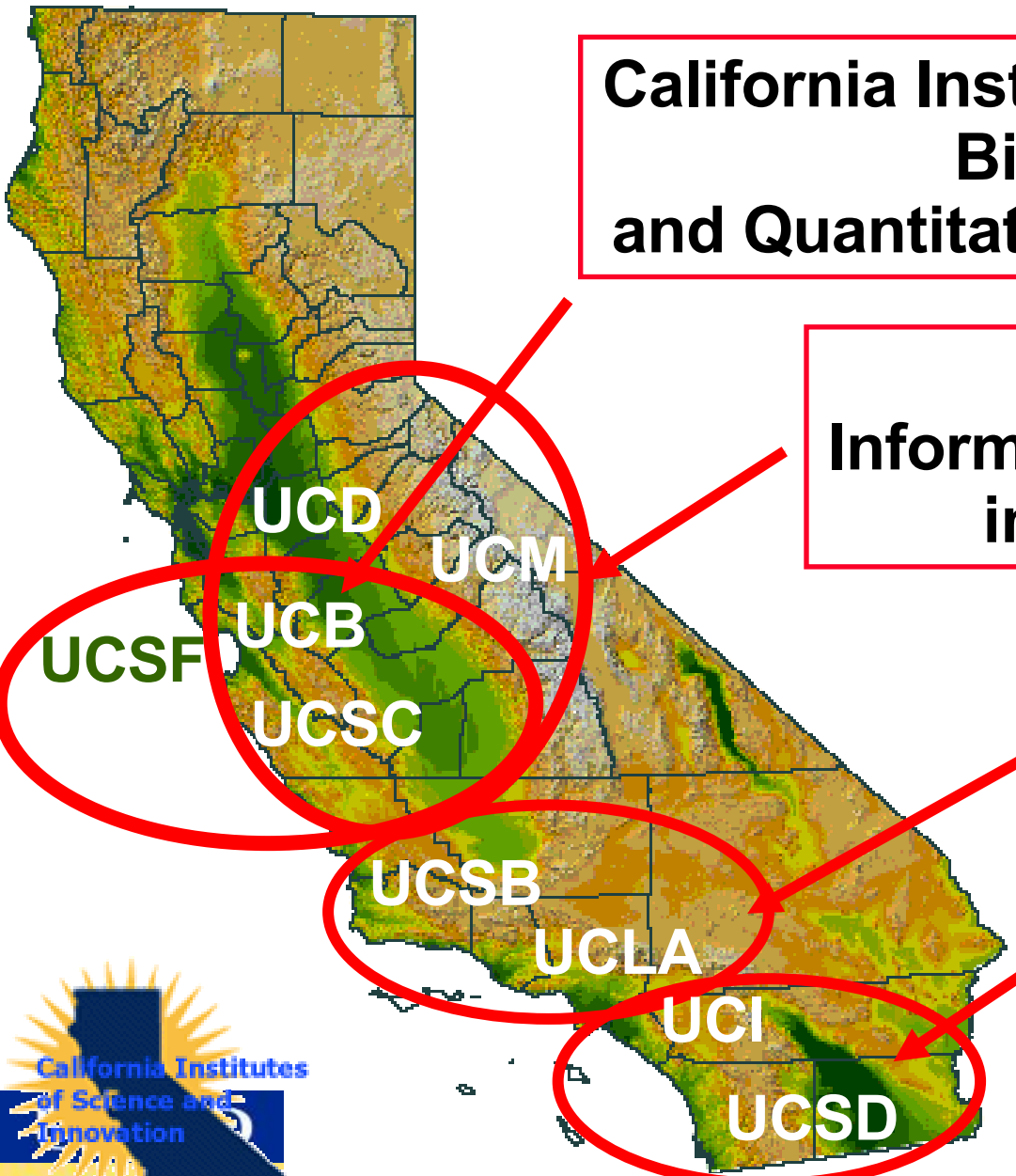
Living in the Future

Institute for the Future
Calit2@ UCSD
June 19, 2007

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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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

UCHV

www.ucop.edu/california-institutes

it²

Scenarios in This New World

- Customized medical care based on genotype plus real-time vital signs
- Intelligent transportation systems to enable efficient traffic flow
- Real-time environmental data collection to inform decision making and policy setting
- Vast networked gaming environments in which to learn, communicate, work
- Digital entertainment networks, CineGrid



"Someday, all this will be infrastructure."

These scenarios are all based on…
- integrated systems of underlying technologies
- applied to real-world problems
- affecting California's economy and quality of life

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What Is Calit2?

- **Research on the Future of the Internet and its Transformation of Our Society**
- **Core Partnership Between UCSD and UCI**
  - **Several Hundred Faculty**
  - **Alliances With Other Campuses**
- **Prototyping Of Infrastructure Through "Living Laboratories"**
  - **From Campus to Planetary Scale**
  - **Partnerships With Multiple Levels of Government and Industry**
  - **Secret Sauce: Technical Professionals to Move Projects Forward**
- **Multidisciplinary Research *Teams***
  - **Faculty, Postdocs, Staff, Students**
  - **Industry Partners –**
    - **From Giants to Start-up Companies**
  - **Community Partners**
    - **Emergency Responders**

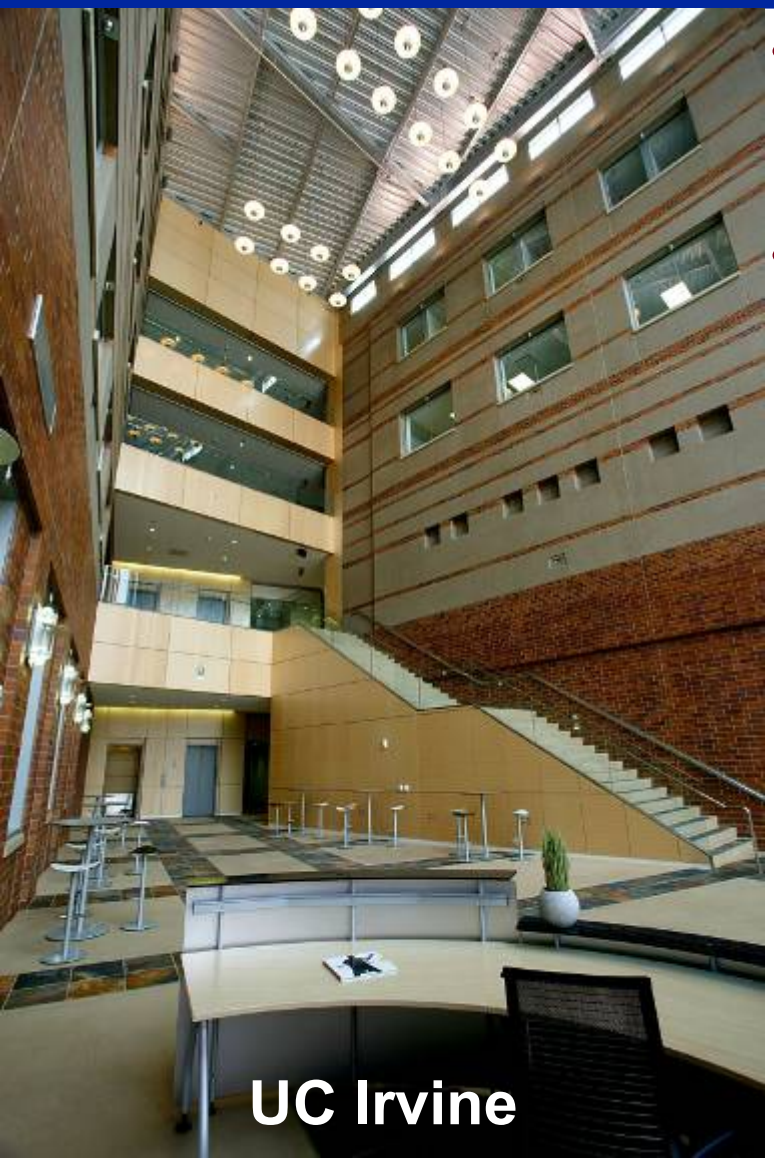


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Jerry Sheehan, Calit2 is Followup Person
jerry@ucsd.edu

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



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



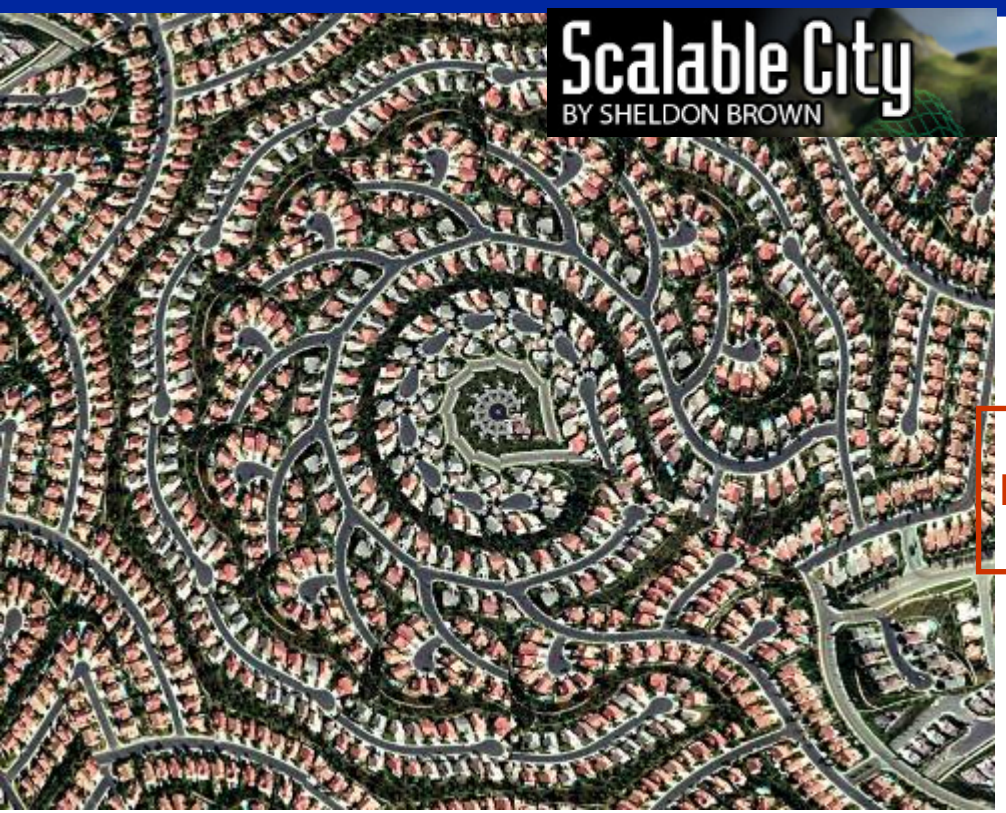
www.calit2.net

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Preparing for a World in Which Distance is Eliminated…

