“The Future of the Internet and its Impact on Digitally Enabled Genomic Medicine"

Invited Talk
InterWest Partners
Menlo Park, CA
May 2, 2005

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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The Internet Is Extending Throughout the Physical World
A Mobile Internet Powered by a Planetary Computer

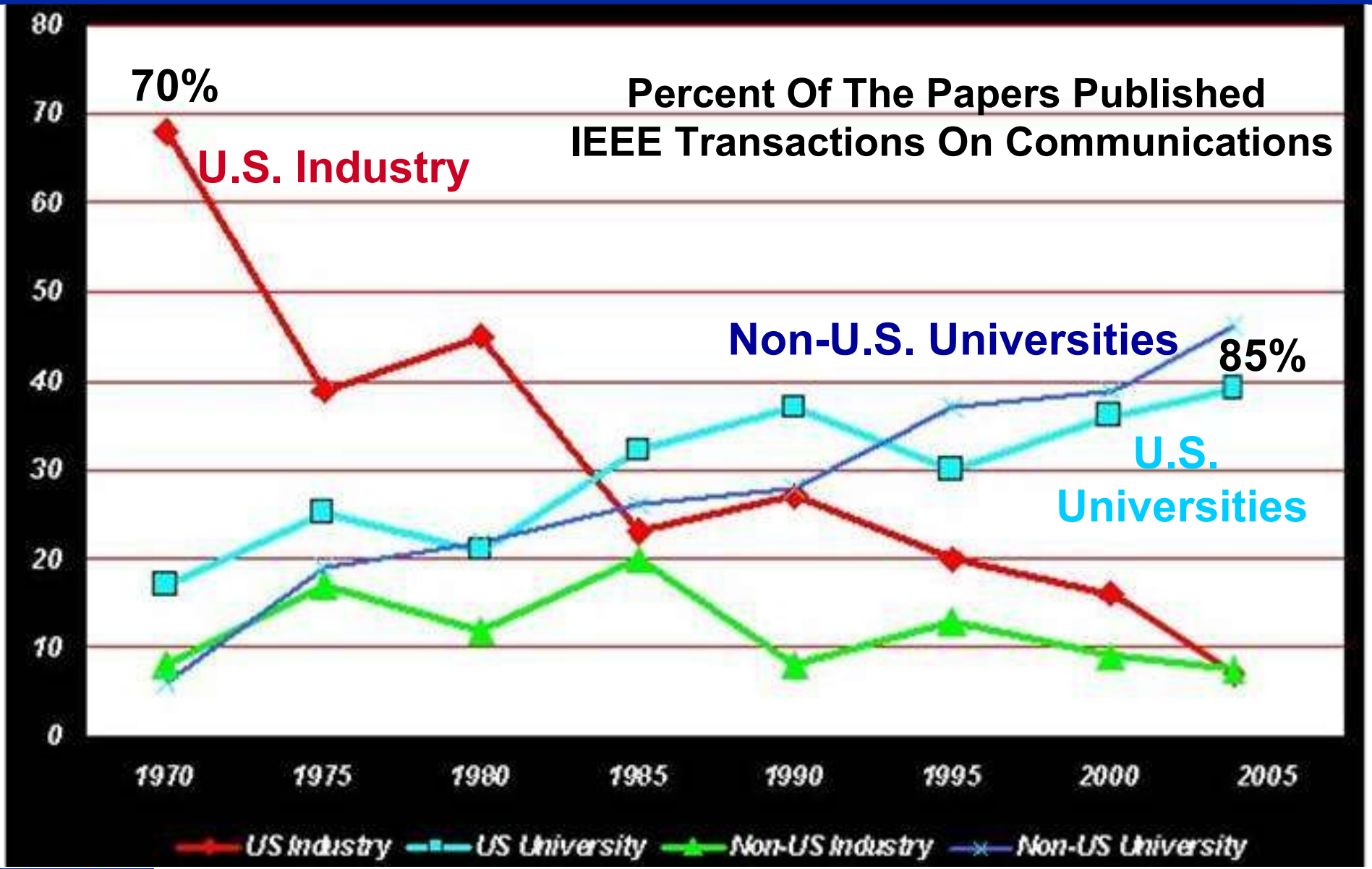
- **Emergence of a Distributed Planetary Computer**
  - Parallel Lambda Optical Backbone
  - Storage of Data Everywhere
  - Scalable Distributed Computing Power
- **Wireless Access--Anywhere, Anytime**
  - Broadband Speeds
  - "Always Best Connected"
- **Billions of New Wireless Internet End Points**
  - Information Appliances
  - Sensors and Actuators
  - Embedded Processors
- **Transformational From Medicine to Transportation**

"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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Where is Telecommunications Research Performed? A Historic Shift



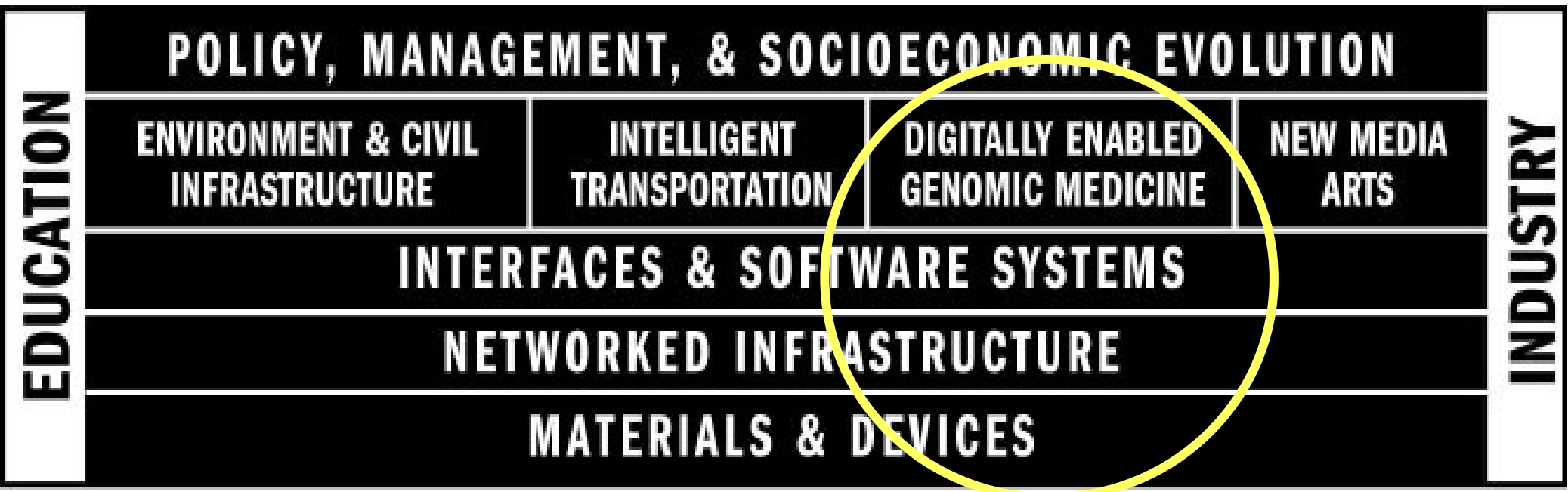
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Source: Bob Lucky, Telcordia/SAIC

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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



Two New Calit2 Buildings Will Provide a Persistent Collaboration "Living Laboratory"



- Will Create New Laboratory Facilities
  - Nano, MEMS, RF, Optical, Visualization
- International Conferences and Testbeds
- Over 1000 Researchers in Two Buildings
- 150 Optical Fibers into UCSD Building



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California Provided $100M for Buildings
Industry Partners $85M, Federal Grants $250M

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Innovation Driven by Calit2 Industrial Partners Teaming with Academic Research and Education

- Funding Faculty Research Projects
- Supporting Graduate/Undergraduate Fellows
- Providing Access to Leading Edge Equipment
- Startups Integrated in “Living Labs”
- Joining on Federal Grants
- Co-Sponsoring Workshops/Conferences
- Hosting Seminars or Lectures
- Endowing Chaired Professorships

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I Will Be Able to Cover Only a Fraction of the Calit2 Research Program

- Optical Networking and Biomedical Imaging
- Wireless Internet, BioMEMS, and Human Sensors
- Computational Biomedicine and Bioinformatics

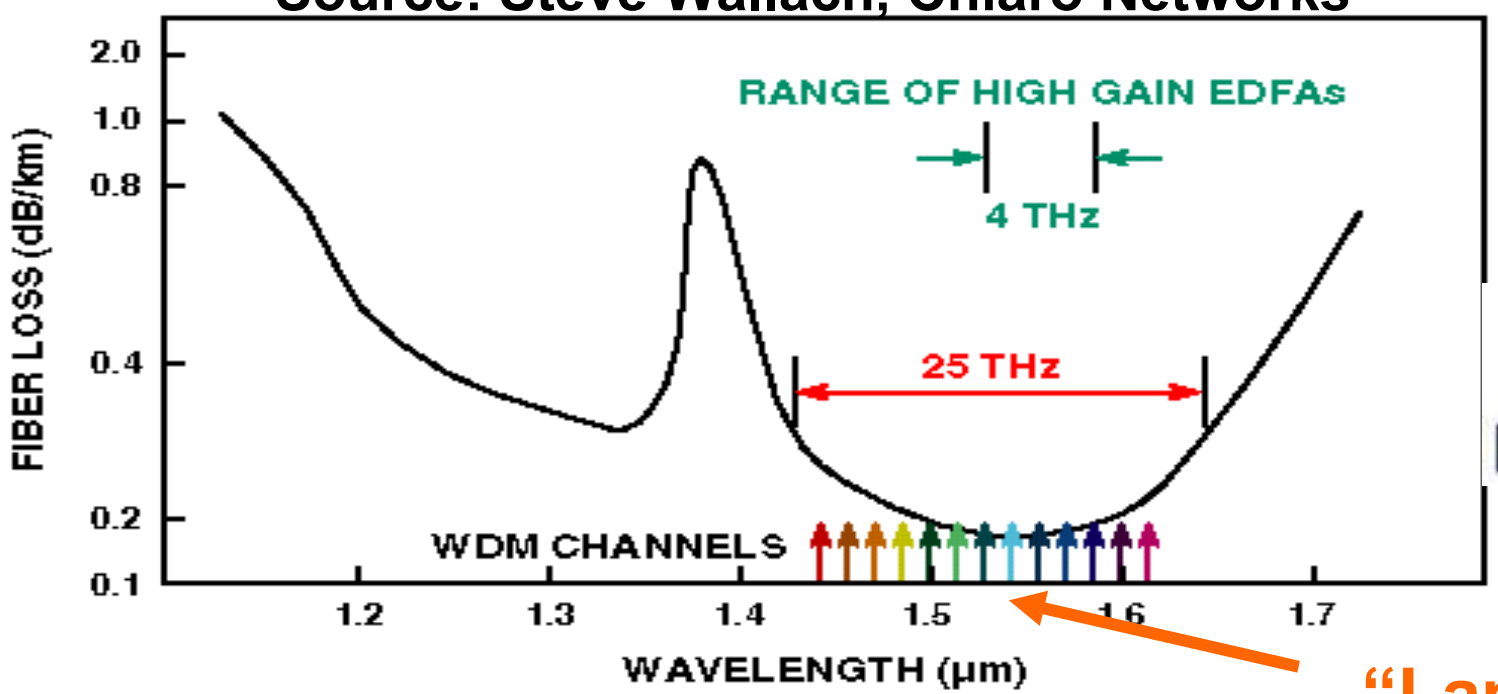
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Dedicated Optical Channels Makes High Performance Cyberinfrastructure Possible

WAVELENGTH DIVISION MULTIPLEXING (WDM)

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

Source: Steve Wallach, Chiaro Networks



CHIARO

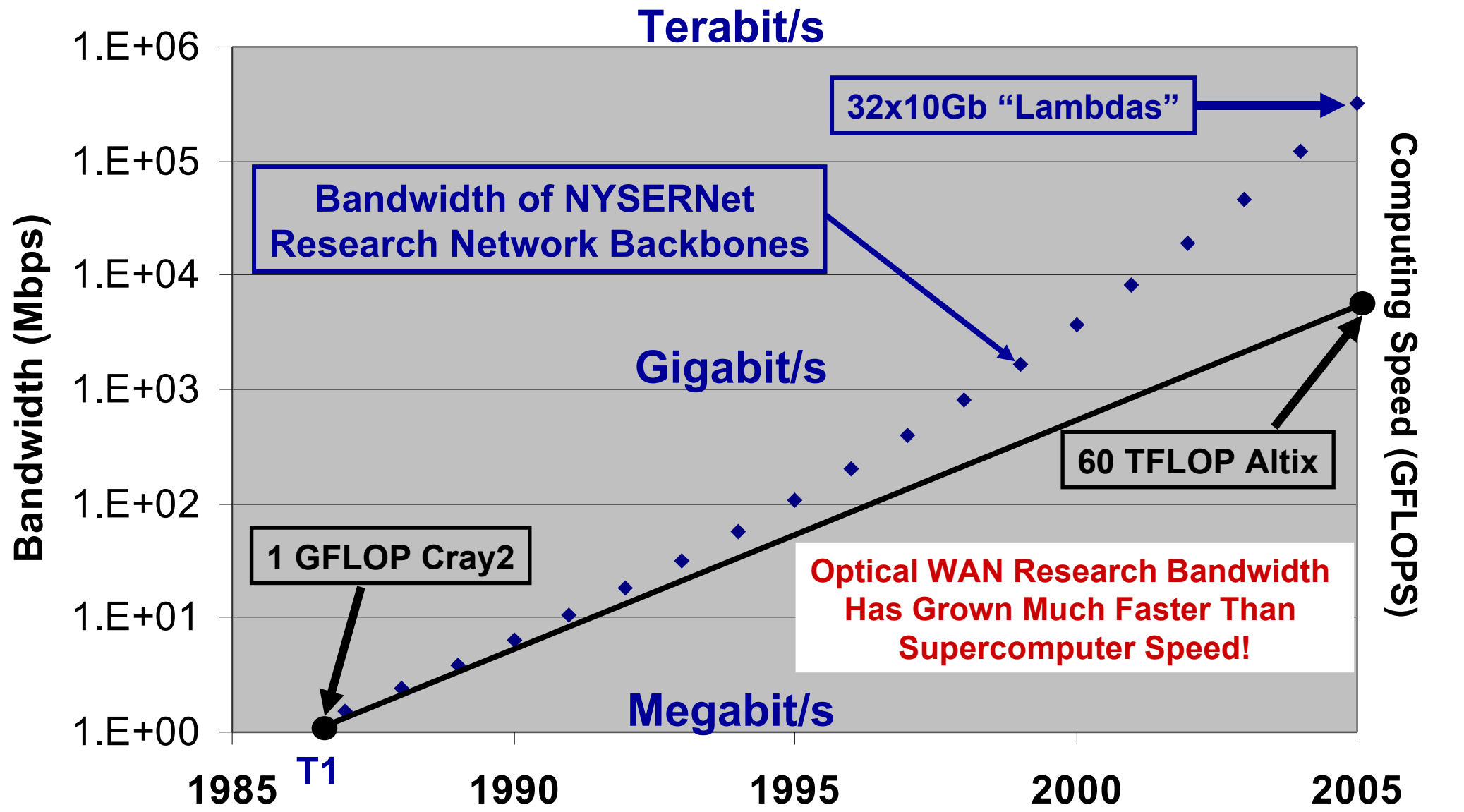
"Lambdas"

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

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From "Supercomputer–Centric" to "Supernetwork-Centric" Cyberinfrastructure



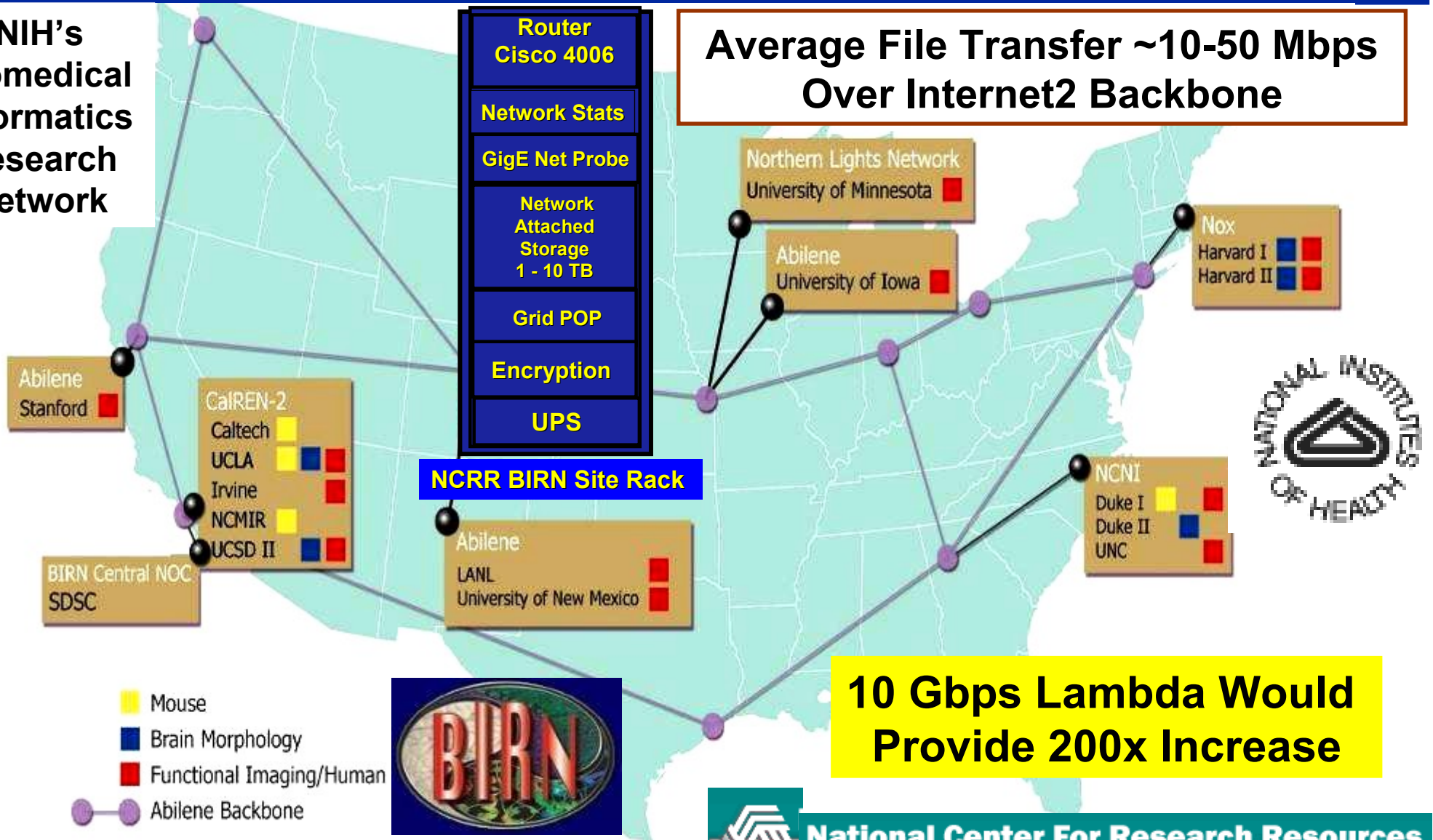
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Network Data Source: Timothy Lance, President, NYSERNet

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Major Challenge for Data Intensive Science:
Bandwidth Barriers Between User and Remote Resources

