“Calit2: Blending Cross-Disciplinary Research with Continual Innovation”

Guest Lecture

Gordon Engineering Leadership Center

UC San Diego

January 29, 2019

Dr. Larry Smarr

Director, California Institute for Telecommunications and Information Technology

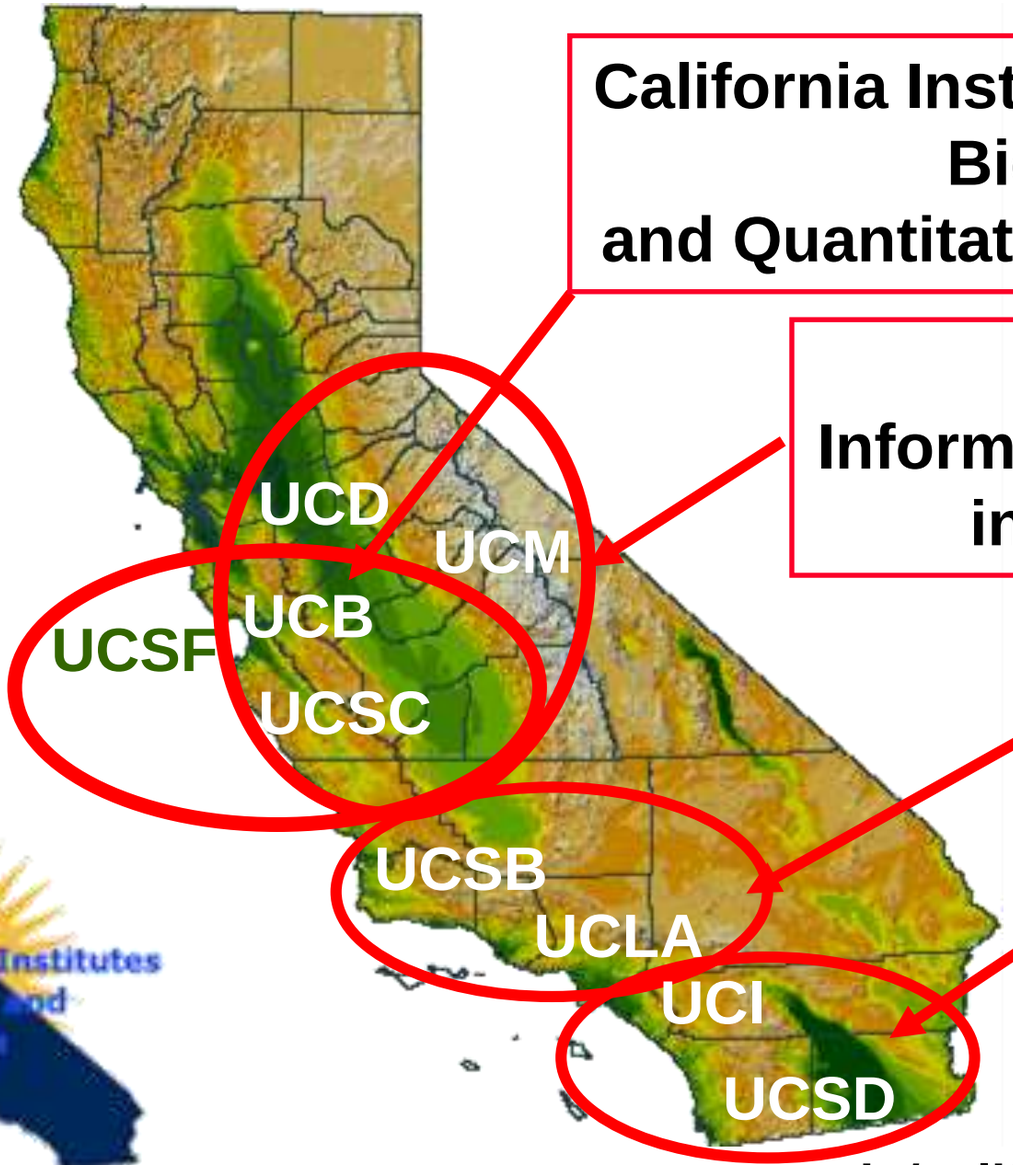
Harry E. Gruber Professor,

Dept. of Computer Science and Engineering

Jacobs School of Engineering, UCSD

http://lsmarr.calit2.net

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

www.ucop.edu/california-institutes

