“Calit2: a View Into the Future of the Wired and Unwired Internet"

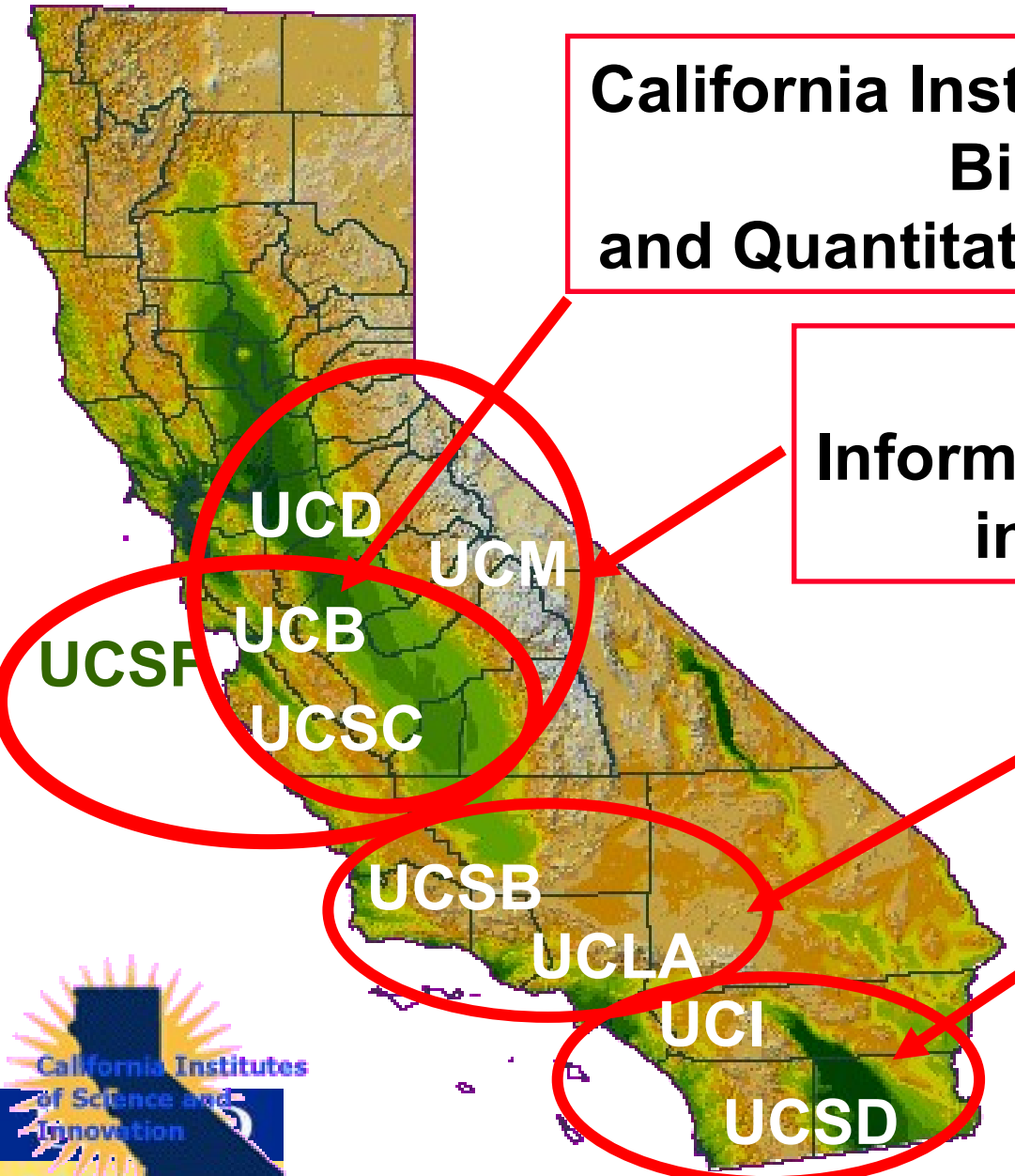
Invited Talk to the National Research Council’s
Computer Science and Telecommunications Board
Mountain View, CA
January 23, 2006

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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UCIrvine

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California's Institutes for Science and Innovation
A Bold Experiment in Collaborative Research



California Institute for Bioengineering, Biotechnology, and Quantitative Biomedical Research

Center for Information Technology Research in the Interest of Society

California NanoSystems Institute

California Institute for Telecommunications and Information Technology

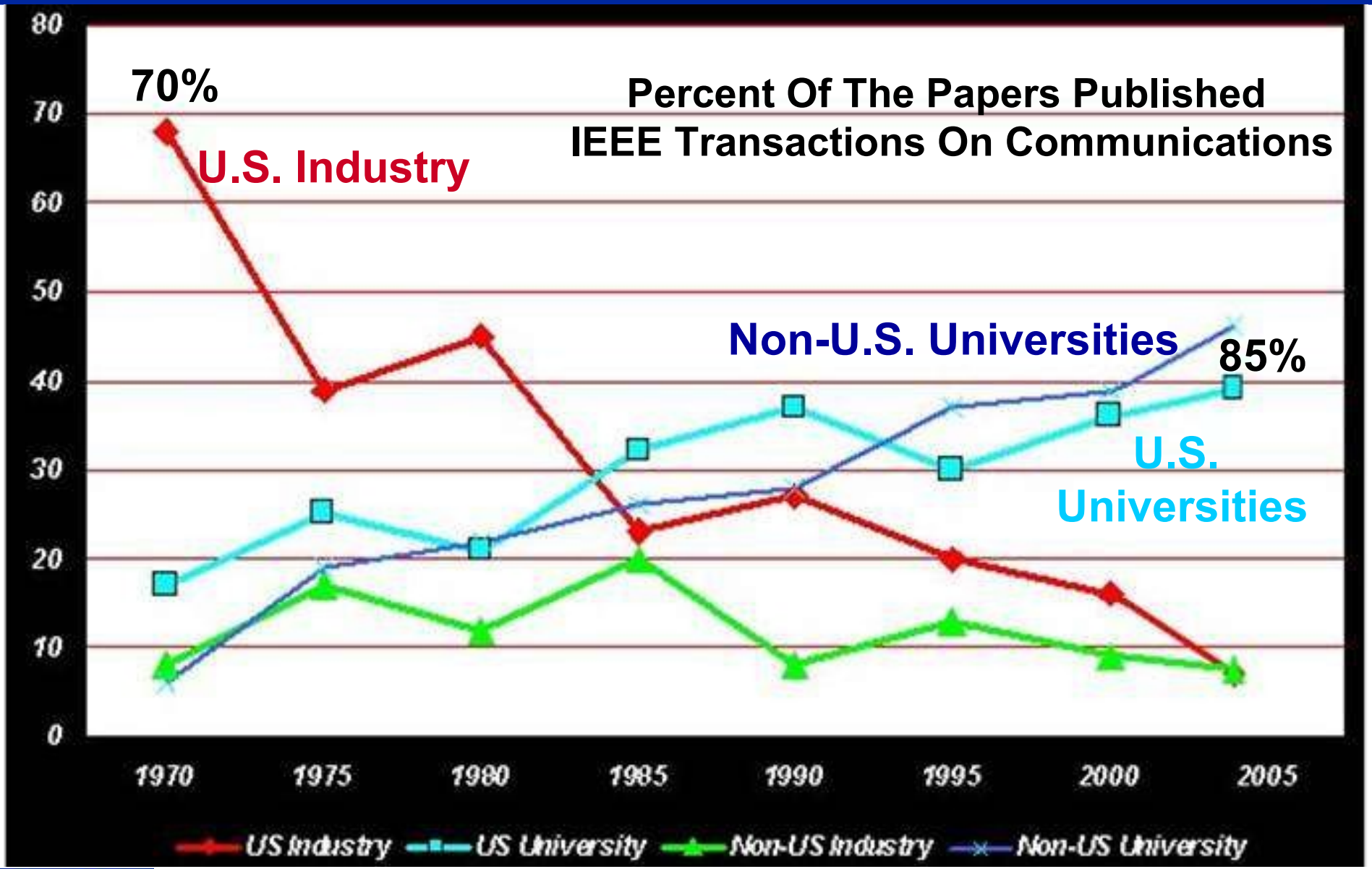
California Institutes of Science and Innovation

UCHVR

www.ucop.edu/california-institutes

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Where is Telecommunications Research Performed? A Historic Shift



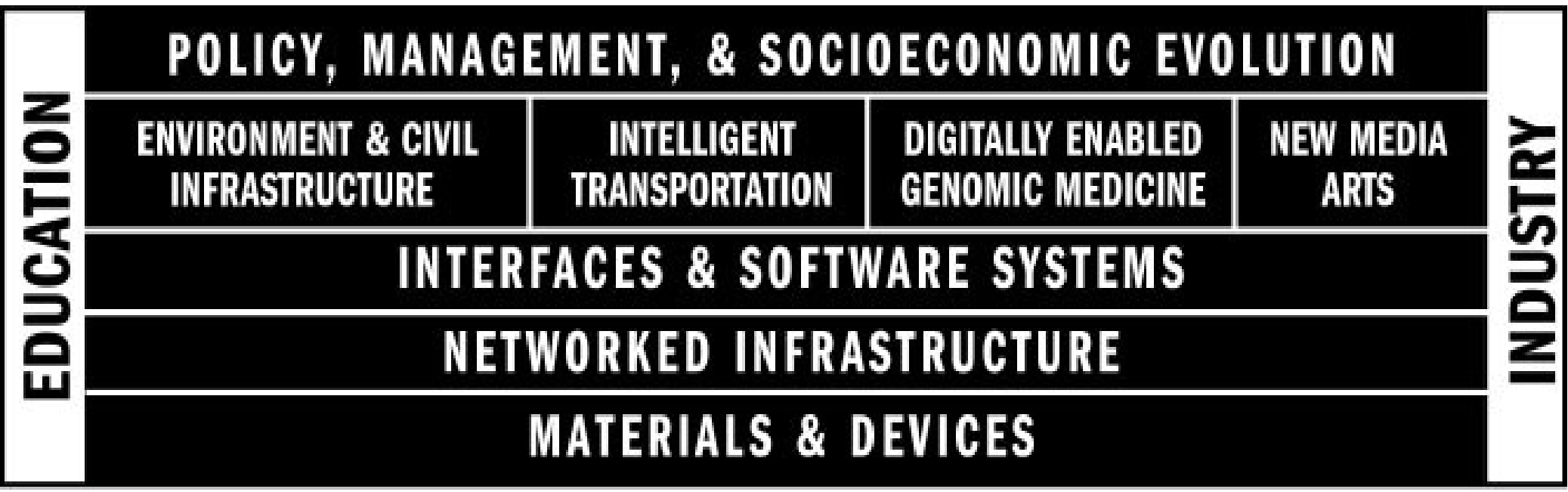
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Source: Bob Lucky, Telcordia/SAIC

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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

California Institute for Telecommunications and Information Technology . Cal-(IT)^2



Extending the Internet Throughout the Physical World

Over the Next Decade
Vast SensorNets Will Feed a Planetary Optical Core

- The Small
  - Pervasive Self-Powered Micro- and Nano-Sensors
- The Cheap
  - Mass Produced Radios
- The Smart
  - System-on-Chip Integration of Computers with Sensors
- The Big
  - Terabit Optical Internet Core
  - Gigabit Wireless Streams

- Calit2's New Approach to Research
  - Large Scale Testbeds
  - Build Integrated Systems
  - Work with End Users
  - Collaborate Across:
    - Disciplines
    - Campuses
    - University / Industry
- Calit2 Large Grant Examples:
  - OptIPuter
  - CAMERA
  - LOOKING
  - RESCUE/WIISARD

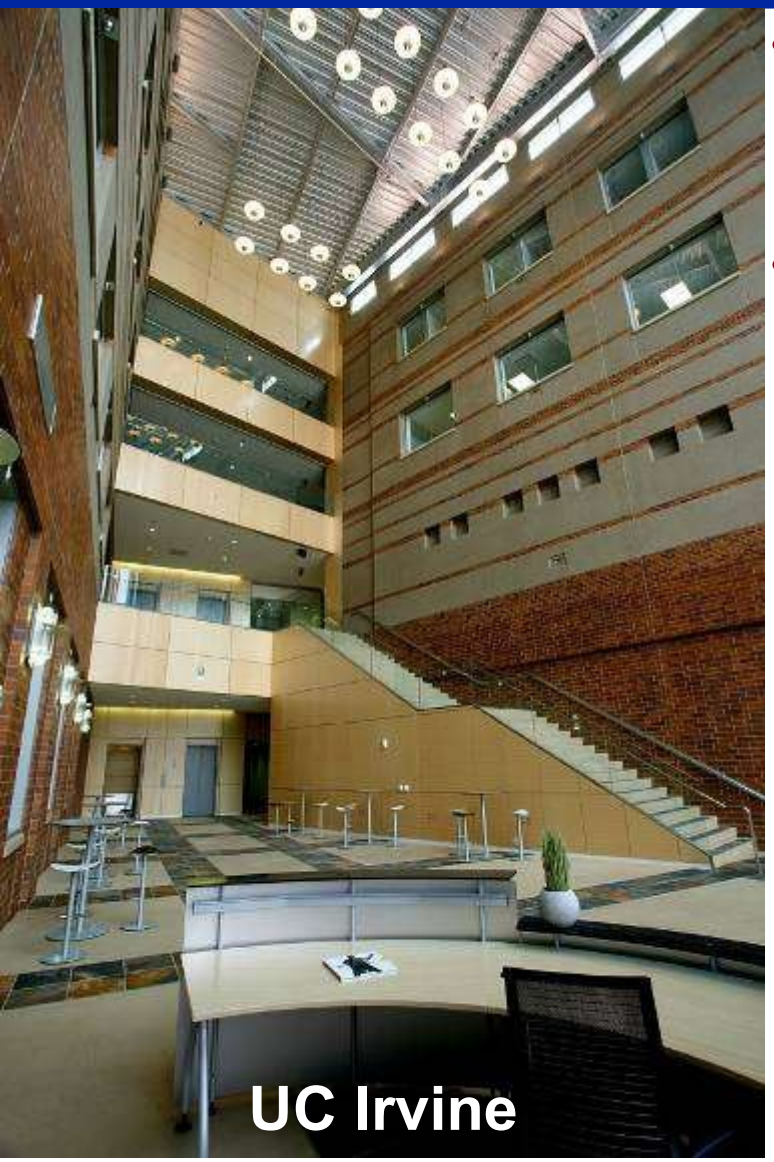
Source: Rajesh Gupta, UCSD

"The all optical fibersphere in the center finds its complement in the wireless ethersphere on the edge of the network."
– George Gilder

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



- New Laboratory Facilities
  - Nanotech, BioMEMS, Chips, Radio, Photonics, Grid, Data, Applications
  - Virtual Reality, Digital Cinema, HDTV, Synthesis
- Over 1000 Researchers in Two Buildings
  - Linked via Dedicated Optical Networks
  - International Conferences and Testbeds

Richard C. Atkinson Hall Dedication Oct. 28, 2005



www.calit2.net

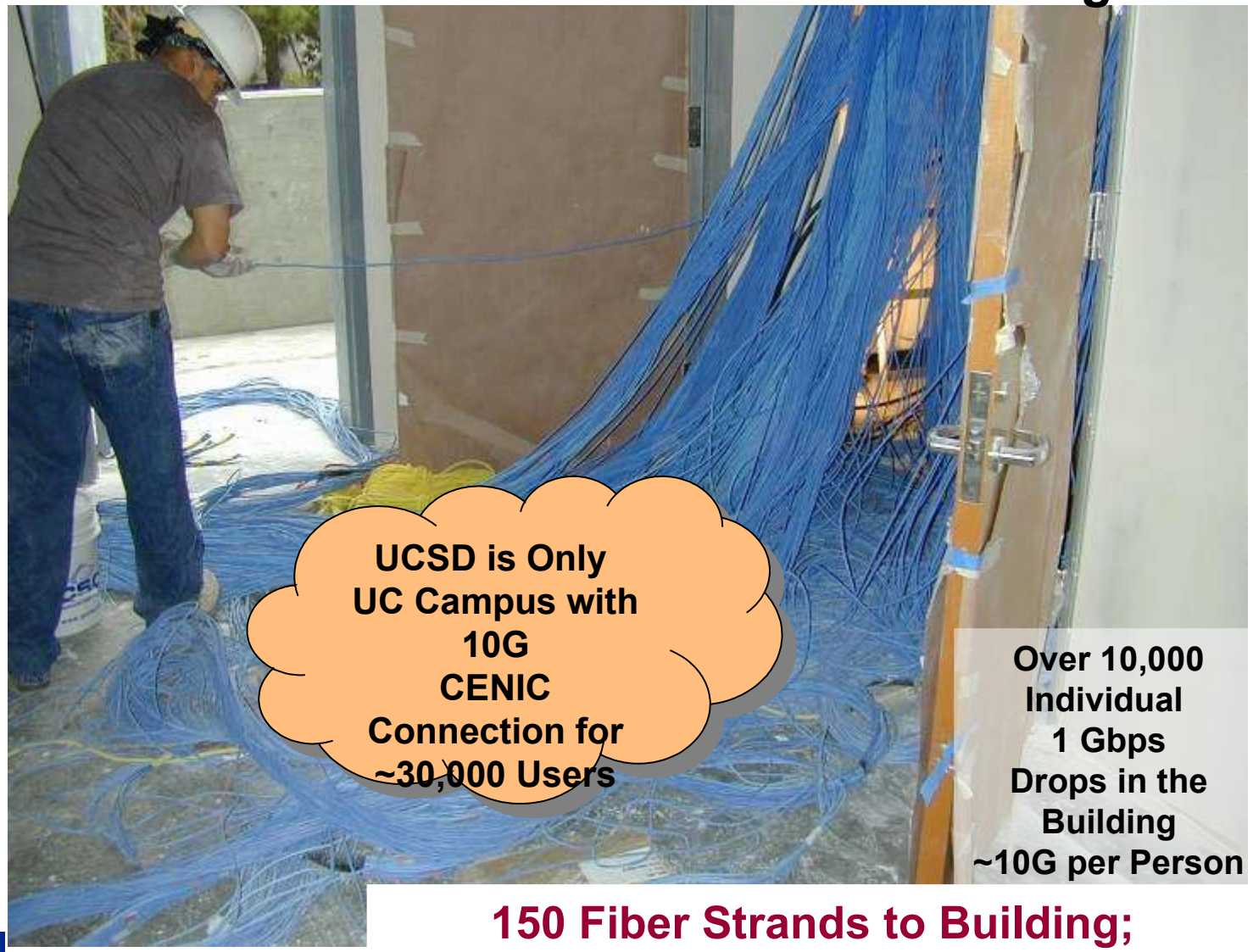
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Preparing for an World in Which Distance Has Been Eliminated…

it2

The Calit2@UCSD Building is Designed for Prototyping Extremely High Bandwidth Applications