NIH's Biomedical Informatics Research Network



Average File Transfer ~10-50 Mbps Over Internet2 Backbone

10 Gbps Lambda Would Provide 200x Increase

National Center For Research Resources

Part of the UCSD CRBS

Center for Research on Biological Structure

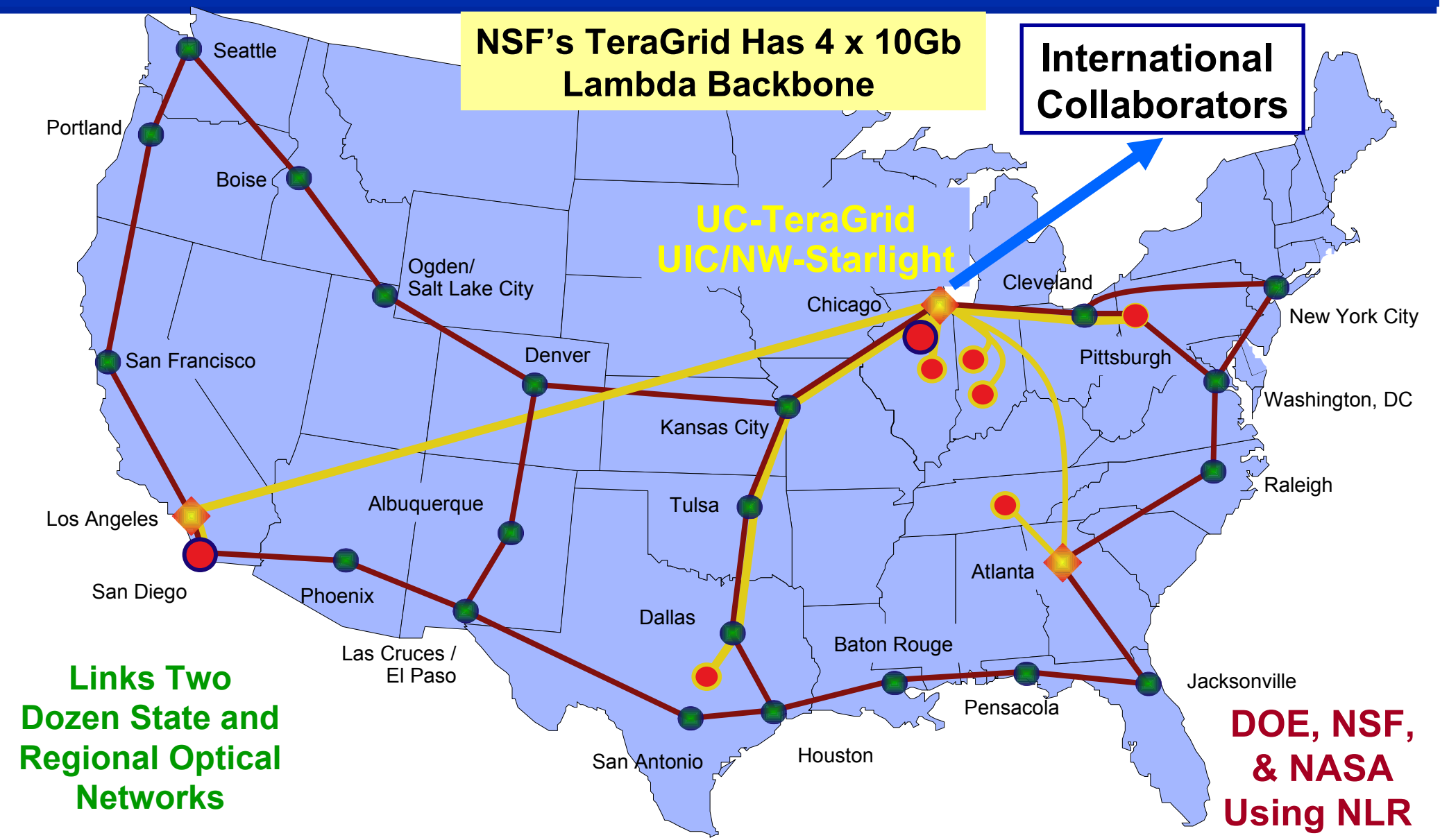
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NBCR NPACI

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

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NLR and TeraGrid Provides the Cyberinfrastructure Backbone for U.S. University Researchers



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Global Lambda Integrated Facility (GLIF)
Integrated Research Lambda Network

Many Countries are Interconnecting Optical Research Networks

to form a Global SuperNetwork



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Visualization courtesy of
Bob Patterson, NCSA

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The Networking Double Header of the Century Will Be Driven by LambdaGrid Applications

Maxine Brown, Tom DeFanti, Co-Organizers



iGrid 2005

THE GLOBAL LAMBDA INTEGRATED FACILITY



www.startap.net/igrid2005/

September 26-30, 2005

University of California, San Diego

California Institute for Telecommunications and Information Technology



SC|05 Gateway to Discovery

Washington State Convention and Trade Center Seattle, WA
November 12-18 2005

http://sc05.supercomp.org

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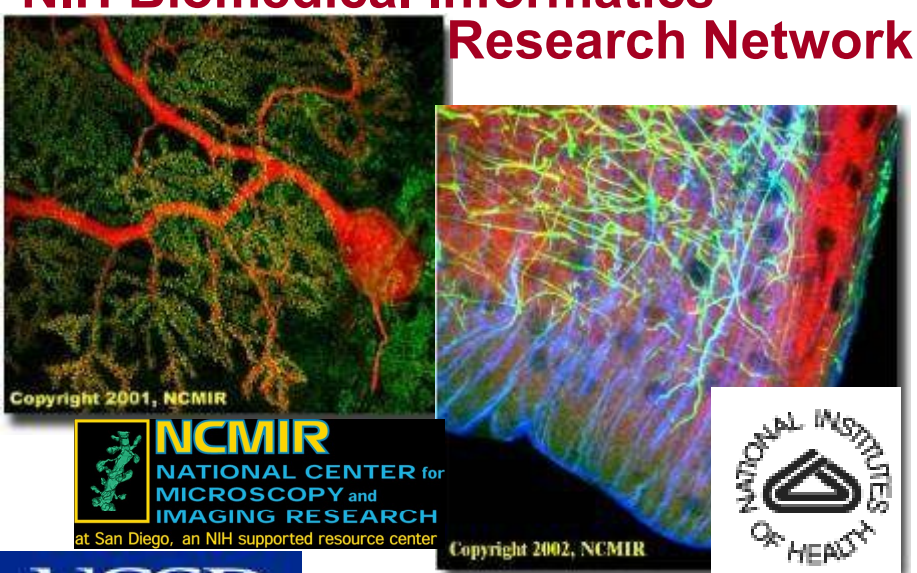
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The OptIPuter Project –
Removing Bandwidth as an Obstacle In Data Intensive Sciences

- **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**
- **Extending the Grid Middleware to Control Optical Circuits**

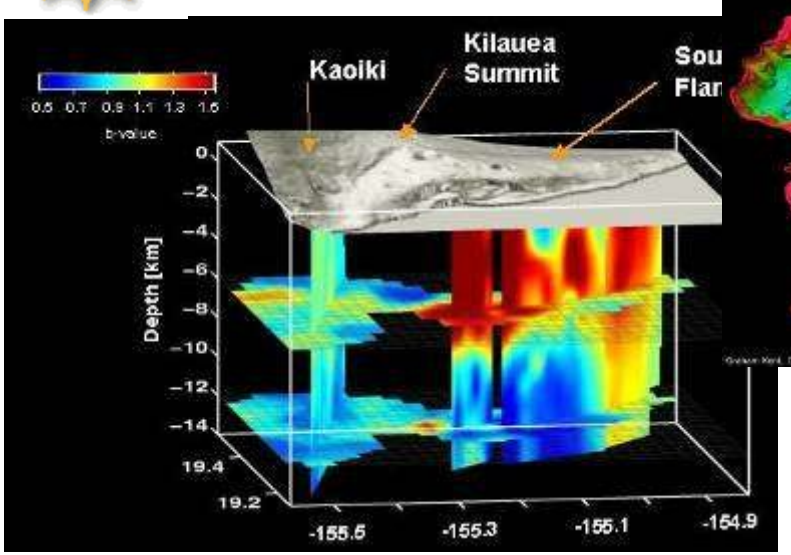
OptIPuter

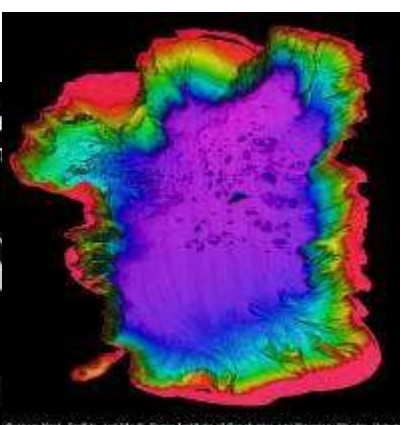
NIH Biomedical Informatics Research Network



http://ncmir.ucsd.edu/gallery.html

NSF EarthScope and ORION





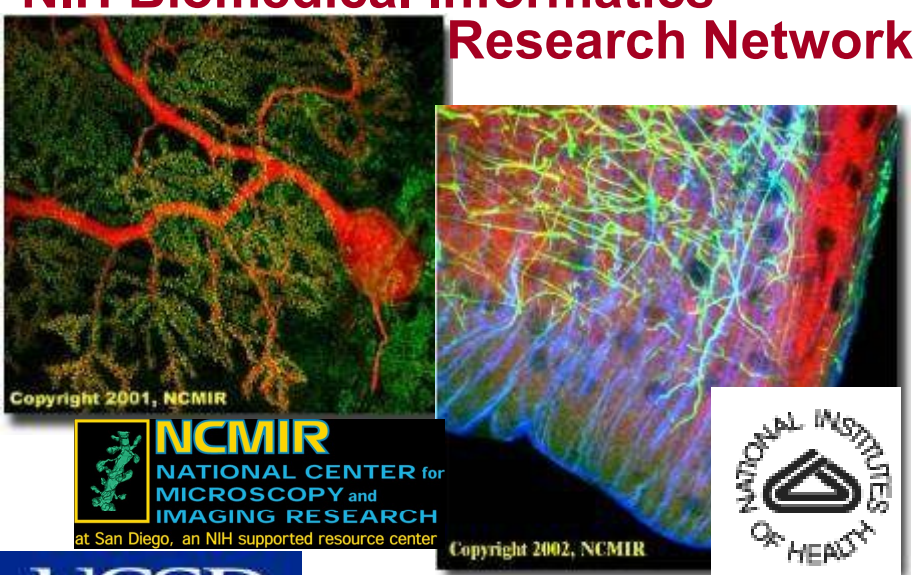
siovizcenter.ucsd.edu/library/gallery/shoot1/index.shtml

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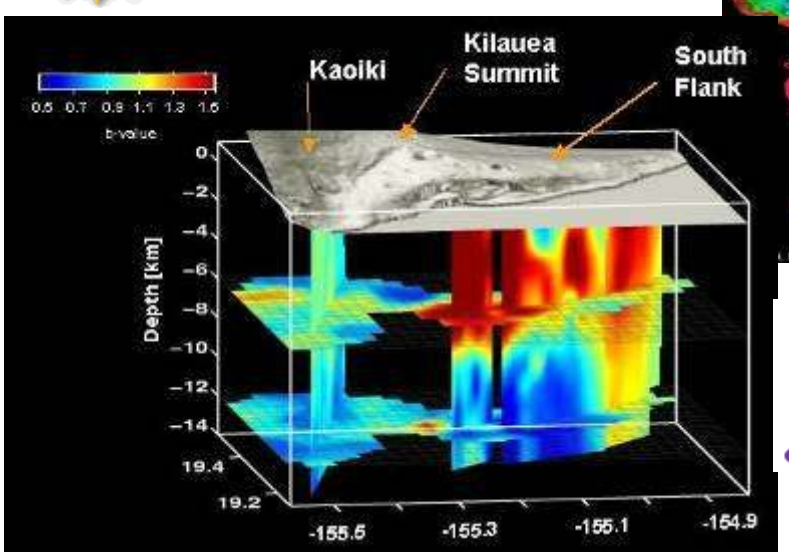
The OptIPuter Project –
Removing Bandwidth as an Obstacle In Data Intensive Sciences

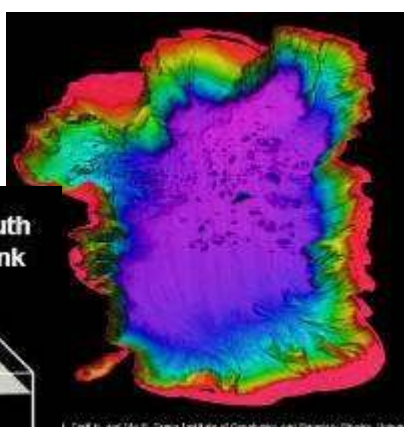
- **NSF Large Information Technology Research Proposal**
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- **Industrial Partners**
  - IBM, Sun, Telcordia, Chiaro, Calient, Glimmerglass, Lucent
- **$13.5 Million Over Five Years**
- **Interactive Visualization of Remote Large Data Objects**

NIH Biomedical Informatics Research Network



NSF EarthScope and ORION





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http://ncmir.ucsd.edu/gallery.html

siovizcenter.ucsd.edu/library/gallery/shoot1/index.shtml

OptIPuter

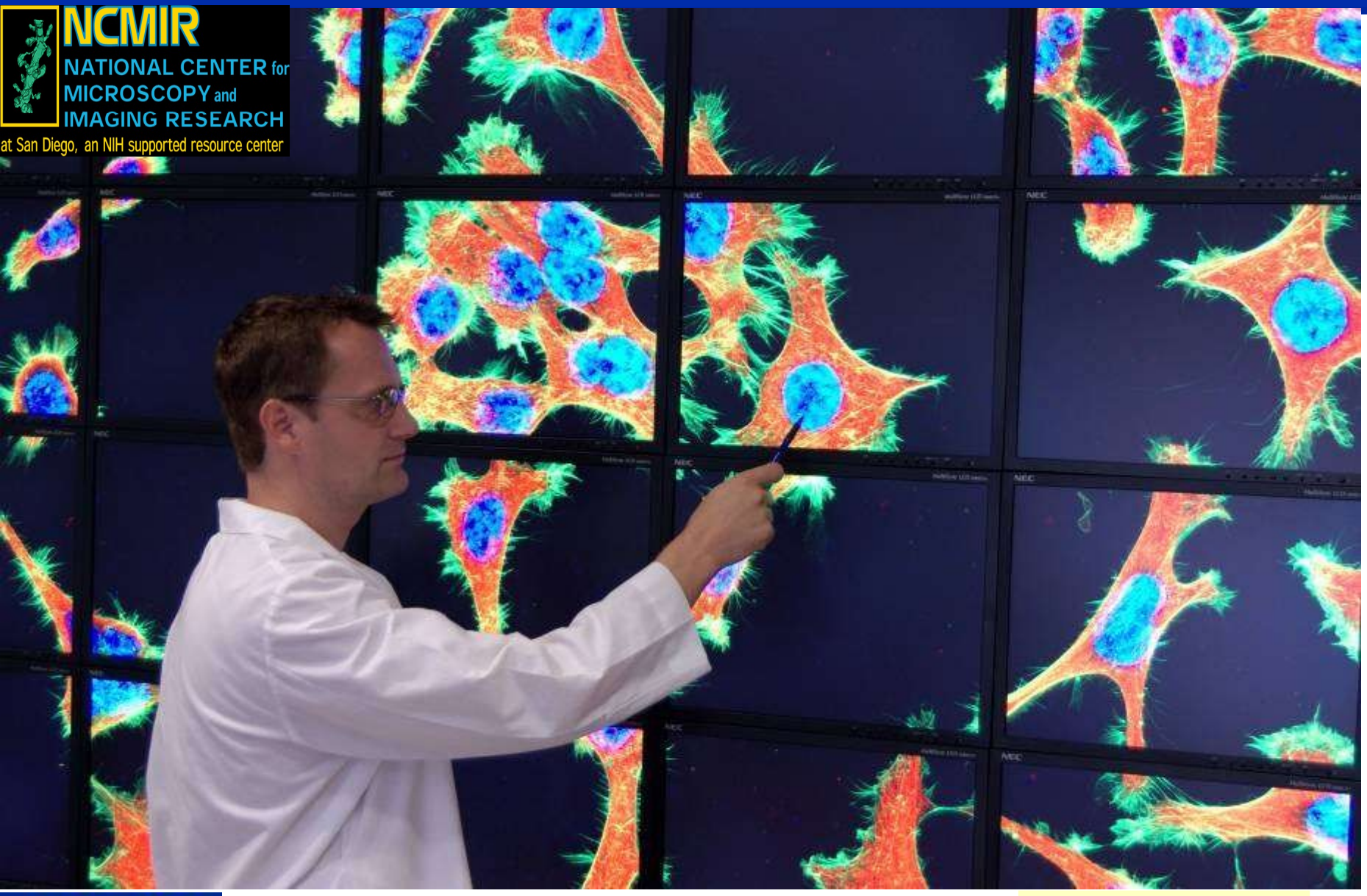
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Optical Networking, Internet Protocol, Computer
Bringing the Power of Lambdas to Users

- **Complete the Grid Paradigm by Extending Grid Middleware to Control Jitter-Free, Fixed Latency, Predictable Optical Circuits**
  - **One or Parallel Dedicated Light-Pipes**
    - **1 or 10 Gbps WAN Lambdas**
  - **Uses Internet Protocol, But Does NOT Require TCP**
  - **Exploring Both Intelligent Routers and Passive Switches**
- **Optical Circuits "Plug Into User Linux Clusters Optimized for Storage, Visualization, or Computing**
  - **1 or 10 Gbps I/O per Node**
  - **Scalable Visualization Displays with OptIPuter Clusters**

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Realizing the Dream: High Resolution Portals to Global Science Data



Source: Mark Ellisman, David Lee, Jason Leigh, Tom Deerinck

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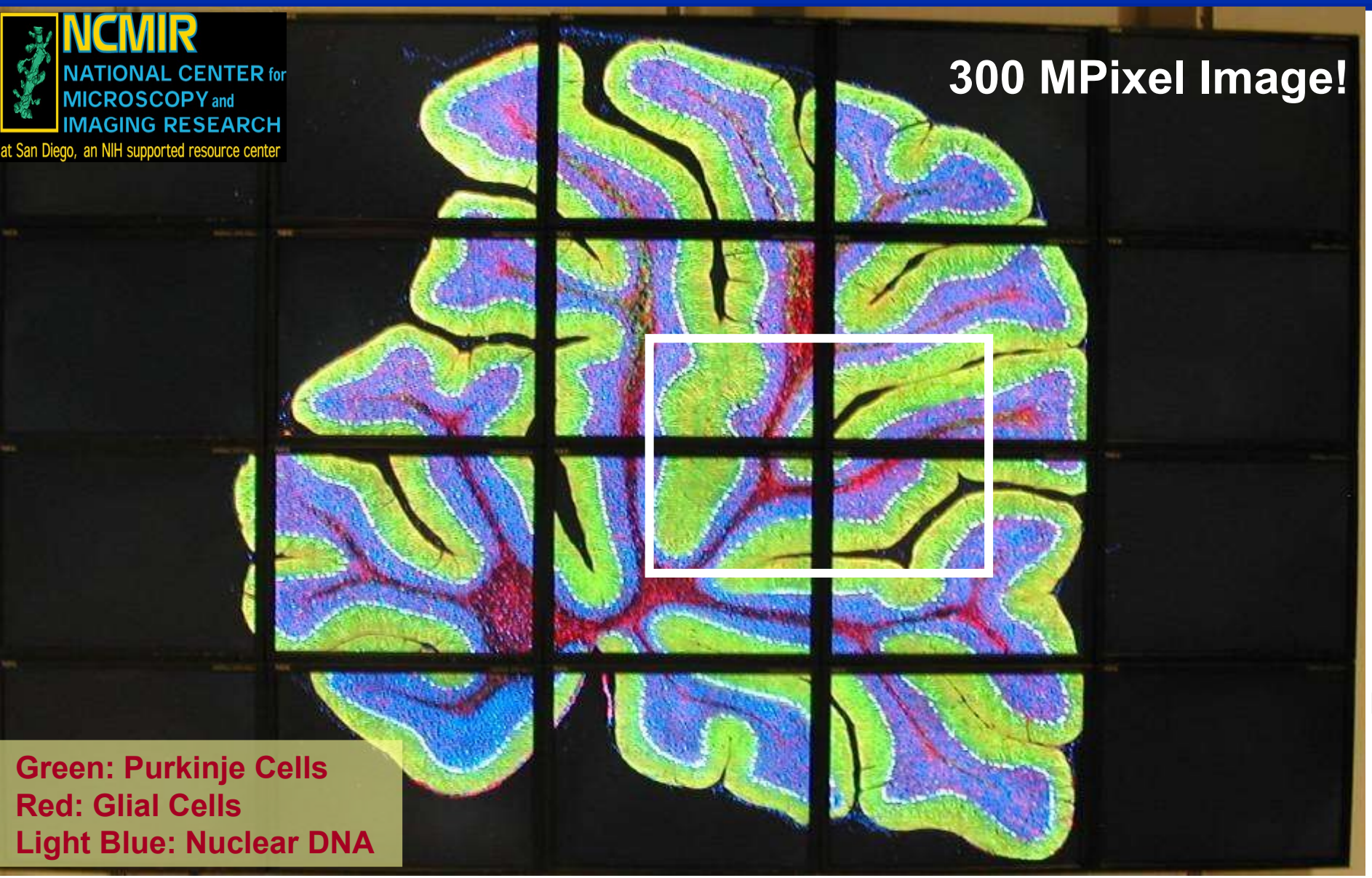
650 Mpixel 2-Photon Microscopy Montage of HeLa Cultured Cancer Cells