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Calit2 Has Facilitated Deep Interactions With the Digital Arts on Both Campuses



Bill Tomlinson, Lynn Carpenter UCI "EcoRaft"



Eric Baumer, UCI

"Researchers Look to Create a Synthesis of Art and Science for the 21st Century"

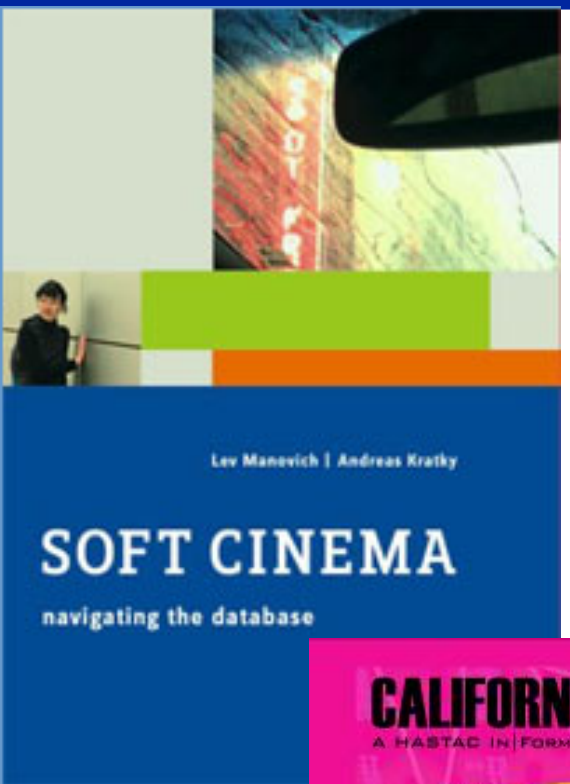
By John Markoff
NYTimes November 5, 2005

Alex Dragulescu, CRCA

SPECFLIC 1.0 – A Speculative Distributed Social Cinema by Adrienne Jenik



Global Reconnaissance on the Frontiers of Media Arts/Digital Culture



UCSD | Spring 2007 | PhD seminar:

Flat World, Branding, Experience Economy, Long Tail, Interaction Design, Mass Collaboration, Search, Elsewhere, and Other Key Forces and Ideas Which Shape Contemporary Global Culture



New Media, Technology, & the Humanities

A Conference at UC Irvine

February 17 & 18, 2006

135 Humanities Instructional Building

9 am to 5 pm Friday
9 am to 12 pm Saturday

Free & Open to the Public

roundtables • conversations • demonstrations

Digging: Media / Archeology
Lev Manovich, Visual Arts, UC San Diego
Erkki Huhtamo, Design & Media Arts, UC Los Angeles
Tara McPherson, Critical Studies, USC Cinema-Television
Jennifer Urban, Intellectual Property Clinic, USC Law School
Mark Poster, History, UC Irvine

Texting: Digital / Humanities
Jeffrey Schnapp, French & Italian, Stanford University
Eyal Amiran, Comparative Literature, UC Irvine
Noah Wardrip-Fruin, Communications, UC San Diego
Mark Hansen, English, University of Chicago
Rita Raley, English, UC Santa Barbara

Gaming: Remix / Culture
Rosemary Coombe, Law & Cultural Studies, York University
Andrew Herman, Communication, Wilfred Laurier University
Robert Nideffer, Studio Art & Computer Science, UC Irvine
Henry Lowood, Stanford University Libraries
John Seely Brown, Former Director, Xerox PARC

Please visit our website for conference schedule and participant topics at: http://www.humanities.uci.edu/humanitech/
Tel: (949) 824-3638



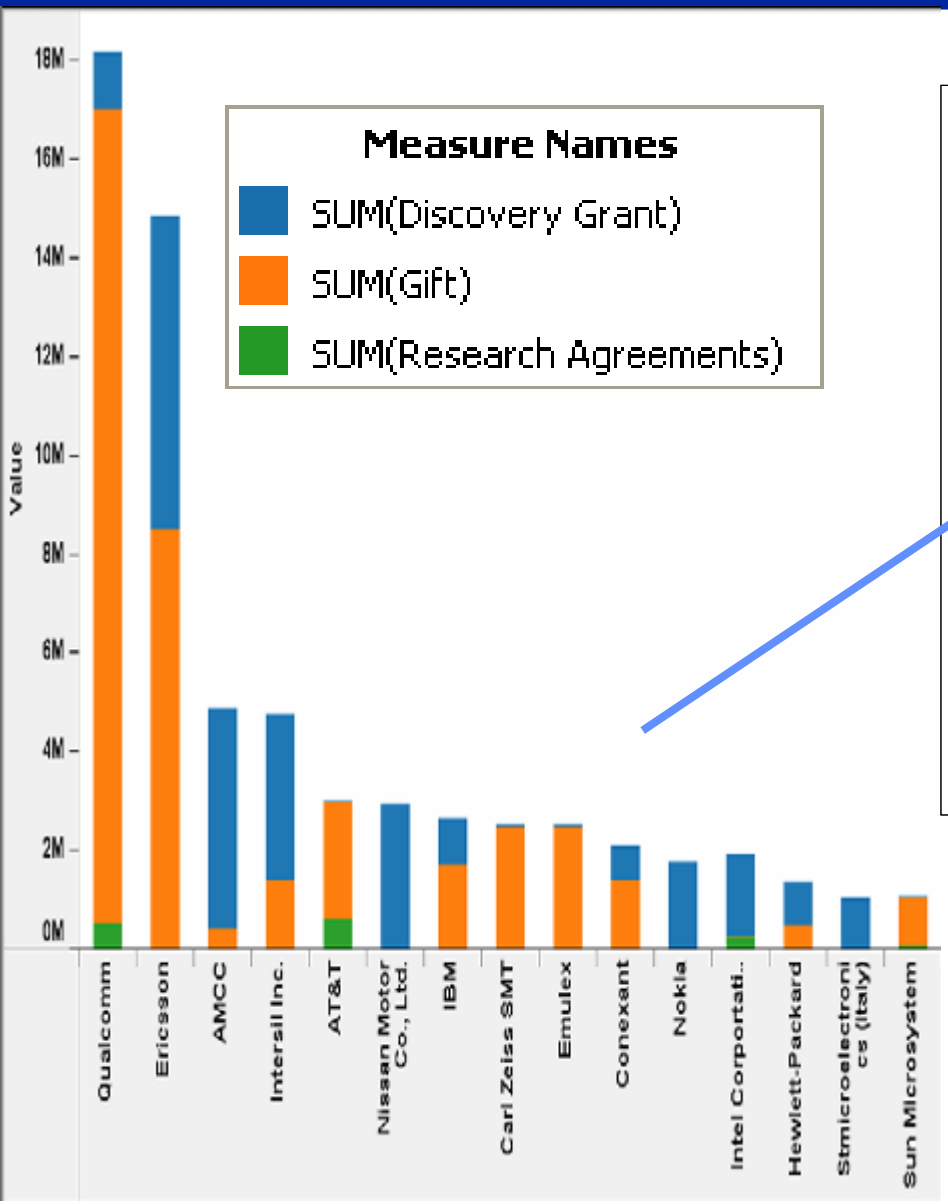


Lev Manovich, UCSD

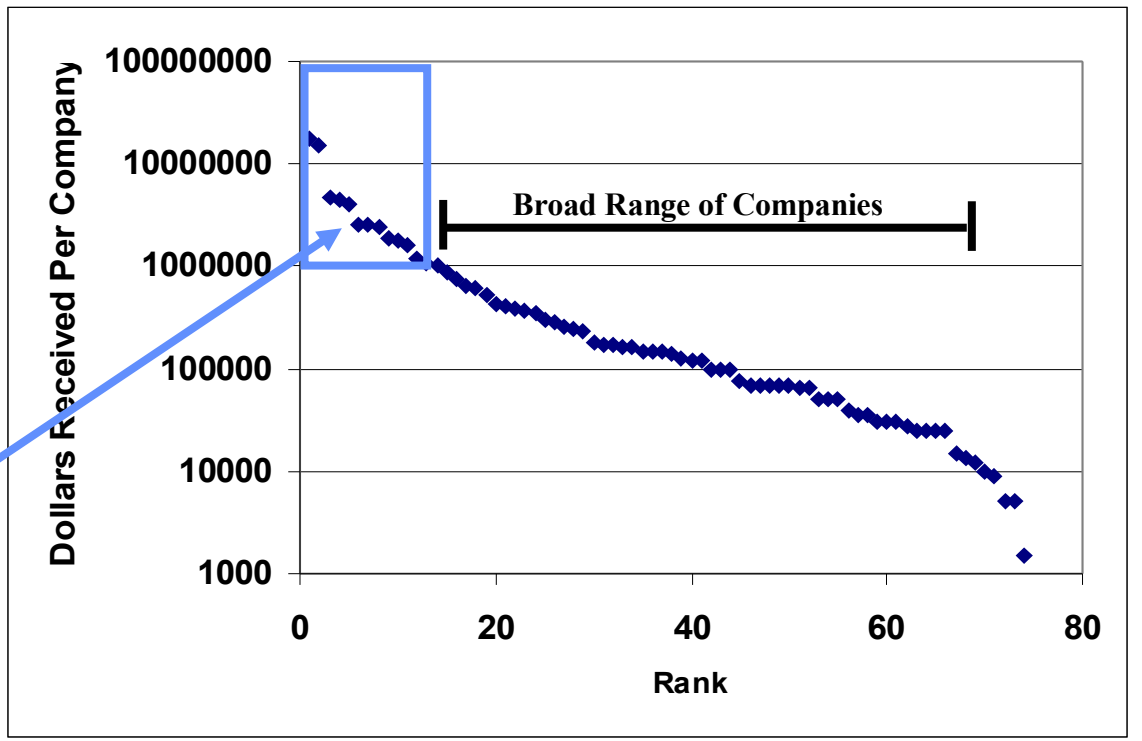
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In Spite of the Bubble Bursting, Calit2 Has Partnered with over 130 Companies



