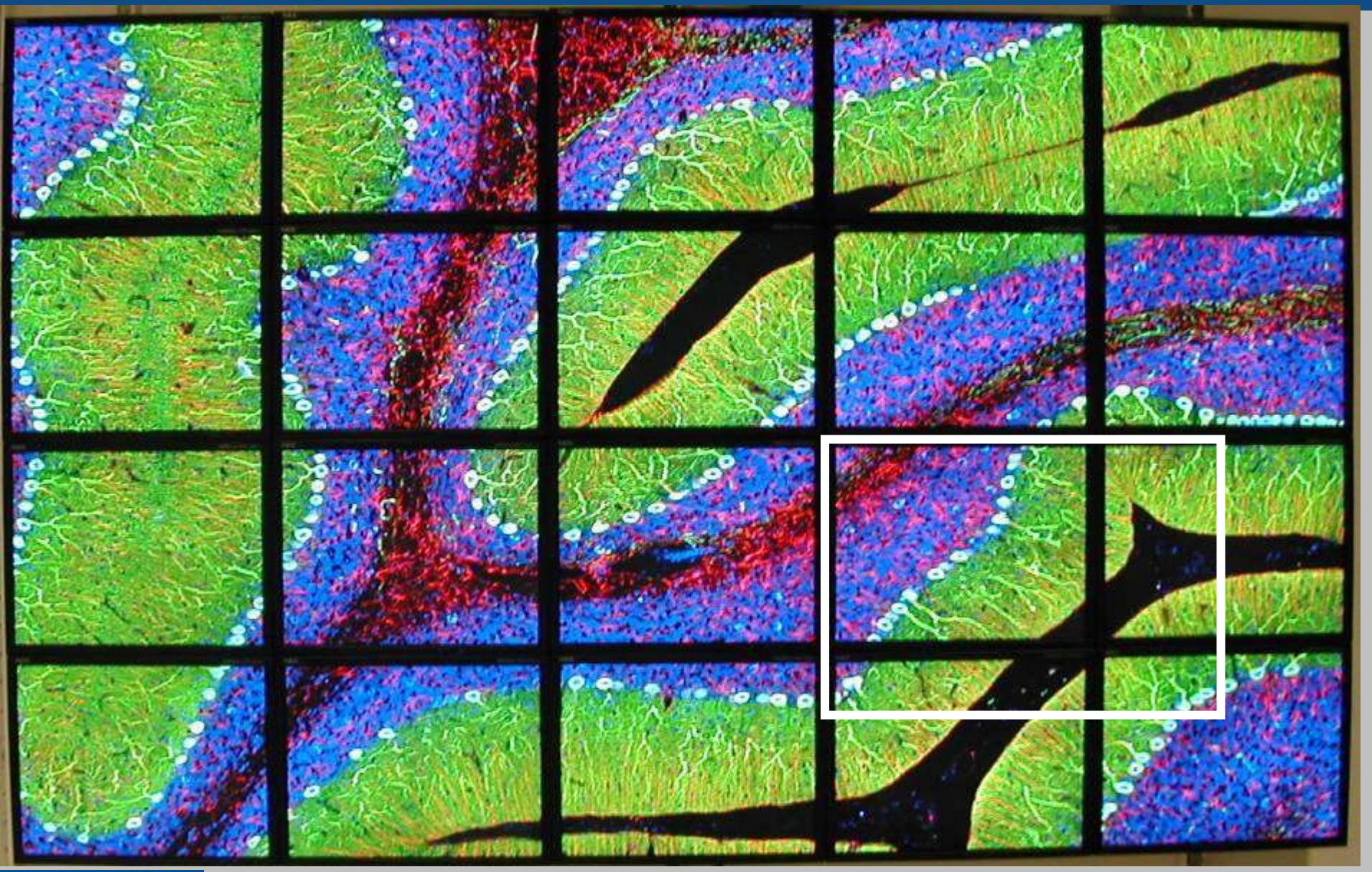
- Pacific Rim Undergraduate Experiences
- 14 UCSD Undergrads
  - Students Work With Researchers During Summer:
    - Australia, Japan, Taiwan, China and Thailand
  - Chemistry, Biomedical, Ecology, Networking