1.8 Million Feet of Cat6 Ethernet Cabling



24 Fiber Pairs to Each Lab

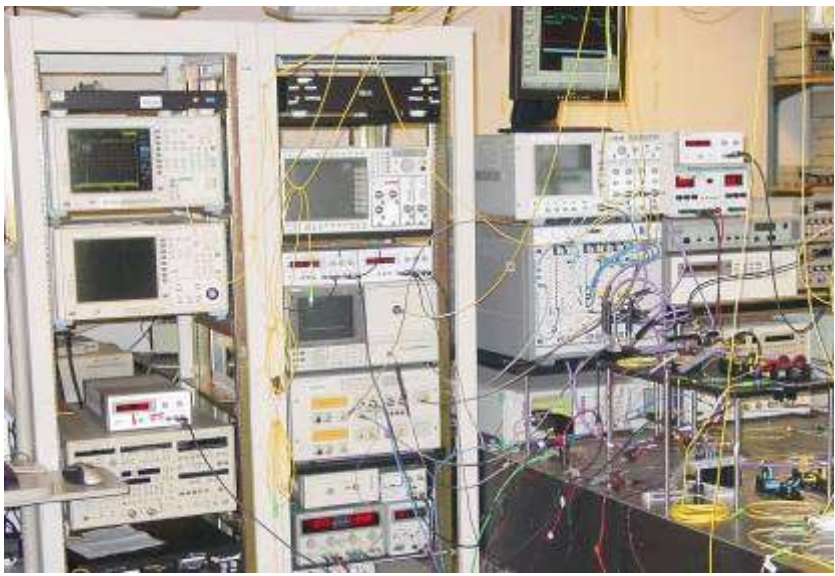
150 Fiber Strands to Building;
Experimental Roof Radio Antenna Farm
Ubiquitous WiFi

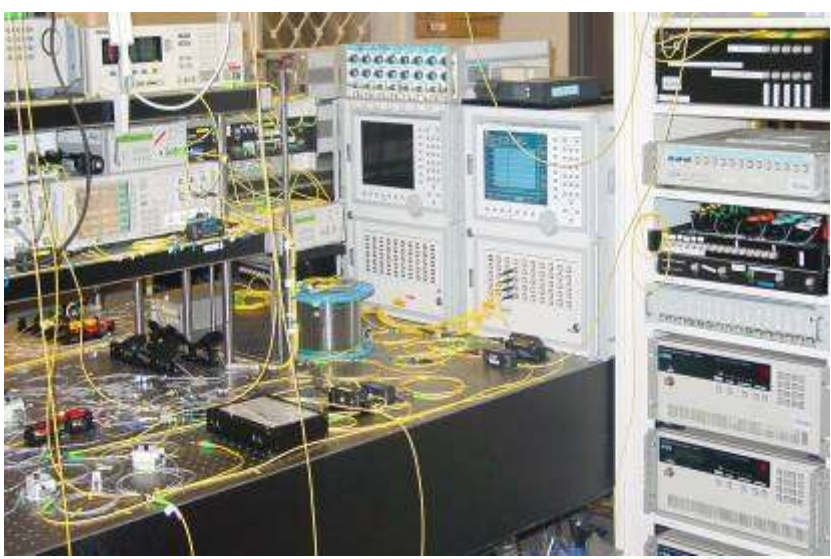
Photo: Tim Beach, Calit2

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Calit2@UCSD Building will House a Photonics Networking Laboratory

- **Networking "Living Lab" Testbed Core**
  - Unconventional Coding
  - High Capacity Networking
  - Bidirectional Architectures
  - Hybrid Signal Processing
- **Interconnected to OptIPuter**
  - Access to Real World Network Flows
  - Allows System Tests of New Concepts





ECE Testbed Faculty



Stojan Radic
Optical communication networks; all-optical processing; parametric processes in high-confinement fiber and semiconductor devices.



George Papen
Advanced photonic systems including optical communication systems, optical networking, and environmental and atmospheric remote sensing.



Joseph Ford
Optoelectronic subsystems integration (MEMS, diffractive optics, VLSI); Fiber optic and free-space communications.



Shaya Fainman
Nanoscale science and technology; ultrafast photonics and signal processing



Shayan Mookherjea
Optical devices and optical communication networks, including photonics, lightwave systems and nano-scale optics.



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UCSD Photonics

UCSD Parametric Processing Laboratory

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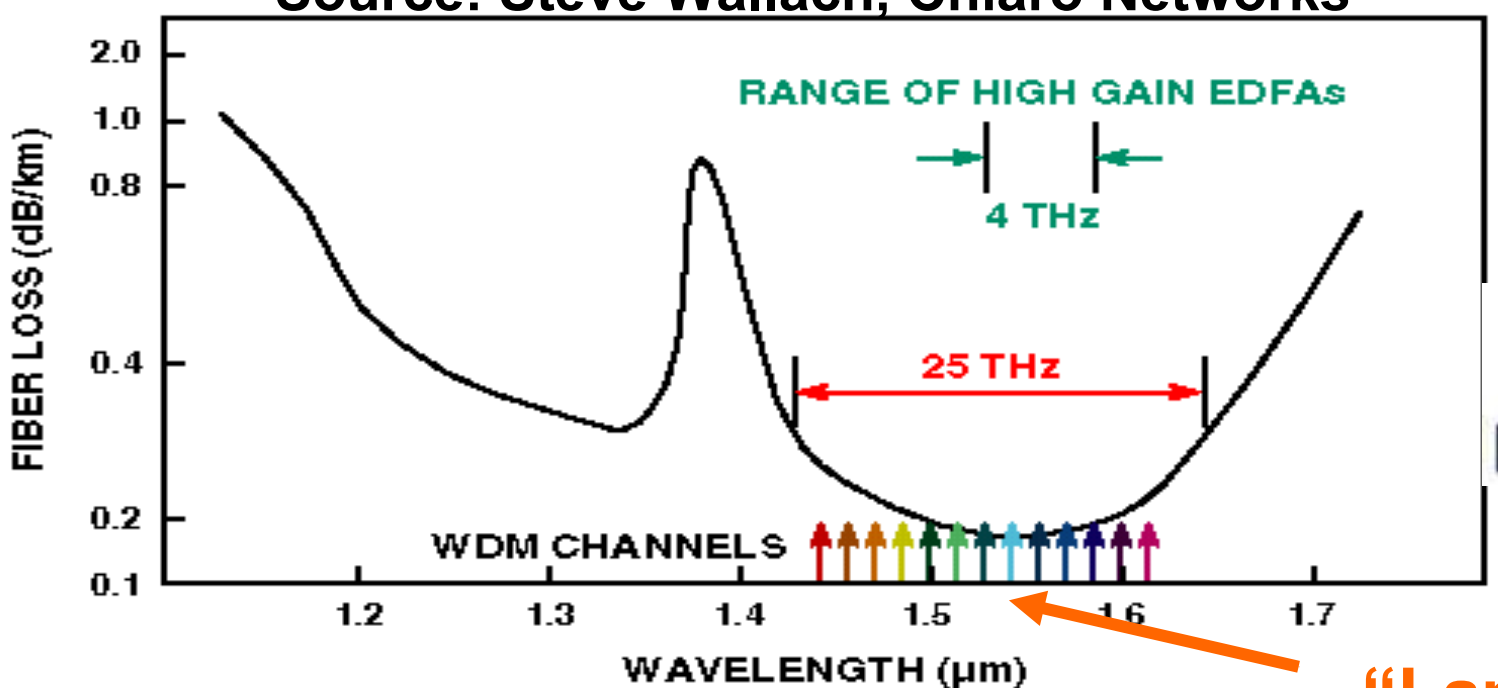
Dedicated Optical Channels Makes High Performance Cyberinfrastructure Possible

WAVELENGTH DIVISION MULTIPLEXING (WDM)

10 Gbps per User ~ 200x Shared Internet Throughput

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

Source: Steve Wallach, Chiaro Networks



CHIARO

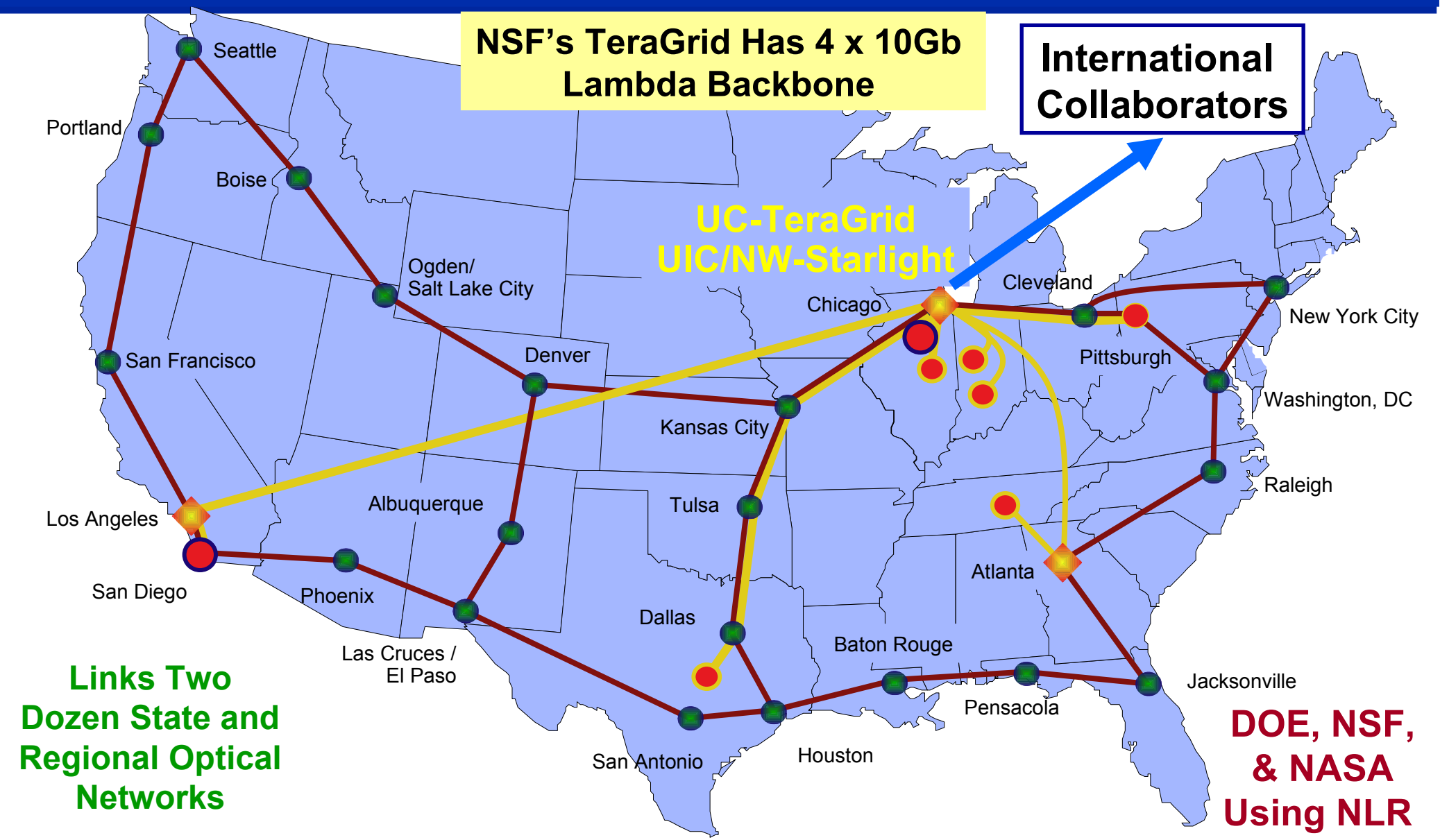
"Lambdas"

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Parallel Lambdas are Driving Optical Networking The Way Parallel Processors Drove 1990s Computing

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National LambdaRail (NLR) Provides the Cyberinfrastructure Backbone for U.S. University Researchers



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

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Global Connections
Between University Research Centers at 10Gbps

Maxine Brown, Tom DeFanti, Co-Chairs

iGrid 2005

THE GLOBAL LAMBDA INTEGRATED FACILITY

www.igrid2005.org

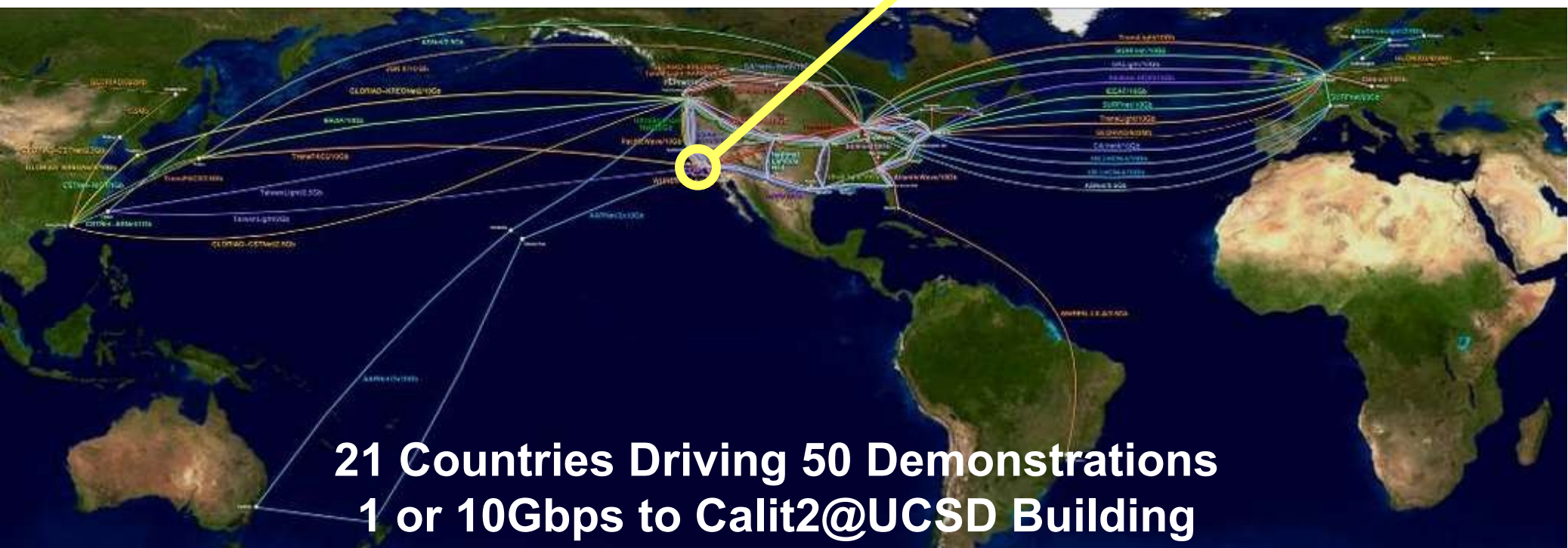


the UC Discovery Grant

September 26-30, 2005

Calit2 @ University of California, San Diego

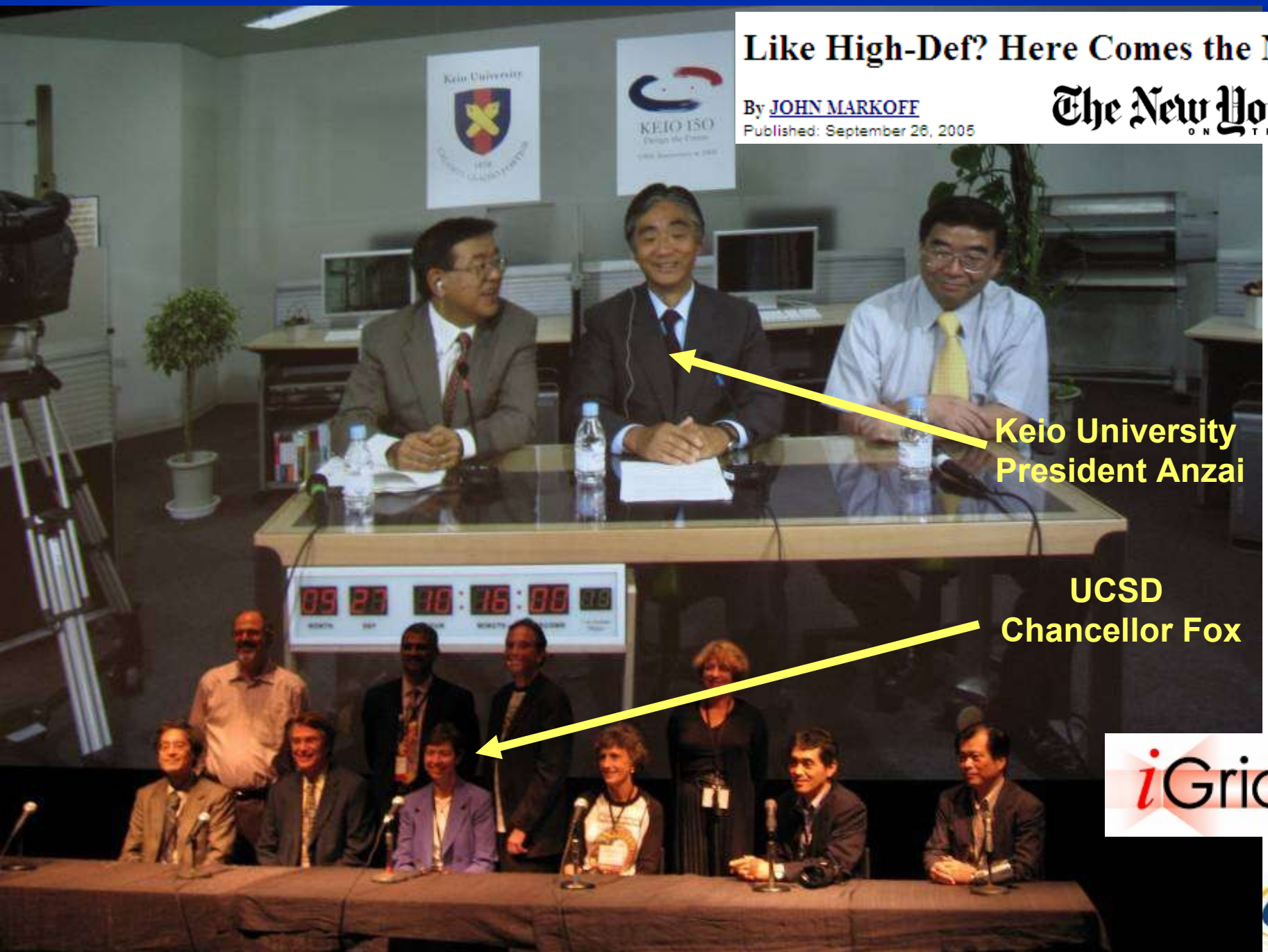
California Institute for Telecommunications and Information Technology