More Than 80 Have Provided Funds or In-kind



Over $80 Million From Industry So Far

Industrial Partners > $1 Million

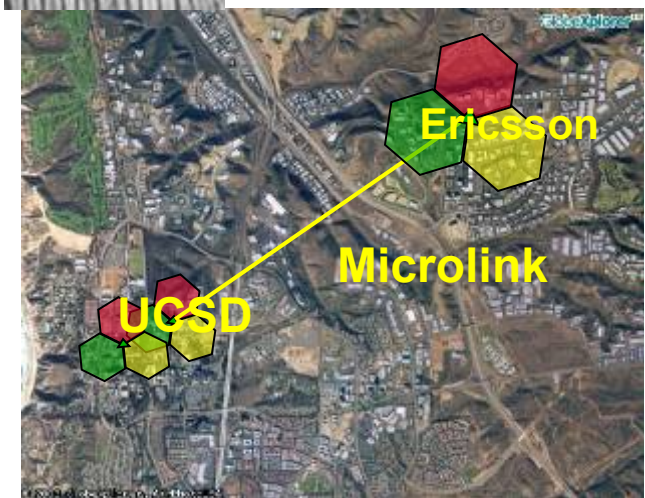
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Ericsson: A Calit2 Industrial Partner with Breadth and Depth

- **Sponsored Research: Non-Exclusive Royalty Free**
  - $ 6.2 Million with UC Discovery Match
  - 17 Professors, 17 Students, 4 Post-docs
- **27 Student Fellowships**
- **Two Endowed Chairs; Two Faculty Fellowships**
- **Collaborations**
  - Magnus Almgren: Taught Course in ECE
  - Jaap Harsten, Bluetooth Hands-On Course
- **Infrastructure**
  - Base Stations, Always Best Connected
- **Help with**
  - New Federal Grants: $22.5 Million
  - Inspired Two Startups

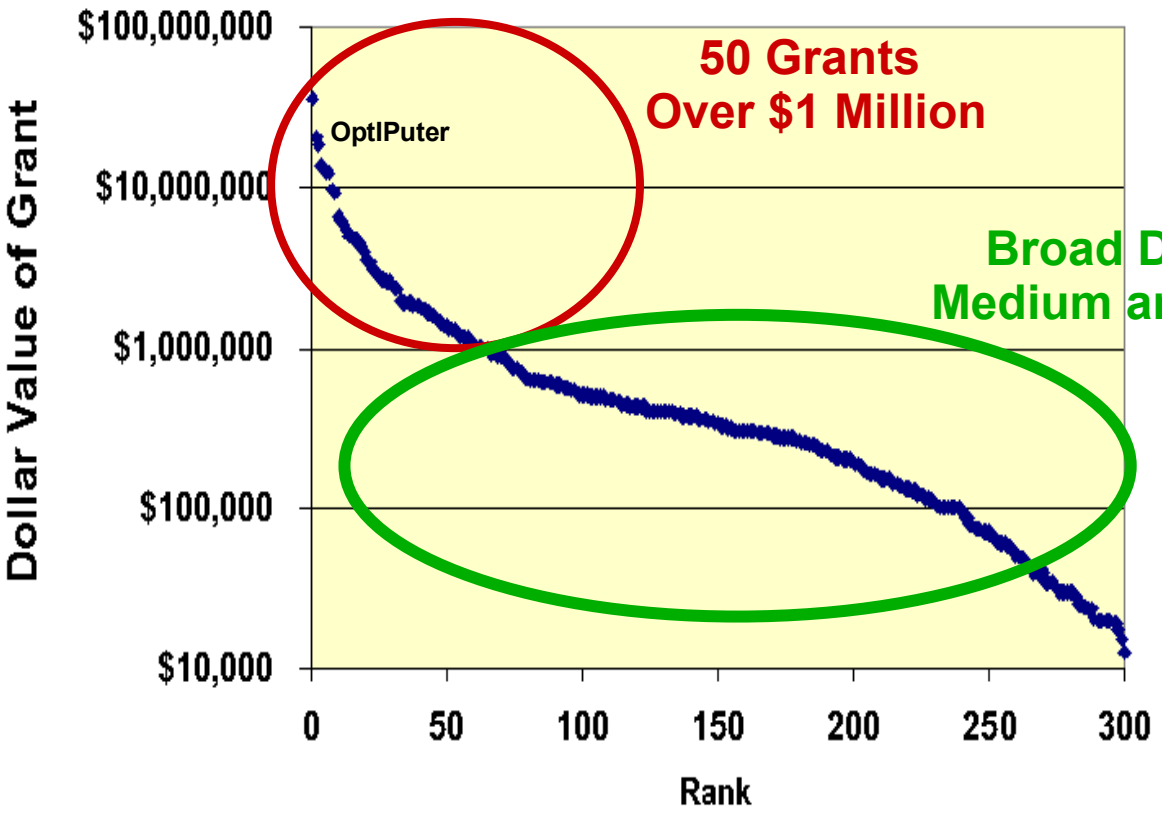




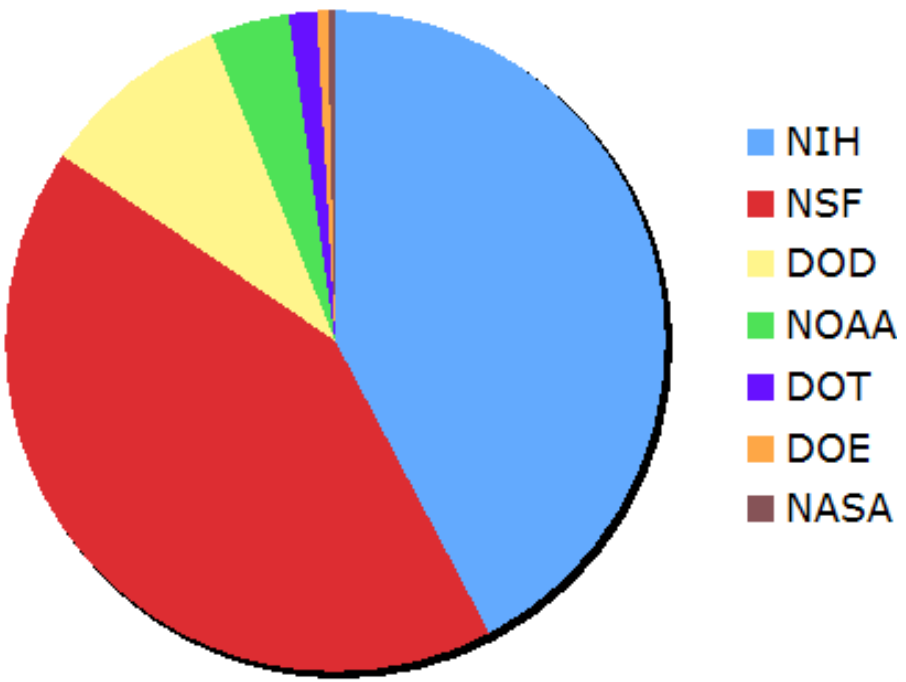


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Federal Agencies Have Funded $350 Million to Over 300 Calit2 Affiliated Grants