Green: Actin
Red: Microtubles
Light Blue: DNA

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OptIPuter LambdaVision Scalable Displays Being Developed for Multi-Scale Biomedical Imaging

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



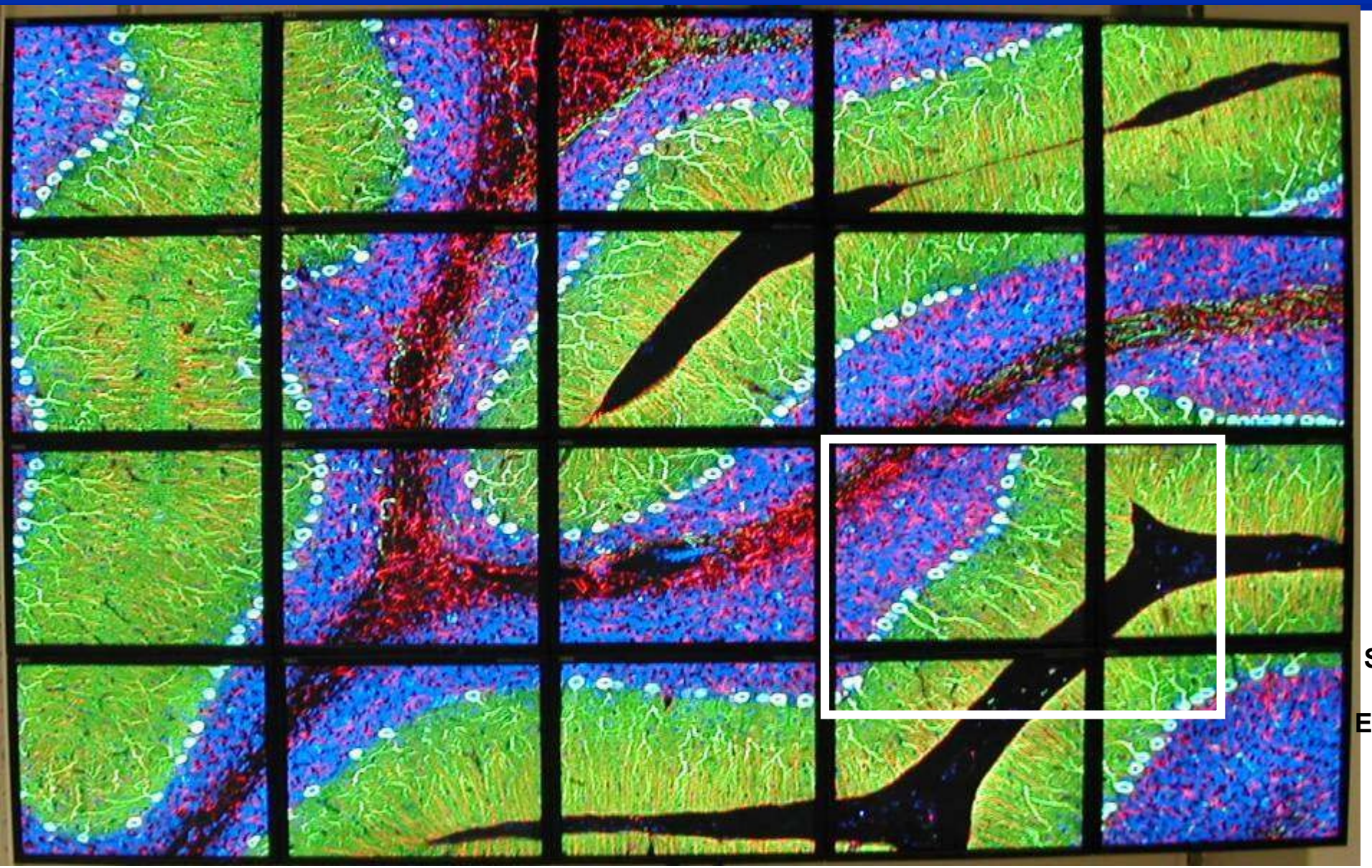
Source: Mark Ellisman, David Lee, Jason Leigh

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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



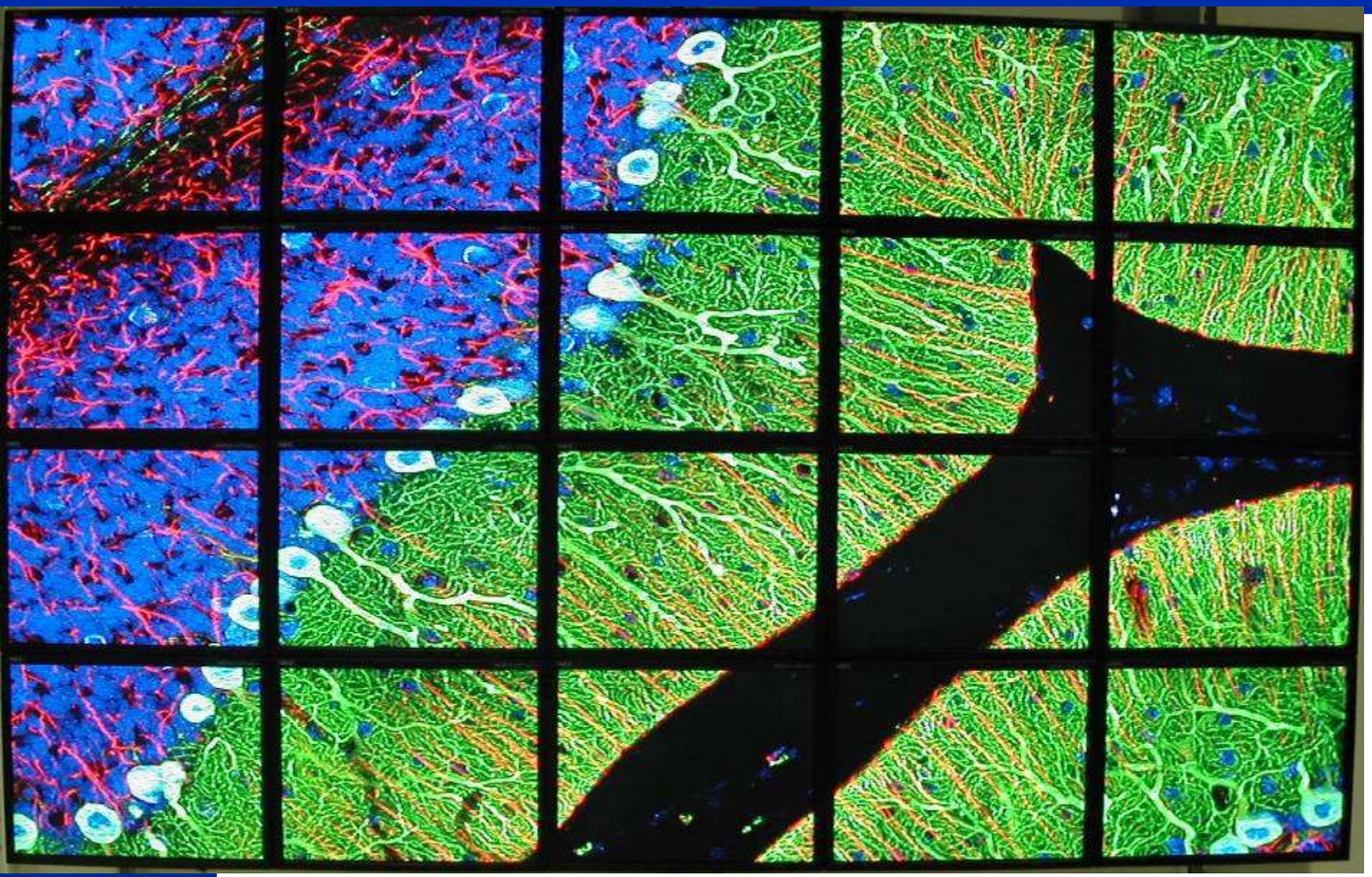
Source: Mark Ellisman, David Lee, Jason Leigh

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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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Toward an Interactive Gigapixel Display

- Scalable Adaptive Graphics Environment (SAGE) Controls:
- 100 Megapixels Display
  - 55-Panel
- 1/4 TeraFLOP
  - Driven by 30-Node Cluster of 64-bit Dual Opterons
- 1/3 Terabit/sec I/O
  - 30 x 10GE interfaces
  - Linked to OptIPuter
- 1/8 TB RAM
- 60 TB Disk

NSF LambdaVision MRI@UIC

Calit2 is Building a LambdaVision Wall in Each of the UCI & UCSD Buildings



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Source: Jason Leigh, Tom DeFanti, EVL@UIC
OptIPuter Co-PIs

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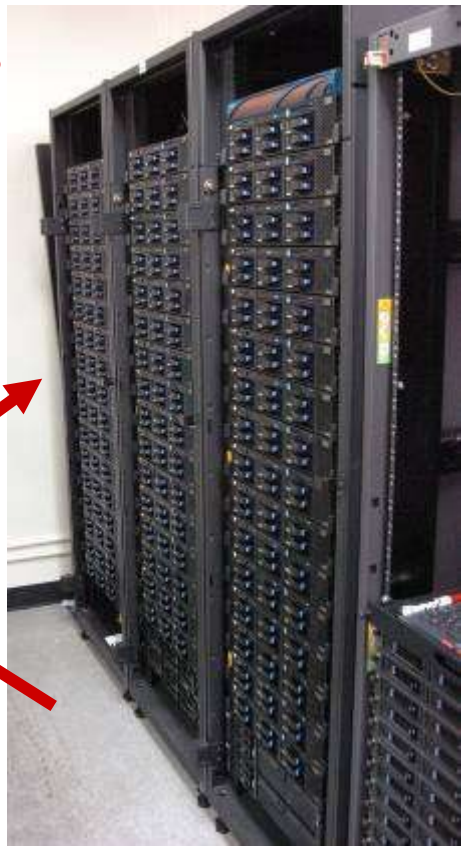
Campuses Must Provide Fiber Infrastructure to End-User Laboratories & Large Rotating Data Stores

SIO Ocean Supercomputer



UCSD Campus LambdaStore Architecture

IBM Storage Cluster



Streaming Microscope

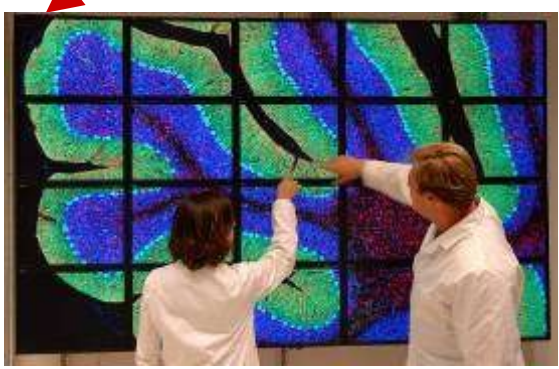






2 Ten Gbps Campus Lambda Raceway







Global LambdaGrid

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Source: Phil Papadopoulos, SDSC, Calit2

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

Goals by 2007:

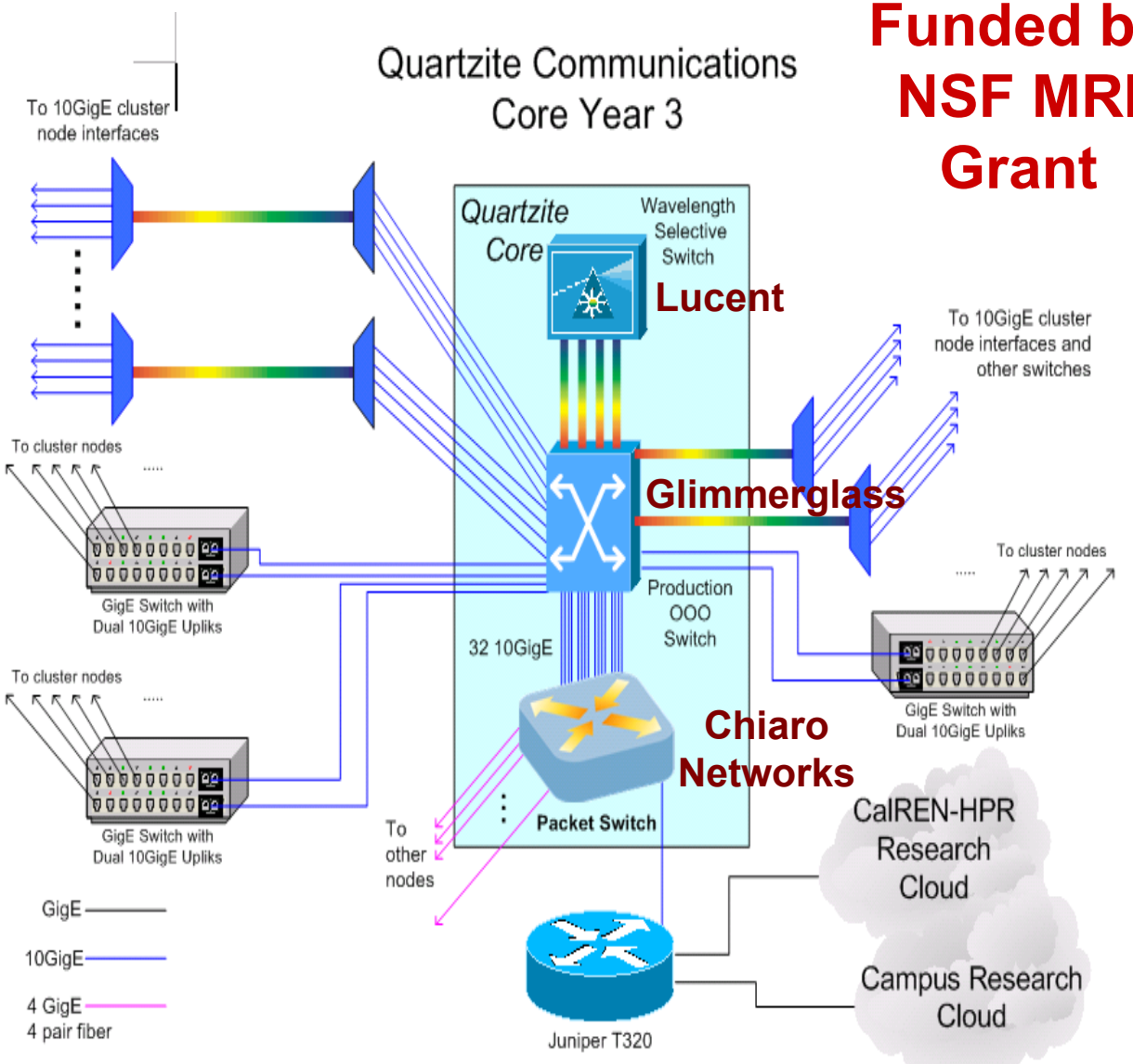
>= 50 endpoints at 10 GigE

>= 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

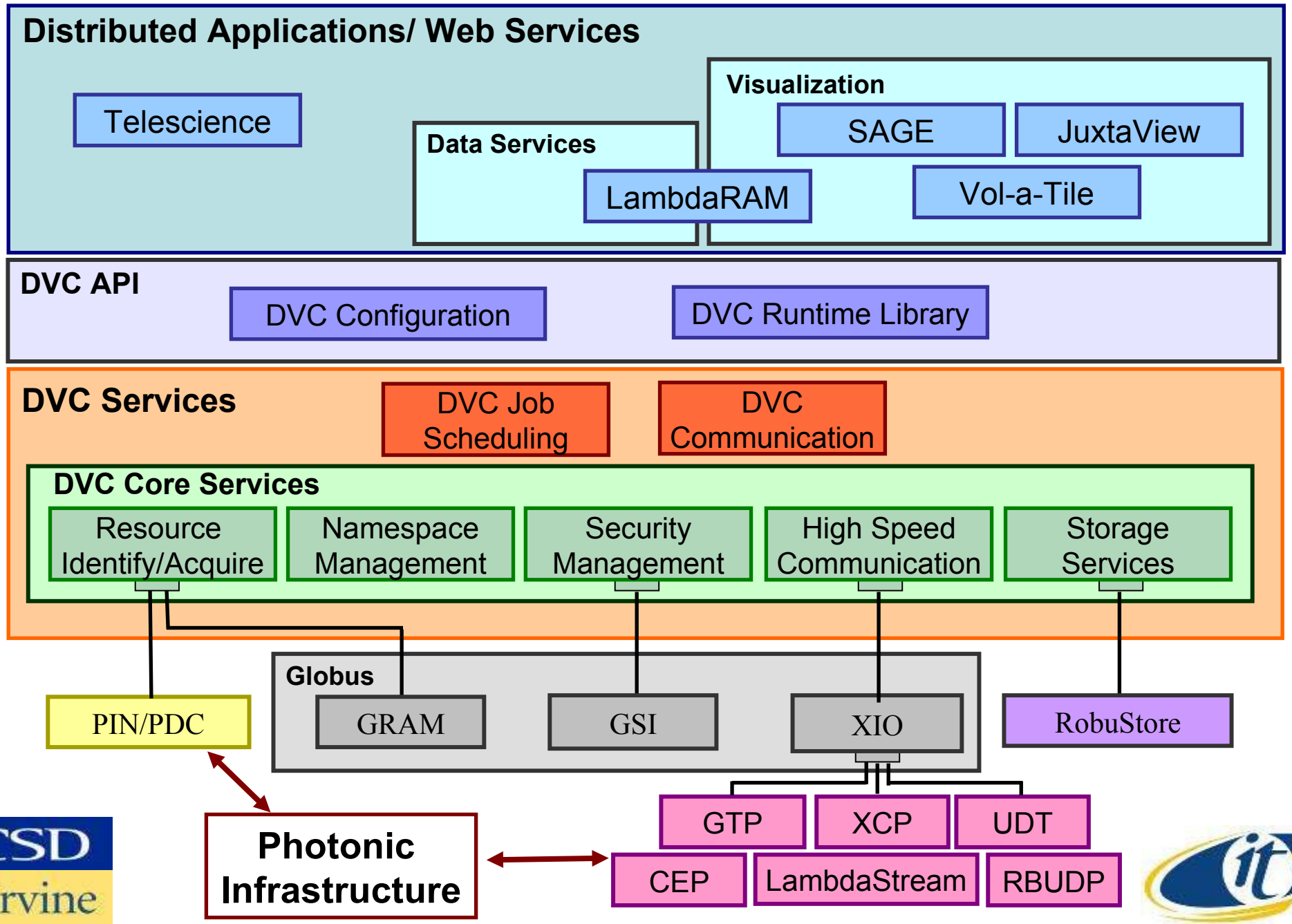


Funded by NSF MRI Grant

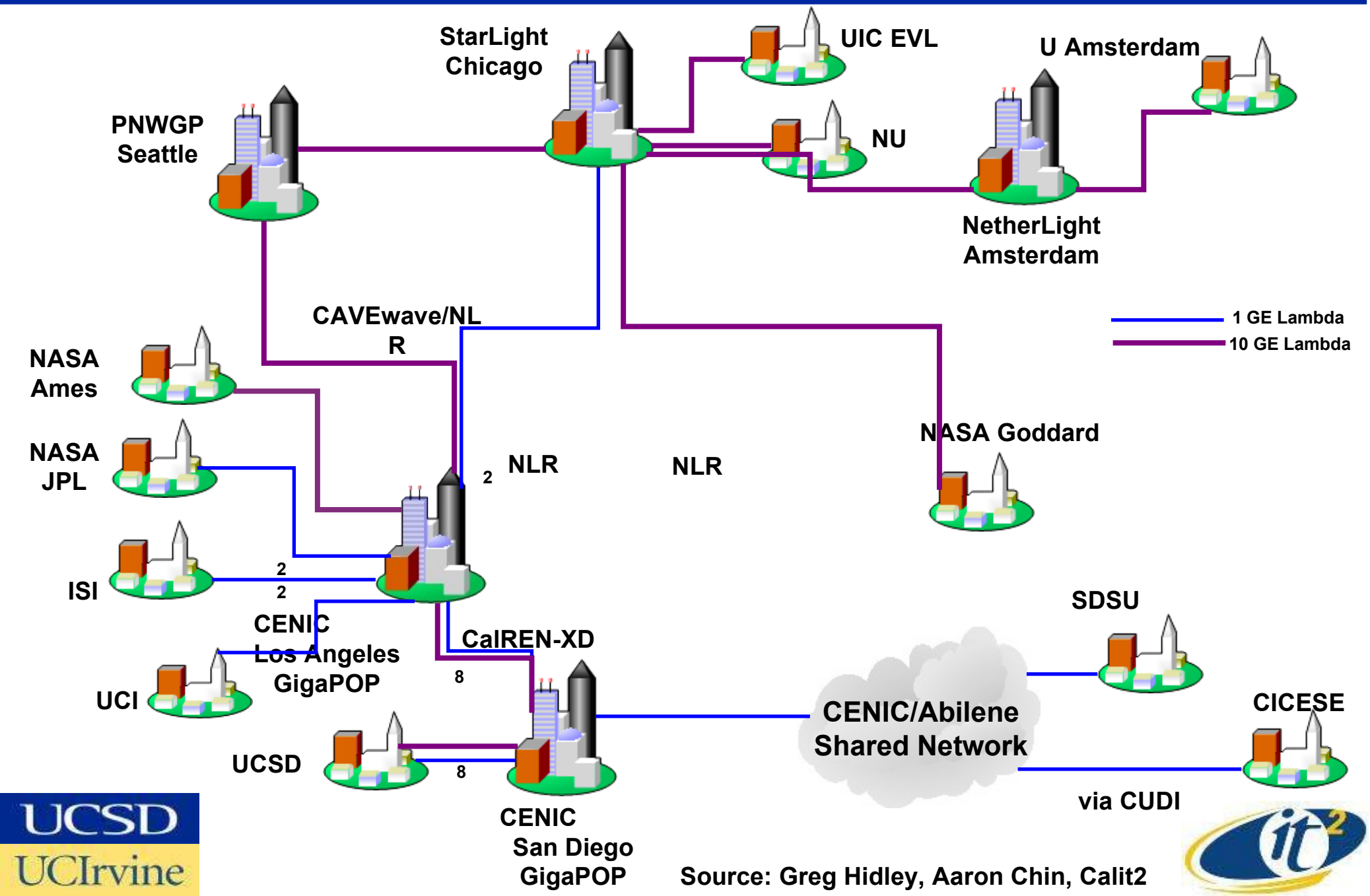
Source: Phil Papadopoulos, SDSC, Calit2

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OptIPuter Middleware Architecture--
The Challenge of Transforming Grids into LambdaGrids