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

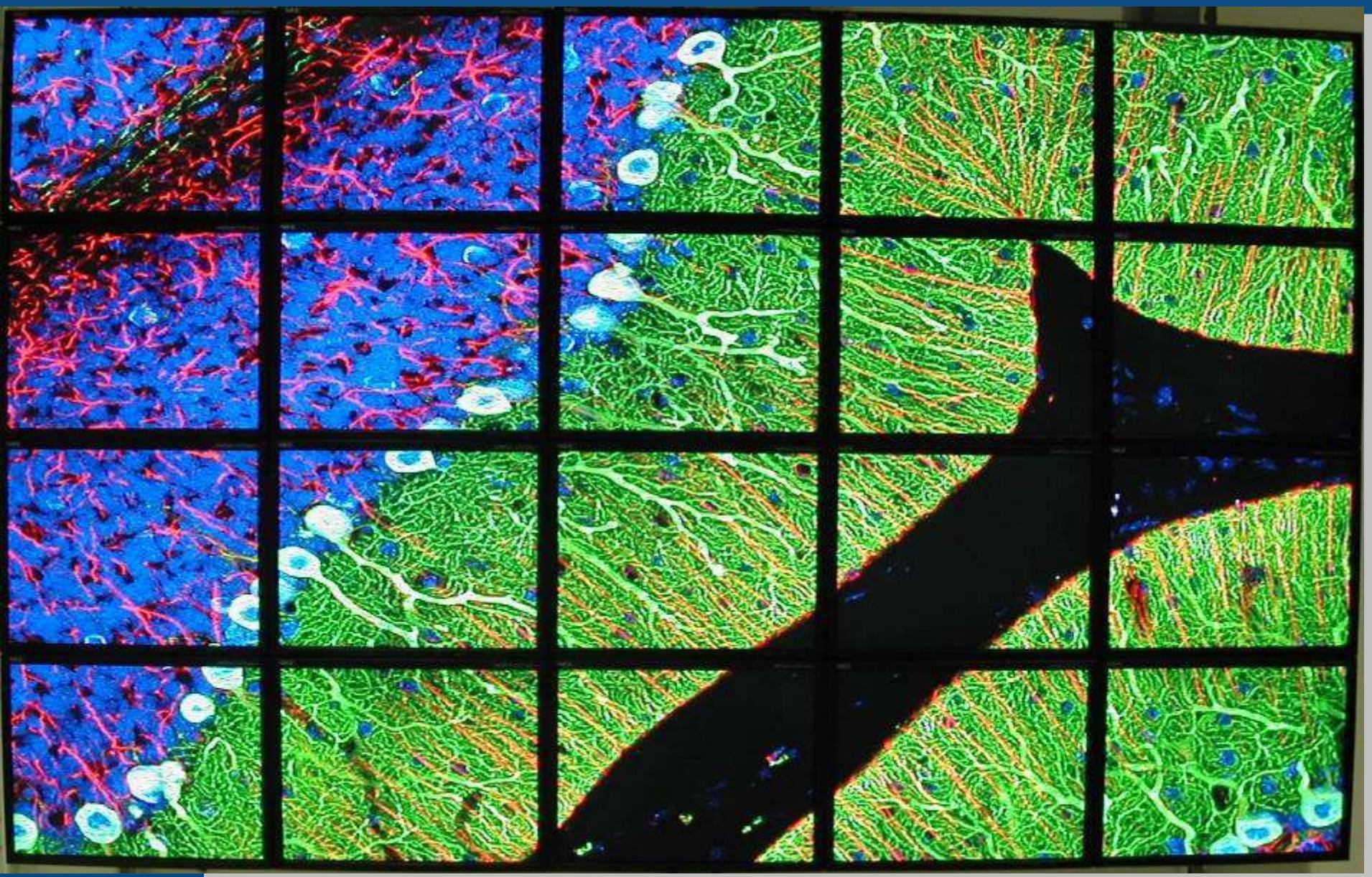


Scalable Displays Allow Both Global Content and Fine Detail



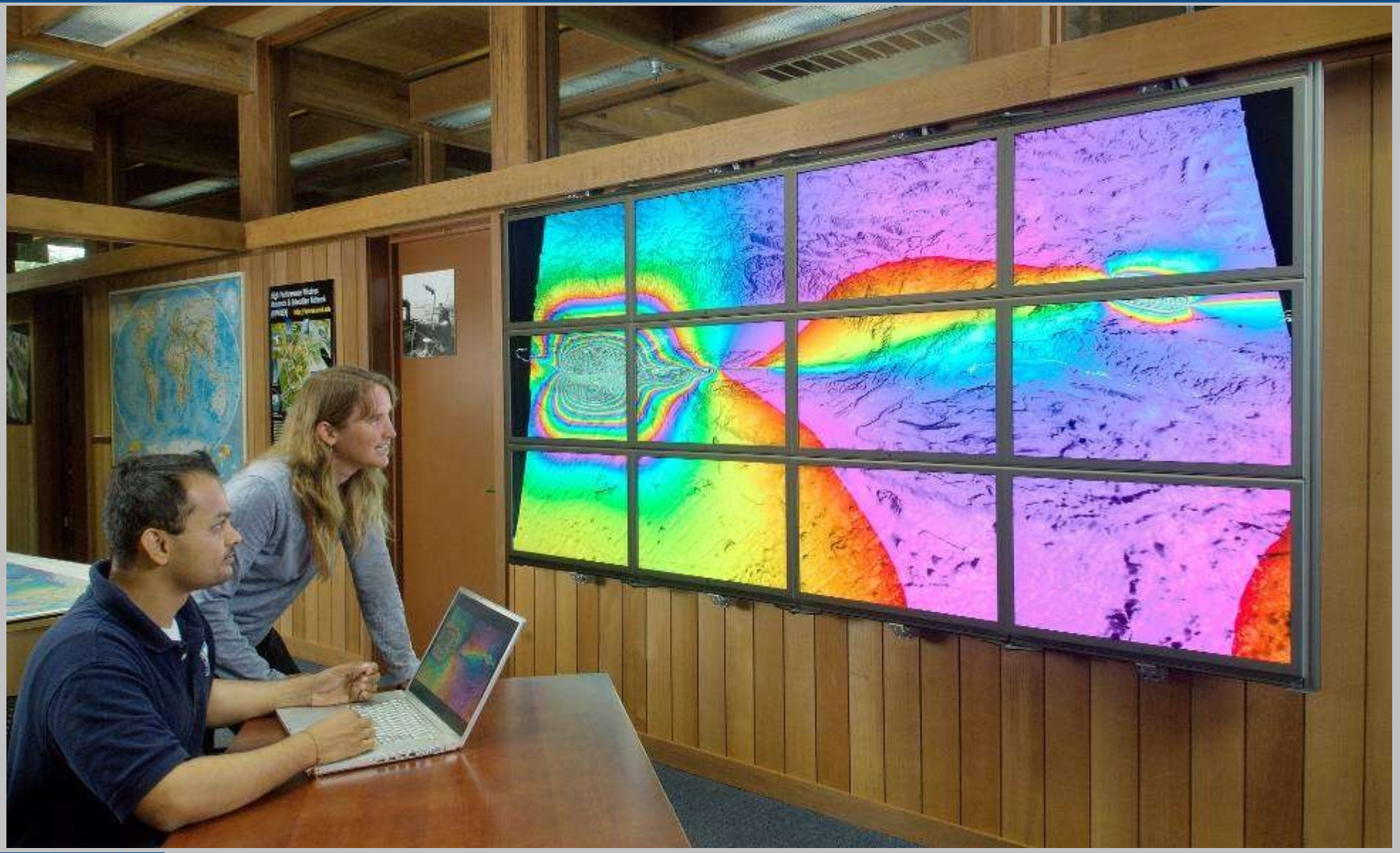
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Allows for Interactive Zooming from Cerebellum to Individual Neurons



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Apple iCluster Display Wall at Scripps Institution of Oceanography



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Displaying Images from Electron Microscope