Creating a Rich Ecology of Basic Research

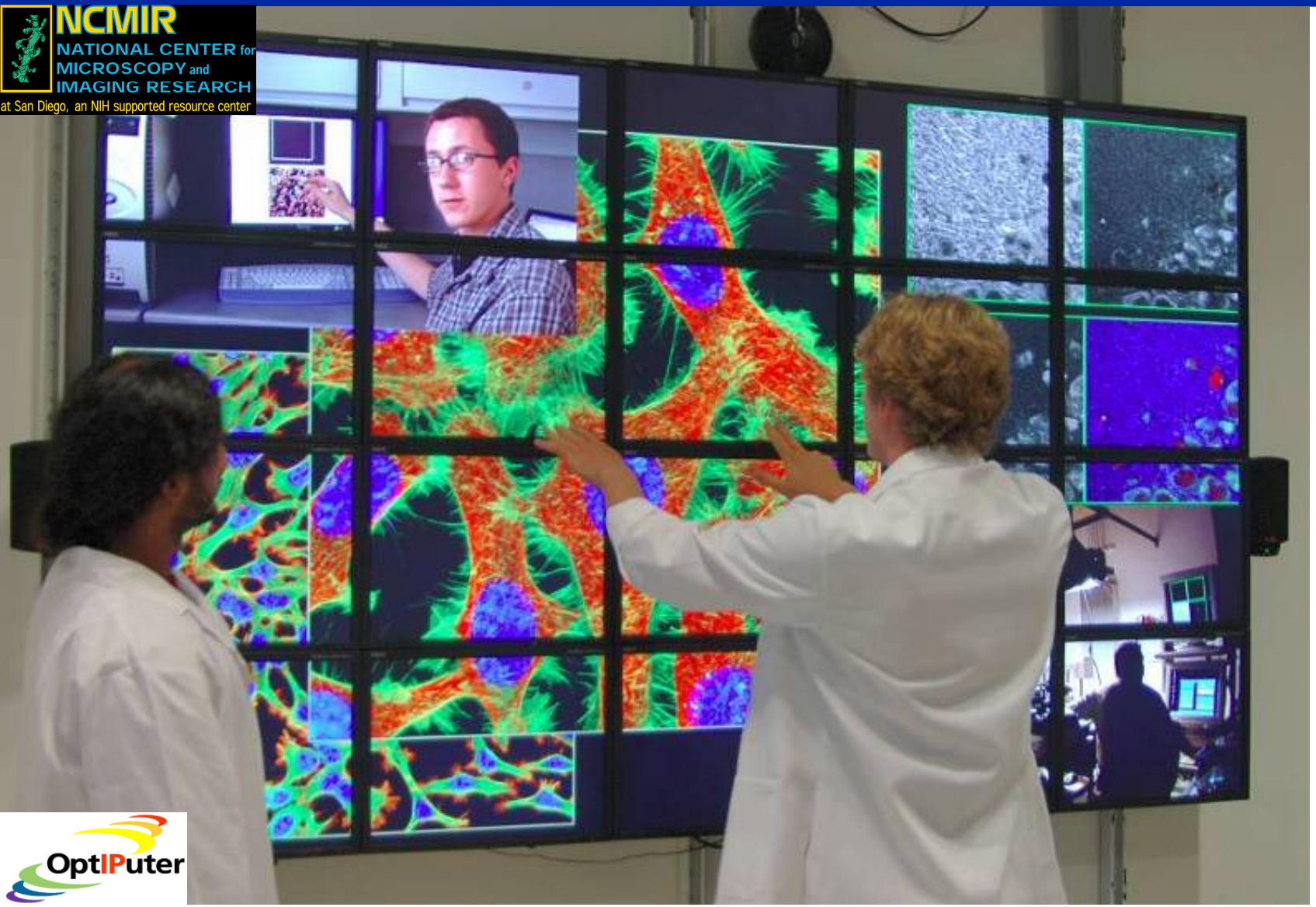


Federal Agency Source of Funds

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The OptIPuter Project: Creating High Resolution Portals Over Dedicated Optical Channels to Global Science Data

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



Scalable Adaptive Graphics Environment (SAGE)

evl electronic visualization laboratory

NSF

$13.5M Over Five Years

Picture Source: Mark Ellisman, David Lee, Jason Leigh

OptIPuter

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Calit2 (UCSD, UCI) and UIC Lead Campuses—Larry Smarr PI
Univ. Partners: SDSC, USC, SDSU, NW, TA&M, UvA, SARA, KISTI, AIST
Industry: IBM, Sun, Telcordia, Chiaro, Calient, Glimmerglass, Lucent

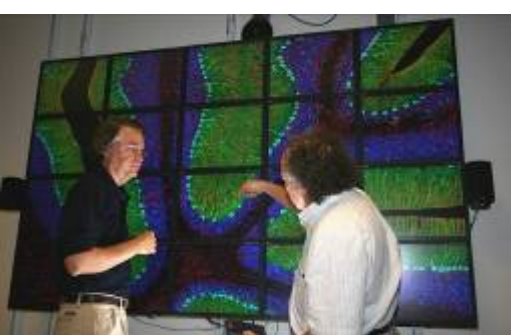
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Broadband Depends on Where You Are









- **Mobile Broadband**
  - **0.1-0.5 Mbps**

100,000 Fold Range
All Here Today!

- **Home Broadband**
  - **1-5 Mbps**

"The future is already here,
it's just not evenly distributed"
William Gibson, Author of Neuromancer

- **University Dorm Room Broadband**
  - **10-100 Mbps**

- **Calit2 Global Broadband**
  - **1,000-10,000 Mbps**

CAMERA: Community Cyberinfrastructure for Advanced Marine Microbial Ecology Research and Analysis



Paul Gilna Ex. Dir.

National LambdaRail Direct Connect Computation and Storage Complex

PI Larry Smarr

Funded by: Gordon and Betty Moore Foundation

Joint Partnership of:

Calit2 is Now Attracting Private Foundation Grants Announced January 17, 2006--$24.5M Over Seven Years

Marine Genome Sequencing Project – Measuring the Genetic Diversity of Ocean Microbes

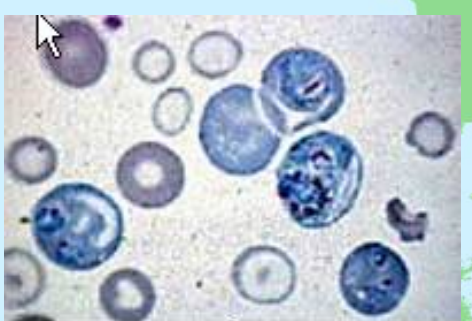
Plus 155 Marine Microbial Genomes



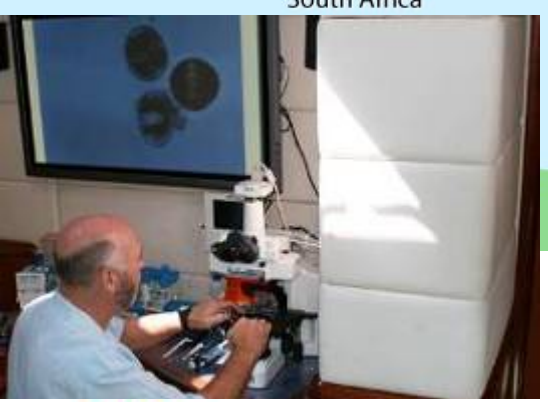
Each Sample ~2000 Microbial Species

Specify Ocean Data

Canada
United States
Mexico
Puerto Rico
Honduras
Costa Rica
Panama
Galapagos Islands
x 10 samples
Tanzania/ Zanzibar
x 7 samples
Seychelles
Madagascar
South Africa
Cocos-Keeling Is.
Vanuatu
x 17 samples
Fiji
Tonga
French Polynesia
Cook Islands
Australia
New Caledonia
x 8 samples



Analyzed Sampled, but not Analyzed



Sorcerer II Data Will Double Number of Proteins in GenBank!

camera
Marine Microbial Ecology

MARINE MICROBIOLOGY INITIATIVE

Gordon and Betty MOORE FOUNDATION

J. Craig Venter INSTITUTE

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An Emerging High Performance Collaboratory for Microbial Metagenomics



Can We Create a "My Space" for Science Researchers? Microbial Metagenomics as a Cyber Community

Over 1000 Registered Users From 45 Countries



USA	583
United Kingdom	46
Canada	35
France	35
Germany	32

camera
Marine Microbial Ecology

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Towards a Total Knowledge Integration System for the Coastal Zone—SensorNets Linked to OptIPuter

- Moorings
- Ships
- Autonomous Vehicles
- Satellite Remote Sensing
- Drifters
- Long Range HF Radar
- Near-Shore Waves/Currents
- COAMPS Wind Model
- Nested ROMS Models
- Data Assimilation and Modeling
- Data Systems

Atul Nayak
Frank Vernon

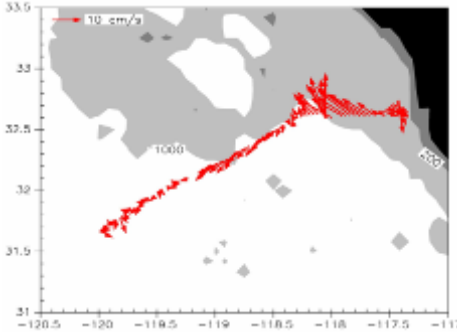


Yellow—Proposed Initial OptIPuter Backbone

SOUTHERN CALIFORNIA COASTAL OCEAN OBSERVING SYSTEM

ROADNet

COCMP
Coastal Ocean Currents Monitoring Program





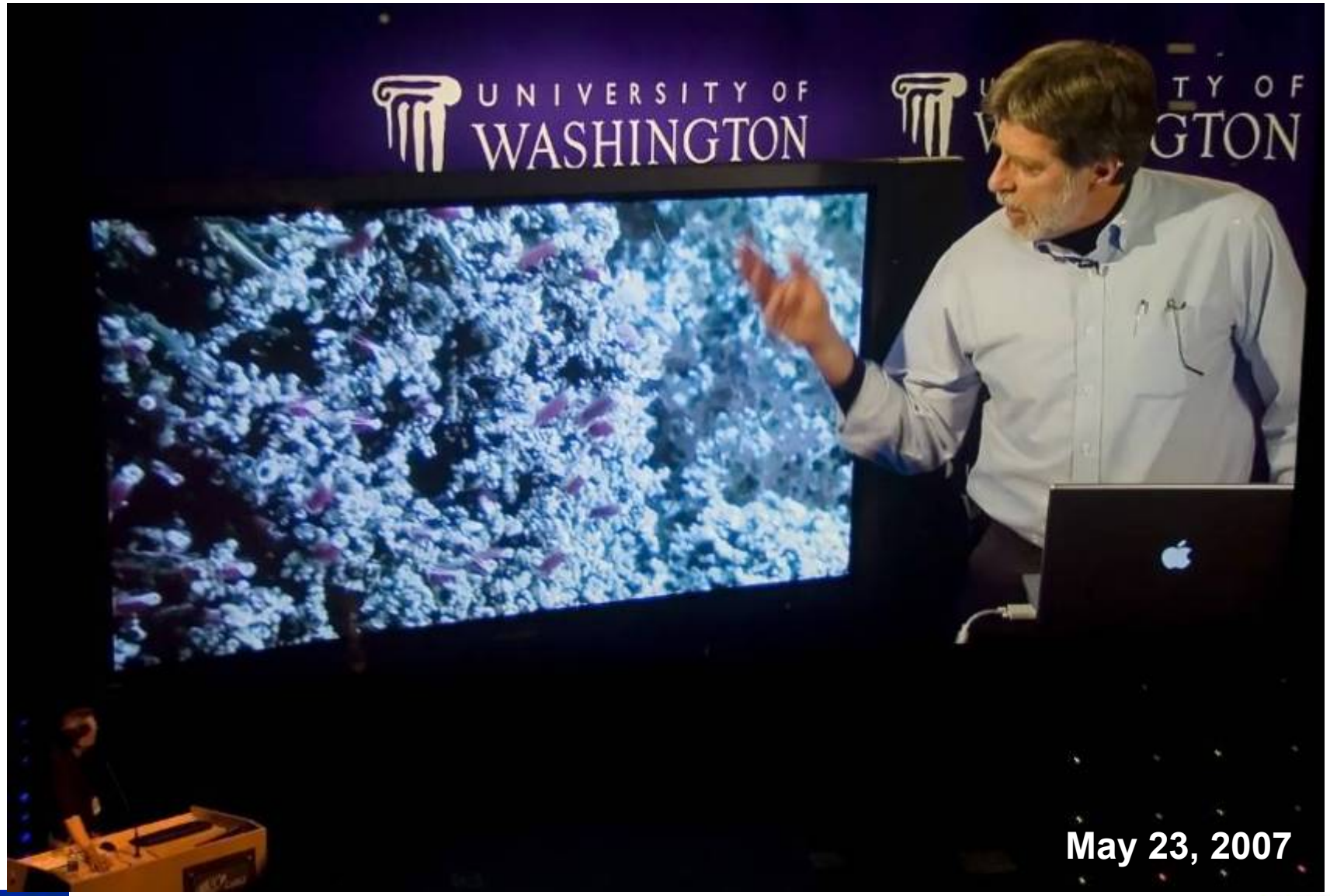
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www.sccoos.org/