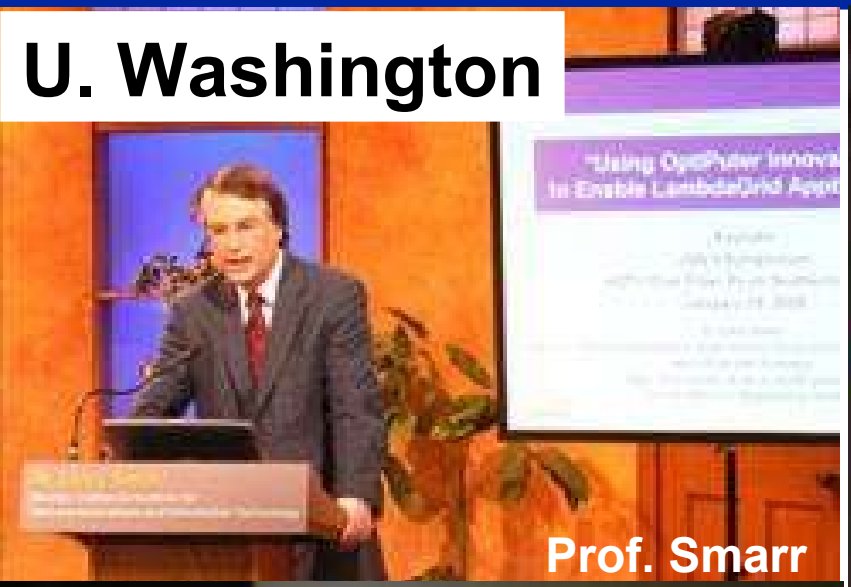


The OptIPuter LambdaGrid is Rapidly Expanding



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Multiple HD Streams Over Lambdas Will Radically Transform Global Collaboration





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



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Source: U Washington Research Channel

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Brain Imaging Collaboration -- UCSD & Osaka Univ. Using Real-Time Instrument Steering and HDTV

Most Powerful Electron Microscope in the World -- Osaka, Japan





HDTV

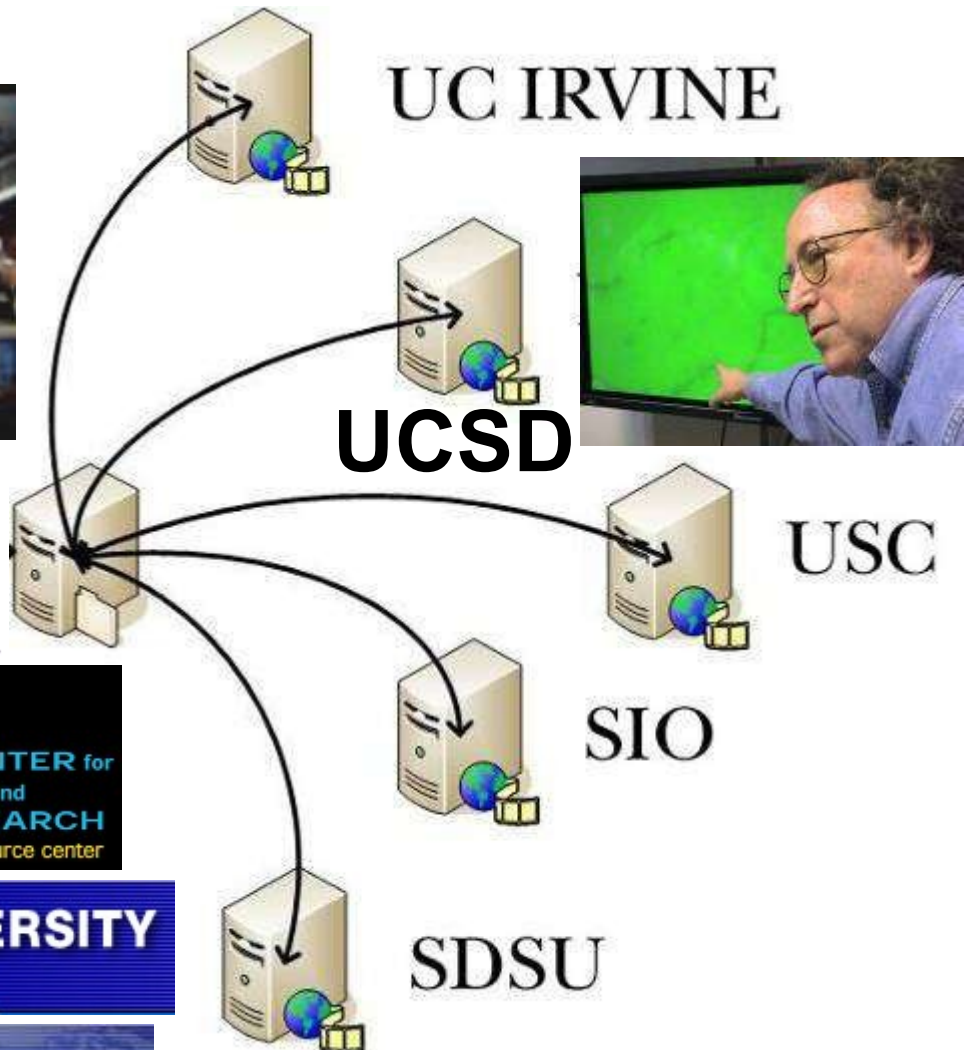
NBCR

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

OSAKA UNIVERSITY

KDDI GROUP KDDI Labs USA

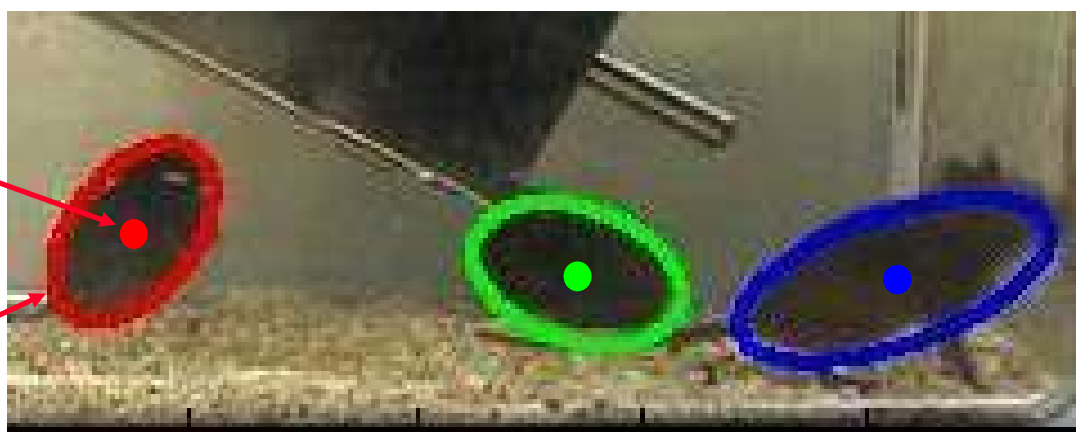
Southern California OptIPuter



Source: Mark Ellisman, UCSD

Digitally Enabled Animal Observation: Mouse Tracking in Calit2 Smart Vivarium

- **Capture and Process Continuous Video Observing Mice**
  - Scalable to Thousands of "Cages"
- **Maintain Health and Welfare & Perform Biomedical Experiments**
  - How Far Does Each Mouse Run in a Day?
  - Behaviour Tracking (Sitting, Running, Grooming, Feeding)
- **Integrated System**
  - Computer Vision
  - Pattern Recognition
  - Embedded Systems
  - Distributed Computation



- **Gigabytes/s of Video Data => Petabytes in Archives**

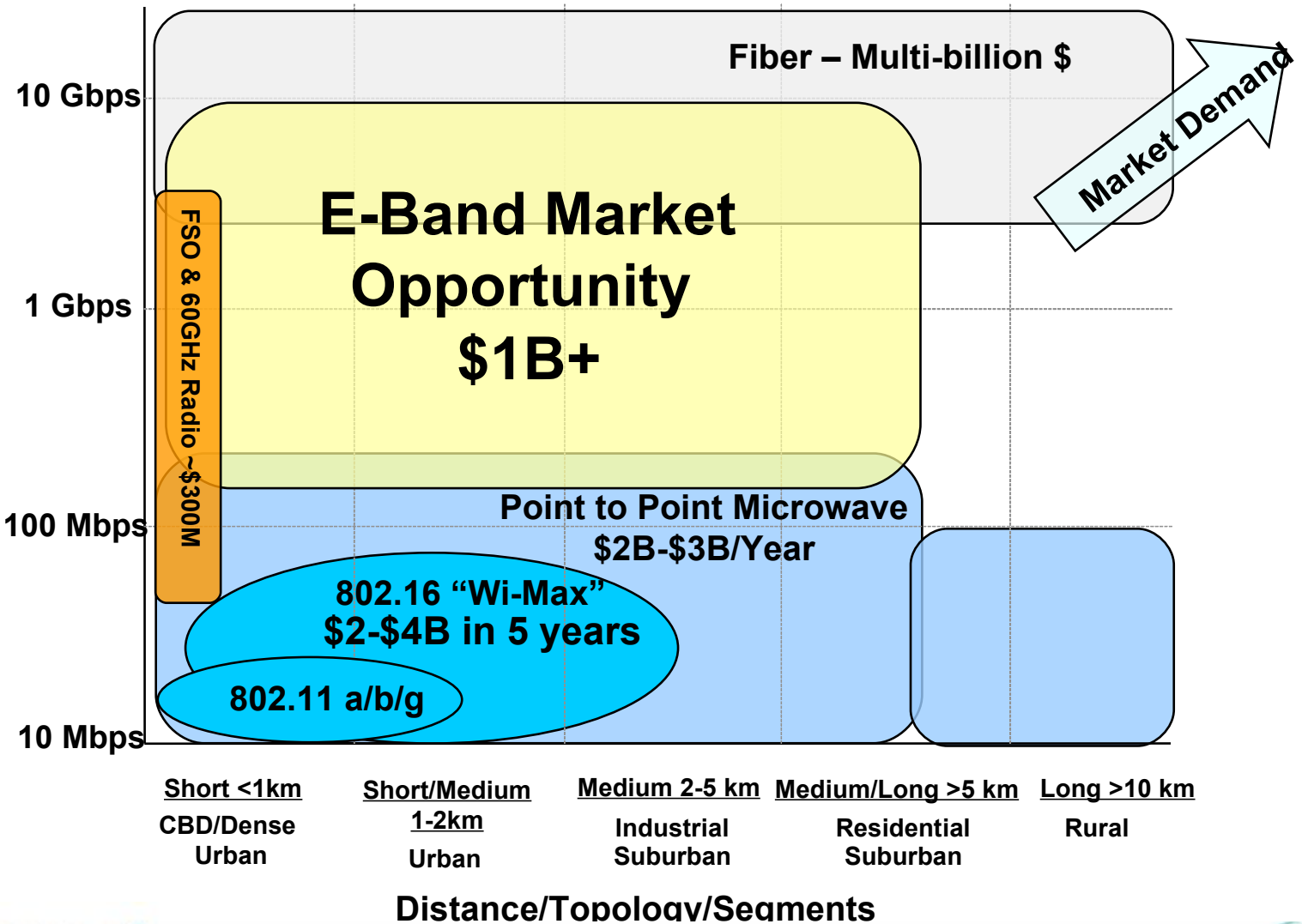
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Source: Serge Belongie, CSE UCSD

it²

An Explosion in Wireless Internet Connectivity is Occuring

Broadband Cellular Internet Plus…



The Calit2@UCSD Building Was Designed for the Wireless Age

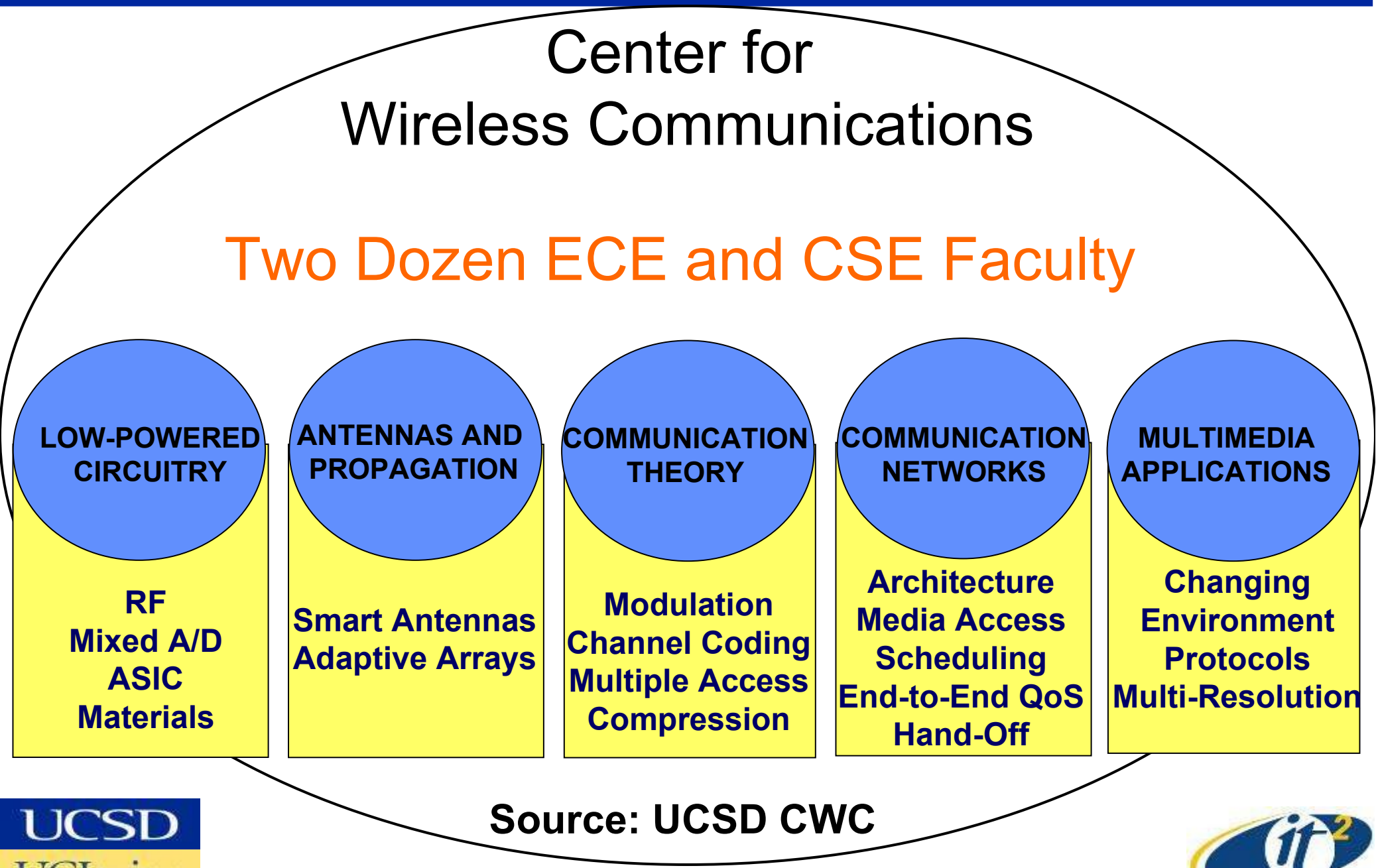
- **Nine Antenna Pedestals on Roof**
  - Can Support Ericsson's Latest Compact Base Station
  - Or Antennas for a Macro Base Station
- **Rooftop Research Shack**
  - Vector Network Analyzers
  - Spectrum Analyzers
  - CDMA Air Interface Software Test Tools
- **Dedicated Fiber Optic and RF connections 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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Building Materials Were Chosen To Maximize Radio Penetration

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The CWC Provides Calit2 With Deep Research in Many Component Areas



Source: UCSD CWC

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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

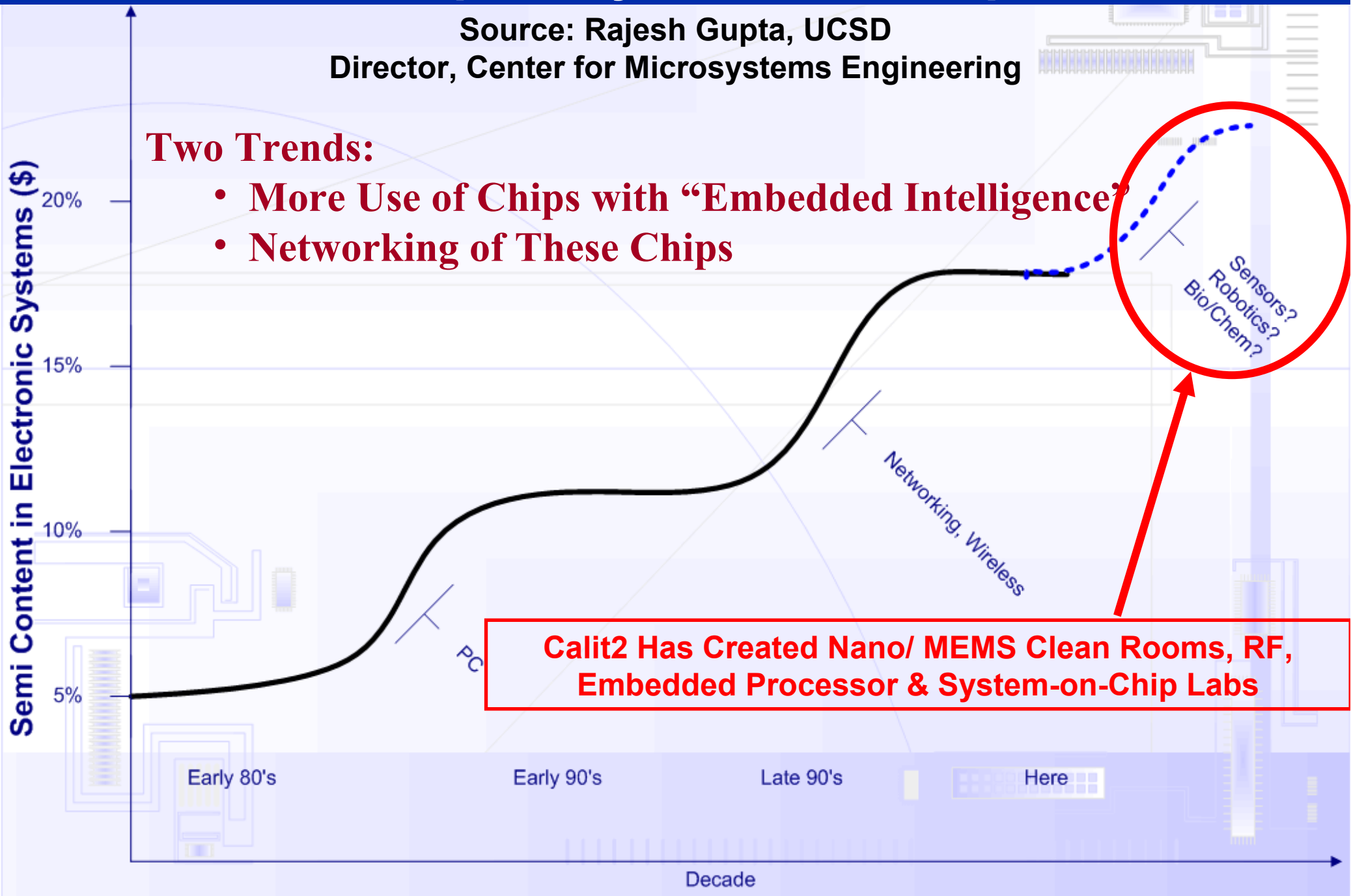
Over 20 Affiliated Faculty

Network Endpoints Are Becoming Complex Systems-on-Chip

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

Two Trends:

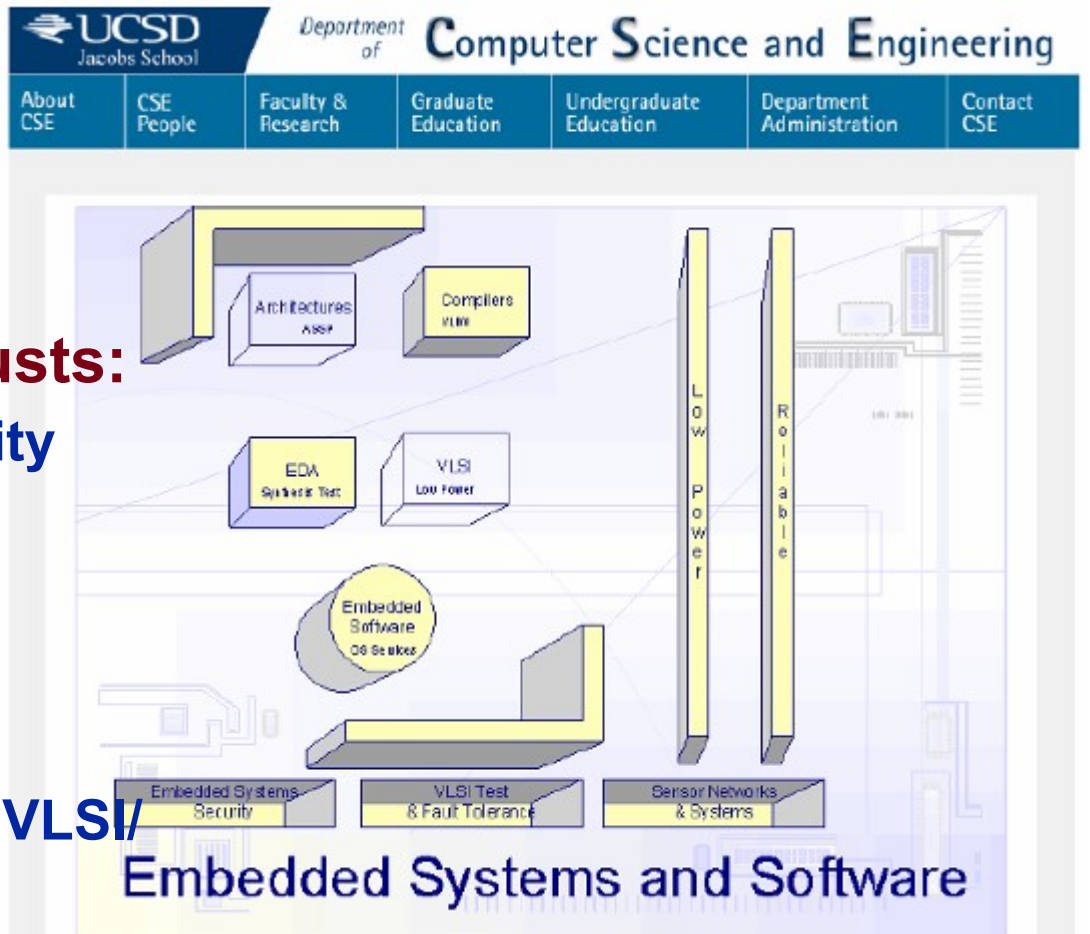
- More Use of Chips with "Embedded Intelligence"
- Networking of These Chips



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

The UCSD Program in Embedded Systems & Software

- **Confluence of:**
  - Architecture, Compilers
  - VLSI, CAD, Test
  - Embedded Software
- **Cross-Cutting Research Thrusts:**
  - Low Power, Reliability, Security
  - Sensor Networks
- **Affiliated Laboratories:**
  - High Performance Processor Architecture and Compiler
  - Microelectronic Systems Lab VLSI/ CAD Lab
  - Reliable System Synthesis Lab



http://mesl.ucsd.edu/gupta/ess/

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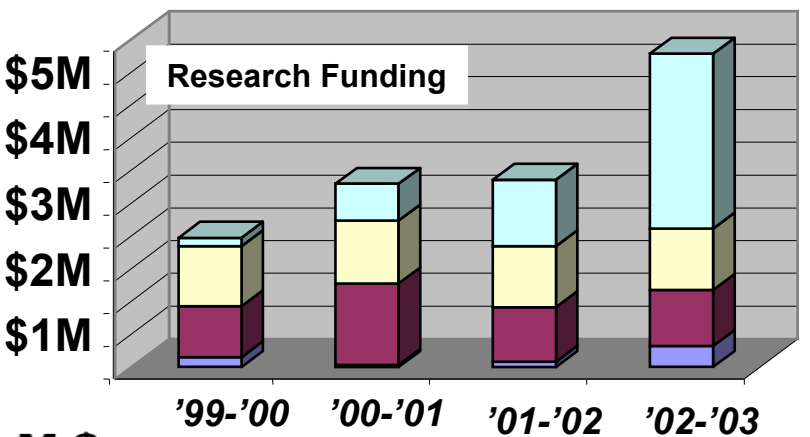
Calit2 MicroSystems Engineering Initiative

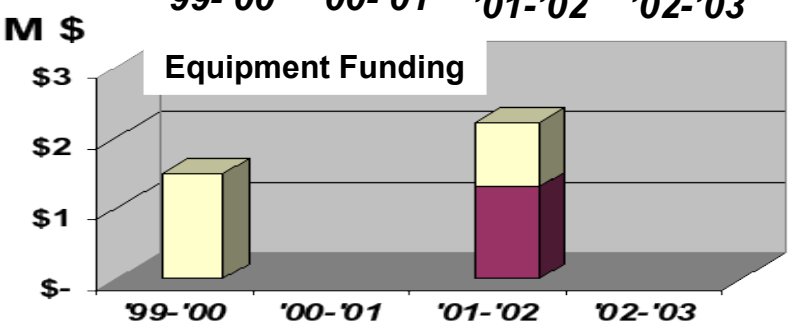
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UC Irvine Integrated Nanoscale Research Facility – Materials and Devices Collaboration with Industry

- **Collaborations with Industry**
  - **Joint Research With Faculty**
  - **Shared Facility Available For Industry Use**
- Working with UCI OTA to Facilitate Tech Transfer
- Industry and VC Interest in Technologies Developed at INRF

Agilent Technologies
TAMARACK scientific co., inc.
Raytheon
Auxora
VERSA TECHNOLOGY, INC.
RFIC
Tanner RESEARCH
Conventor
IRVINE SENSORS
hp invent
GCS
BROADCOM.
SKYWORKS
DRS
POC Physical Optics Corporation
TEXAS INSTRUMENTS
nexgen
BMR
MICROTEK
SWT ASSOCIATES
WIN Semiconductors Corp.
ROCKWELL SCIENTIFIC
delivering the winning technical edge
GENERAL MONITORS
ENDEVCO
SEQUENOM
ALPINE SEMICONDUCTOR
SST
MetroLaser, Inc.
MOOG
CONEXANT
IntelliEPI
VSK Photonics
COHERENT
PRINTRONIX
ASI
IJ Research, Inc.
XTAL
TRW
Umachines
Broadley-James
NUMERICAL TECHNOLOGIES, INC. GET THERE
Microsemi
OPLINK
NORTHROP GRUMMAN
UCSD
UCIrvine





UCI Has Built a World Class Multi-Departmental BioMEMS Faculty

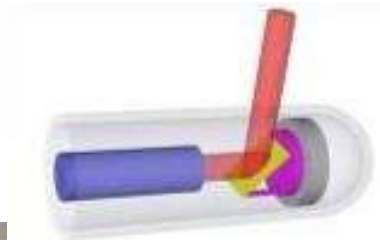
- **Developing BioMEMS**
  - Mark Bachman (EECS)
  - Peter Burke (EECS)
  - Noo Li Jeon (BME)
  - John LaRue (MAE)
  - Abe Lee (BME)
  - G.P. Li (EECS)
  - Marc Madou (MAE)
  - Rick Nelson (EECS)
  - Andrei Shkel (MAE)
  - Bill Tang (BME)
- **Using BioMEMS**
  - Nancy Allbritton (MED)
  - Zhongping Chen (BME)
  - BME faculty
  - Many in College of Medicine

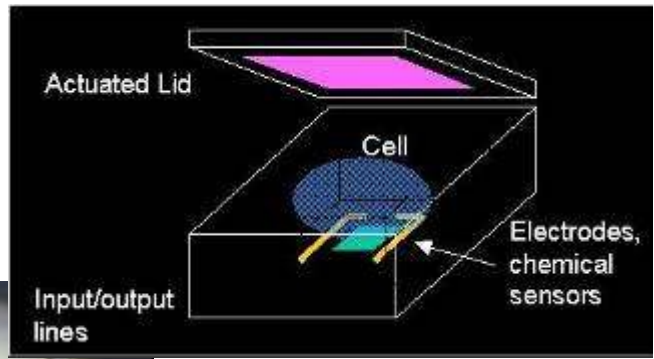


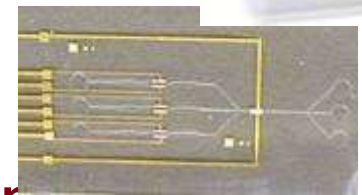
- Orange County has the Largest Concentration of Biomedical Device Industry
- San Diego has the 3rd Largest Concentration of Biotech Industry

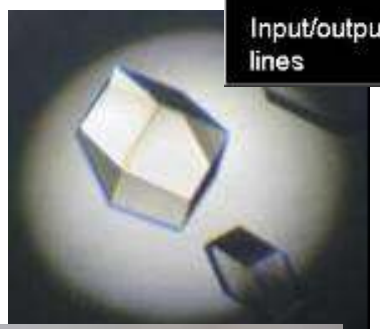
Research Topics of INRF / Calit2@UCI BioMEMS Team

- 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





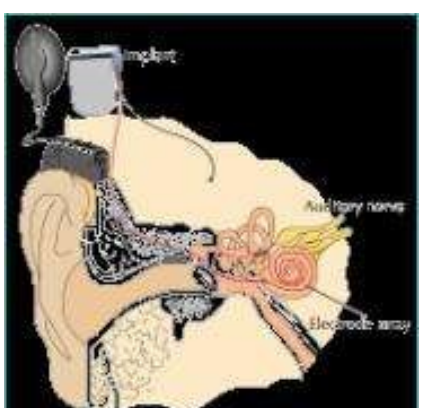


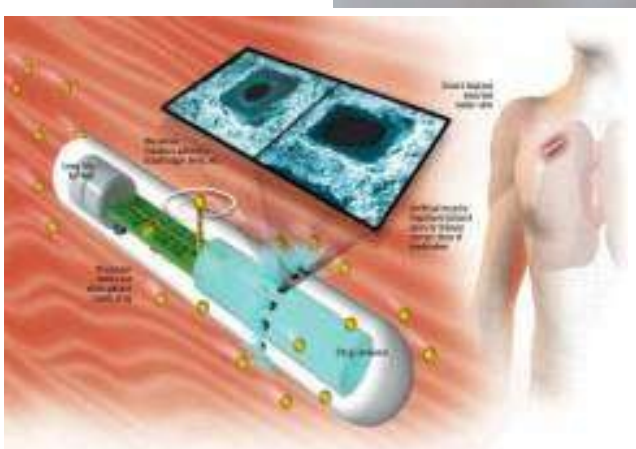












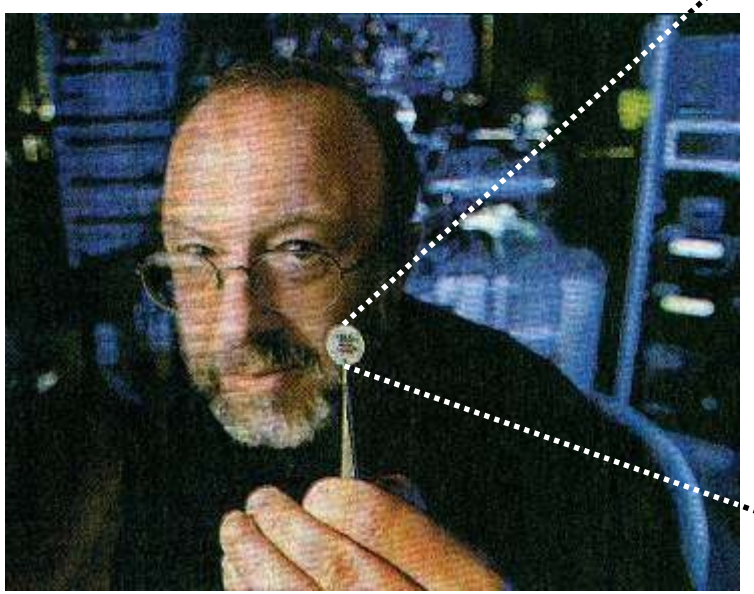
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UCI INRF

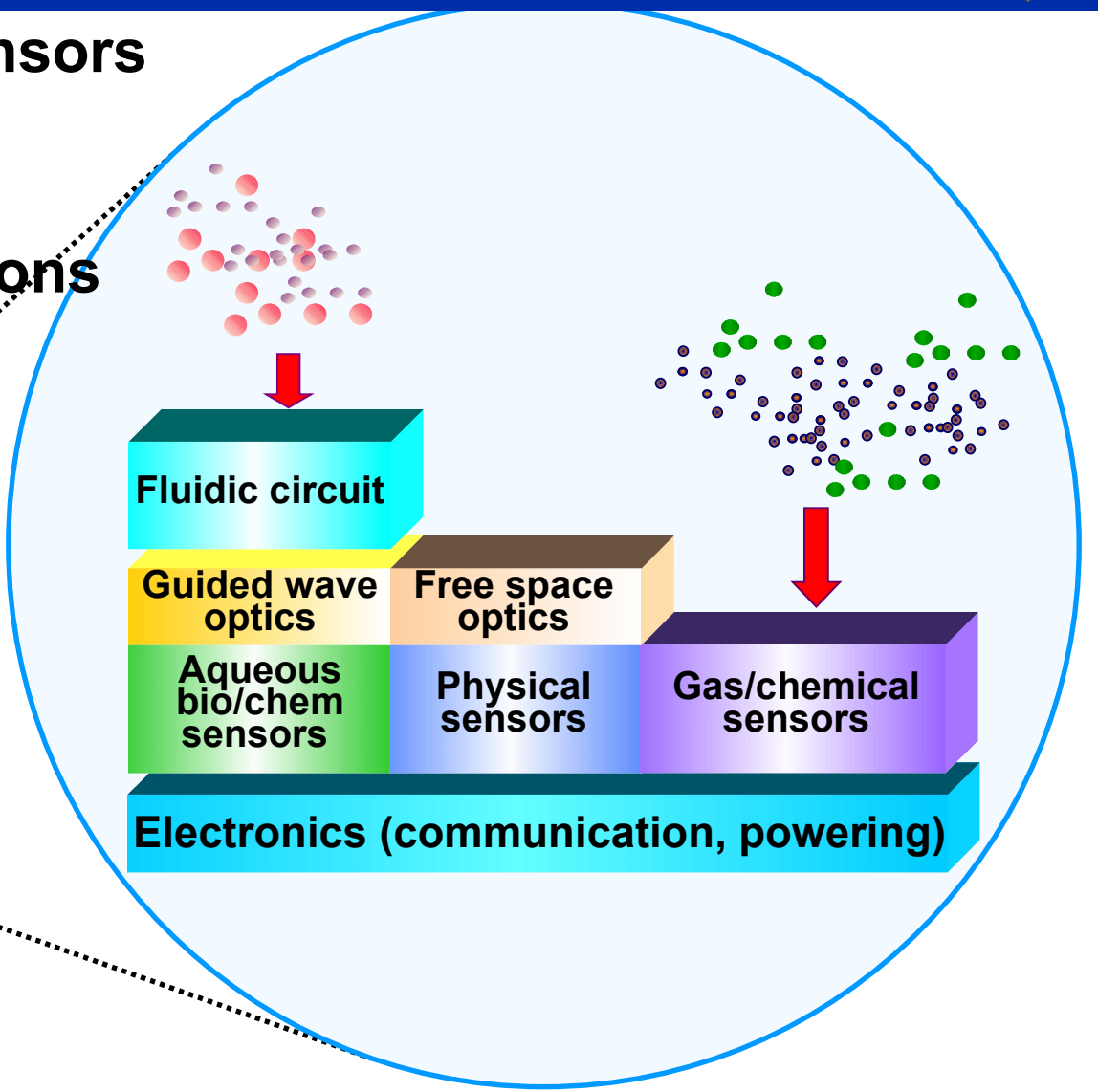
it²

Integrated Nanosensors—
Collaborative Research Between
Physicists, Chemists, Material Scientists and Engineers

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

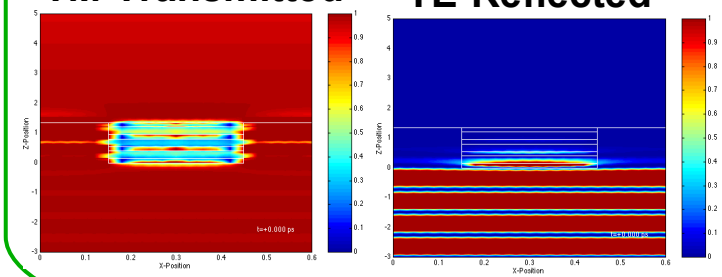
UCSD Optofluidics Faculty are Working Toward Photonic Integrated Information Systems

Electrical, Optical, Fluidic, Magnetic, Mechanical, Acoustic, Chemical, & Biological Signals and Processes on a Chip

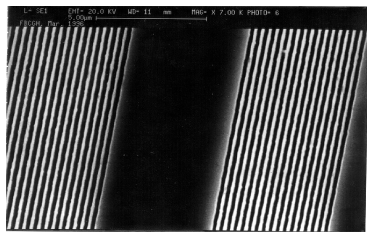
Ultrashort pulses in Photonic Crystals

TM-Transmitted

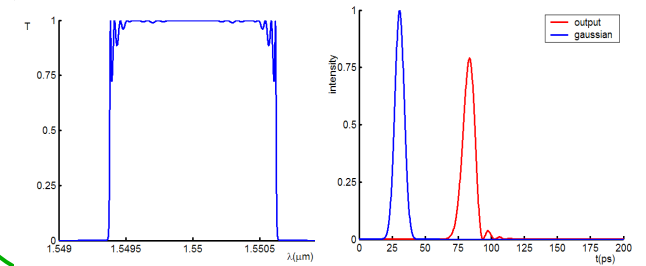
TE-Reflected



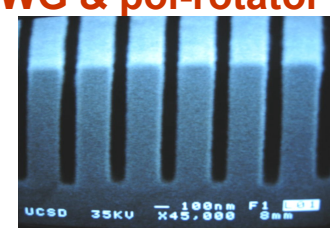
Form-birefringent Polarization splitter



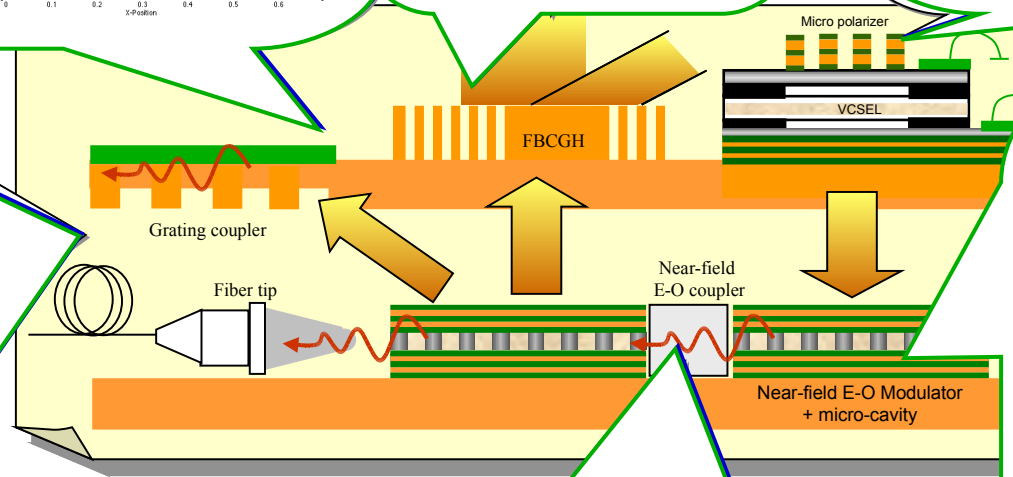
Multicavity resonant delay line



Form birefringent WG & pol-rotator



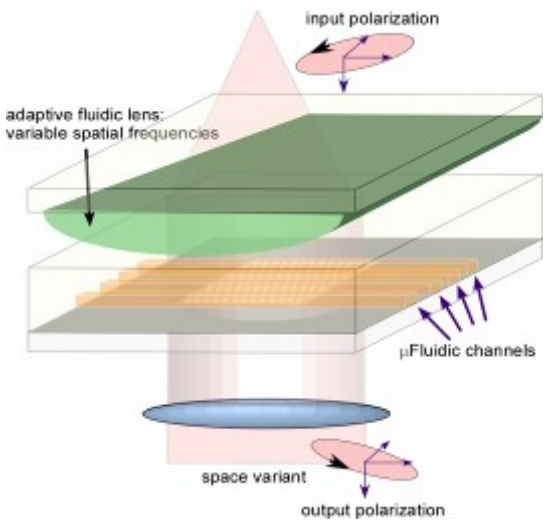




Composite, nonlinear, E-O, and artificial dielectric materials control and enhance near-field coupling