Zeiss Scanning Electron Microscope in Calit2@ UCI

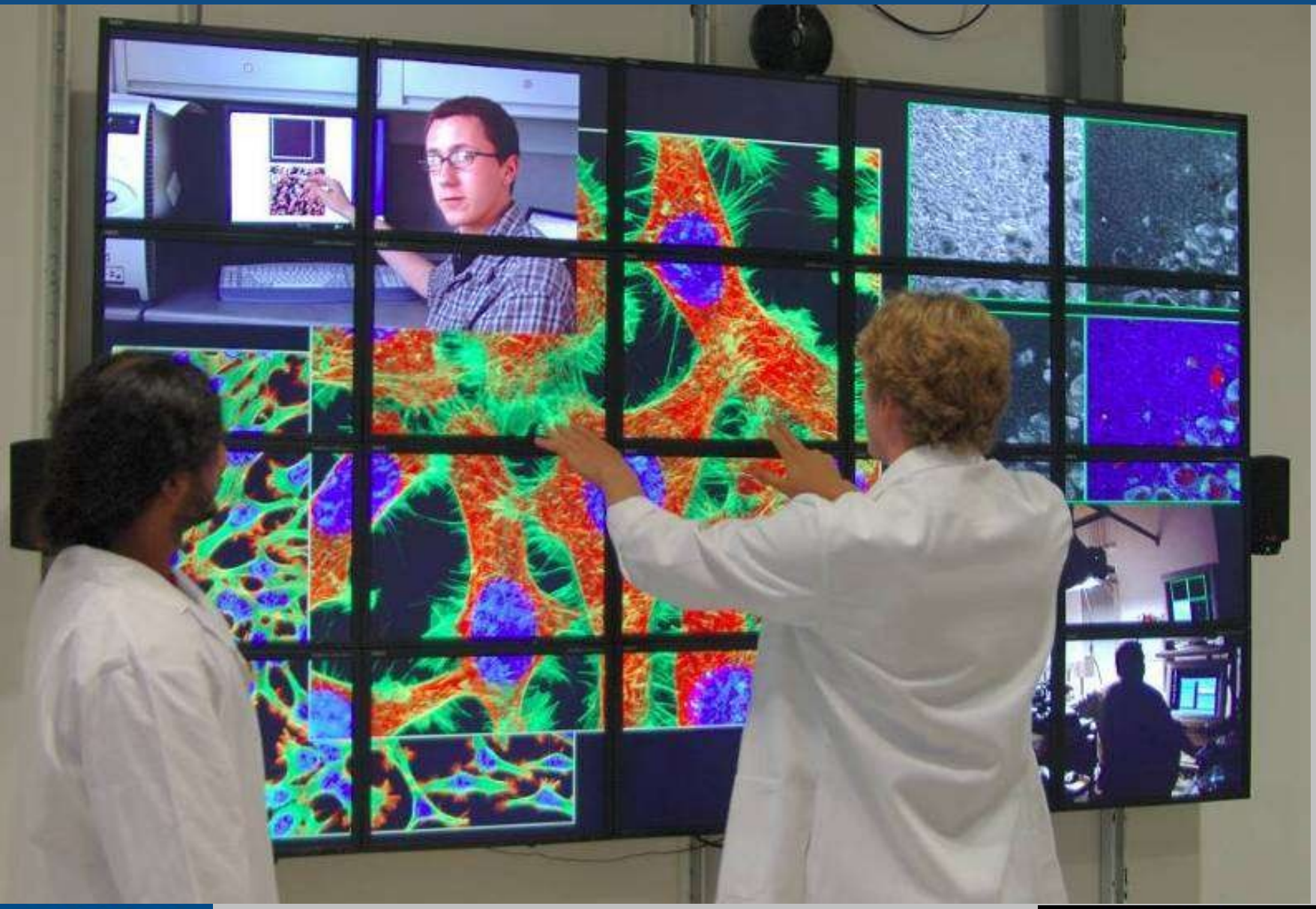


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Zooming In on Bug Eye



OptIPuter Scalable Adaptive Graphics Environment (SAGE) Allows Integration of HD Streams



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evl electronic visualization laboratory

Source: David Lee, NCMIR, UCSD

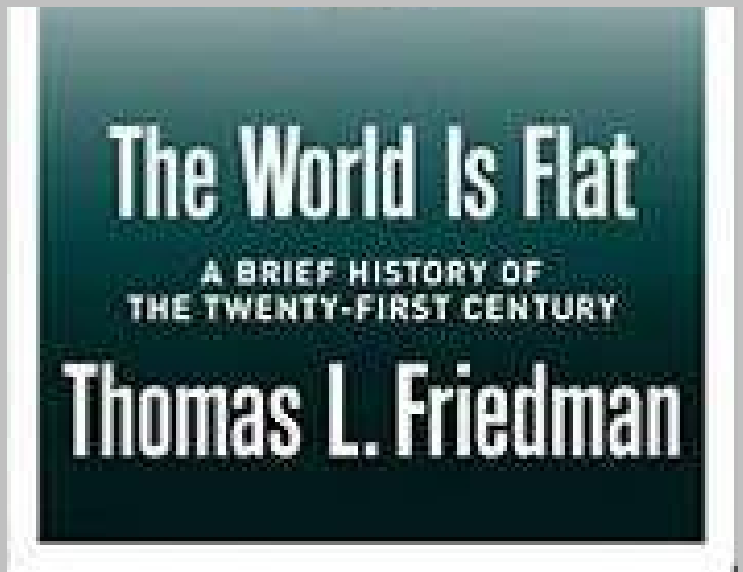
NCMIR NATIONAL CENTER for MICROSCOPY and IMAGING RESEARCH at San Diego, an NIH supported resource center

it²

"Infosys's Global Conferencing Center Ground Zero for the Indian Outsourcing Industry."