it²

e-Science Collaboratory Without Walls Enabled by Uncompressed HD Telepresence

1500 Mbits/sec Calit2 to UW Research Channel Over NLR



John Delaney, PI LOOKING, Neptune

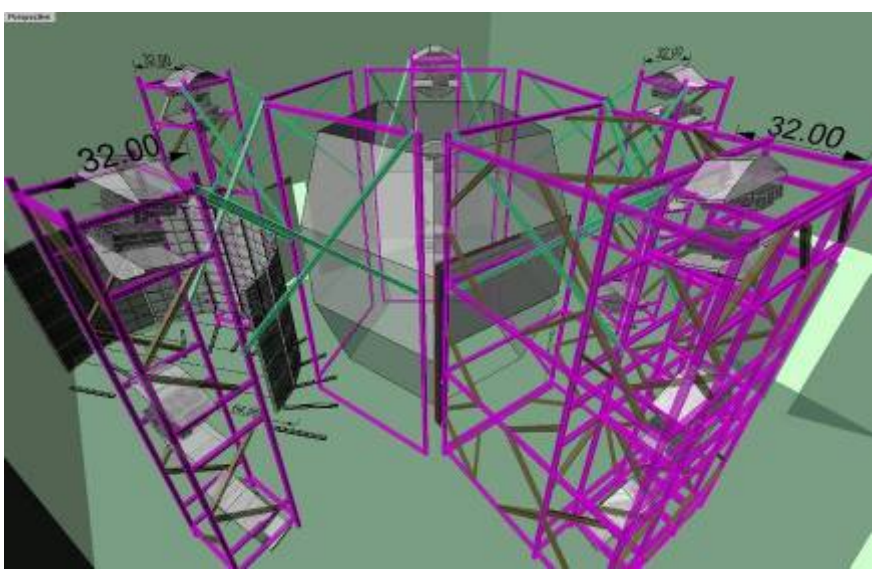
Photo: Harry Ammons, SDSC

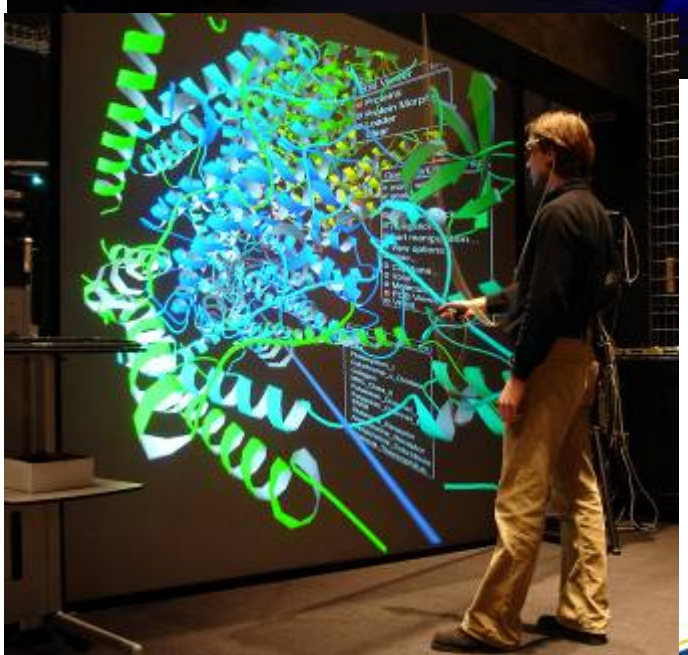
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Partnering with UIC Electronic Visualization Lab to Create Next Generation OptIPortals

- Varrier Autostereo Virtual Reality
  - Head-Tracked No Need for Glasses
  - 65 High Resolution LCD Tiles
  - 45 Mpixels/eye of Visual Stereo
- StarCAVE
  - Working Prototype 4 Mpixel Wall
  - Full Scale StarCAVE Being Built
    - Six HD Projectors Per Wall
    - 3200 Times Rendering Speed of a PC!







evl electronic visualization laboratory

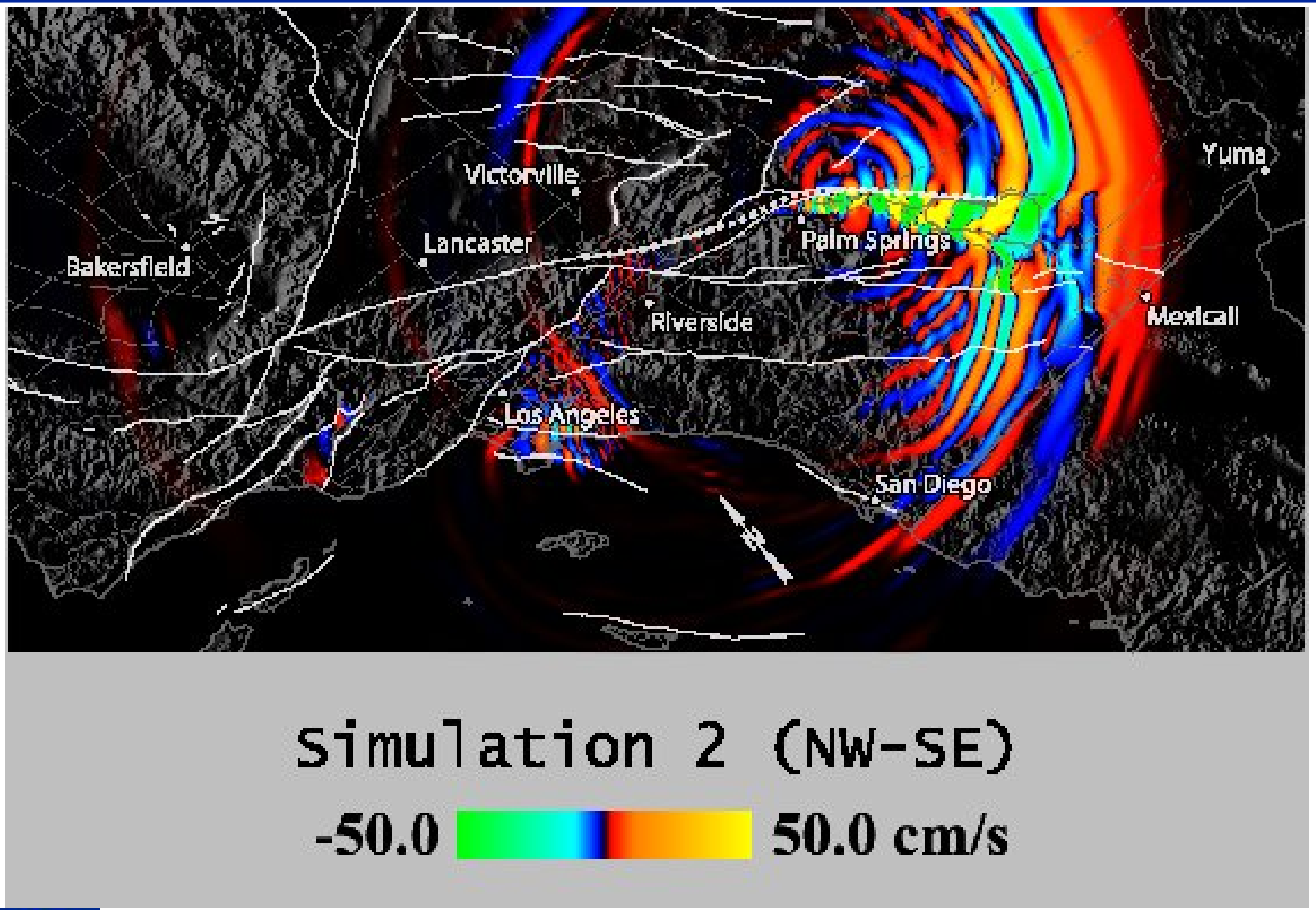
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Dan Sandin, Greg Dawe, Tom Peterka, Tom DeFanti, Jason Leigh, Jinghua Ge, Javier Girado, Bob Kooima, Todd Margolis, Lance Long, Alan Verlo, Maxine Brown, Jurgen Schulze, Qian Liu, Ian Kaufman, Bryan Glogowski

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TeraShake – SDSC Supports Researchers Simulating and Visualizing "The Big One"