21 Countries Driving 50 Demonstrations

1 or 10Gbps to Calit2@UCSD Building

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



Like High-Def? Here Comes the Next Level

By JOHN MARKOFF
Published: September 26, 2005

The New York Times ON THE WEB

Keio University President Anzai

UCSD Chancellor Fox

Lays Technical Basis for Global Digital Cinema

Sony
NTT
SGI

iGrid 2005

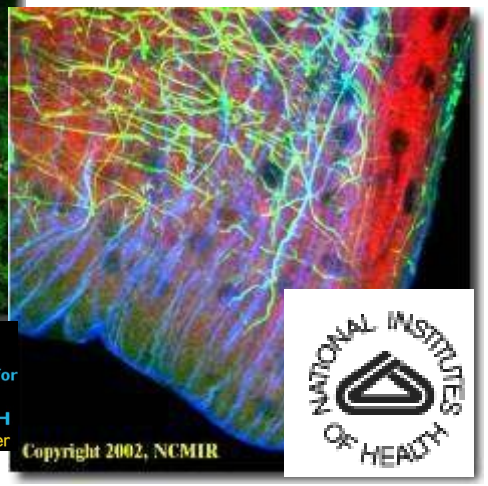
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The OptIPuter Project –
Linking Global Scale Science Projects to User's Linux Clusters

- **NSF Large Information Technology Research Proposal**
  - Calit2 (UCSD, UCI) and UIC Lead Campuses—Larry Smarr PI
  - Partnering Campuses: USC, SDSU, NW, TA&M, UvA, SARA, NASA
- **Industrial Partners**
  - IBM, Sun, Telcordia, Chiaro, Calient, Glimmerglass, Lucent
- **$13.5 Million Over Five Years**
- **Creating a LambdaGrid "Web" for Gigabyte Data Objects**

NIH Biomedical Informatics Research Network

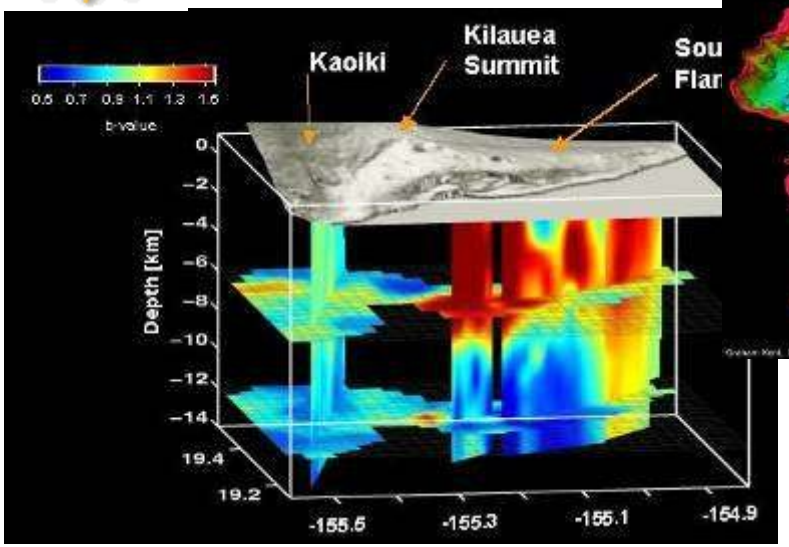


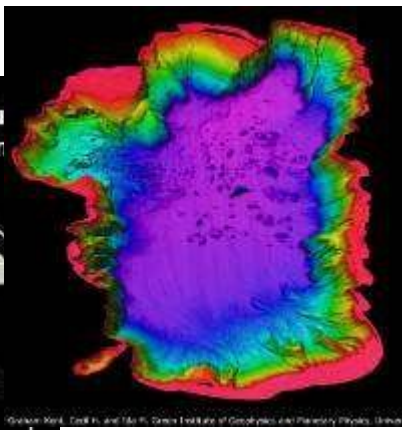


NCMIR
NATIONAL CENTER for MICROSCOPY and IMAGING RESEARCH
at San Diego, an NIH supported resource center

NATIONAL INSTITUTES OF HEALTH

NSF EarthScope and ORION



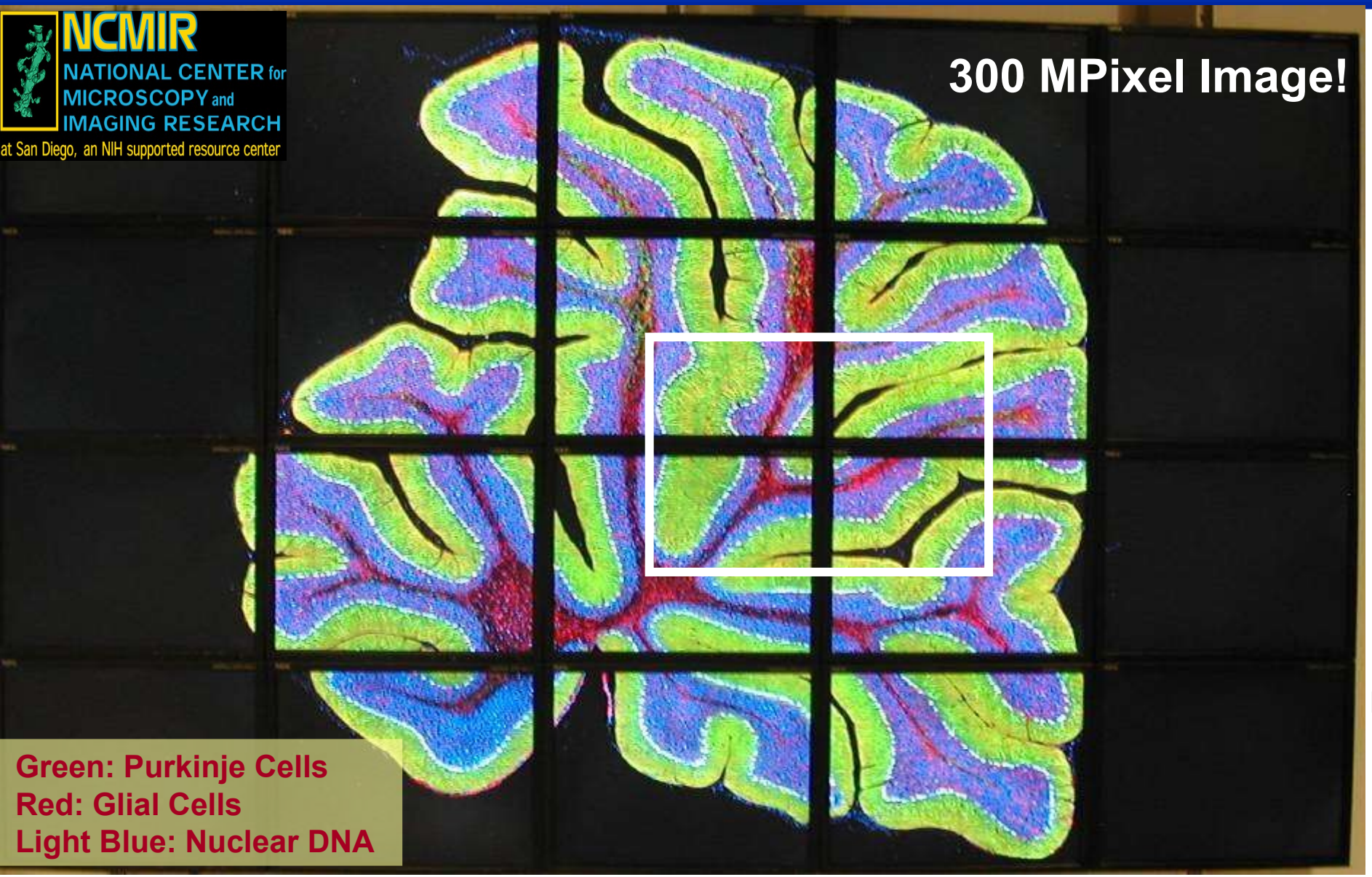


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SDSC
SAN DIEGO SUPERCOMPUTER CENTER

it2

The OptIPuter -- From the Grid to the LambdaGrid: High Resolution Portals to Global Science Data



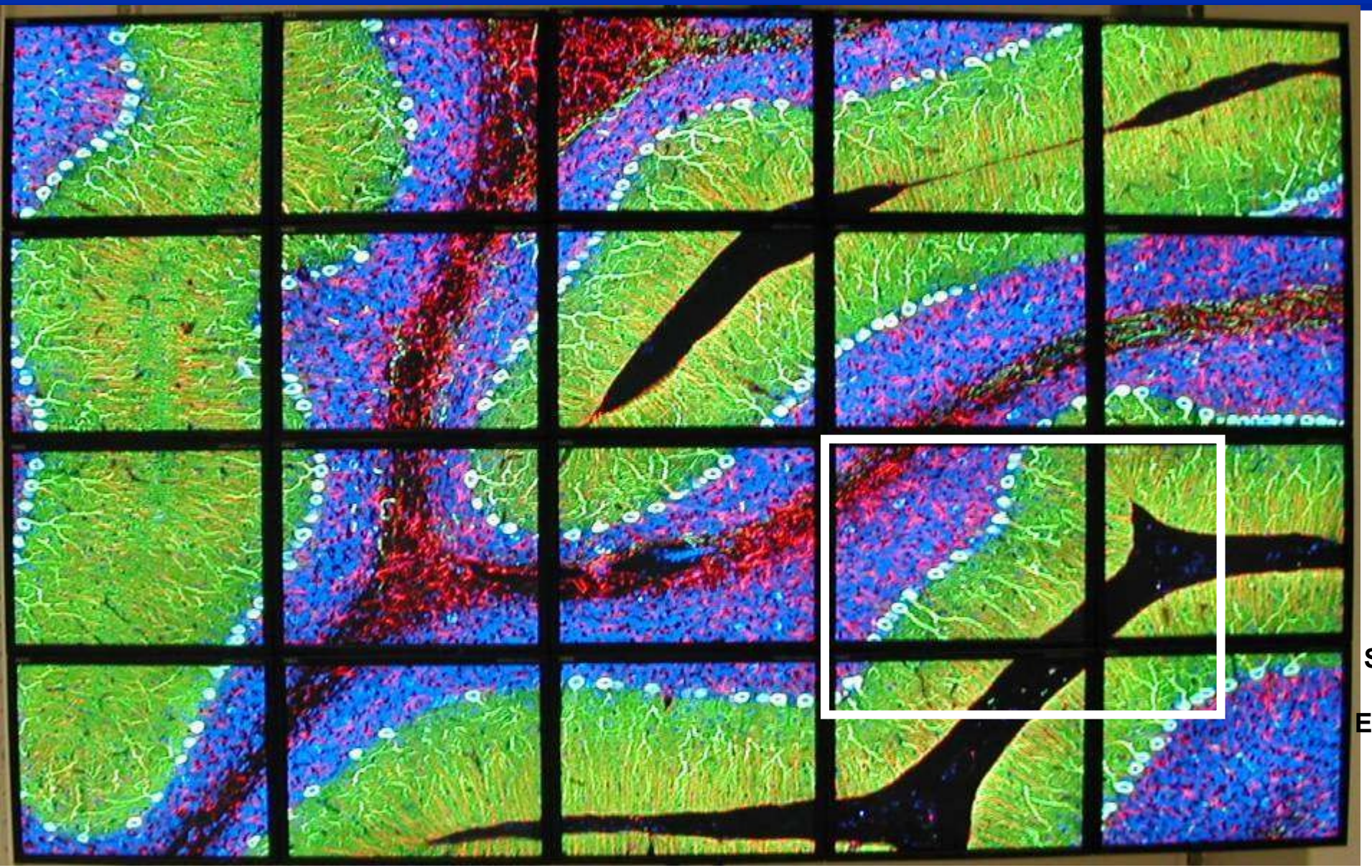
Source: Mark Ellisman, David Lee, Jason Leigh

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Two-Photon Laser Confocal Microscope Montage of 40x36=1440 Images in 3 Channels of a Mid-Sagittal Section of Rat Cerebellum Acquired Over an 8-hour Period

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Scalable Displays Allow Both Global Content and Fine Detail



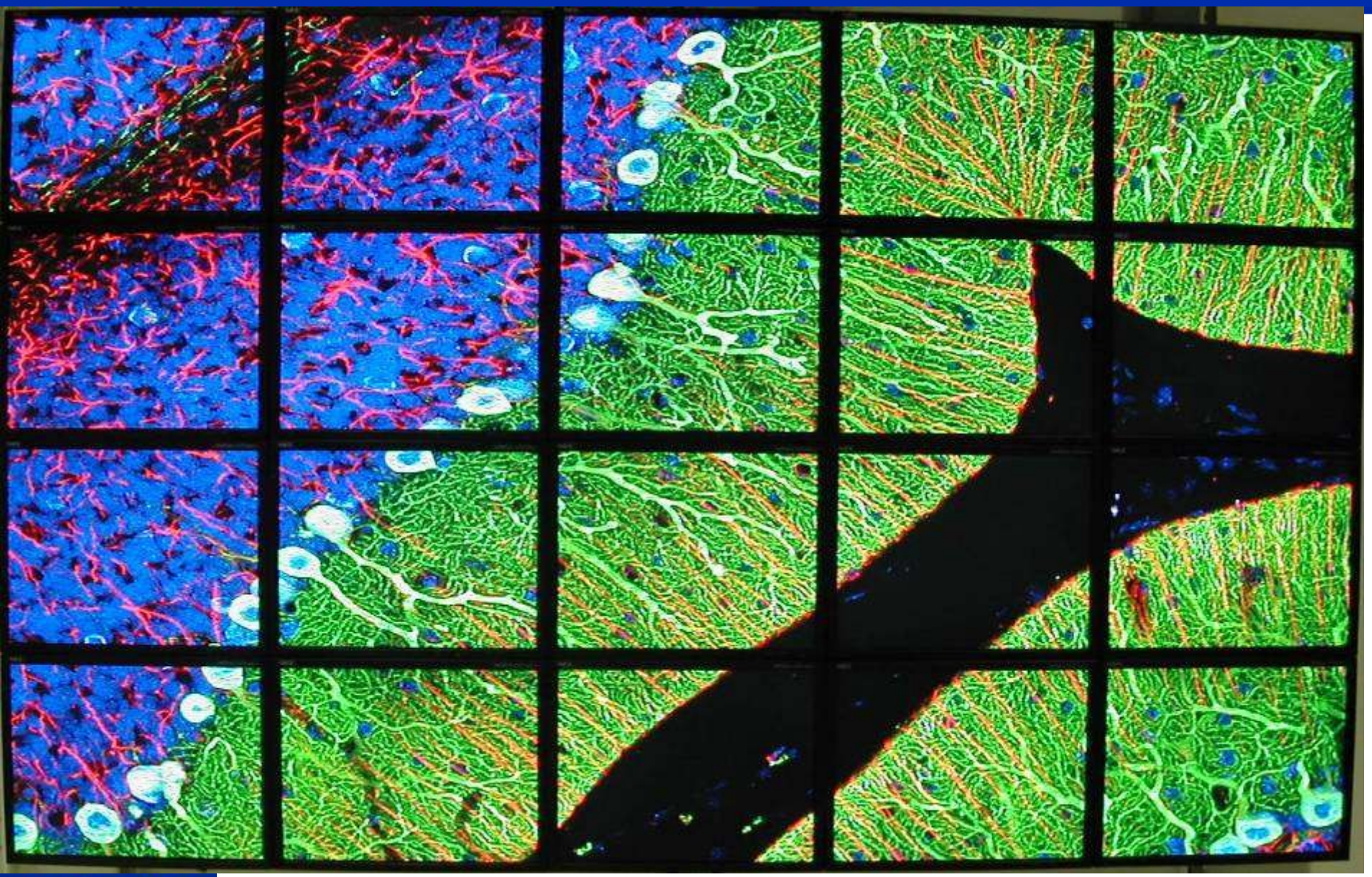
Source: Mark Ellisman, David Lee, Jason Leigh

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30 MPixel SunScreen Display Driven by a 20-node Sun Opteron Visualization Cluster

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Allows for Interactive Zooming from Cerebellum to Individual Neurons