μ-fluidic integrated systems



Wireless Internet Information System for Medical Response in Disasters (WIISARD)

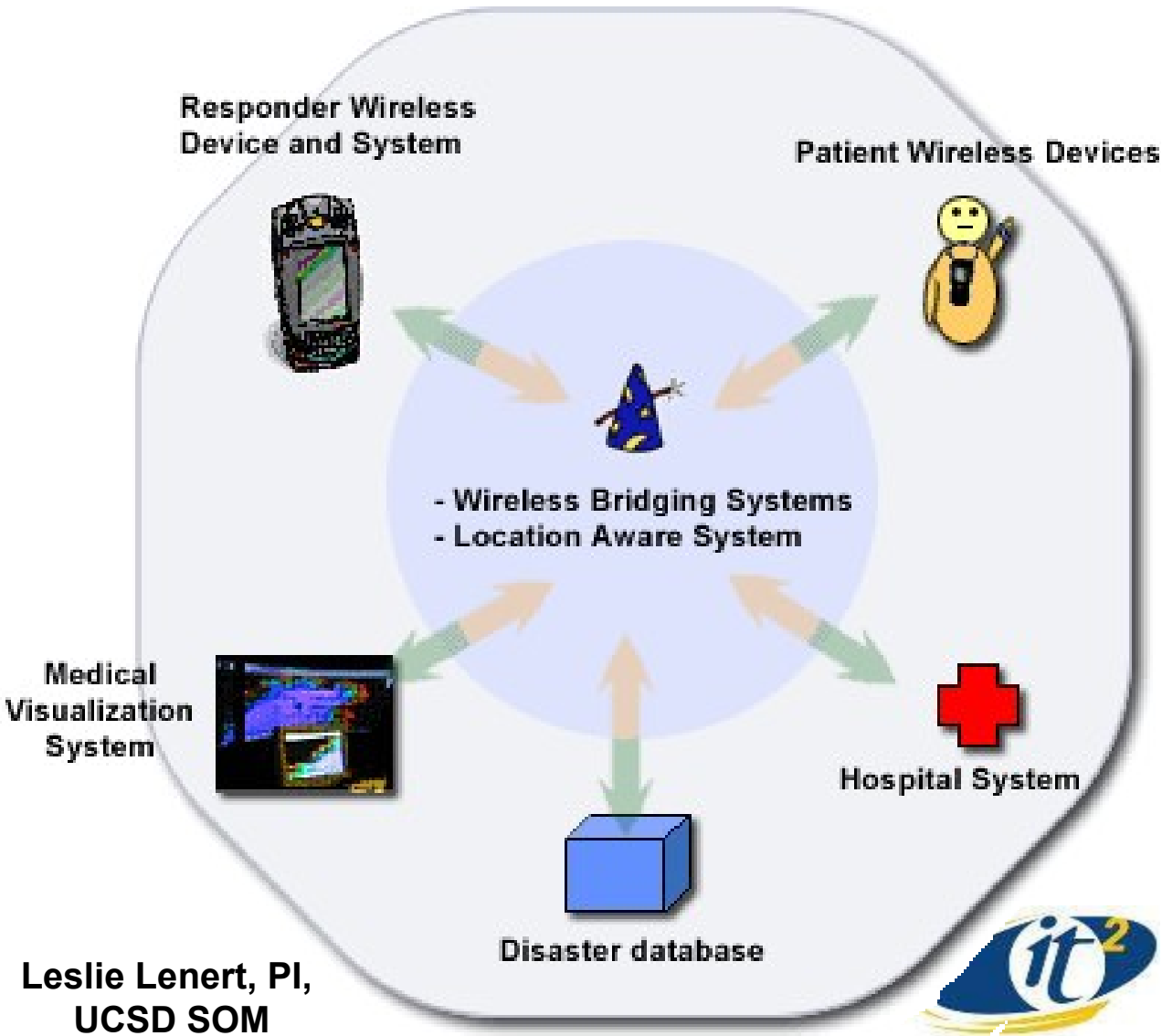
- **First Responder Wireless Location Aware Systems For Nuclear, Chemical & Radiologic Attacks**
  - **Total NIH Award: $4.1 Million.**
  - **Duration 10/03 To 10/06**





WIISARD Drill 3/16/04

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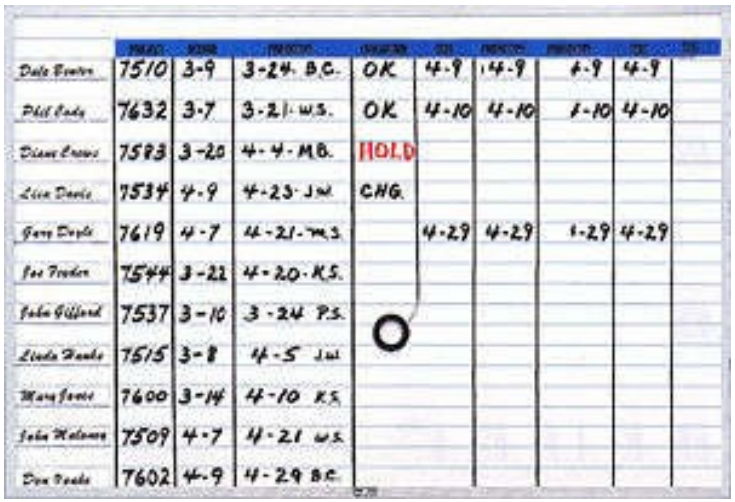


Leslie Lenert, PI, UCSD SOM

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

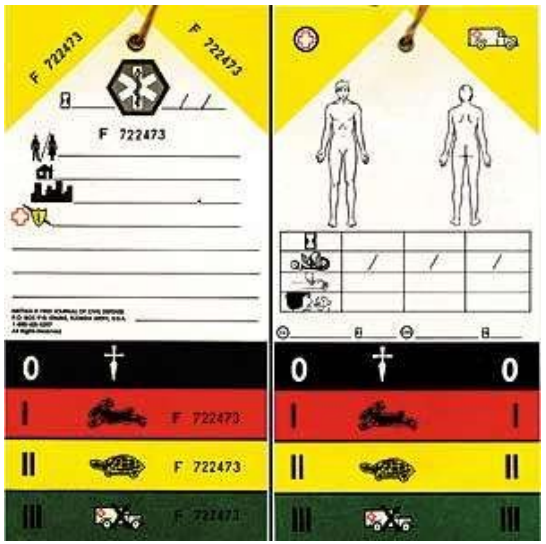


800 mHz Shared Radios



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



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

Wireless Video Transmission Capability
Major Improvement for Hazmat and Medical Units







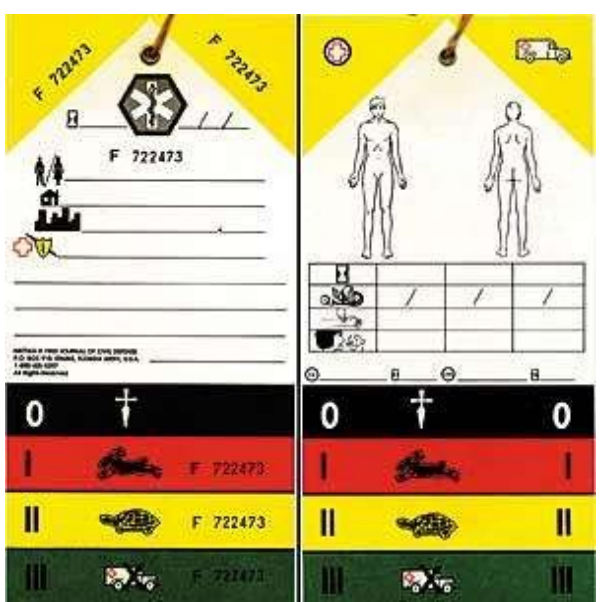
WISARD

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Calit2 Prototype--Active RFID Triage Tag Built on WiFi Embedded Systems Technologies

- **Build from Commercial Components**
  - Dpac WiFi Module
  - Ubicom Application and Web Server Processor
  - Rapid Association with Network and Battery Conservation Cycle
- **TCP/IP Communications**
  - Heart Beat + Geolocation
  - Receives Instructions from Command Center Systems & Responds
  - Displays Triage Status & Alerts With LEDs
  - Stores Medical Data in Flash ROM for Offsite Access





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UBICOM™

Embedded Systems WiFi Pulse Oximeter: Low Cost Improved Aid Stations

WiFi Module





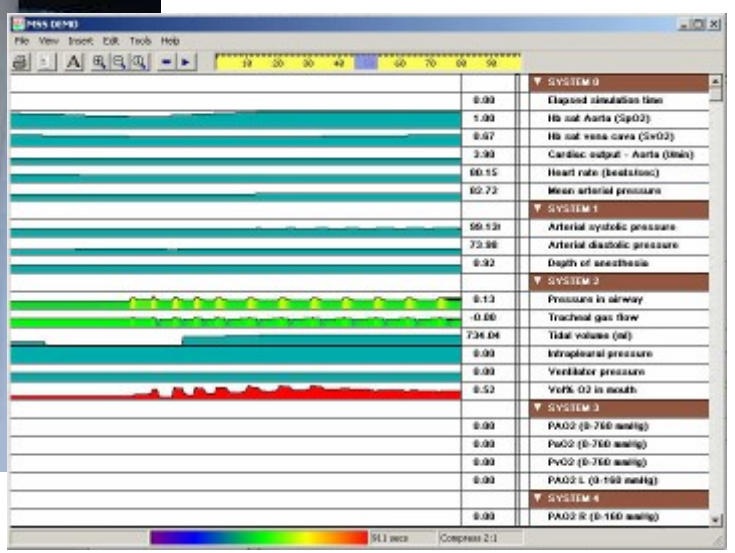
Waterproof Case With LCD/LED



Nellcor MP100 OEM Pulse Oximetry Board



Nellcor Forehead O2 Sensor



Windows XP Monitoring App

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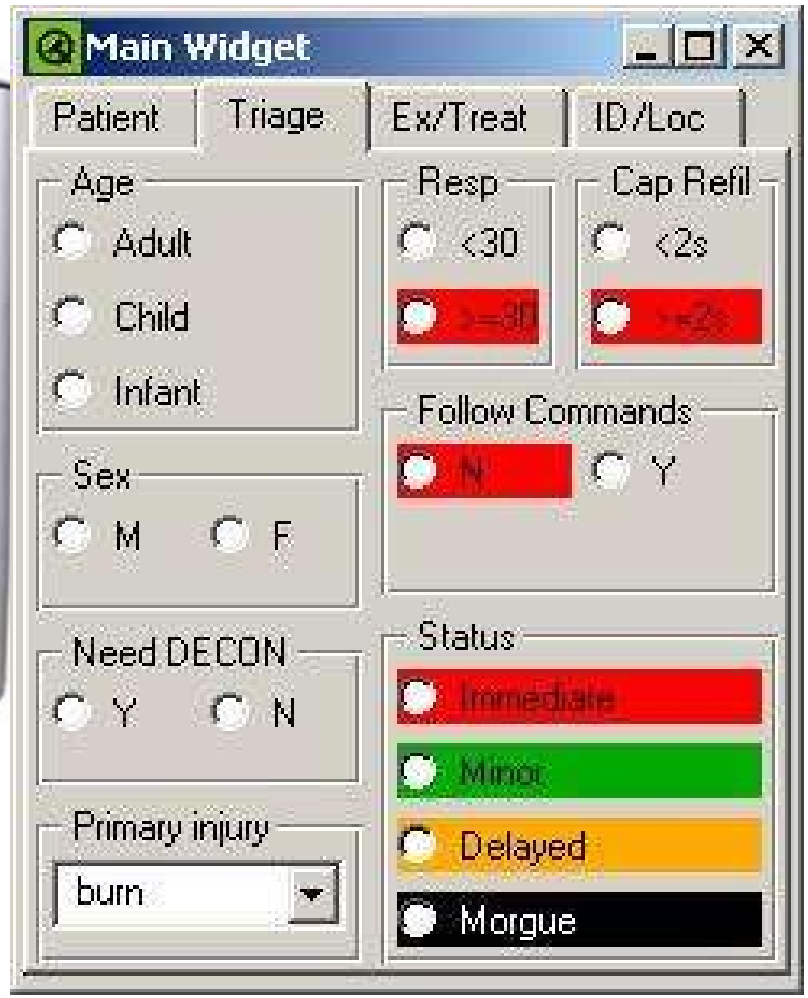
WISARD

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First Tier Provider
Handheld WiFi Systems

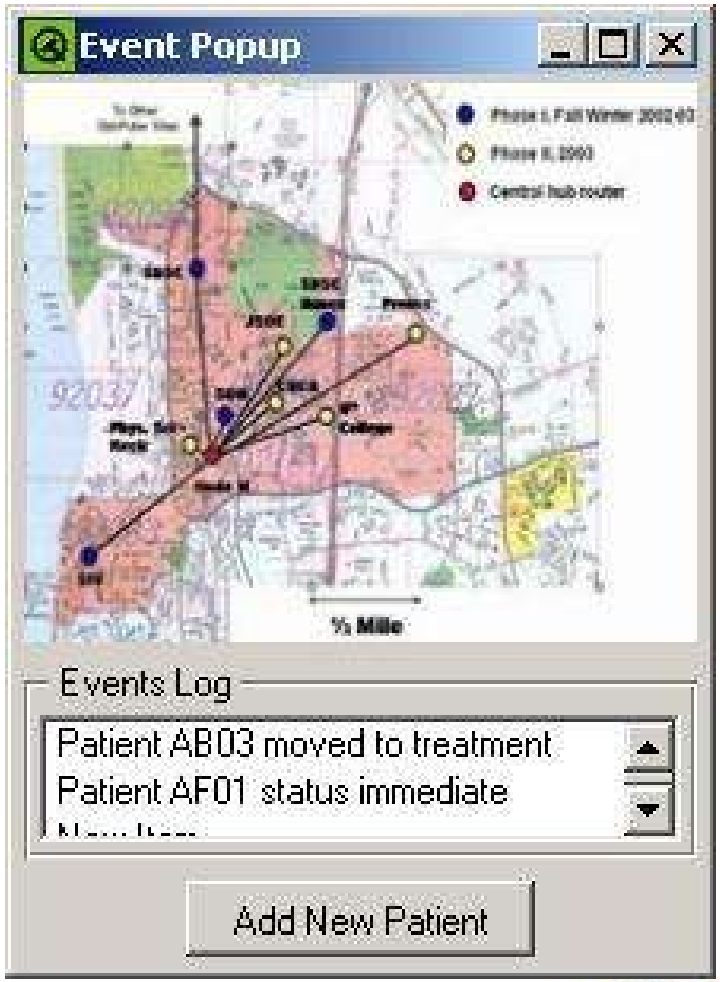






Triage and Care

Tactical Maps and Communications



Calit2 is Collaborating with UCSD and UCI as They Design Smart Hospitals

The new UCI medical center will be a "smart hospital," utilizing the latest telecommunications, automation and Internet developments to elevate patient care, teaching and research to a new level. Wired and wireless technology will improve and expedite communications among all members of a patient's medical team, enabling critical patient data and test results to be transmitted immediately to all members. Additionally, the latest technology will enhance ultrasound, communications, security, computer networking, closed-network television and the dispensing of pharmaceuticals.

Calit2 Testbed in UCSD/VA iTech



To be Completed in Late 2008

Discussing Collaborations with Mayo, IBM, NIH, Navy

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Calit2 Brings Computer Scientists and Mathematicians Together with Biomedical Researchers

- **Some Areas of Concentration:**
  - Genomic Analysis of Organisms
  - Evolution of Genomes
  - Cancer Genomics
  - Human Genomic Variation and Disease
  - Mitochondrial Evolution
  - Proteomics
  - Computational Biology
  - Information Theory and Biological Systems

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Comparative Genomics Utilizes Advanced Algorithmic Techniques

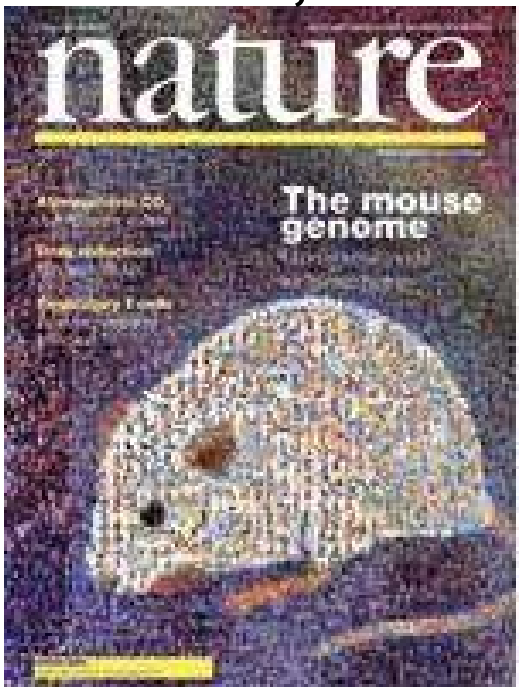
Co-Authors Pavel Pevzner and Glenn Tesler, UCSD



December 9, 2004



April 1, 2004



December 05, 2002

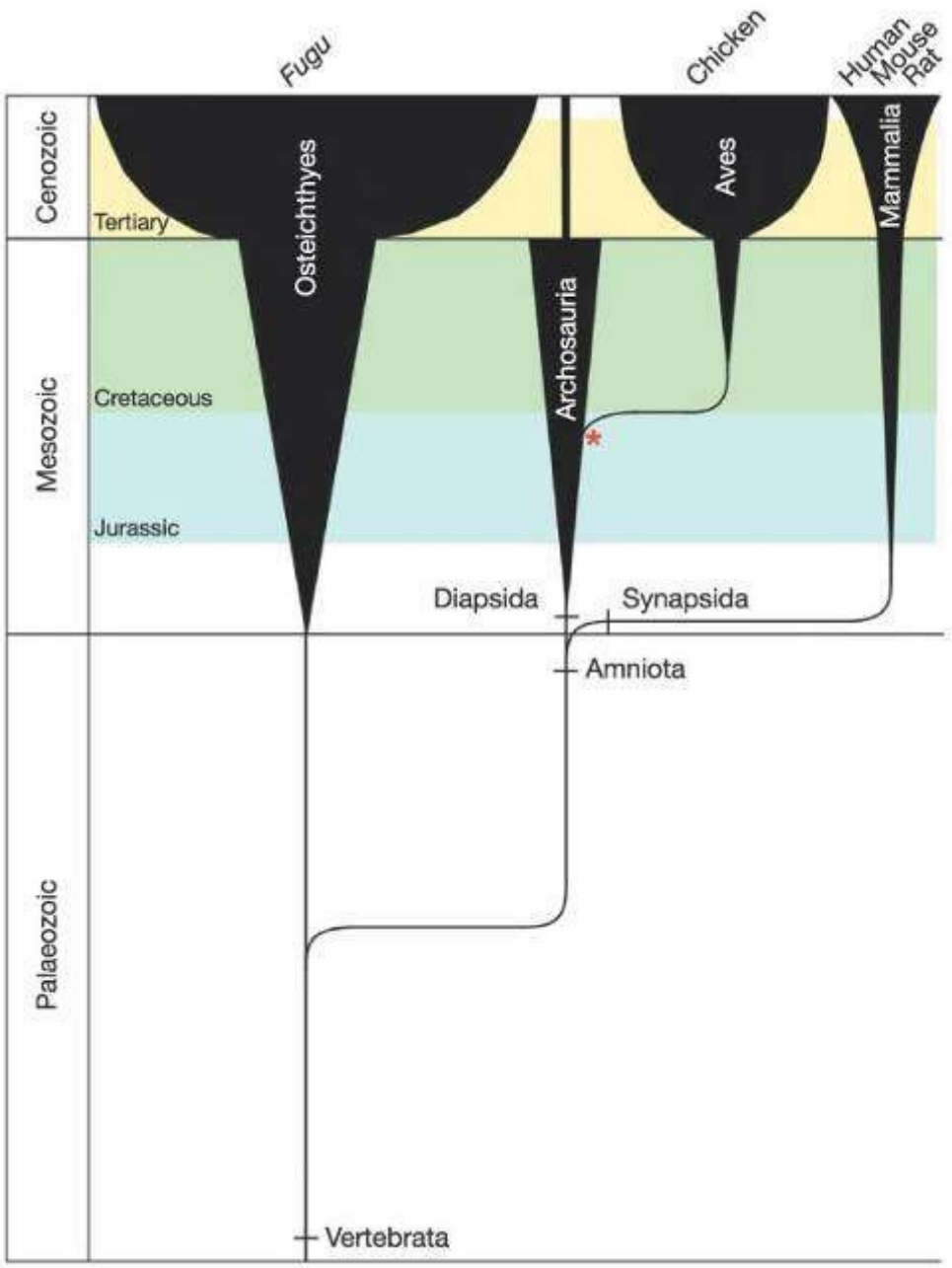
"After sequencing these three genomes, it is clear that substantial rearrangements in the human genome happen only once in a million years, while the rate of rearrangements in the rat and mouse is much faster."