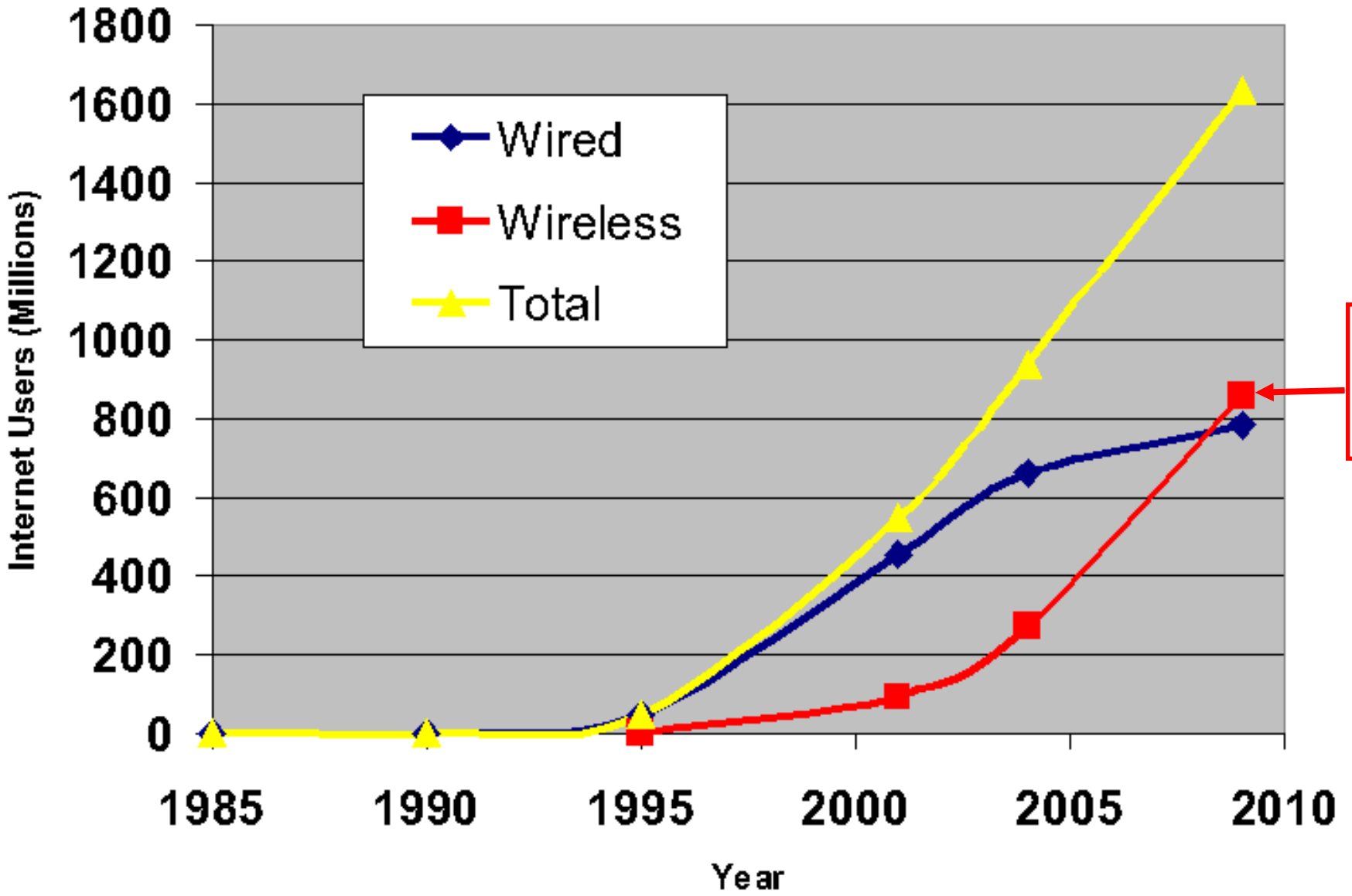


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Vijay Samalam, SDSC

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Transitioning to the "Always-On" Mobile Internet

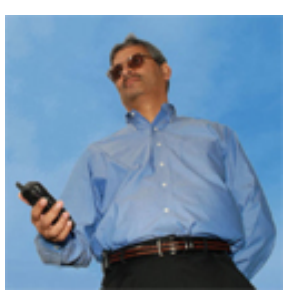


http://www.etforecasts.com/products/ES_intusersv2.htm

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

- ***Gaslamp Quarter*, San Diego/UCSD**
  - **Ubiquitous Wireless Coverage in Downtown San Diego**
  - **Test Network Architecture Enhancement and New Applications**
- ***Crisis Assessment, Mitigation, And Analysis* – UCI Campus**
  - **Field-Test and Refine Research on Information Collection, Analysis, Sharing, and Dissemination in Controlled yet Realistic Settings**



Sensor and network devices on Gaslamp corner



Don Kimball configures his satellite dish.



Evac-Pack and mounted video equipment assist rescuers in locating building occupants during emergency evacuations.

Alex Hubenko
Project Manager, RESCUE, ResponSphere

www.responsphere.org

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

Les Lenert, UCSD PI



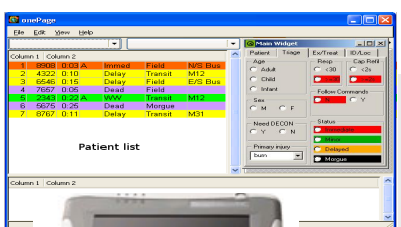




Triage

First Tier





Mid Tier



802.11 pulse ox



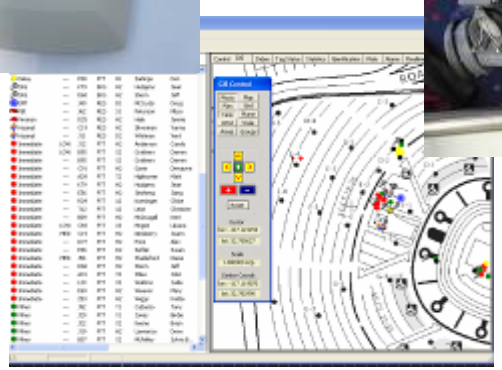




Reality Flythrough
Mobile Video



Wireless Networks



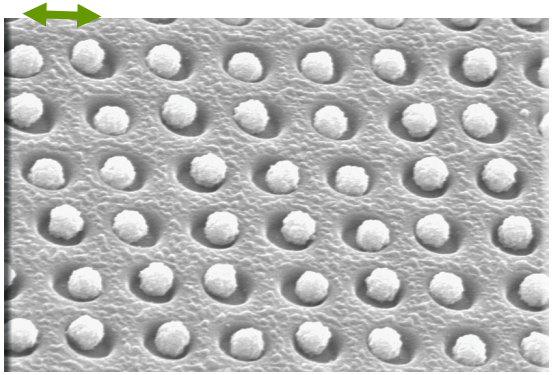
Command Center

Accelerator: The Perfect Storm-- Convergence of Engineering with Bio, Physics, & IT

1000x Magnification

MEMS

2 micron

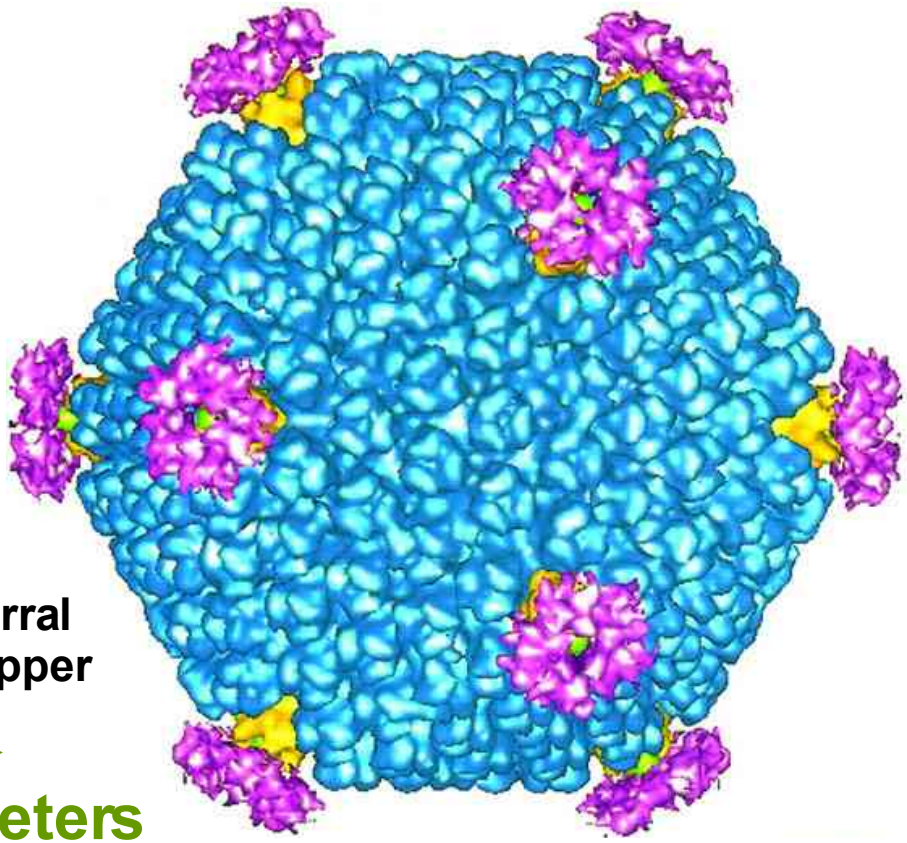


DNA-Conjugated Microbeads

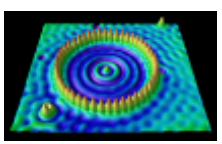


2 mm

400,000 x !