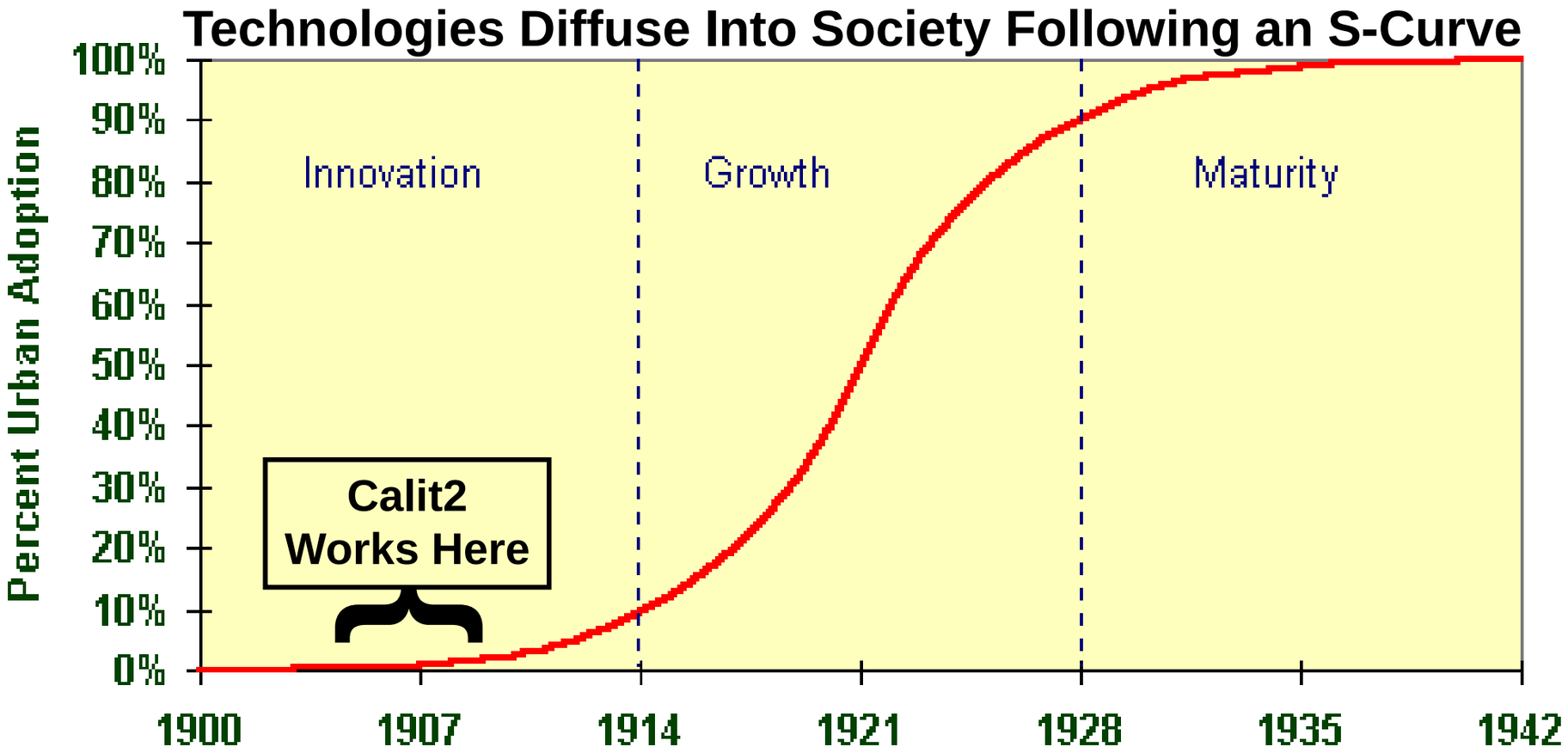
Calit2's Initial Mission Statement

Envisioning How the Extension of Innovative Telecommunications and Information Technologies Throughout the Physical World will Transform Critical Applications Important to the California Economy and its Citizens' Quality Of Life.

Calit2 is a University of California "Institutional Innovation" Experiment on How to Invent a Persistent Collaborative Research and Education Environment that Provides Insight into How the UC, a Major Research University, Might Evolve in the Future.