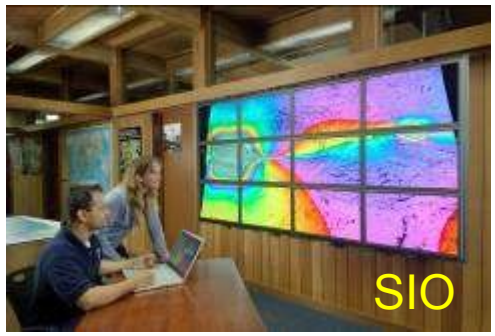


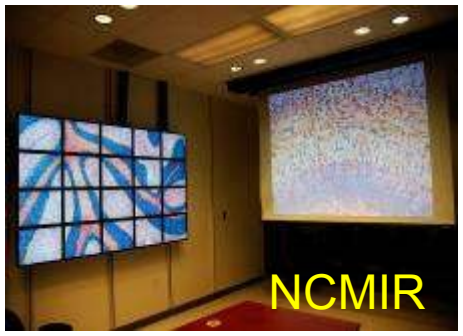
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Source: Mark Ellisman, David Lee, Jason Leigh

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OptIPuter Scalable Display Systems Are Being Rapidly Deployed







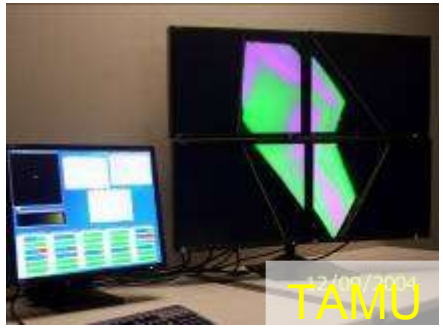




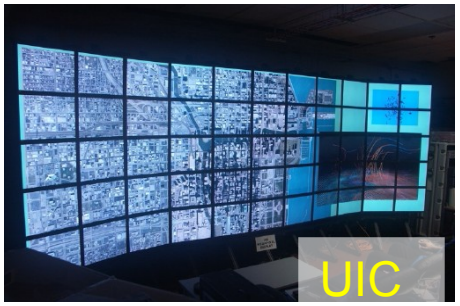














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Source: Jason Leigh, EVL, UIC

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The OptIPuter Creates a MetaComputer on the Scale of Planet Earth

The Global Lambda Integrated Facility (GLIF) Interconnecting Optical Research Networks to form a Global SuperNetwork



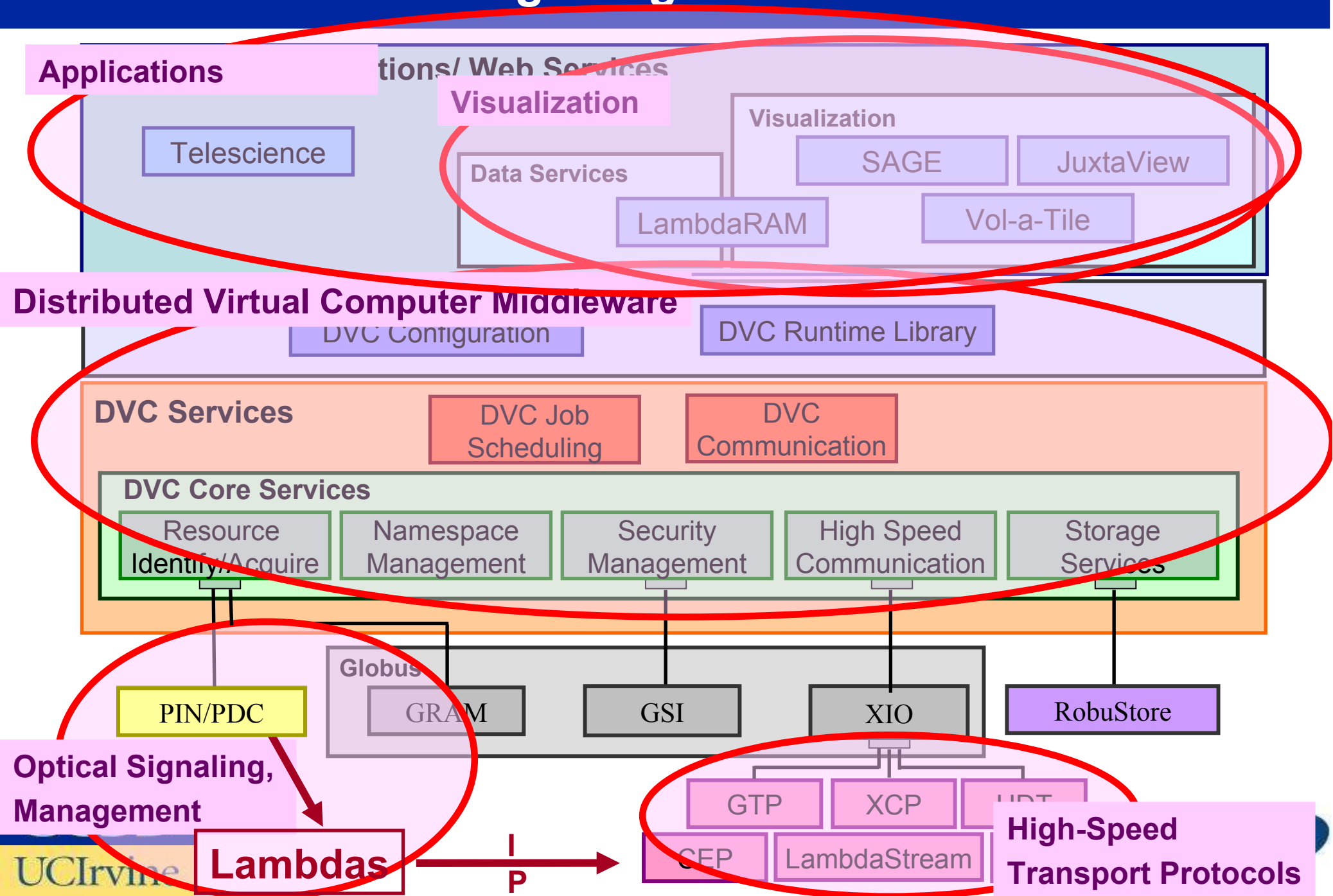
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OptIPuter with 10G Single Optical Backplane

OptIPuter Partner End Points

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OptIPuter Software Architecture--a Service-Oriented Architecture Integrating Lambdas Into the Grid



Current Campus and Regional Infrastructure Needs Major Upgrades

"Research is being stalled by 'information overload,' Mr. Bement said, because data from digital instruments are piling up far faster than researchers can study. In particular, he said, campus networks need to be improved. High-speed data lines crossing the nation are the equivalent of six-lane superhighways, he said. But networks at colleges and universities are not so capable. "Those massive conduits are reduced to two-lane roads at most college and university campuses," he said. Improving cyberinfrastructure, he said, "will transform the capabilities of campus-based scientists."

-- Arden Bement, the director of the National Science Foundation



www.ctwatch.org

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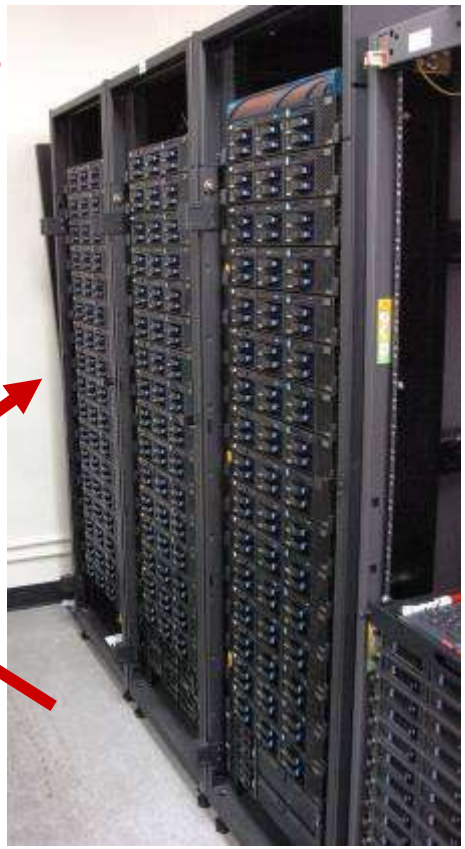
Campuses Must Provide Fiber Infrastructure to End-User Laboratories & Large Rotating Data Stores

SIO Ocean Supercomputer



UCSD Campus LambdaStore Architecture

IBM Storage Cluster



Streaming Microscope

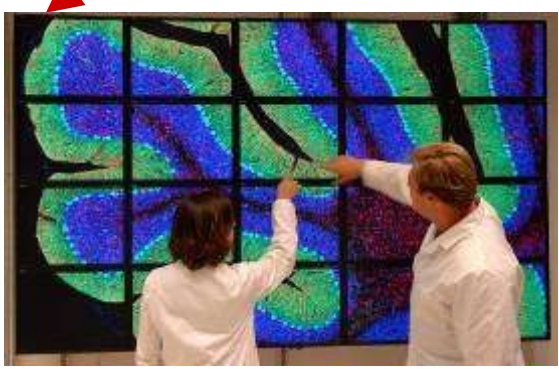






2 Ten Gbps Campus Lambda Raceway







Global LambdaGrid

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Source: Phil Papadopoulos, SDSC, Calit2

it2

The Optical Core of the UCSD Campus-Scale Testbed -- Evaluating Packet Routing versus Lambda Switching

Goals by 2007:

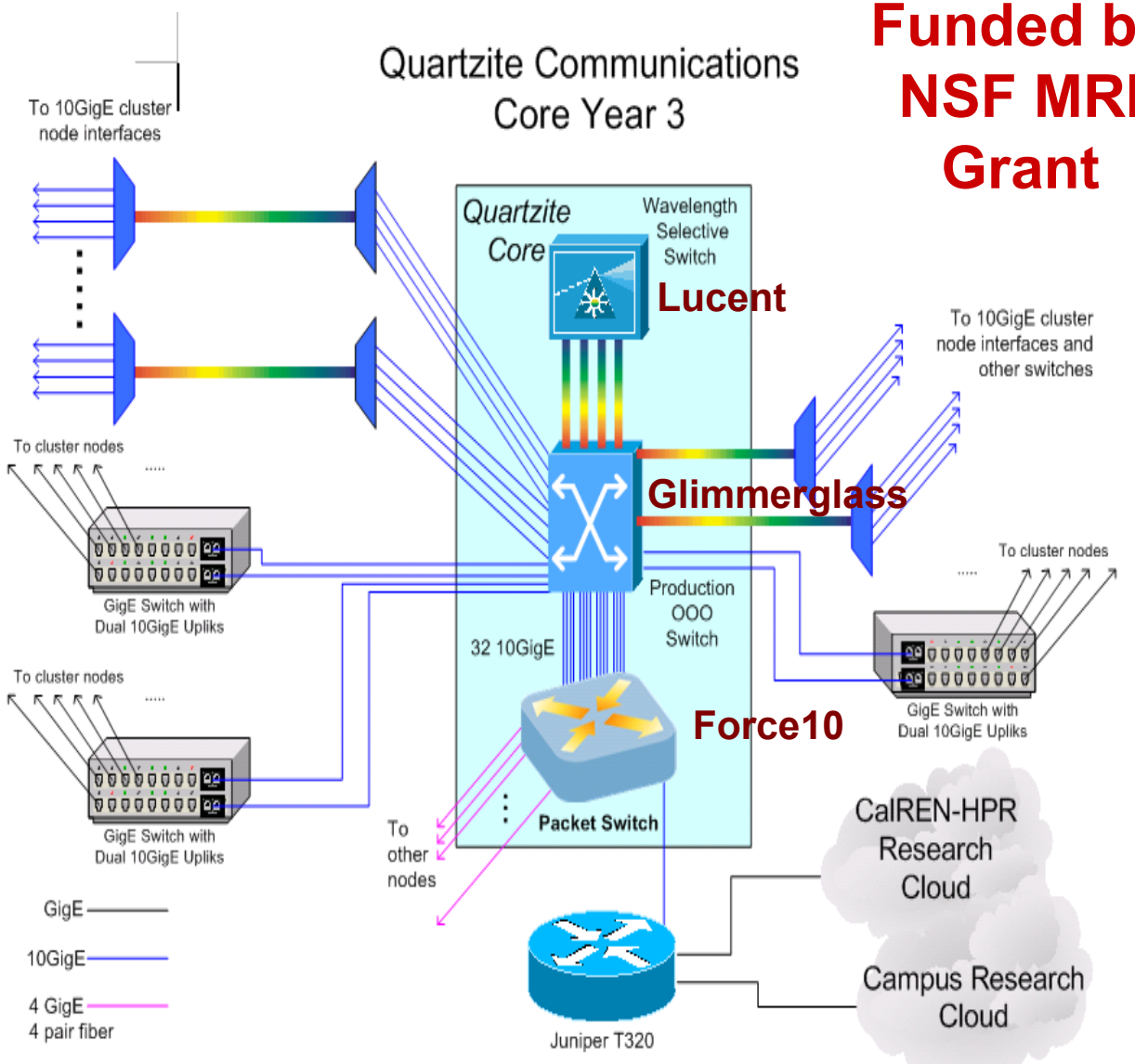
>= 50 endpoints at 10 GigE

>= 32 Packet switched

>= 32 Switched wavelengths

>= 300 Connected endpoints

Approximately 0.5 TBit/s Arrive at the "Optical" Center of Campus
Switching will be a Hybrid Combination of:
Packet, Lambda, Circuit -- OOO and Packet Switches Already in Place



Funded by NSF MRI Grant

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Calit2's Direct Access Core Architecture Will Create Next Generation Metagenomics Server

Sargasso Sea Data

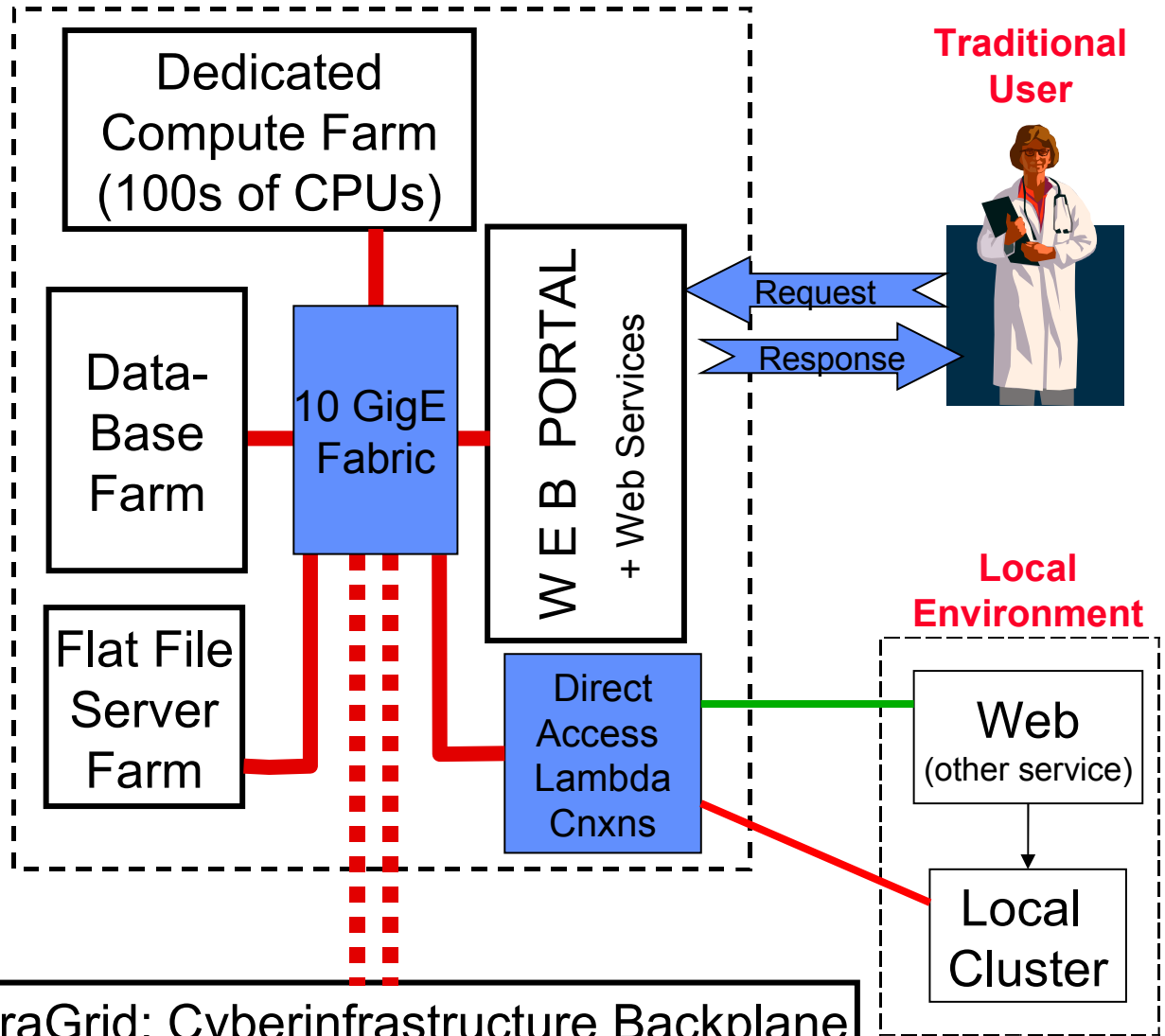
Sorcerer II Expedition (GOS)