Human Adenovirus



IBM Quantum Corral
Iron Atoms on Copper

5 nanometers

400x Magnification

NANO

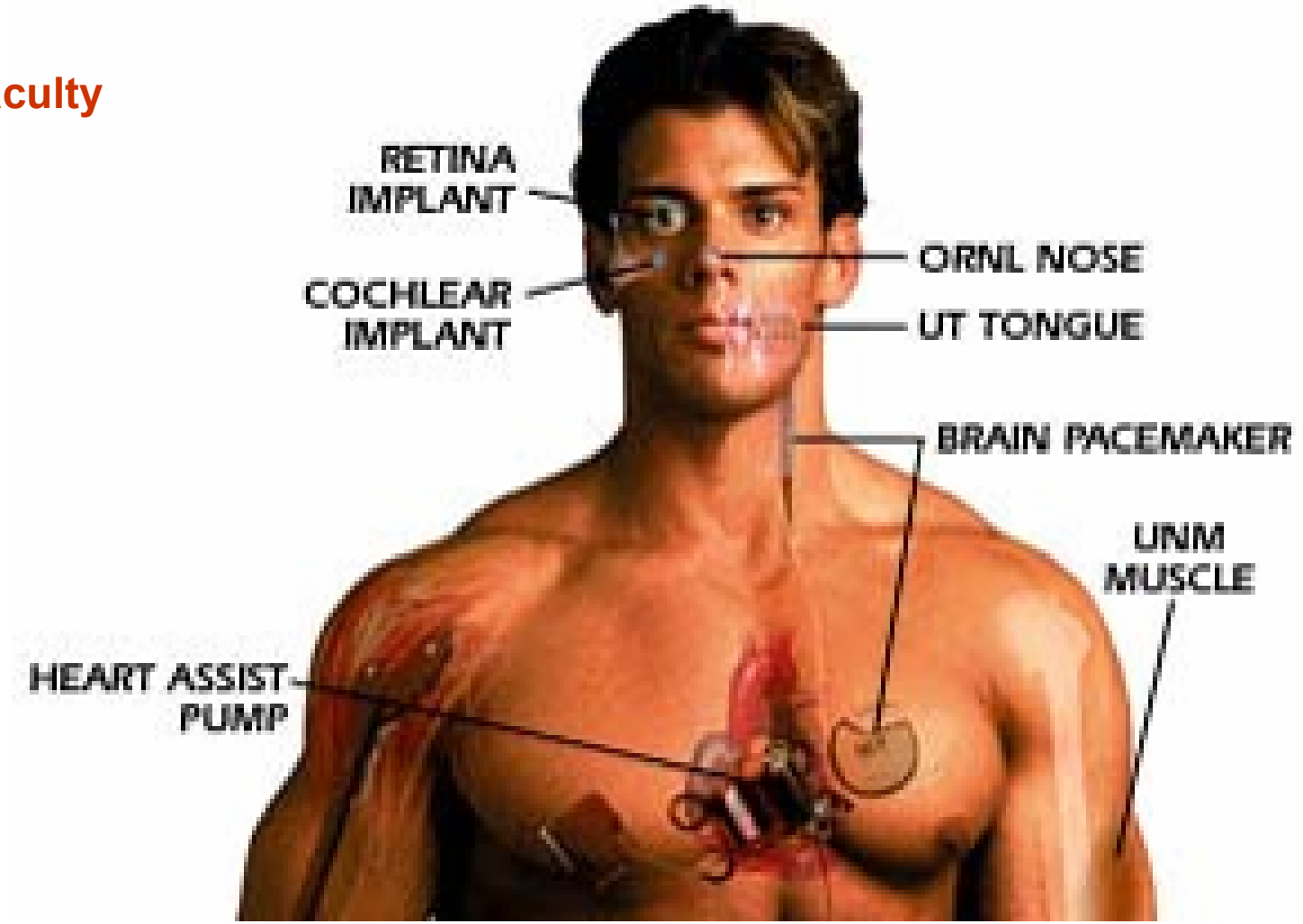
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Nanobioinfotechnology

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Lifechips--Merging Two Major Industries: Microelectronic Chips & Life Sciences

65 UCI Faculty



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lifechips
university of california, irvine
www.lifechips.org

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Calit2 Materials and Devices Laboratory: "Nano3" – Science, Engineering, Medicine



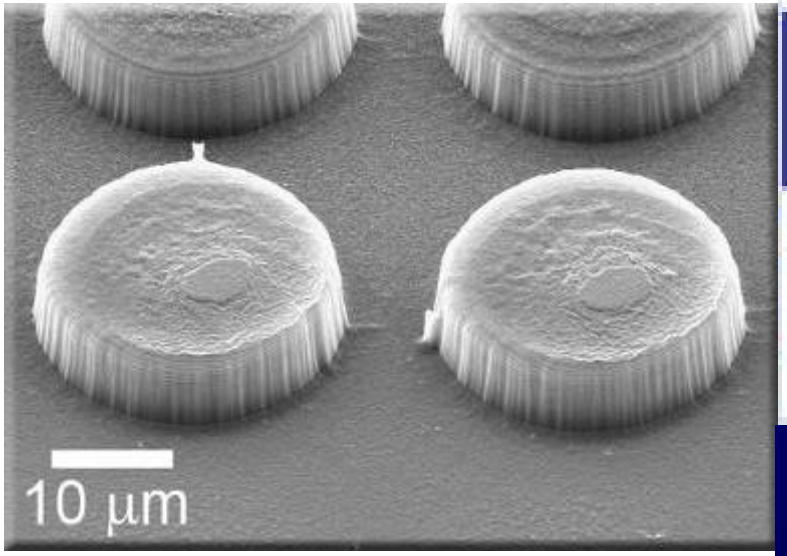
10,000 sq. feet Materials and Devices Labs

Class 100/1000

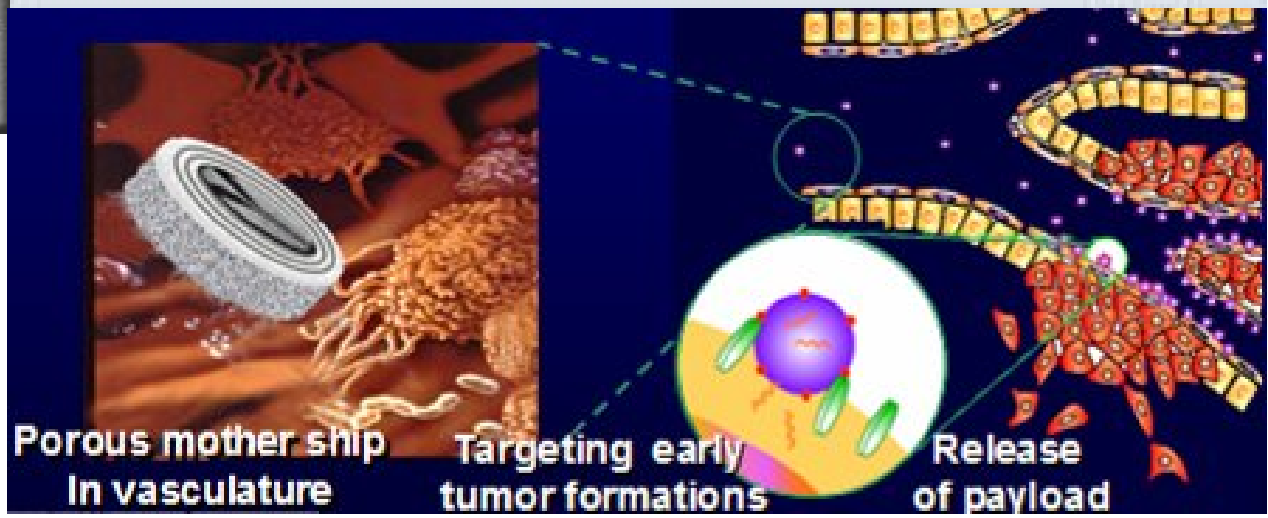
Nearly 50 Academic Projects

Nano-Structured Porous Silicon Applied to Cancer Treatment

Nanodevices for In-vivo Detection & Treatment of Cancerous Tumors



Nanostructured “Mother Ships”
for Delivery of Cancer Therapeutics



Michael J. Sailor Research Group
Chemistry and Biochemistry

Building a Genome-Scale Model of E. Coli *in Silico*

JTB 2002

E. coli i2K

Genomics

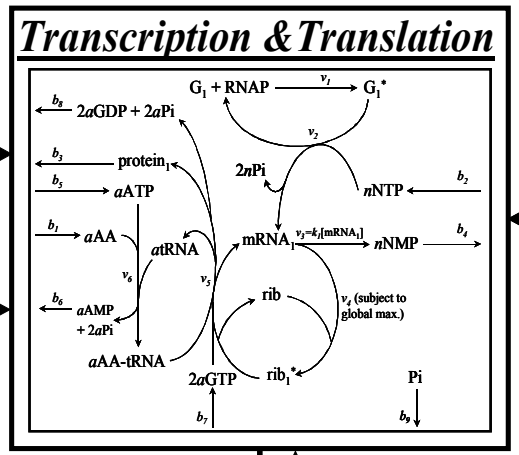
Transcriptomics

Proteomics

Metabolomics

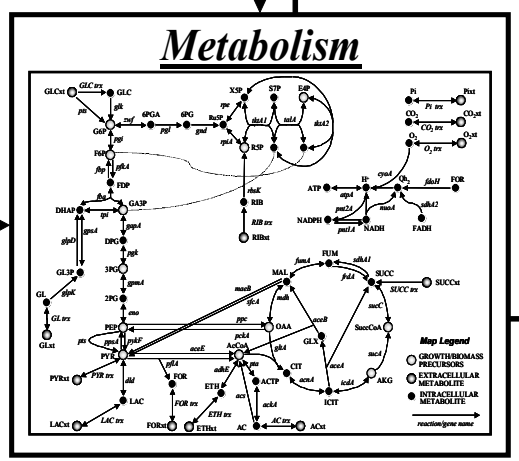
Interactomics

Environment



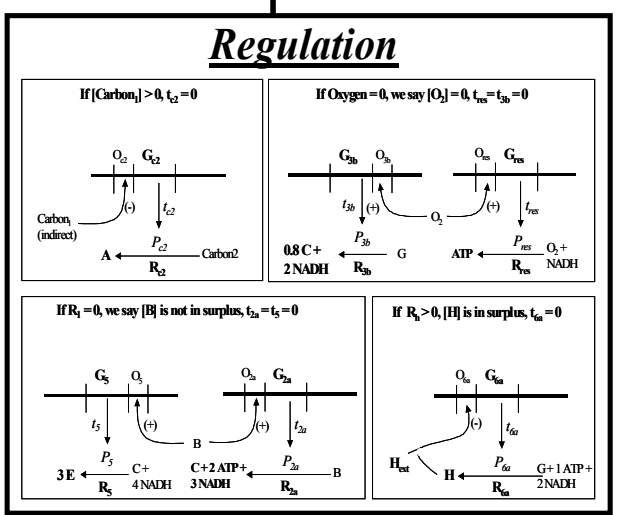
Proteins

Monomers & Energy



Regulatory Actions

JBC 2002



Input Signals

- **E. Coli**
  - **Has 4300 Genes**
  - **Model Has 2000!**

***in Silico* Organisms Now Available 2007:**

- Escherichia coli
- Haemophilus influenzae
- Helicobacter pylori
- Homo sapiens Build 1
- Human red blood cell
- Human cardiac mitochondria
- Methanosarcina barkeri
- Mouse Cardiomyocyte
- Mycobacterium tuberculosis
- Saccharomyces cerevisiae
- Staphylococcus aureus