Calit2 “Lives in the Future” By Building Systems of Emerging Disruptive Technologies

Co-Evolution of Personal Automobile and Highway/Petroleum Infrastructure



Source: Harry Dent, The Great Boom Ahead

Complex Problems Require a New Research and Education Framework

220 UCSD & UCI Faculty Working in Multidisciplinary Teams With Students, Industry, and the Community

Calit2 Slide 2001



The State Provides $100 M For New Buildings and Equipment

www.calit2.net

Elements of the Cal -(IT)^2 Industrial Partnerships

- Endowed Chairs for Professors
- Start-Up Support for Young Faculty
- Graduate Student Fellowships
- Research and Academic Professionals
- Sponsored Research Programs
- Equipment Donations for Cal-(IT)^2 and Campus
- Named Laboratories in new Institute Buildings
- Pro Bono Services and Software

Calit2 Slide 2001

Calit2 Phase I: 2001-2005
~8,000 GSF, ~25 People, and No Facilities



Room 416 Engineering Tower
Calit2@UCI Division

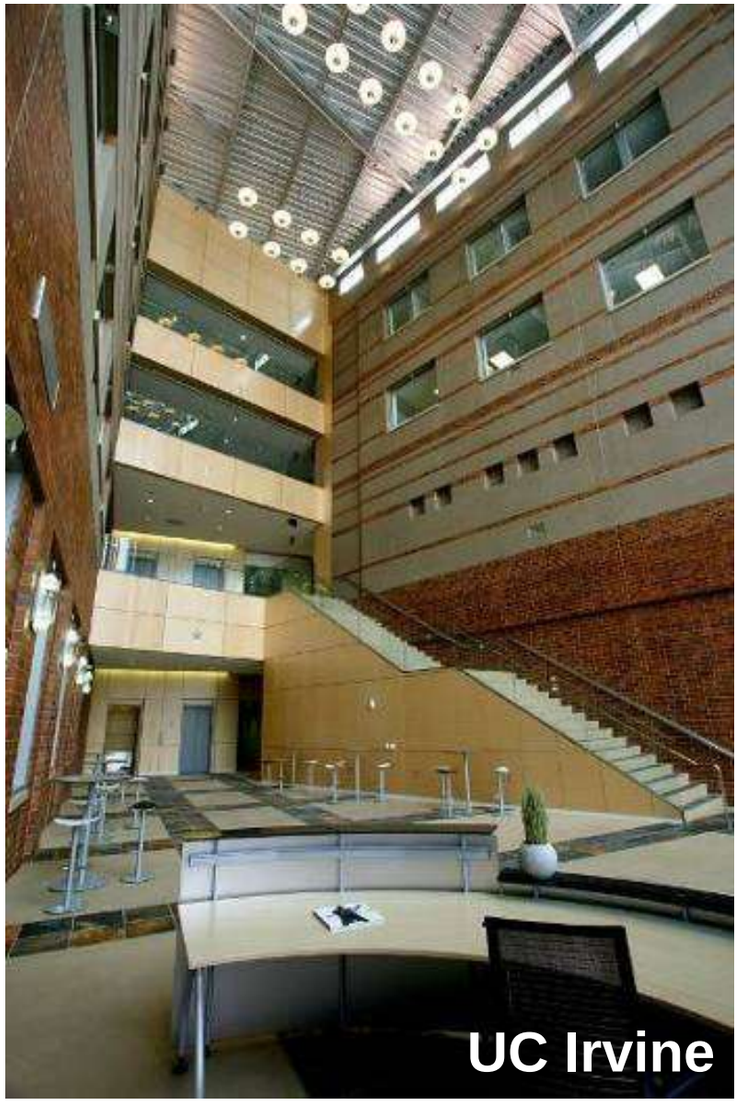


Triple Wide Trailer
Calit2@UCSD Division

From Incubation to Full Scale Operations
2005-2006

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

2005

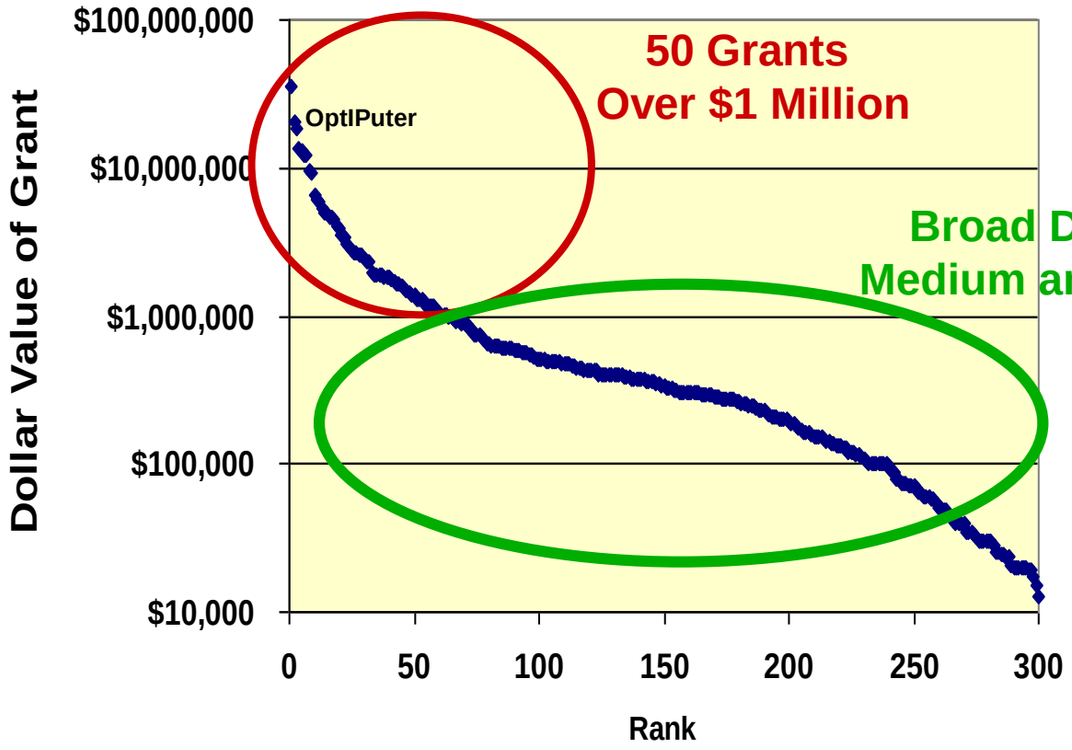


- "Convergence" Laboratory Facilities
  - Nanotech, BioMEMS, Chips, Radio, Photonics
  - Virtual Reality, Digital Cinema, HDTV, Gaming
- Over 1000 Researchers in Two Buildings
  - Linked via Dedicated Optical Networks

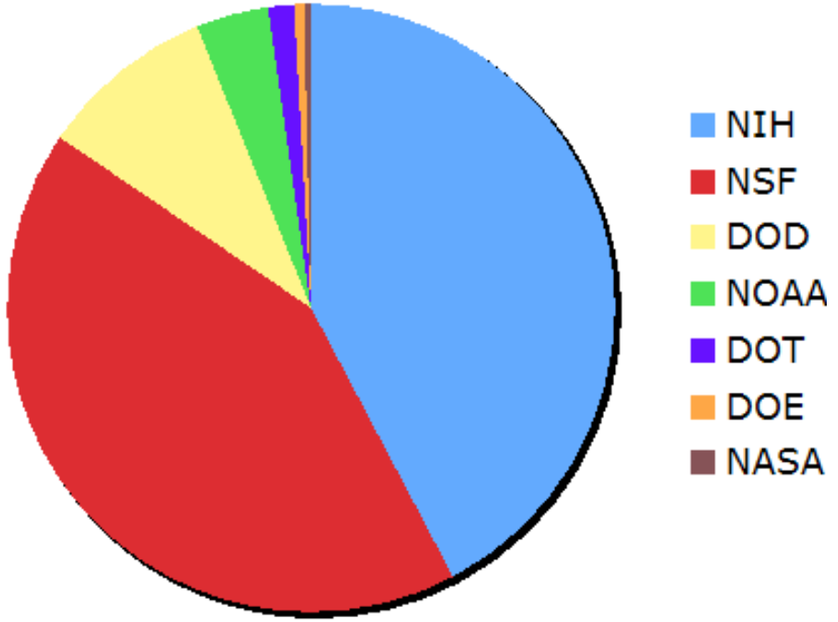


$100M From State for New Facilities

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



Creating a Rich Ecology of Basic Research



Federal Agency Source of Funds

Calit2 Review Report p.4,21

Calit2 Materials and Devices Laboratory: "Nano3"–NanoScience, NanoEngineering, NanoMedicine