--Glenn Tesler, UCSD Dept. of Mathematics

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www.calit2.net/culture/features/2004/4-1_pevzner.html

Evolution is the Principle of Biological Systems: Computational Techniques are Critical for Discovery



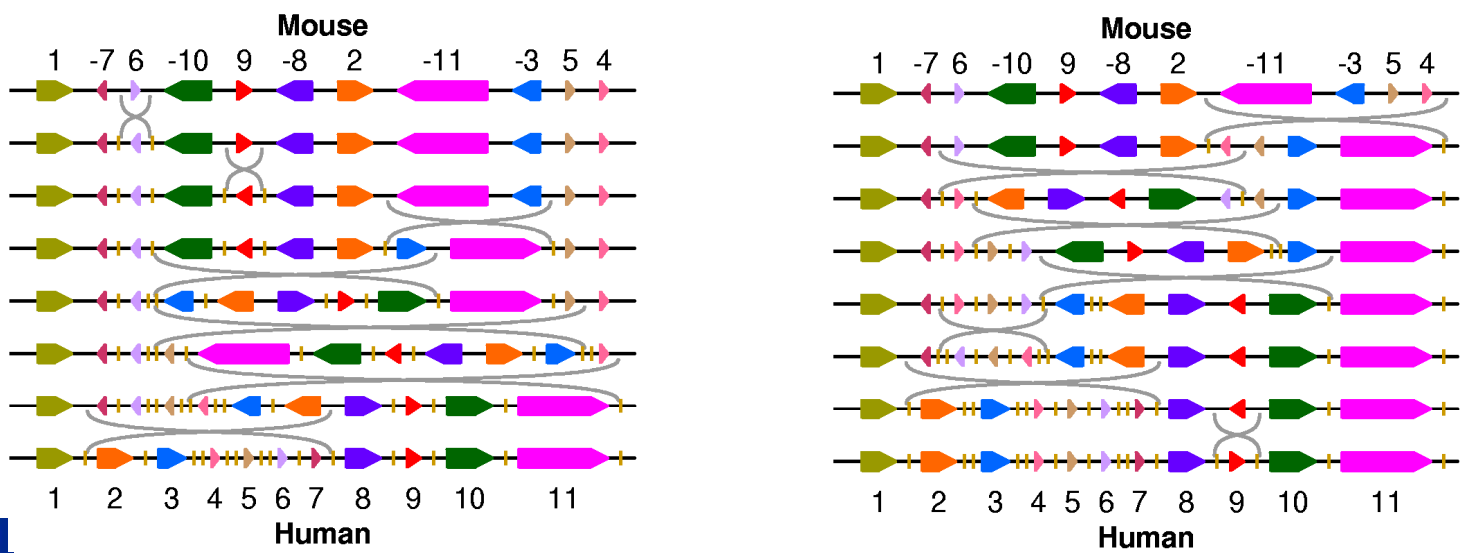
"Many of the chicken–human aligned, non-coding sequences occur far from genes, frequently in clusters that seem to be under selection for functions that are not yet understood."

Nature 432, 695 - 716 (09 December 2004)

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Algorithms for Untangling Genome Rearrangements are Critical to Understanding Genetic Evolution

- **Pevzner & Tesler Derived the Multi-Chromosomal Rearrangement Scenaria for Entire Human-Mouse Genomes**
  - **Nature, 2002, Genome Research, 2003**
- **What are the "Architectural Blocks" Forming the Existing Genomes?**
  - **How Do We Find Them?**
  - **What is the Evolutionary Scenario for Transforming One Genome into the Other?**



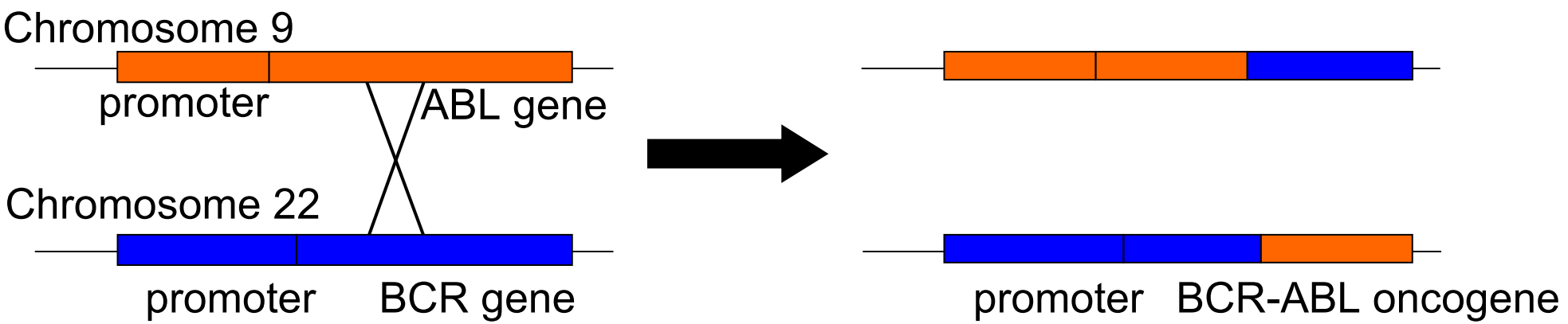
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Source: Pavel Pevzner, UCSD

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Evolutionary Genomic Rearrangements are Central to Cancer Genomics

- Change Gene Structure & Regulatory "Wiring" of the Genome
- Create "Bad" Novel Fusion Genes & Break "Good" Old Genes
- Example:
  - Translocation In Leukemia
  - e.g. Gleevec™ (Novartis 2001) Targets BCR-ABL Oncogene



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Source: Pavel Pevzner and Ben Raphael, Computer Science, UCSD;
Colin Collins lab at UCSF Cancer Center

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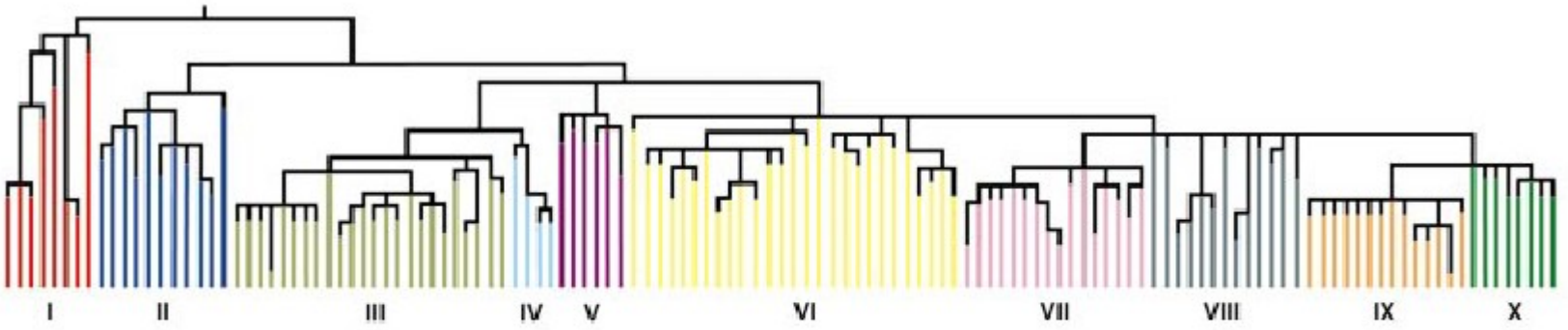
Toward Digitally Enabled Genetic Medicine: Statistical Analysis of Human Genetic Variation

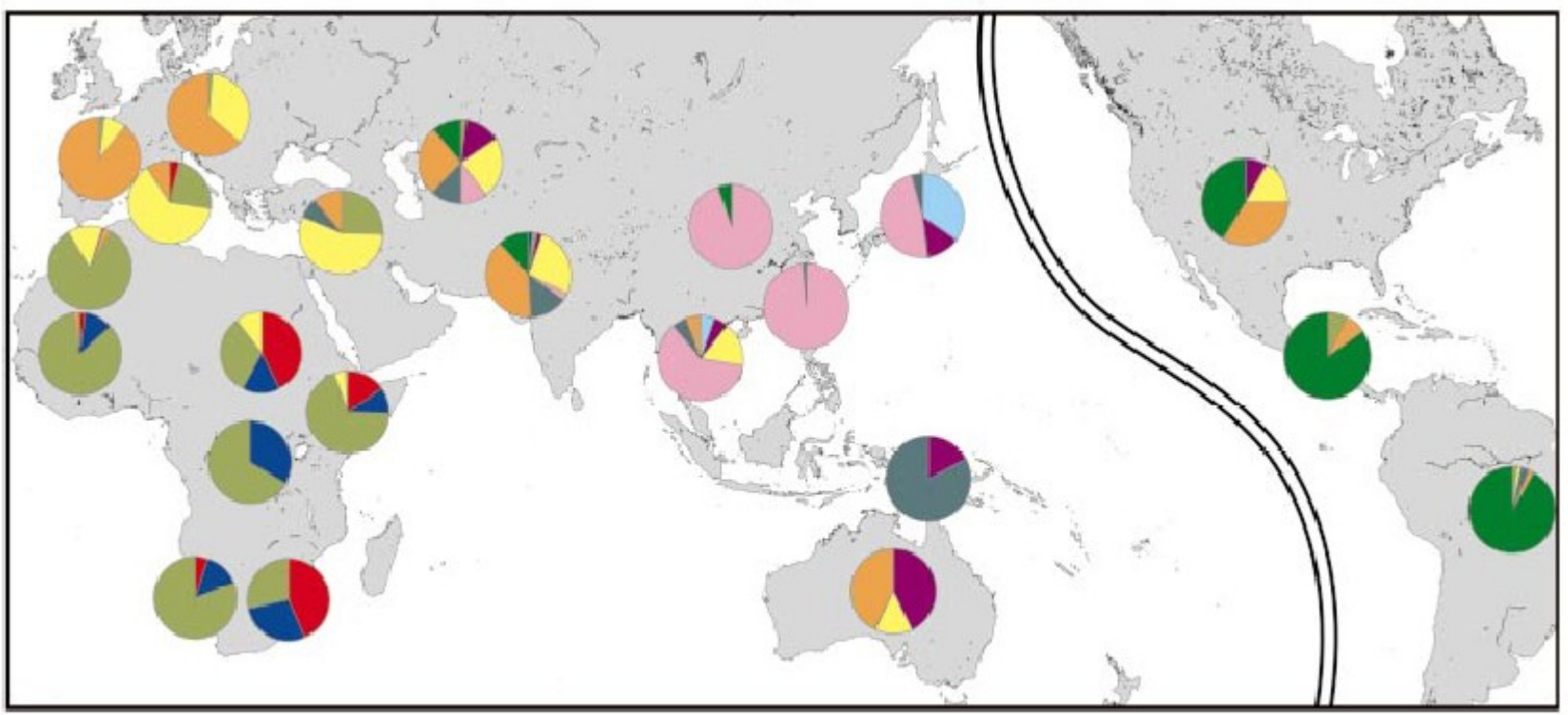
"The structure of human populations is relevant in various epidemiological contexts. As a result of variation in frequencies of both genetic and non-genetic risk factors, rates of disease and of such phenotypes as adverse drug response vary across populations. Further, information about a patient's population of origin might provide health-care practitioners with information about risk when direct causes of disease are unknown."

--*Genetic Structure of Human Populations*
Rosenberg, et al. Science 298: 2381-2385 (2002)

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The Phylogeography of Y Chromosome Binary Haplotypes and the Origins of Modern Human Populations





1062 Men from 21 Populations
218 Polymorphisms from NRY
Underhill, et al. Ann. Hum. Genet. (2001) 65: 43-62

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The Private Sector is Becoming an Essential Partner in Genomics

THE GENOGRAPHIC PROJECT

POWERED BY IBM

MAIN MENU | GENETICS OVERVIEW | ATLAS OF THE HUMAN JOURNEY | YOUR GENET JOURNEY

INTRODUCTION | ABOUT THE PROJECT | HOW TO PARTICIPATE | FREQUENTLY ASKED QUESTIONS | CREDI



A LANDMARK STUDY OF THE HUMAN JOURNEY

Who was **your** first ancestor? New DNA studies say that all humans descended from an African ancestor who lived only 60,000 years ago. Uncover the specific paths that led from him to you—the ultimate human history, as written in our genes.



Public participation, including yours, is critical to the Genographic Project's success. Here's how you can get involved:

Purchasing a Public Participation Kit will fund important research around the world—and open the door to the ancient past of your own genetic background.



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Calit2 Researcher Eskin Collaborates with Perlegen Sciences on Map of Human Genetic Variation Across Populations



"We have characterized whole-genome patterns of common human DNA variation by genotyping 1,586,383 single-nucleotide polymorphisms (SNPs) in 71 Americans of European, African, and Asian ancestry."

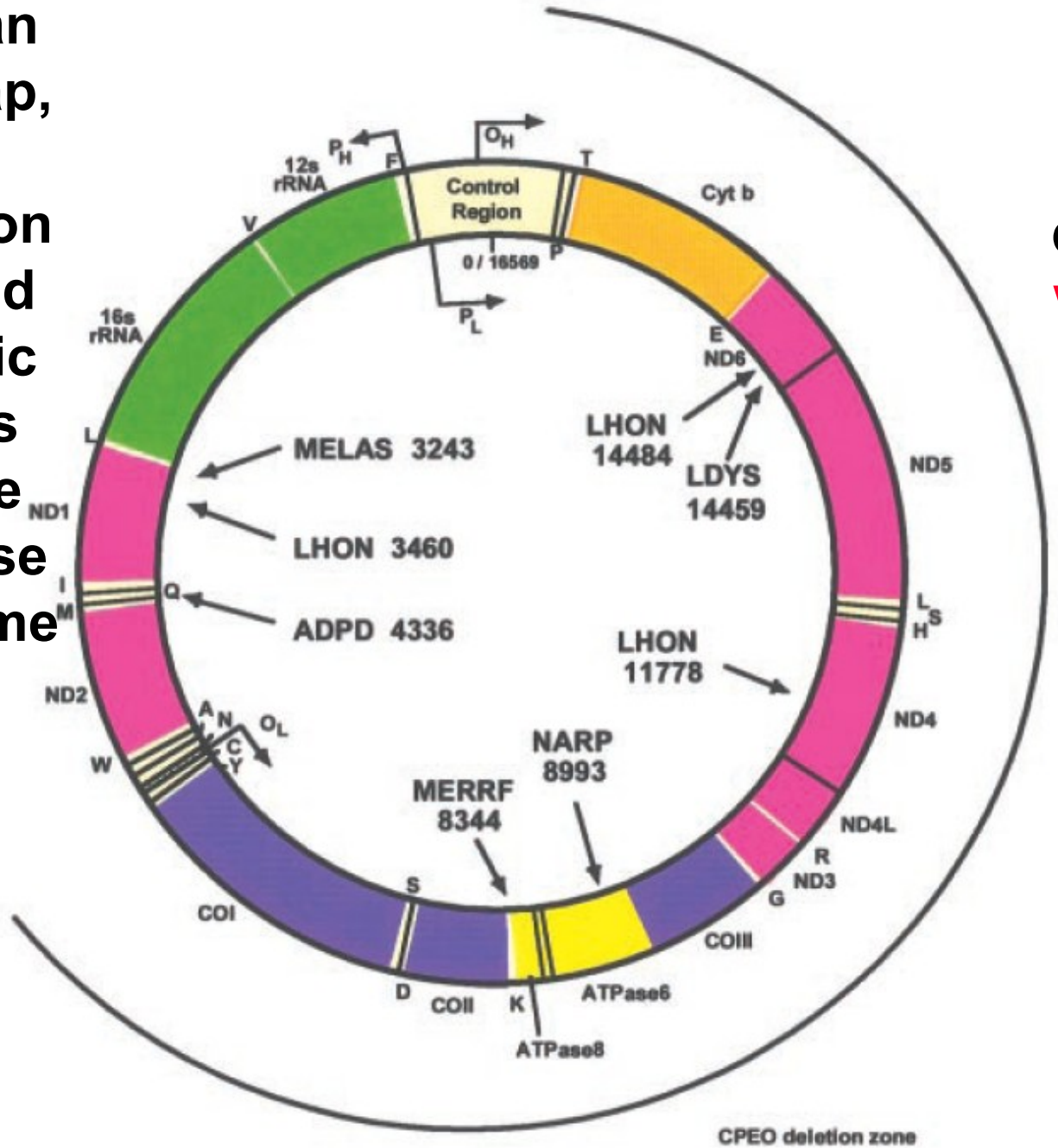
David A. Hinds, Laura L. Stuve, Geoffrey B. Nilsen, Eran Halperin, **Eleazar Eskin**, Dennis G. Ballinger, Kelly A. Frazer, David R. Cox.
"Whole-Genome Patterns of Common DNA Variation in Three Human Populations"
Science 18 February, 2005: 307(5712):1072-1079.

"Although knowledge of a single genetic risk factor can seldom be used to predict the treatment outcome of a common disease, knowledge of a large fraction of all the major genetic risk factors contributing to a treatment response or common disease could have immediate utility, allowing existing treatment options to be matched to individual patients without requiring additional knowledge of the mechanisms by which the genetic differences lead to different outcomes ."