JGI Community Sequencing Project

Moore Marine Microbial Project

NASA Goddard Satellite Data

Community Microbial Metagenomics Data



Source: Phil Papadopoulos, SDSC, Calit2

CENTER FOR EARTH OBSERVATIONS & APPLICATIONS

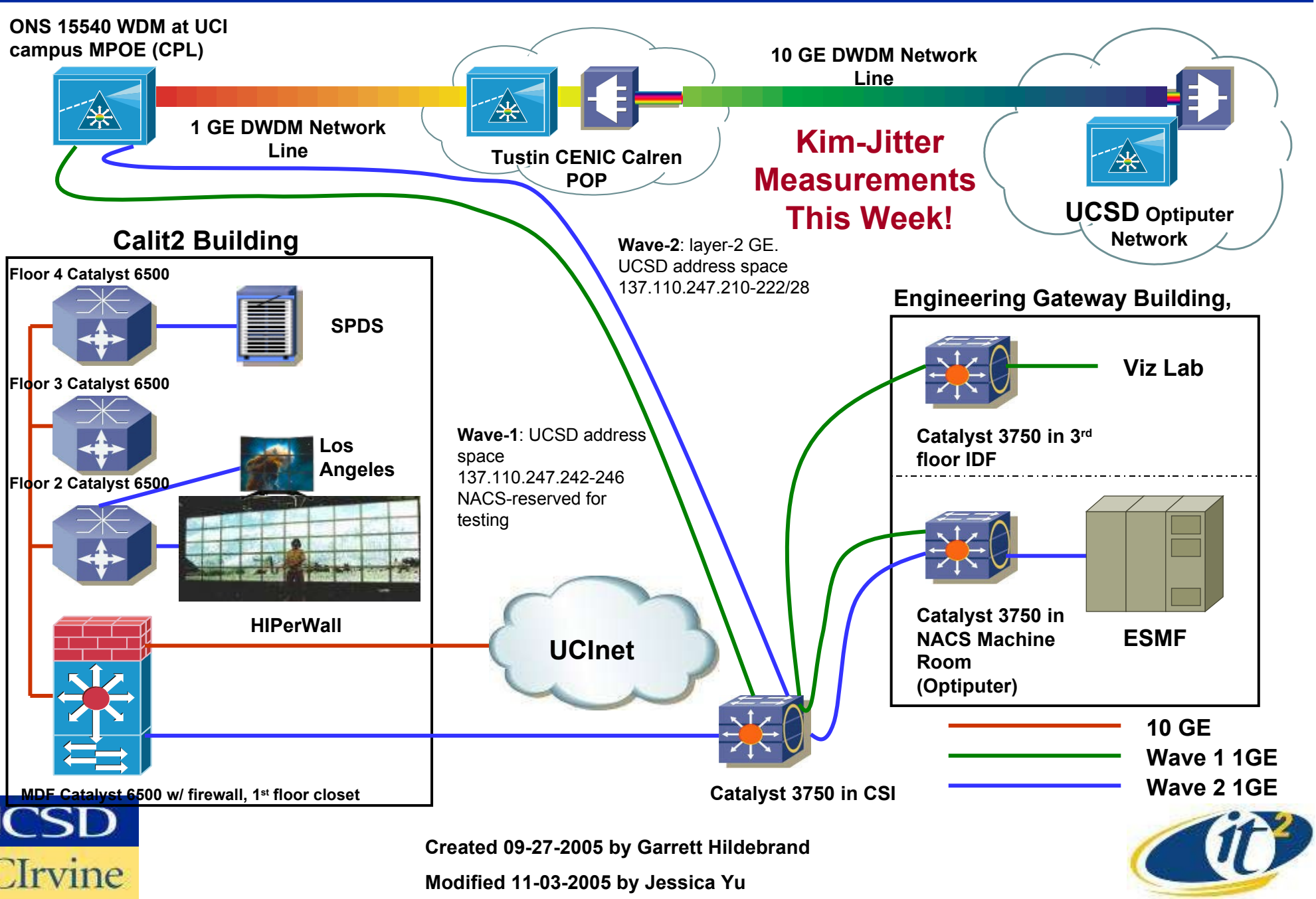
J. Craig Venter INSTITUTE

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SDSC SAN DIEGO SUPERCOMPUTER CENTER

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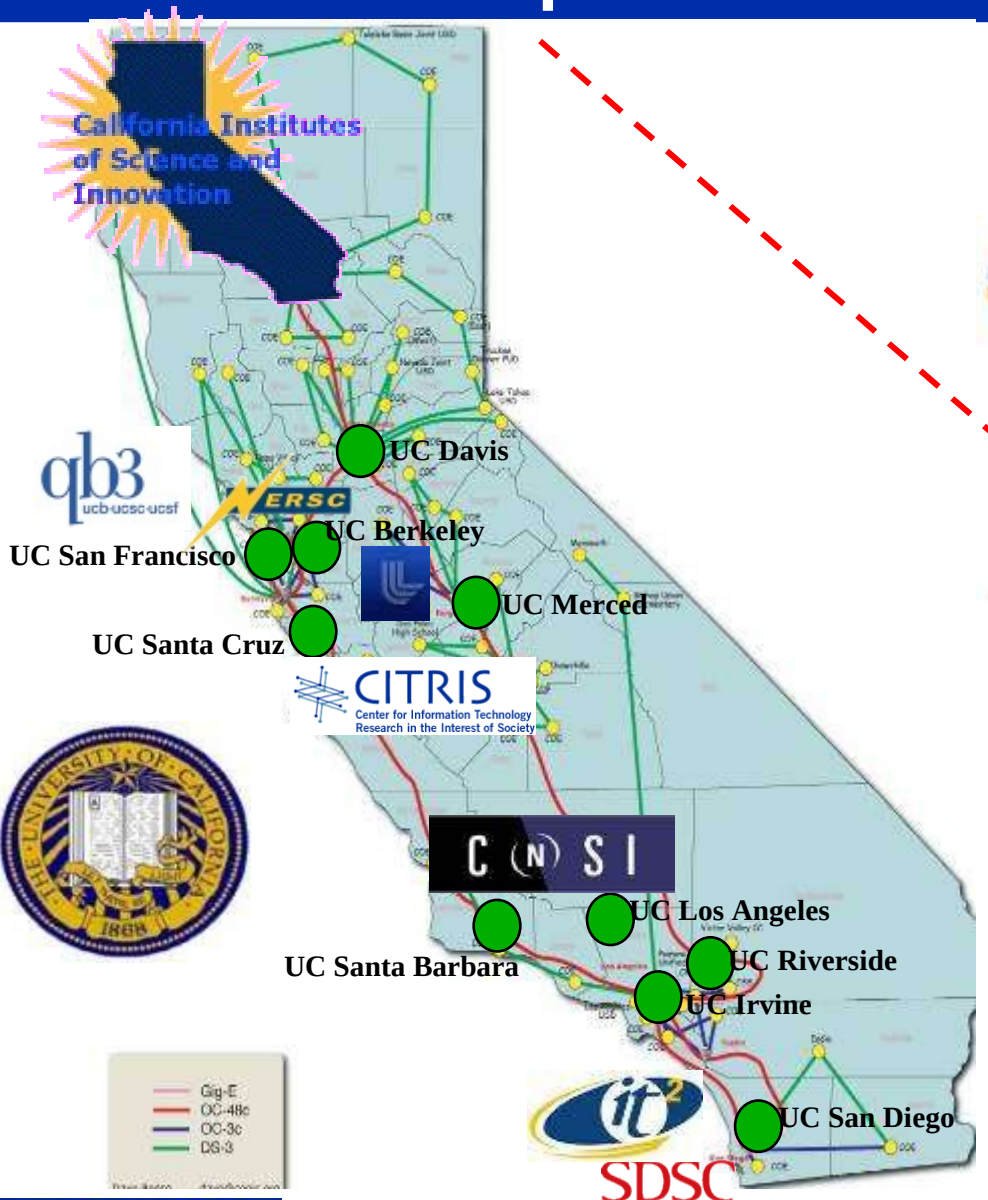
OptIPuter@UCI is Up and Working



Created 09-27-2005 by Garrett Hildebrand

Modified 11-03-2005 by Jessica Yu

Calit2/SDSC Proposal to Create a UC Cyberinfrastructure of "On-Ramps" to National LambdaRail Resources



OptIPuter + CalREN-XD + TeraGrid = "OptiGrid"

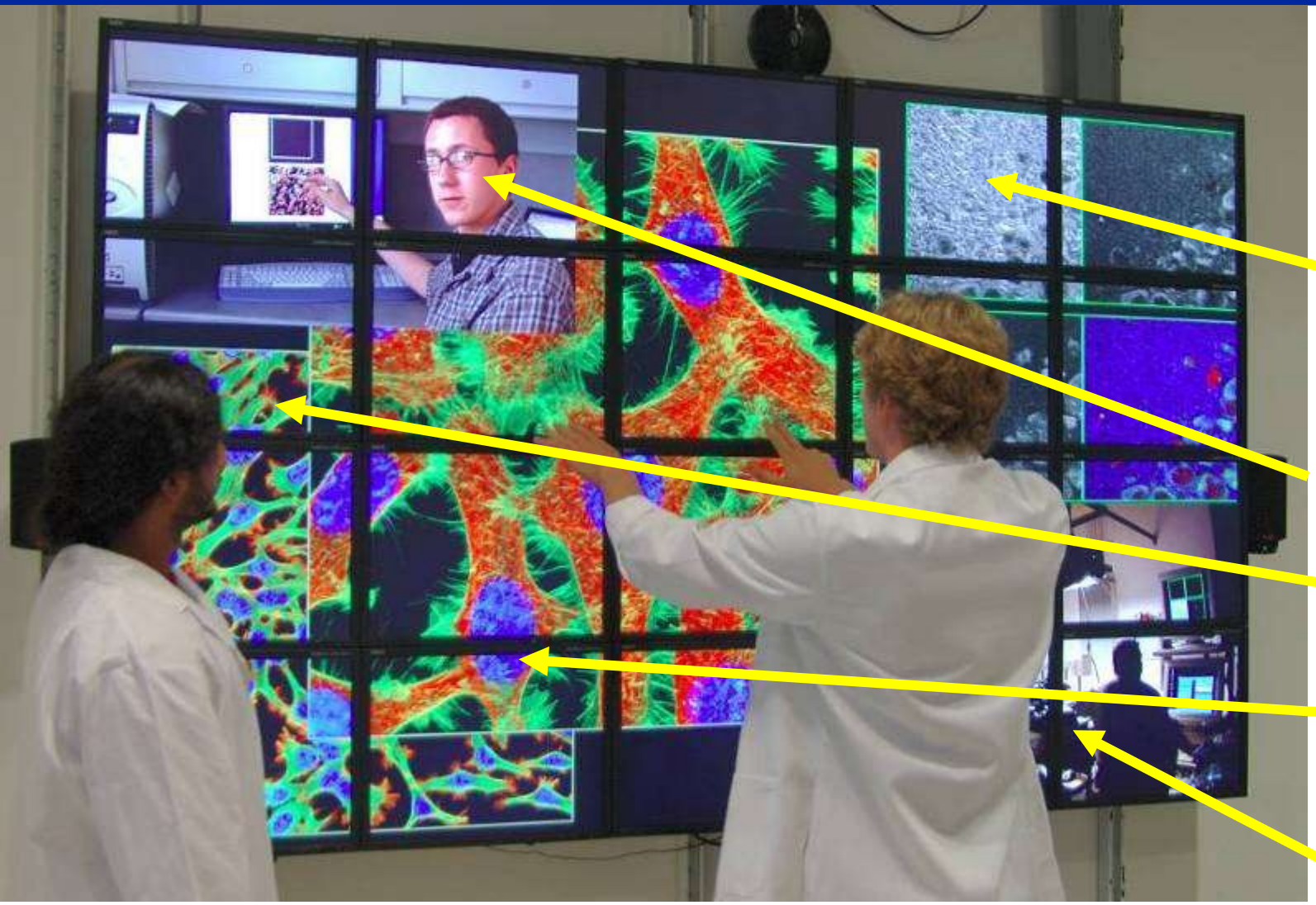


Creating a Critical Mass of End Users on a Secure LambdaGrid

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Source: Fran Berman, SDSC , Larry Smarr, Calit2

Scalable Adaptive Graphics Environment (SAGE) Defines the OptIPuter



SAGE Developed Under Jason Leigh, EVL

- Live Streaming Video of the RTS-2000 Microscope
- HD Video from Remote BIRN Site
- Macro View of Montage Data
- Micro View of Montage Data
- HD Video from the RTS Microscope Room

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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

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Calit2@UCI Has the Largest Tiled Display Wall--HIPerWall



Calit2@UCI Apple Tiled Display Wall
Driven by 25 Dual-Processor G5s
50 Apple 30” Cinema Displays
200 Million Pixels of Viewing Real Estate!

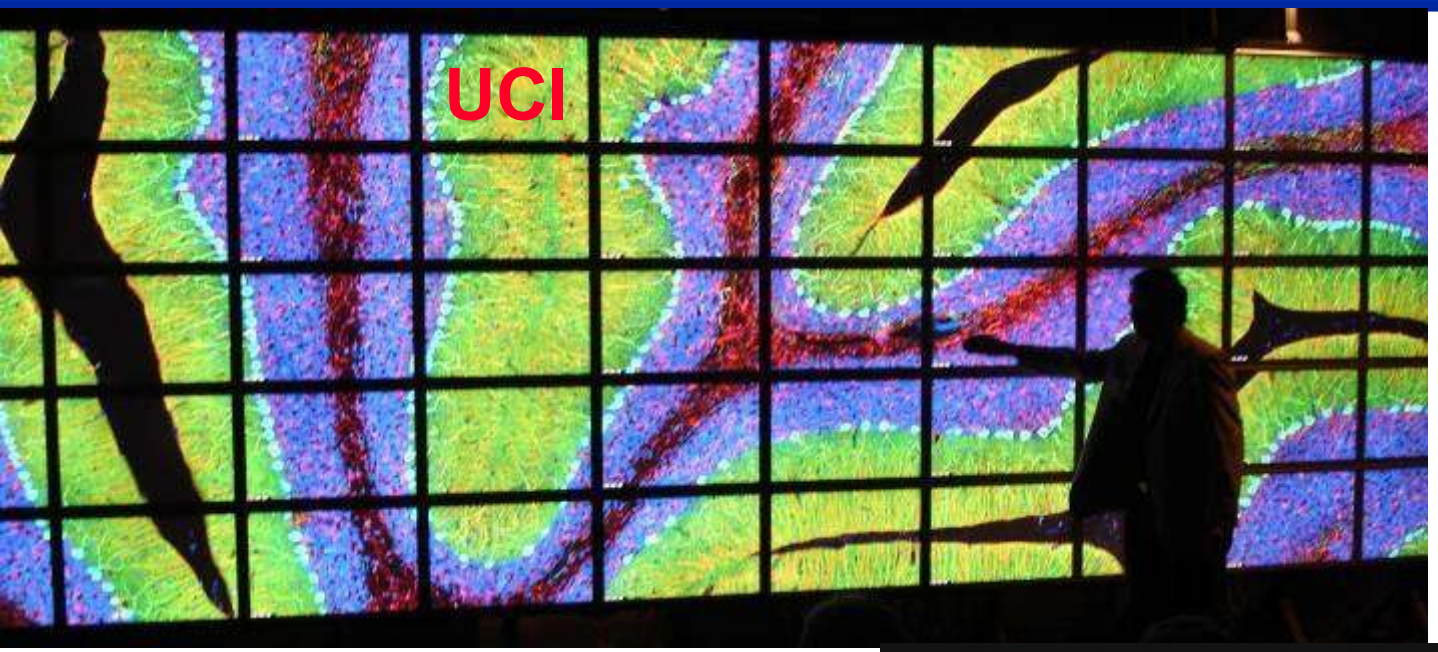
Zeiss Scanning Electron Microscope in Calit2@ UCI



However, SAGE Must be Modified to Run on Mac Walls

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The OptIPuter Enabled Collaboratory: Remote Researchers Jointly Exploring Complex Data



OptIPuter

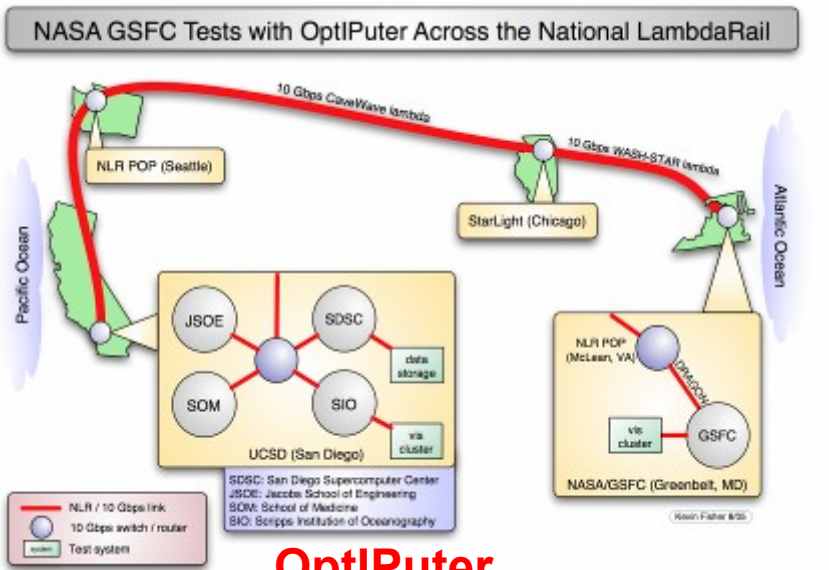
OptIPuter will Connect
The Calit2@UCI
200M-Pixel Wall to
the 100M-Pixel Display
at Calit2@UCSD
With Shared Fast Deep Storage



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Combining Telepresence with Remote Interactive Analysis of Earth Sciences Data Over NLR