**So this is our conference room,
probably the largest screen in Asia-
this is forty digital screens [put together].
We could be sitting here [in Bangalore] with somebody
from New York, London, Boston, San Francisco, all live.
…That's globalization."**

--Nandan Nilekani, CEO Infosys



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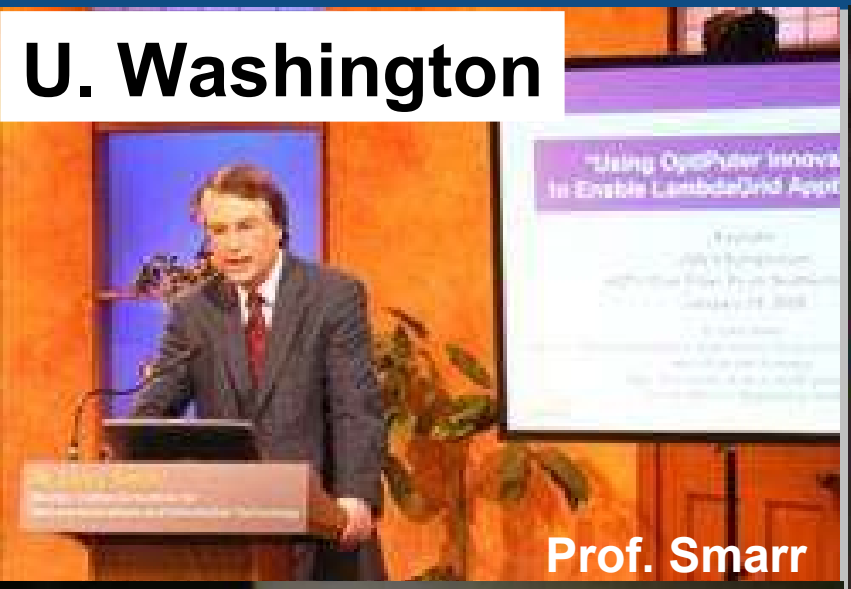
it²

Researchers use the “Access Grid” for Global Conferencing



Access Grid Talk with 35 Locations on 5 Continents— SC Global Keynote Supercomputing ‘04

Multiple HD Streams Over Lambdas Will Radically Transform Global Collaboration







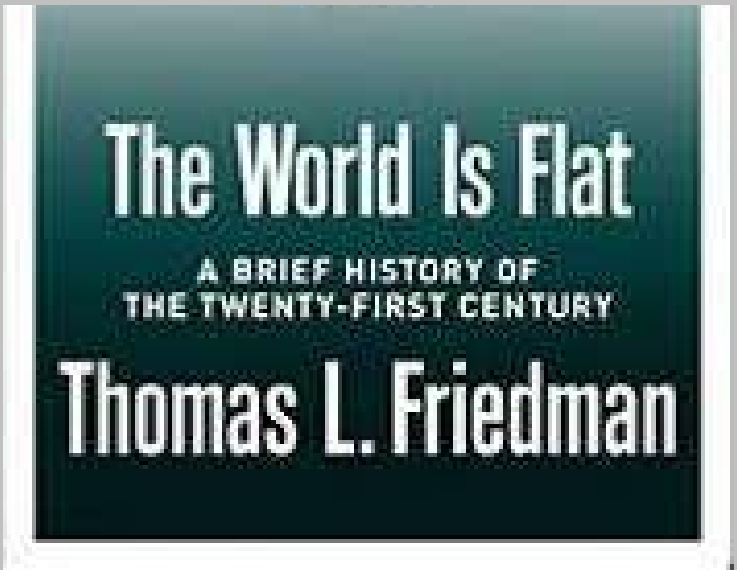
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Source: U Washington Research Channel

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Ten Years Old Technologies--the Shared Internet & the Web--Have Been Adopted Globally

- But Today's Innovations
  - Dedicated Fiber Paths
  - Streaming HD TV
  - Ubiquitous Wireless Internet
  - Location Aware Software
  - SensorNets
- Will Reduce the World to a "Single Point" in Ten Years



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