"More detailed haplotype analysis results are available at http://research.calit2.net/hap/wgha/ "

Calit2 is Collaborating with Doug Wallace Planning to Bring MITOMAP into Calit2 Domain

The Human mtDNA Map, Showing the Location of Selected Pathogenic Mutations Within the 16,569-Base Pair Genome



MITOMAP: A Human Mitochondrial Genome Database. www.mitomap.org, 2005



5 March 1999

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For Mitochondrial Diseases It Has Been More Productive
to Classify Patients by Genetic Defect Rather than by Clinical Manifestation

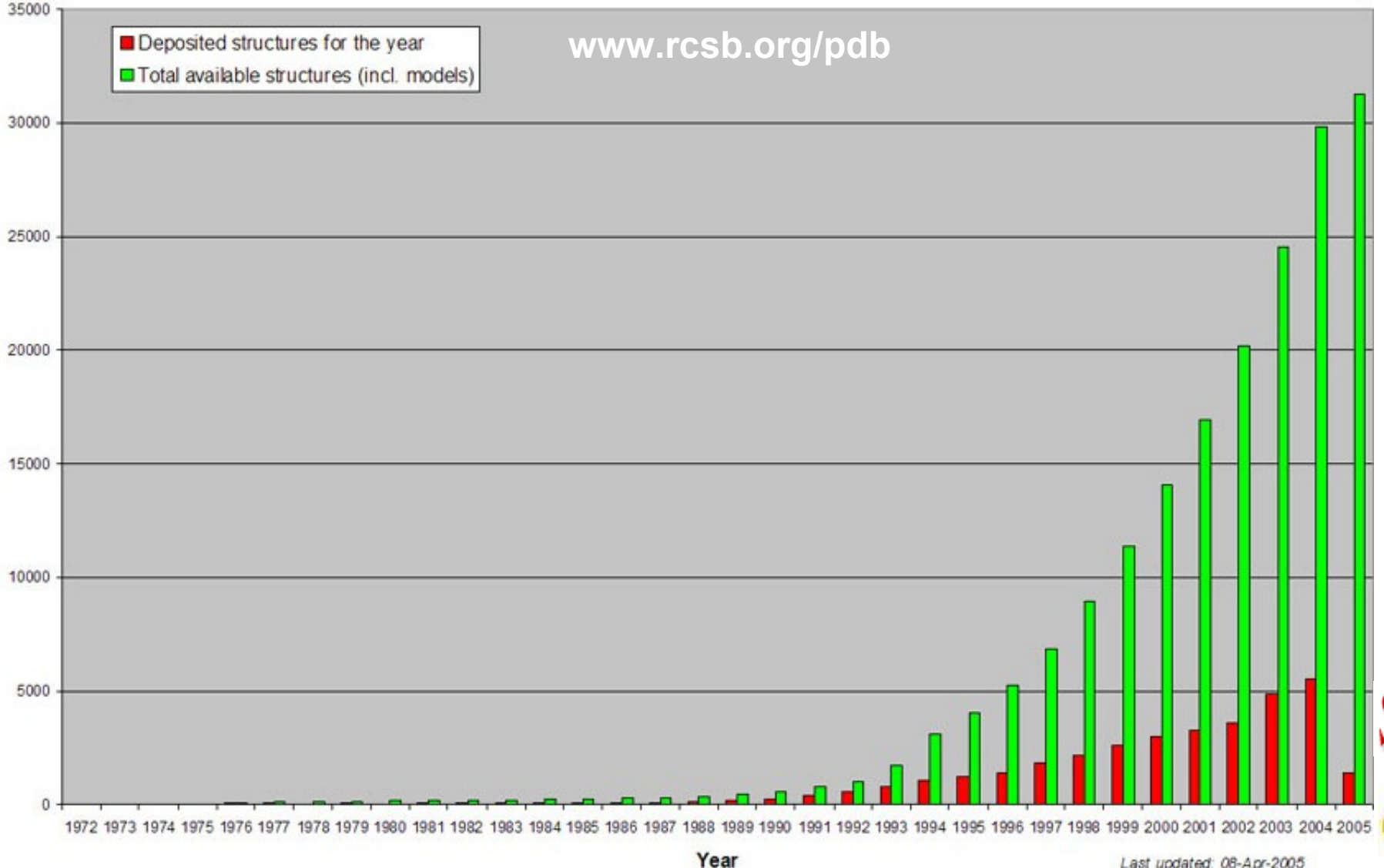
Over the past 10 years, mitochondrial defects have been implicated in a wide variety of degenerative diseases, aging, and cancer… The same mtDNA mutation can produce quite different phenotypes, and different mutations can produce similar phenotypes. …The essential role of mitochondrial oxidative phosphorylation in cellular energy production, the generation of reactive oxygen species, and the initiation of apoptosis has suggested a number of novel mechanisms for mitochondrial pathology.

--Douglas Wallace, Science, Vol. 283, 1482-1488, 5 March 1999

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The Protein Data Bank Personnel Supported by SDSC Will Be Housed in the new Calit2@UCSD Building

- **The Single International Repository for 3-D Structure Data of Biological Macro-molecules (Over 30,000 Structures)**
- **More Than 160,000 Web Hits Per Day**



SDSC

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The Bioinformatics Core of the Joint Center for Structural Genomics will be Housed in the Calit2@UCSD Building



The Bioinformatics Core (BIC) is Responsible for:
(2) Target Selection; (2) Sample Tracking;
(3) Information Management; (4) Structure Validation;
(5) Deposition; And (6) Post-structural Analysis.

TSRI SDSC SSRL UCSD GNF Burnham

UCSD UCIrvine

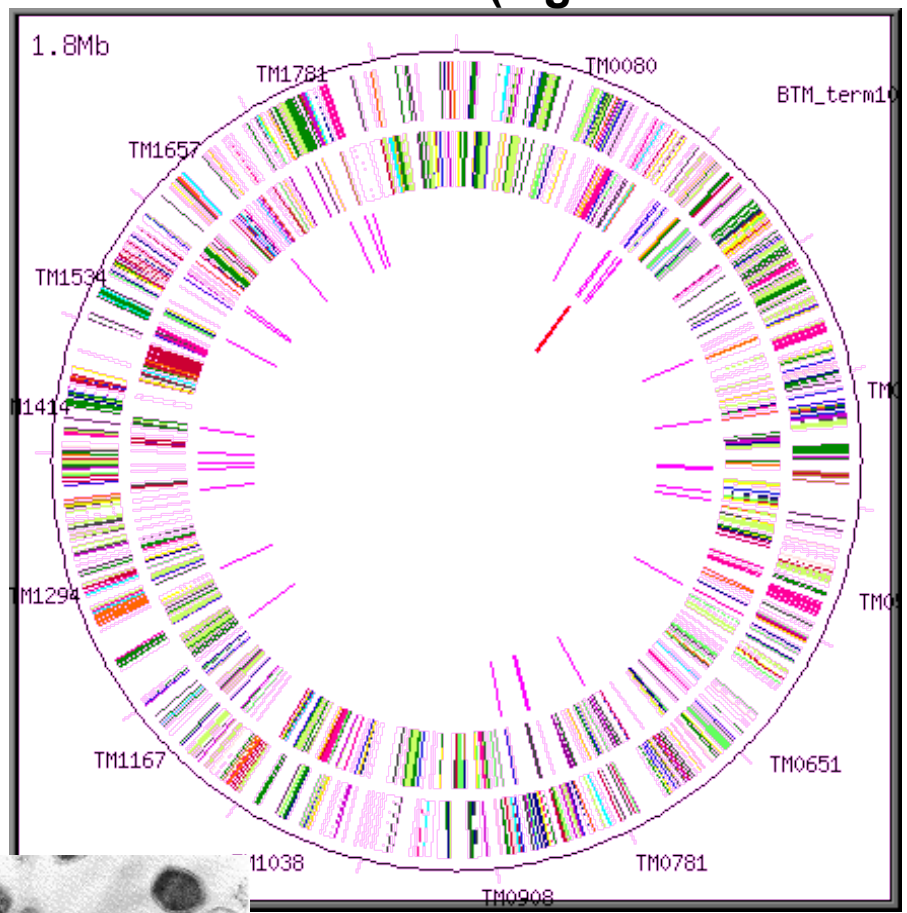
PSI Protein Structure Initiative

NATIONAL INSTITUTES OF HEALTH

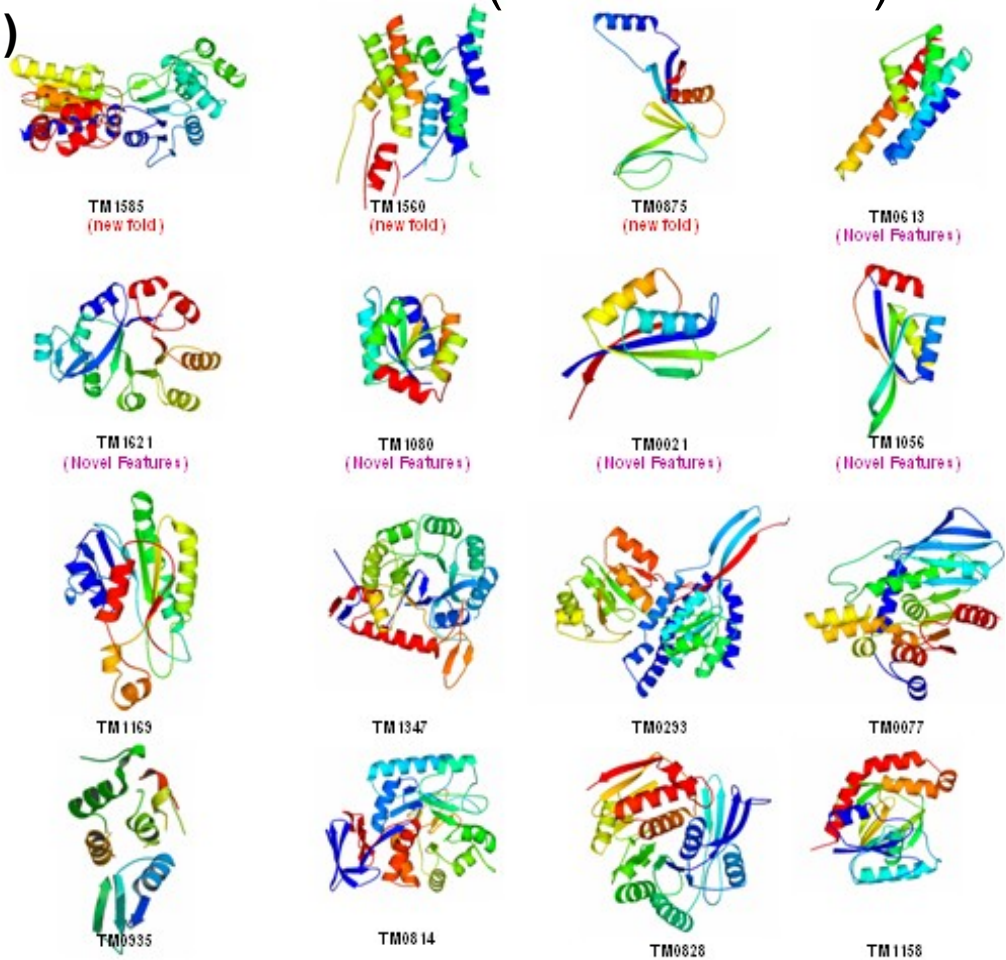
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Determining the Protein Structures of the Thermophilic Thermotoga Maritima Genome—Life at 80°C!

Extremely Thermostable -- Useful for Many Industrial Processes (e.g. Chemical and Food)



173 Structures (122 from JCSG)





- 122 T.M. Structures Solved by JCSG (75 Unique In The PDB)
- Direct Structural Coverage of 25% of the Expressed Soluble Proteins
- Probably Represents the Highest Structural Coverage of Any Organism

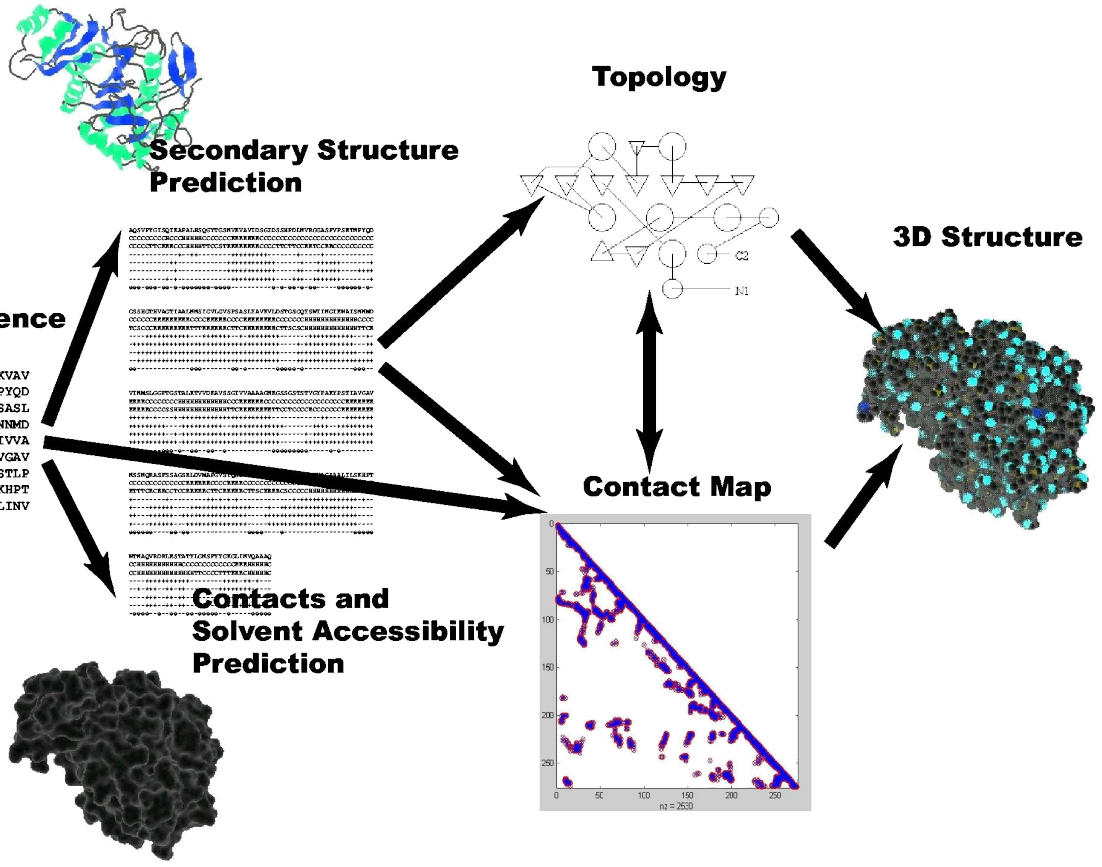
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Source: John Wooley, UCSD

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UCI's IGB Develops a Suite of Programs and Servers for Protein Structure and Structural Feature Prediction

INSTITUTE FOR GENOMICS AND BIOINFORMATICS
University of California, Irvine





CODA Genomics Inc. Obtains License on Patents for Technology Developed at UCI

4.28.2005 - Orange County's CODA Genomics Inc. and UC Irvine's Donald Bren School of Information and Computer Sciences announced today that CODA was granted an exclusive license to certain issued patents (US 5,082,767) and patent applications of the university related to Computer Optimized DNA Assembly (CODA) and protein expression optimization.
[More]

Sixty Affiliated IGB Labs at UCI e.g.:

The Center for Virus Research

www.igb.uci.edu/tools.htm

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Source: Pierre Baldi, UCI

Providing Integrated Grid Software and Infrastructure for Multi-Scale BioModeling

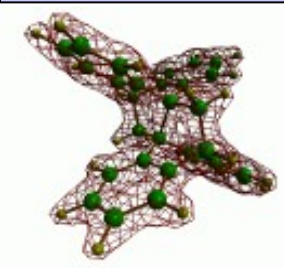
NBCR

National Biomedical Computation Resource

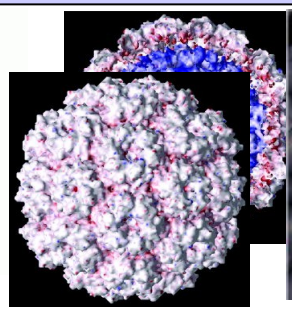
an NIH supported resource center

Located in Calit2@UCSD Building

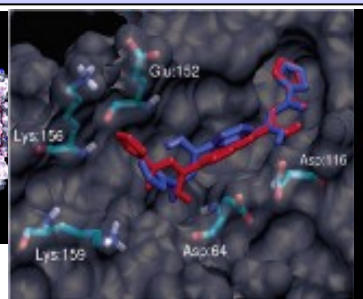
Grid and Cluster Computing Applications



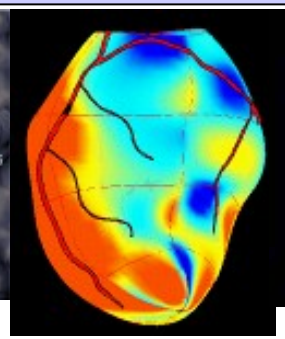
QMView
GAMESS



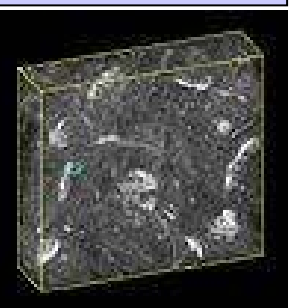
APBS



Autodock



Continuity



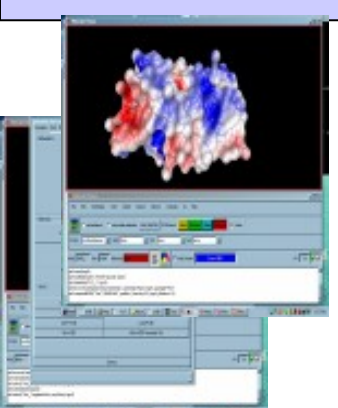
Gtomo2
TxBR

Infrastructure

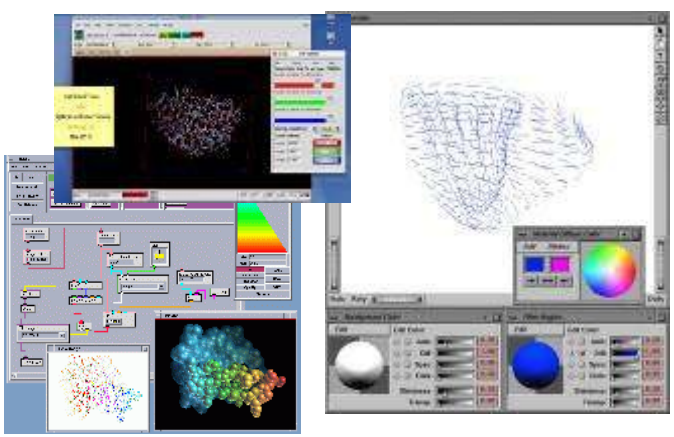


Rocks Grid of Clusters

Rich Clients



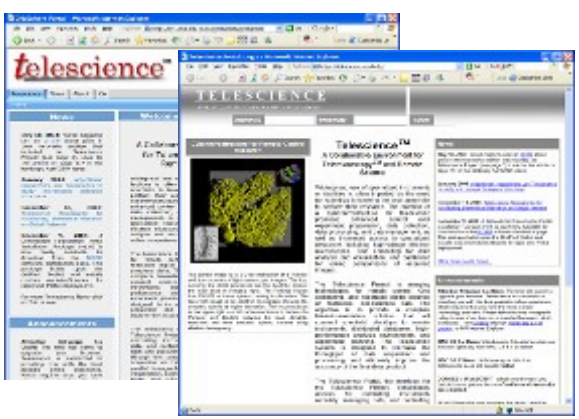
APBSCommand



PMV ADT
Vision

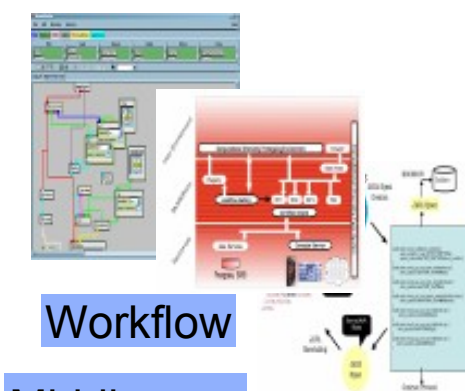
Continuity

Web Portal



Telescience Portal

Grid Middleware and Web Services



Workflow

Middleware

UCSD
UCIrvine

it2

Information Theorists Working with Biologists and Computer Scientists Will Radically Transform Our View of Living Systems

CAL-(IT)² EVENT

3rd Annual Shannon Memorial Lecture



Guest Speaker: Robert McEliece
Professor, California Institute of Technology

Date: April 29th, 2005

Time: 2:00pm

Location: CMRR Auditorium, UCSD

Live Webcast:
http://earth.ucsd.edu:8080/ramgen/encoder/mceliece.rm.

More Information:
After the talk, McEliece's presentation will be available for on-demand viewing in streaming video at the Calit2 Multimedia website: http://www.calit2.net/multimedia/.

Host: Jack Wolf, CMRR

"Through the strong loupe of information theory, we will be able to watch how such [living] beings do what nonliving systems cannot do: extract information from their surrounds, store it is a stable molecular form, and eventually parcel it out for their creative endeavors. ... So viewed, the information circle becomes the unit of life."
--Werner Loewenstein
The Touchstone of Life (1999)

Toby Berger
IEEE Shannon Award 2002
"Living Systems are Shannon-Optimum Without Coding"

UCSD
UCIrvine

Calit2@UCSD Will House One of the World's Best Information Theory Groups