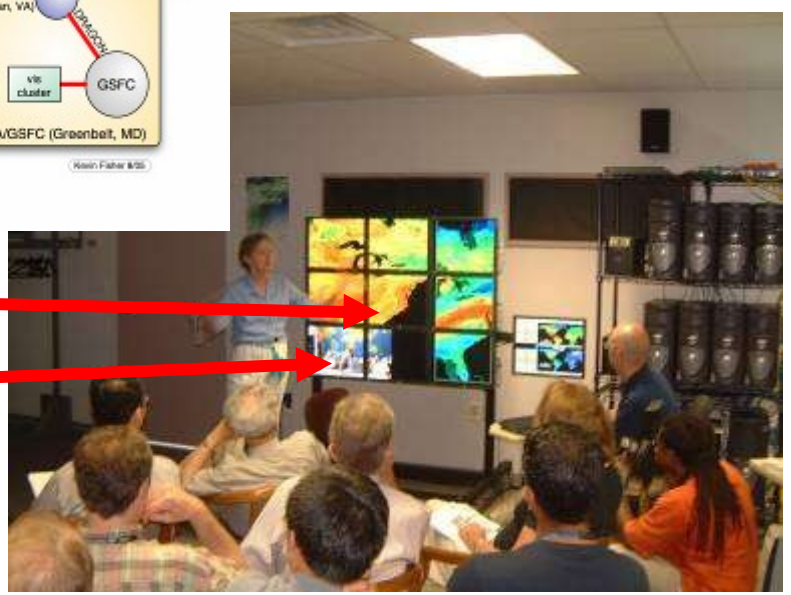
Live Demonstration of 21st Century National-Scale Team Science





OptIPuter Visualized Data

HDTV Over Lambda

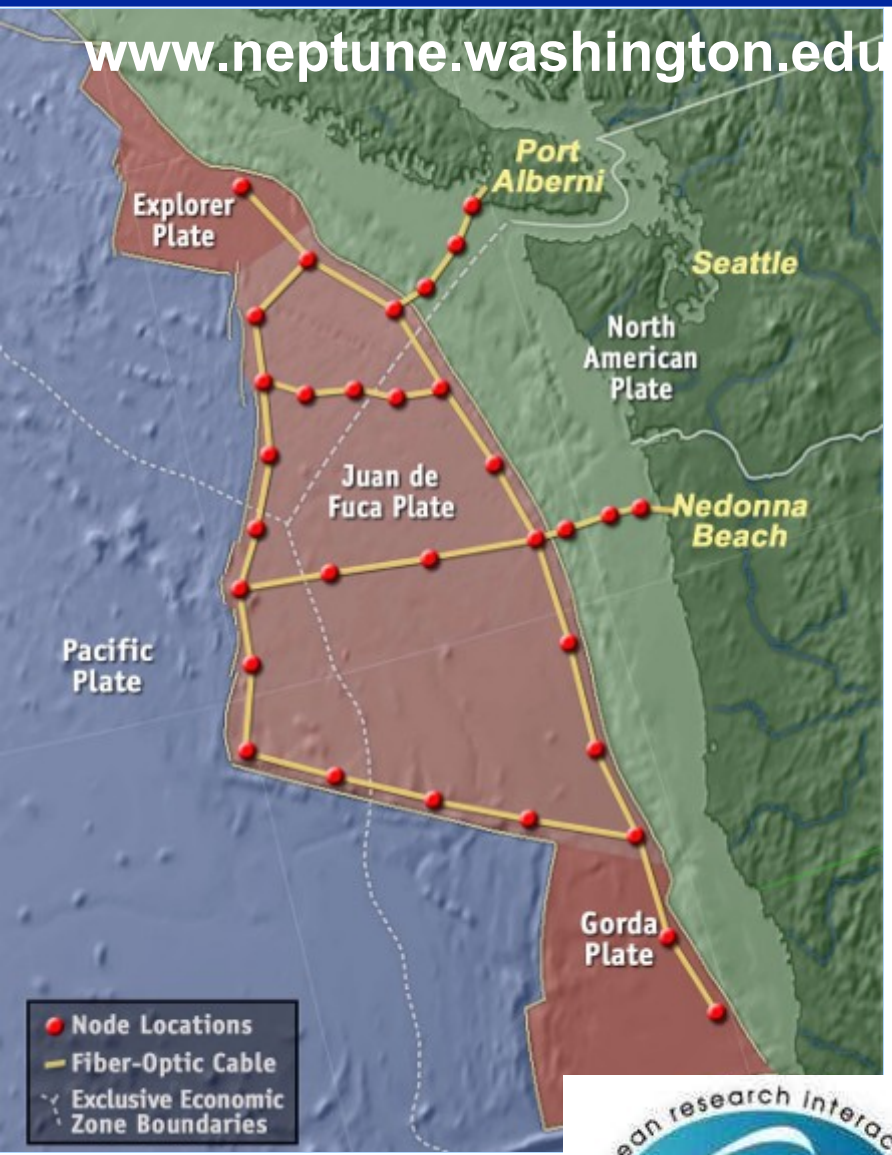


- **SIO and NASA Goddard Space Flight Center Linked Using OptIPuter Technologies over a 10-Gbps National LambdaRail Dedicated Optical Path.**
  - **"We added a virtual fifth wing," says NASA Emeritus Scientist Milton Halem (August 8, 2005)**
  - **SIO, NCMIR, Calit2, EVL, NASA Goddard and Ames, ANL, NLR and DRAGON staff worked on this demonstration**

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Adding Web and Grid Services to Lambdas to Provide Real Time Control of Ocean Observatories



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

http://lookingtosea.ucsd.edu/

- **Goal:**
  - Prototype Cyberinfrastructure for NSF's Ocean Research Interactive Observatory Networks (ORION) Building on OptIPuter
- **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

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NSF
ocean research interactive ORION observatory networks
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First Remote Interactive High Definition Video Exploration of Deep Sea Vents



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Source John Delaney & Deborah Kelley, UWash

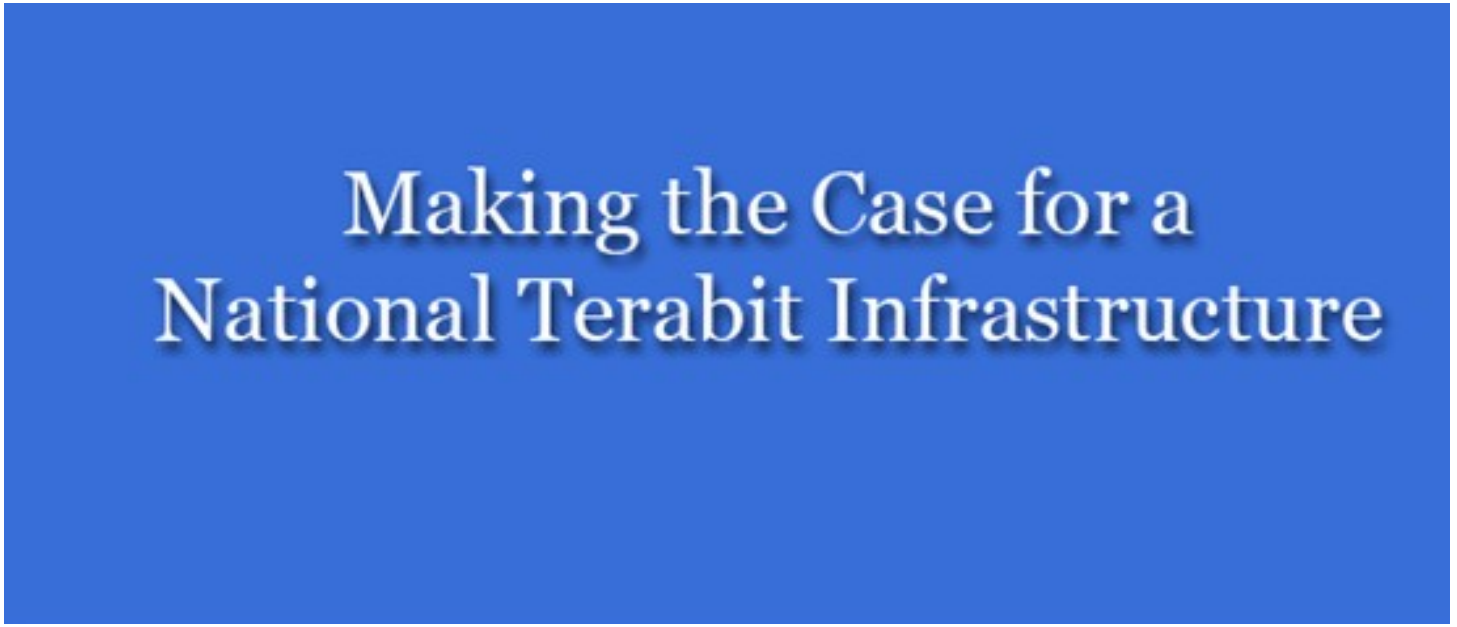
it2

A Near Future Metagenomics Fiber Optic Cable Observatory



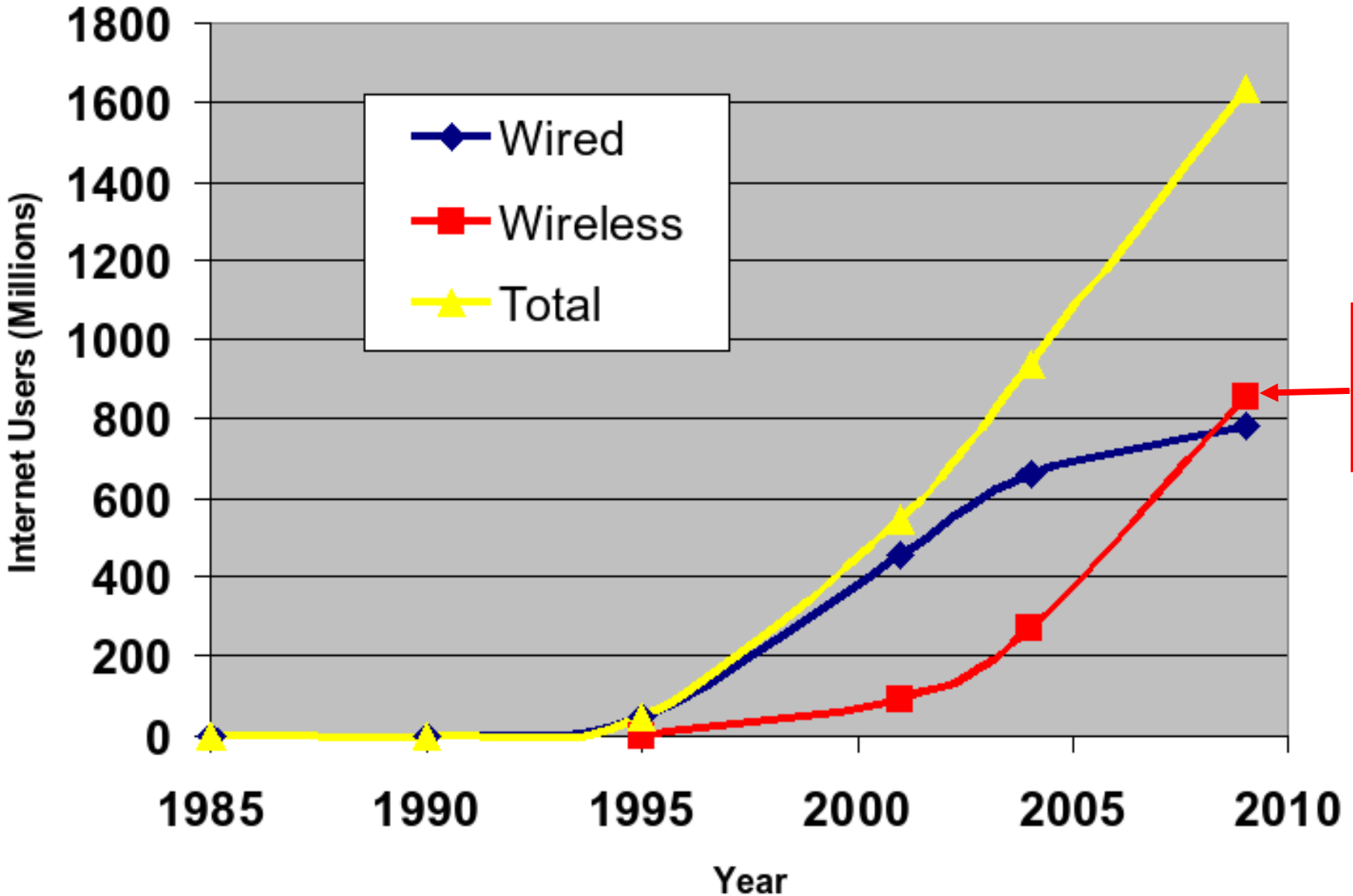
Source John Delaney, UWash

Emerging U.S. Federal Government Initiative



Source: Ervin Frazier, Rincon

Transitioning to the "Always-On" Mobile Internet



http://www.etforecasts.com/products/ES_intusersv2.htm

The Calit2@UCSD Building Was Designed for the Wireless Age

- **Nine Antenna Pedestals on Roof**
  - Can Support Ericsson's Latest Compact Base Station
  - Or Antennas for a Macro Base Station
- **Rooftop Research Shack**
  - Vector Network Analyzers
  - Spectrum Analyzers
  - CDMA Air Interface Software Test Tools
- **Dedicated Fiber Optic and RF connections Between Labs**
- **Network of Interconnected Labs**
  - Antenna Garden, e.g. Roof Top
  - Radio Base Station Lab, e.g. 6th floor
  - Radio Network Controller Lab, e.g. 5th floor
  - Always Best Connected & Located—Throughout Building
- **GPS Re-Radiators in Labs**
  - Distribution of Timing Signals

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The CWC Provides Calit2 With Deep Research in Many Component Areas



Center for Wireless Communications

Two Dozen ECE and CSE Faculty

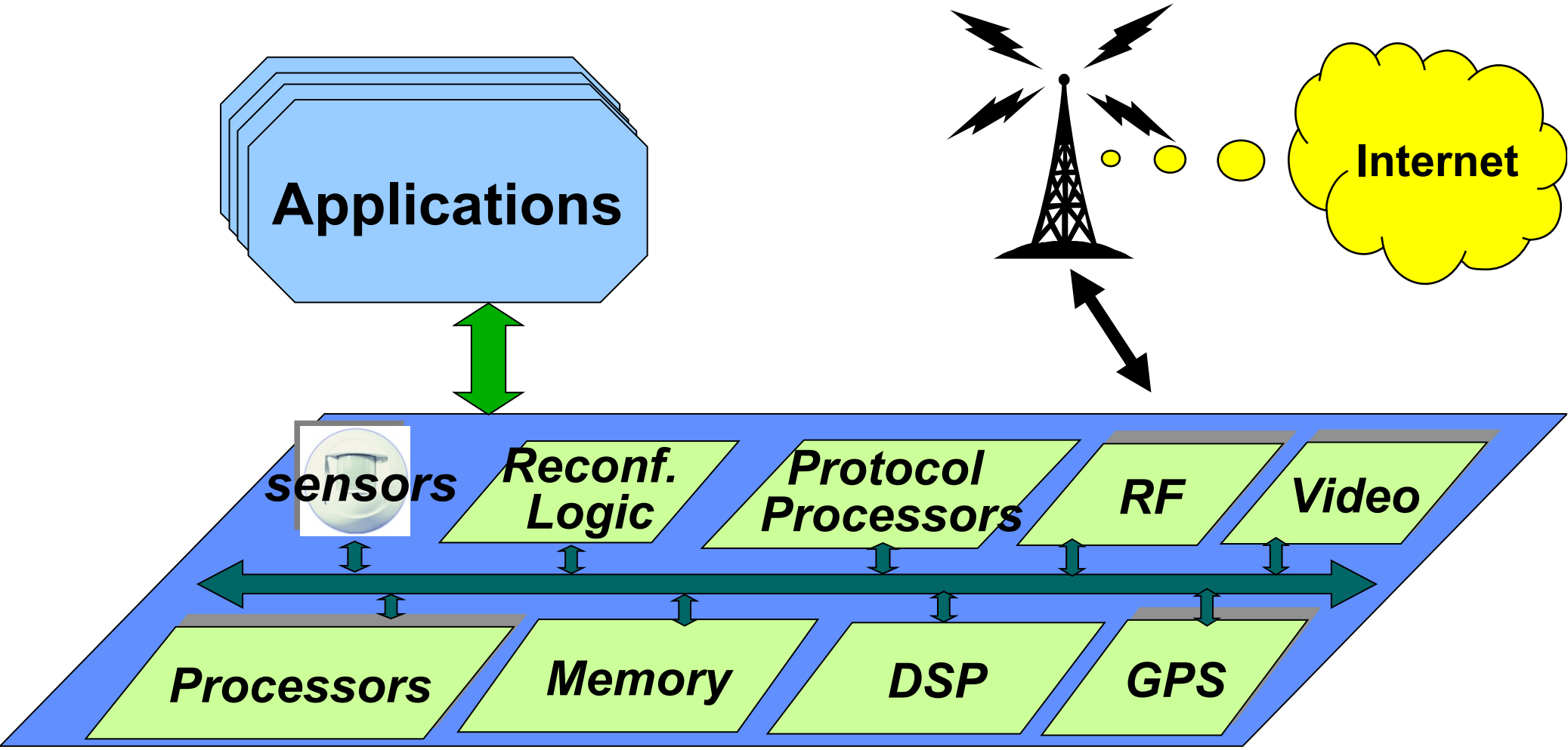
LOW-POWERED CIRCUITRY	ANTENNAS AND PROPAGATION	COMMUNICATION THEORY	COMMUNICATION NETWORKS	MULTIMEDIA APPLICATIONS
RF Mixed A/D ASIC Materials	Smart Antennas Adaptive Arrays	Modulation Channel Coding Multiple Access Compression	Architecture Media Access Scheduling End-to-End QoS Hand-Off	Scalable Video Smart Spaces Speech Recognition

Source: UCSD CWC

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Convergence of Embedded Computers and Radios to Create "Smart Radios"



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Source: Sujit Dey, UCSD ECE

it²

CalRADIO – A Calit2 Academic-Industrial Platform Launches Open Source Software Defined Radio