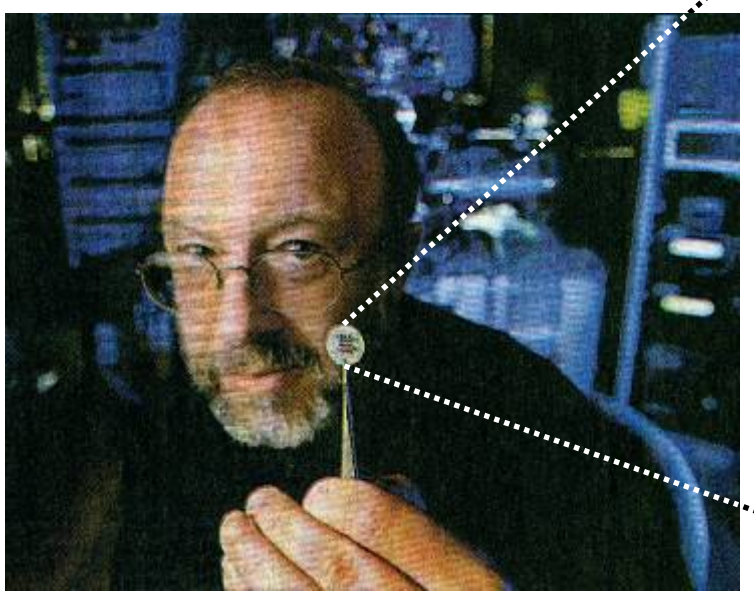
Source: Bernhard Palsson
UCSD Genetic Circuits Research Group
http://gcrg.ucsd.edu

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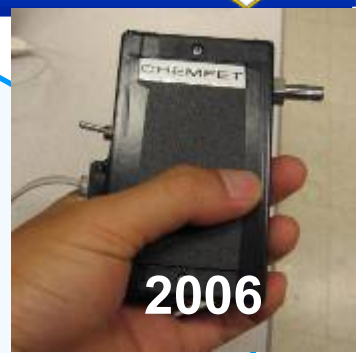
A World of Distributed Sensors Starts with Integrated Nanosensors

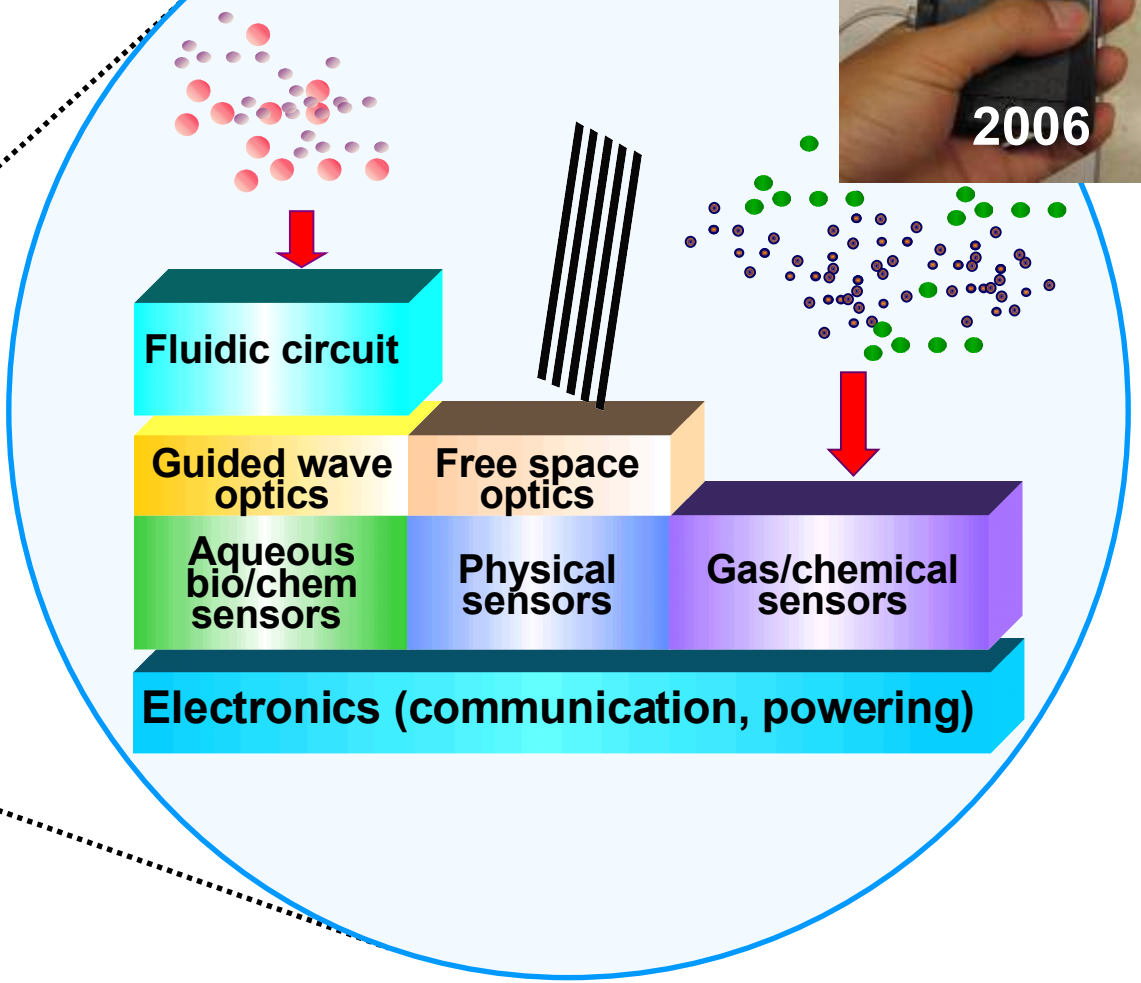
MURI for Nanostructured Supersensors

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



Ivan Schuller holding the first prototype in 2004





Technology Transfer:
RedX (Explosive Sensors), RheVision (Fauvation Optics)

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

President Kalam of India Believes Nanobioinfotech is the Future for 600,000 Villages

- Interactive Knowledge System
- Convergence of Info- Nano - Bio
- Make the Bandwidth Available with No Limits
- PURA--Societal Grid With Electronic Connection of a Billion People

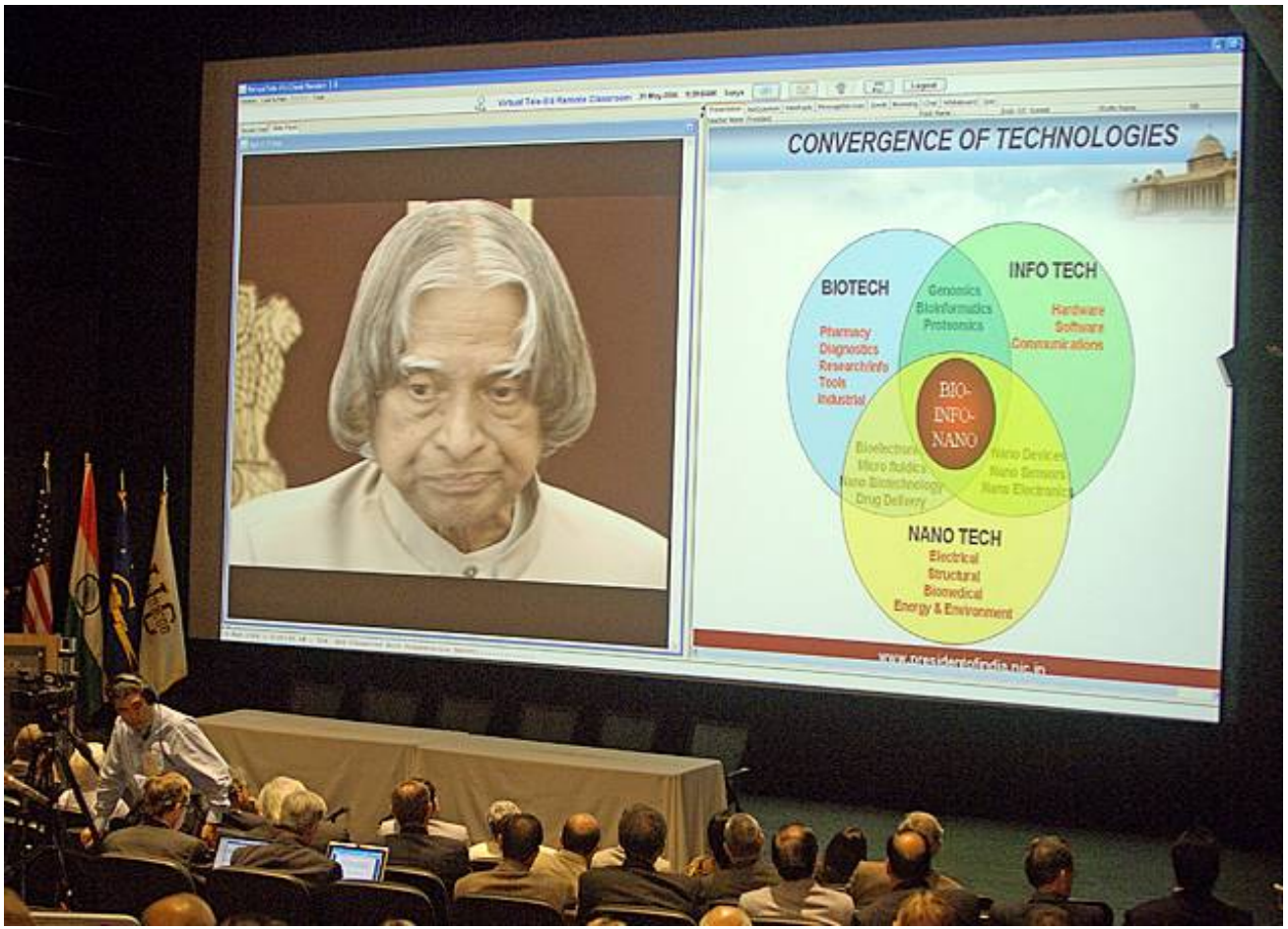


Photo: Alan Decker, UCSD

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