- Allows Researchers to Test Out New Algorithms and New Techniques for Wireless Communications
- Teaching Tool for Graduate and Undergraduate Researchers
- Developed with Industrial Partners
  - Symbol Technologies—RF Module and Early MAC Code
  - Texas Instruments—Development System
- Being Used in Calit2 Projects
  - ResponseSphere, RESCUE, WIISARD
- Won Best Demo Award at Information Processing in Sensor Networks (IPSN'05)



Calit2 principal development engineer Doug Palmer

Souce: Doug Palmer, Calit2

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Calit2 CalRADIO
Smart Radio Hardware/Software Teaching & Research Platform

- **CalRADIO-I**
  - Digital Signaling Processor + ARM
  - µClinux Operating System
  - RF WiFi (802.11x) Chip Set
  - MAC Functionality into 'C' Code
  - A Test Instrument, An Access Point, And A WiFi Client
- **CalRADIO-II**
  - Gather Requirements and Specifications
  - Layer 1 to Layer 7 Software Access
  - Several RF Front-End Modules
    - 802.11x
    - 802.16
    - Cell
    - General RF



Application
Presentation
Session layer
Transport
Network layer
Link layer
Physical layer

General Development Platform For Physical to Application Layers of Wireless Design

UCSD UCIrvine ARM Texas Instruments intersil

http://research.calit2.net/calradio/

symbol The Enterprise Mobility Company™ it2

CalRADIO Will Support Research in Many Areas

- MODEM Schemes
- CODEC Design
- Propagation Studies
- Channel Studies
- Adaptive Radio
- Software Radio
- Chip Design
- Diversity Methods
- MIMO signal processing
- ABC (Heterogeneous Connectivity)
- Low-Power Sensor Networks
- Embedded Processing
- Store-and-Forward Networks
- Ad Hoc Networks
- Mesh Networks
- Cognitive Radio

Allows for the Capability of Publishing Standards in Software/Firmware and Hardware

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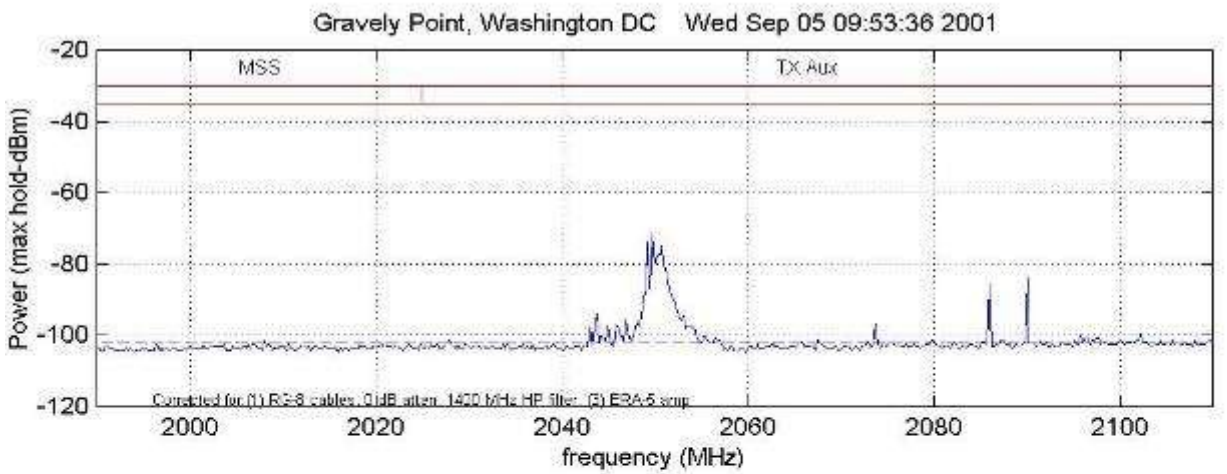
Source: Douglas Palmer, Cal-(IT)^2

it^2

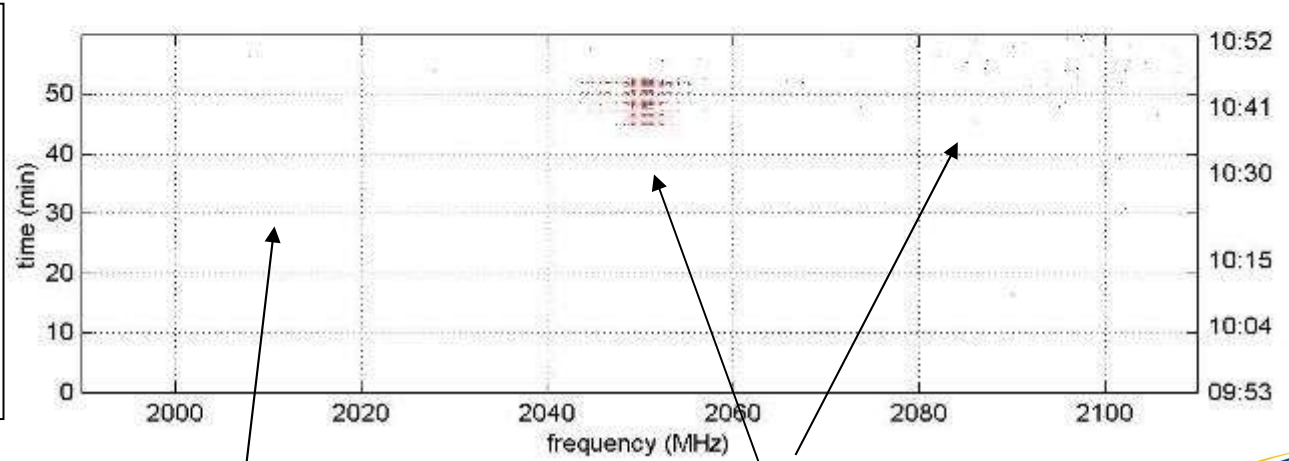
Can We Provide Access to Under-Utilized Assigned Spectrum?

"In many bands, spectrum access is a more significant problem than physical scarcity of spectrum, in large part due to legacy command-and-control regulation that limits the ability of potential spectrum users to obtain such access."—FCC Spectrum Policy Task Force Report





FCC Should Conduct and Publish Spectrum Occupancy Measurements to Identify Low Occupancy Bands



No signals

Medium and short duration signals

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Emergence of Cognitive Radio: Promoting Efficient Use of Limited Spectrum

- **Cognitive Radio is a RF Transmitter/Receiver Which:**
  - Detects Intelligently Whether a Particular Segment of the Radio Spectrum is Currently in Use
  - Jumps into (and out of, as Necessary) the Temporarily-Unused Spectrum Very Rapidly
  - Without Interfering with the Transmissions of Other Authorized Users
- **Mobile Terminals Must be "Smart"**
  - Network Awareness Required
  - Cooperation, Negotiation, and Reconfigurability are Necessary
- **Frequency, Modulation, and Receiver Standards are Context Dependent**
- **Supporting Technologies –**
  - Ultra Wideband Systems
  - Agile Antennas
  - Digital Beam-Forming
  - RF Systems

The Center for Networked Systems

Technologies and Frameworks for Robust, Secure, and Open Networked Systems

Incoming CNS Director Amin Vahdat (left) with predecessor Andrew Chien



Member Companies

Research Interests

Center Faculty



Project Proposals

Diverse Research Projects

-Multiple faculty
-Multiple students
-Multidisciplinary
-CNS Research Theme

UCSD Jacobs School of Engineering

UCSD Jacobs Computer Science and Engineering

UCSD Jacobs Electrical and Computer Engineering

Collaborative Center for Internet Epidemiology and Defenses

- **Joint project (UCSD/ICSI)**
  - One of Four National NSF CyberTrust Centers
  - ~30 Participants (PIs, Staff, Students, etc)
  - ~7M in Federal/State Funding :
    - Microsoft, Intel, HP, VMWare, AT&T, Qualcomm
    - With Additional Support
- **Three Key Areas Of Interest**
  - Infrastructure and Analysis for Understanding Large-Scale Internet Threats
  - Automated Defensive Technologies
  - Forensic, Economic and Legal Issues
- **Formed in November 2004**

Principal Investigators
Stefan Savage, UCSD
Vern Paxson, ICSI

Co-Principal Investigators
Alex Snoeren, UCSD
George Varghese, UCSD
Geoffrey M. Voelker, UCSD
Nicholas Weaver, ICSI



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UCSDCSE Computer Science and Engineering

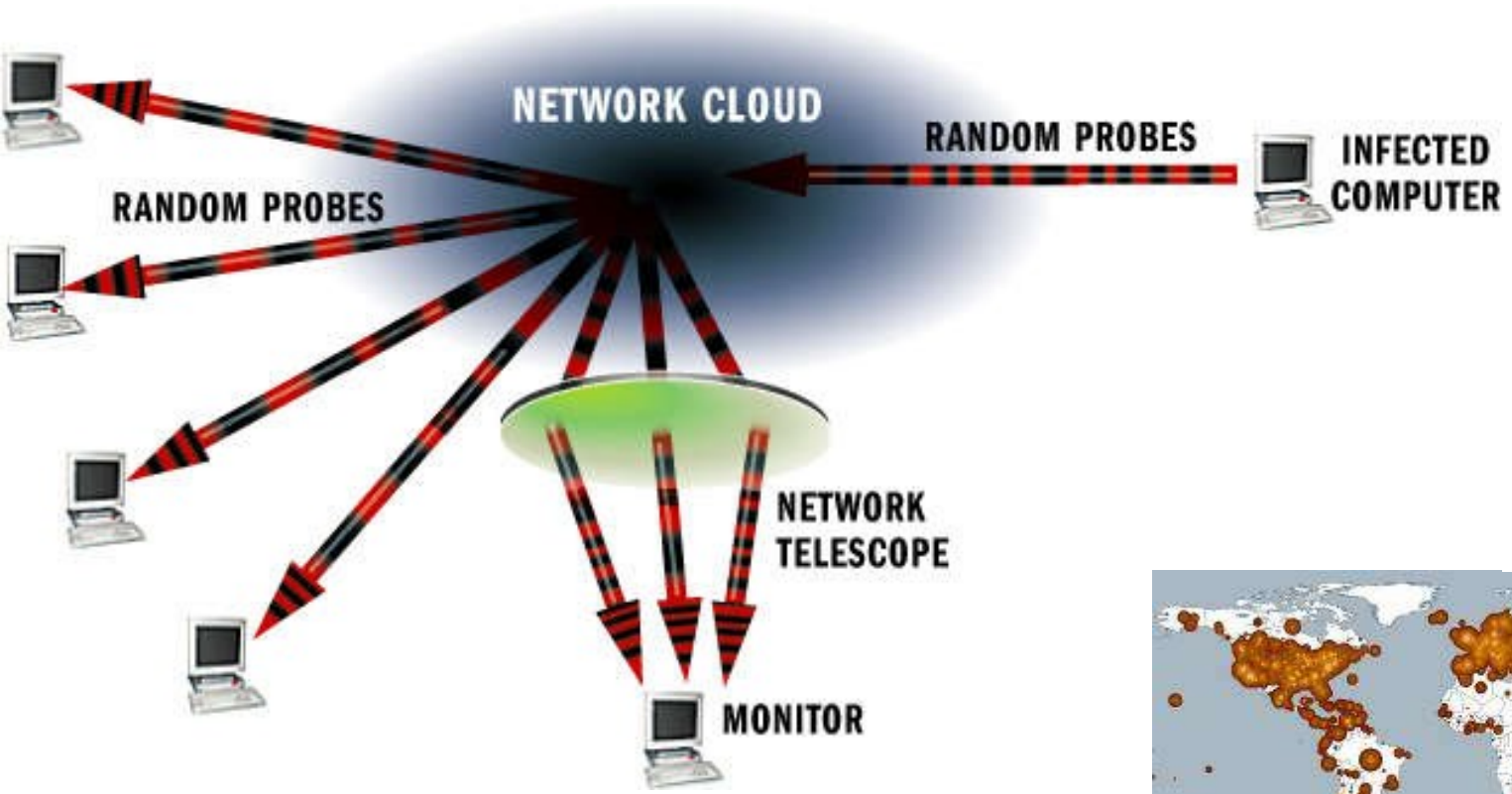
www.ccied.org

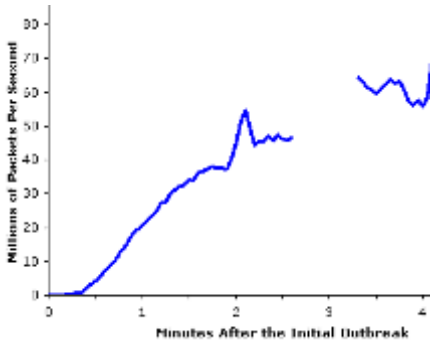
Source: Stefan Savage, CSE, UCSD

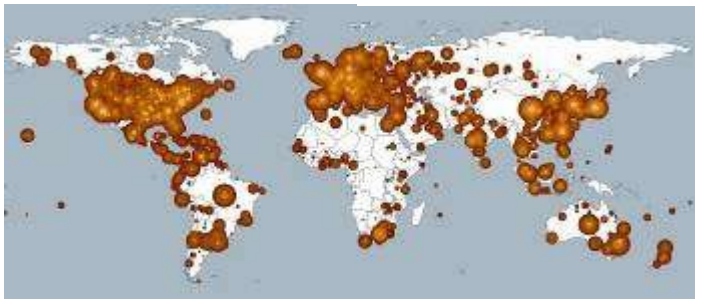
cns center for networked systems

it2

UCSD Network Telescope







- **Network Telescope: Monitor Large Range of Unused IP Addresses**
  - **Will Receive Scans from Infected Hosts (or DDoS Backscatter)**
- **Very Scalable.**
  - **UCSD Telescope Monitors 17M+ Addresses**

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UCSDCSE Computer Science and Engineering

www.ccied.org

Source: Stefan Savage, CSE, UCSD

cns center for networked systems

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The Center for Pervasive Communications and Computing Will Have a Major Presence in the Calit2@UCI Building

Center for Pervasive Communications and Computing

408 Engineering Tower
University of California, Irvine
Irvine, CA 92697-2625
cpcc-info@uci.edu

CPCC Inauguration



Dwight Decker, Chairman and CEO, Conexant Systems; Henry Samueli, CTO and Co-Founder, Broadcom Corp.; Gray Davis, Governor, State of California; Ralph J. Cicerone, Chancellor, UC Irvine; Nicolaos G. Alexopoulos, Dean, The Henry Samueli School of Engineering



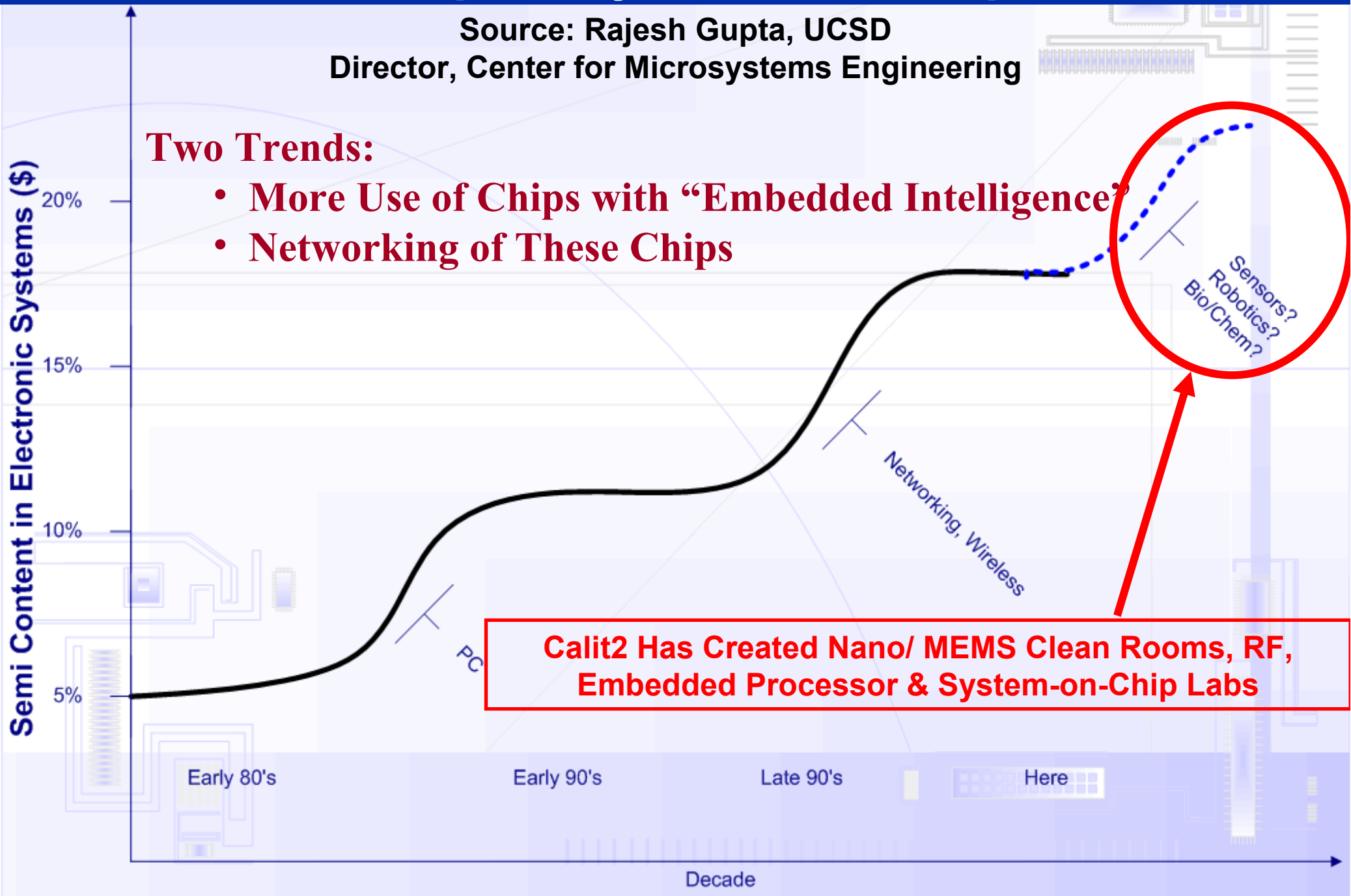
Director Ender Ayanoglu

Network Endpoints Are Becoming Complex Systems-on-Chip

Source: Rajesh Gupta, UCSD
Director, Center for Microsystems Engineering

Two Trends:

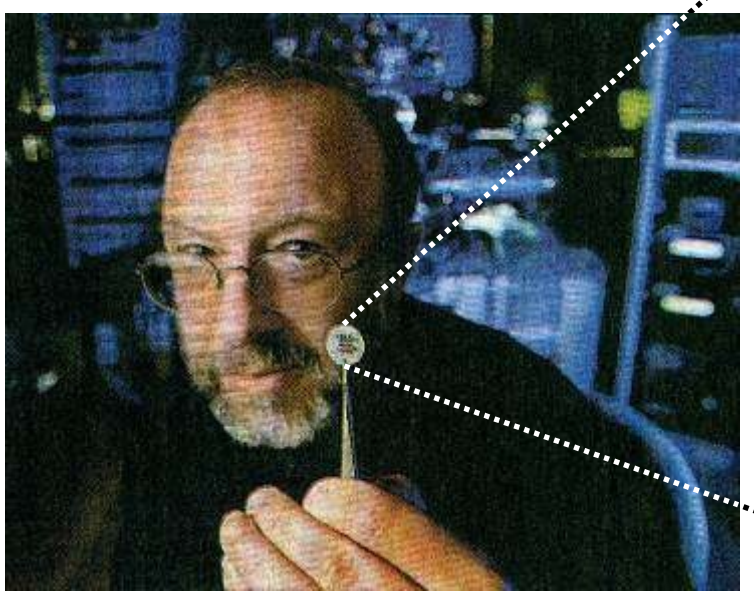
- More Use of Chips with "Embedded Intelligence"
- Networking of These Chips



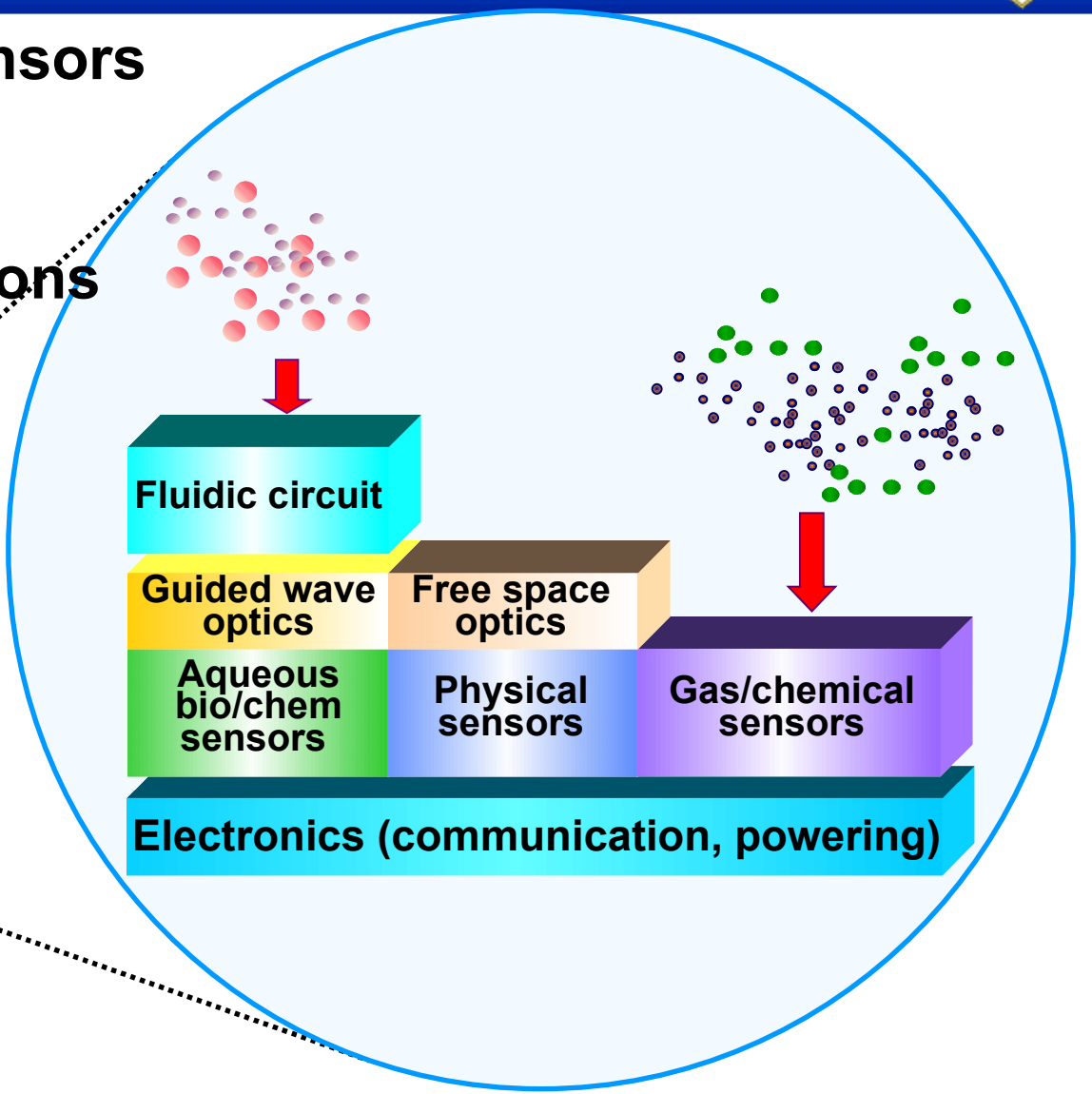
Calit2 Has Created Nano/ MEMS Clean Rooms, RF, Embedded Processor & System-on-Chip Labs

A World of Distributed Sensors Starts with Integrated Nanosensors

Developing Multiple Nanosensors on a Single Chip, with Local Processing and Wireless Communications



I. K. Schuller holding the first prototype

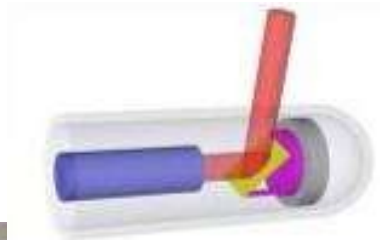


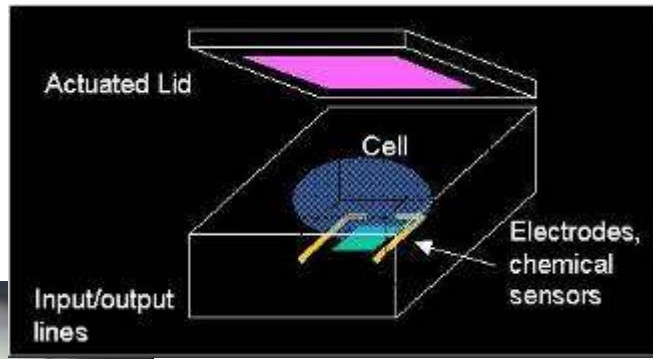
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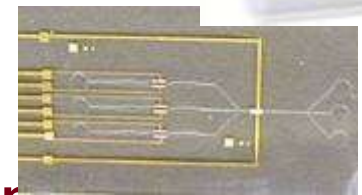
I. K. Schuller, A. Kummel, M. Sailor, W. Trogler, Y-H Lo

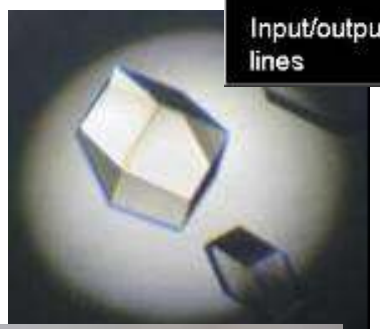
Research Topics of INRF / Calit2@UCI BioMEMS Team

- Micro Resonators for Wireless Communications
- Optical Coherence Tomography
- Mechanosensitivity Microplatforms
- Micro- and Nano- Fluidics
- Protein Crystallization in Nanovolumes
- Nano-Biosensors
- Catheter-Based Microtools
- Silicon-Based HF Ultrasonic Atomizers
- Smart Pills
- Bionic Ear





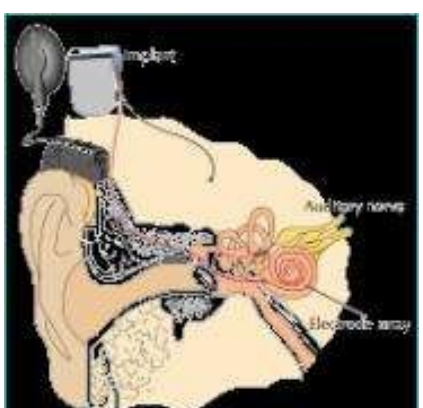


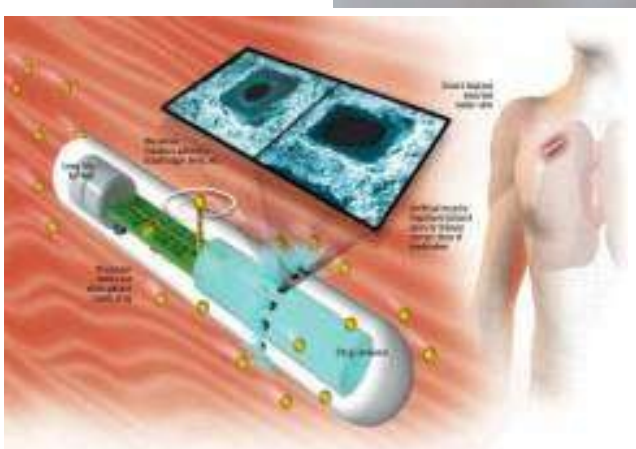












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UCI INRF

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Collaborating with City, County, State Agencies
A Classic "One-Institute, Two-Campus" Grant

- **Project RESCUE**
  - Transforming Data Collection, Management, Analysis, Sharing, and Dissemination to Improve Crisis Response
  - Five-Year $12.5 Million Large ITR Award-Started Oct 1, 2003
  - Twenty-Five Researchers and Professors
    - UCI PI: Sharad Mehrotra, ICS
    - UCSD PI: Ramesh Rao, ECE
    - Univ. Maryland, Univ. Of Illinois, BYU, Univ. Colorado, ImageCat
  - Community and Industrial Partners
    - Cities of Los Angeles, Irvine, and San Diego
    - County Partners: of Los Angeles
    - State of California
    - Ericsson, HNS, HP, Intersil, Parity, SAIC, SBC, Symbol, Qualcomm





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www.calit2.net/briefingPapers/unexpectd.html

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RESCUE Community Advisory Board

Ellis Stanley – Chair
General Manager, City of Los Angeles
Emergency Preparedness Department

Jim Watkins (retired)
Governor's Office
Emergency Services

Bob Garrott
Los Angeles County
Office of Emergency Mgmt.

Paulette Murphy
Space and Naval Warfare
Systems Command
(SPAWAR)

Dawna Finley
Tom Hume
Eileen Salmon
City of Irvine

Karen Butler
Program Manager
Communications Division
San Diego Police Department

William Maheu
Assistant Chief of Police
City of San Diego

David Rose
Lieutenant Officer
UC San Diego Police Department

Linda Bogue
Emergency Mgmt. Coordinator
Environmental Health and Safety



Research on Responding to Crises and Unexpected Events (RESCUE)



Information Flow Within the Responding Organizations and the Public

Security, Privacy& Trust
Cross Cutting Issue at Every Level

Social & Disaster Science
Context, Model &
Understanding of Process,
Organizational Structure, Needs

Engineering & Transportation
Validation Platform for
Role of IT Research

Information Centric Computing
Enhanced Situational Awareness

Networking & Computing Systems
Computing, Communication, & Storage Systems Under Extreme Situations

rescue

PIs: Sharad Mehrotra, UCI; Ramesh Rao, UCSD

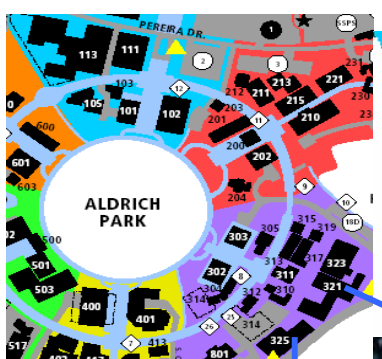
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NSF-Funded ResponSphere Establishes Calit2 Project Rescue Testbeds in Irvine and in San Diego

- **Localized Site-Specific Disasters Via Crisis Response Drills**
- **Large Scale Regional Disasters Via Simulations**
- **Transportation (Simulation) – ImageCat**
  - **Test & Validate IT and Social Science Research Within the Context of Regional Crisis Response**
- **CAMAS (*Crisis Assessment, Mitigation, And Analysis*) – UCI Campus**
  - **Field-Test and Refine Research on Information Collection, Analysis, Sharing, and Dissemination in Controlled yet Realistic Settings**
- **GLQ (*Gaslamp Quarter*, San Diego/UCSD)**
  - **Ubiquitous Wireless Coverage in Downtown San Diego**
  - **Test Network Architecture Enhancement and New Applications**















bren:school information and computer sciences

responsphere

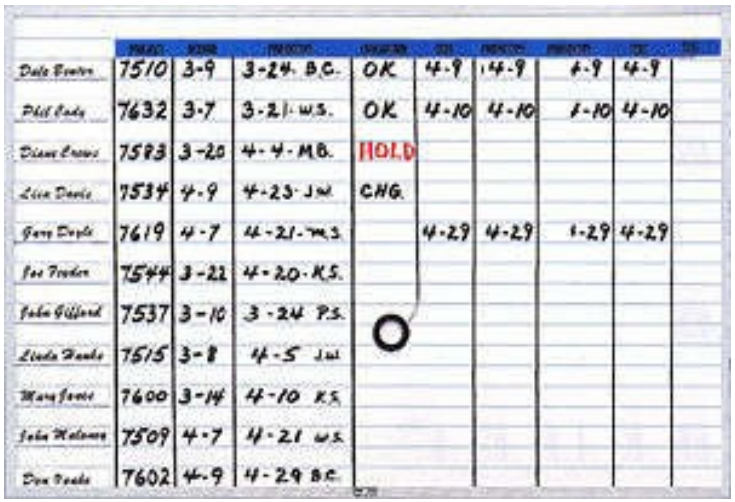
UCSD UCIrvine

PI: Magda El Zarki, ICS, UCI
www.responsphere.org

Current Information Management Tools for Mass Casualty Events are "Pre-Digital"

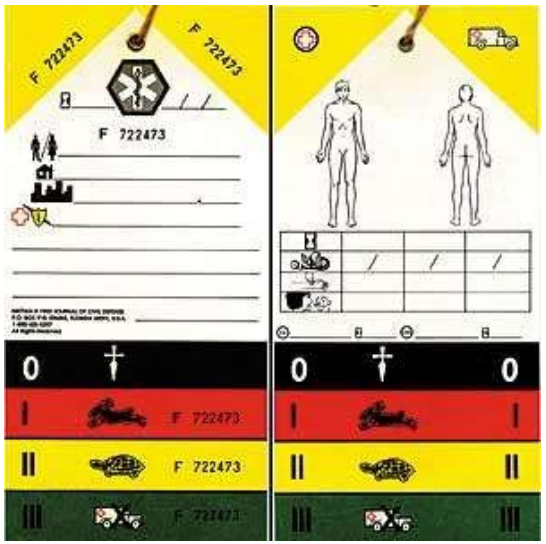


800 mHz Shared Radios



Dale Evans	7510	3-9	3-24. B.C.	OK	4-9	4-9	4-9	4-9
Phil Rudy	7632	3-7	3-21. W.S.	OK	4-10	4-10	4-10	4-10
Diane Evans	7583	3-20	4-4-M.B.	HOLD				
Lisa Davis	7534	4-9	4-23. J.W.	CNG.				
Gary Doyle	7619	4-7	4-21-M.S.		4-29	4-29	4-29	4-29
Joe Trader	7544	3-22	4-20-K.S.					
John Gilford	7537	3-10	3-24 P.S.					
Linda Rhodes	7515	3-8	4-5 J.W.					
Mary Jones	7600	3-14	4-10 K.S.					
John Holmes	7509	4-7	4-21 W.S.					
Don Rhodes	7602	4-9	4-29 B.C.					

Felt Pen/Whiteboard



Disaster Triage Tags



Fire Trucks and Chalk!

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WISARD

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NSF RESCUE Strongly Coupled with NIH WIISARD Grant

Wireless Internet Information System for Medical Response in Disasters

Calit2 is Working Closely with the First Responder Community



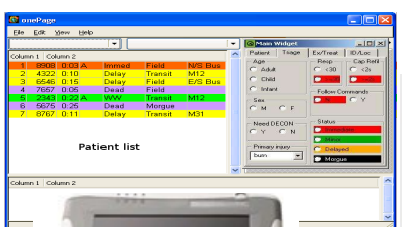




Triage

First Tier





Patient list



Mid Tier



802.11 pulse ox



Wireless Networks



Command Center







Reality Flythrough
Mobile Video

Calit2 Cybershuttle Operations Base for Disaster Drills With Rapid Setup Wireless Mesh Network



Self Configuring Mesh Network with Multiple Access Points that ate Uplink Bandwidth with Auto-Reconfiguration and Fail-Over

Wireless Video Transmission Capability
Major Improvement for Hazmat and Medical Units







Translating Field Experience Through CSTB

Summary of a Workshop on Using Information Technology to Enhance Disaster Management

Committee on Using Information Technology to Enhance Disaster Management

Computer Science and Telecommunications Board

NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

COMMITTEE ON USING INFORMATION TECHNOLOGY TO ENHANCE DISASTER MANAGEMENT

RAMESH R. RAO, University of California, San Diego, *Chair*

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