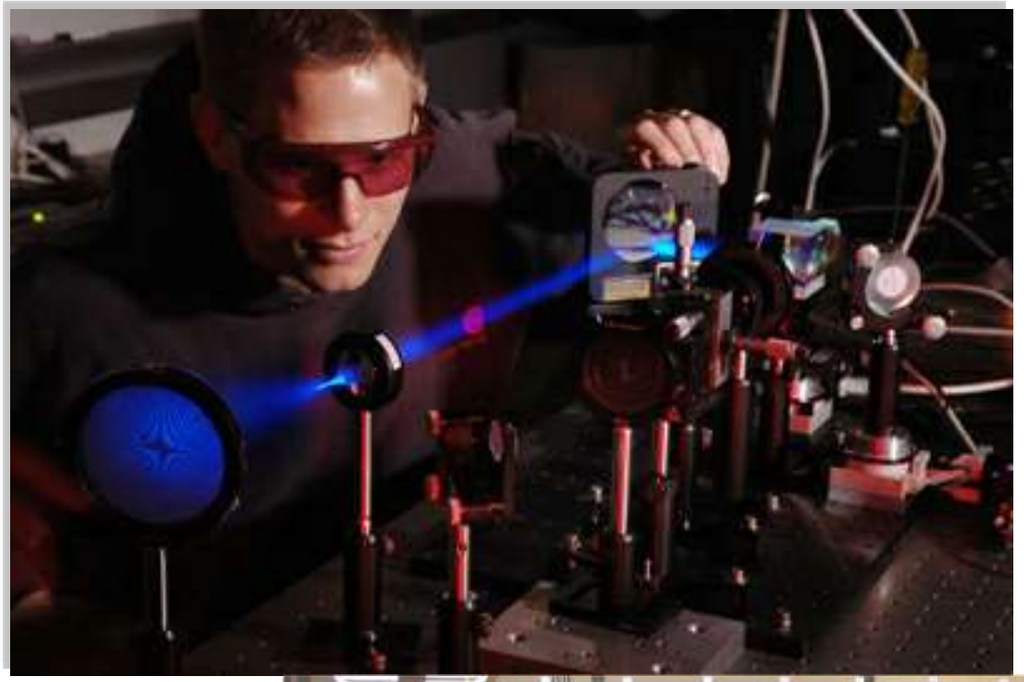
10,000 sq. feet State-of-the-Art Materials and Devices Laboratory

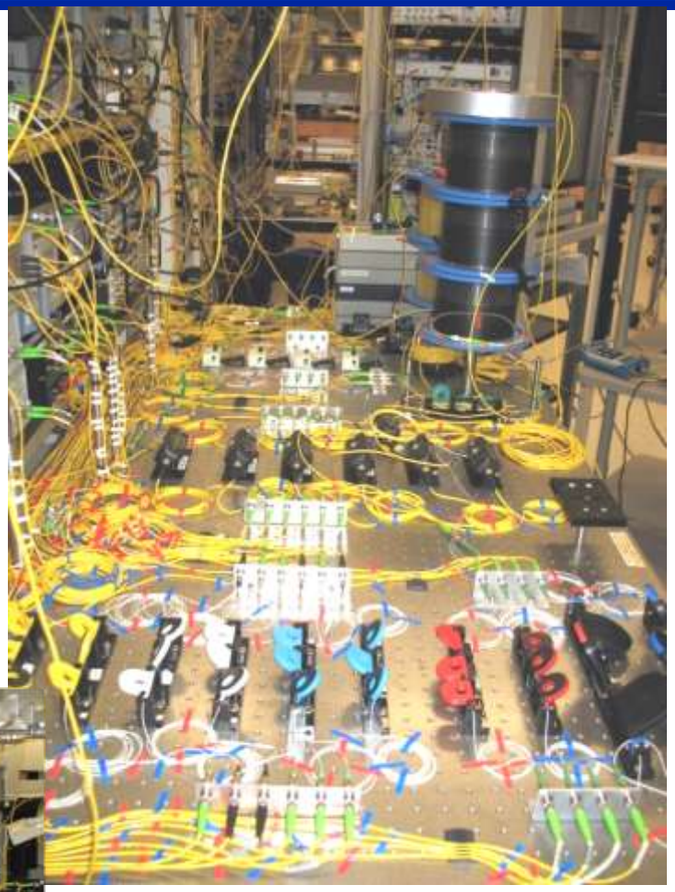


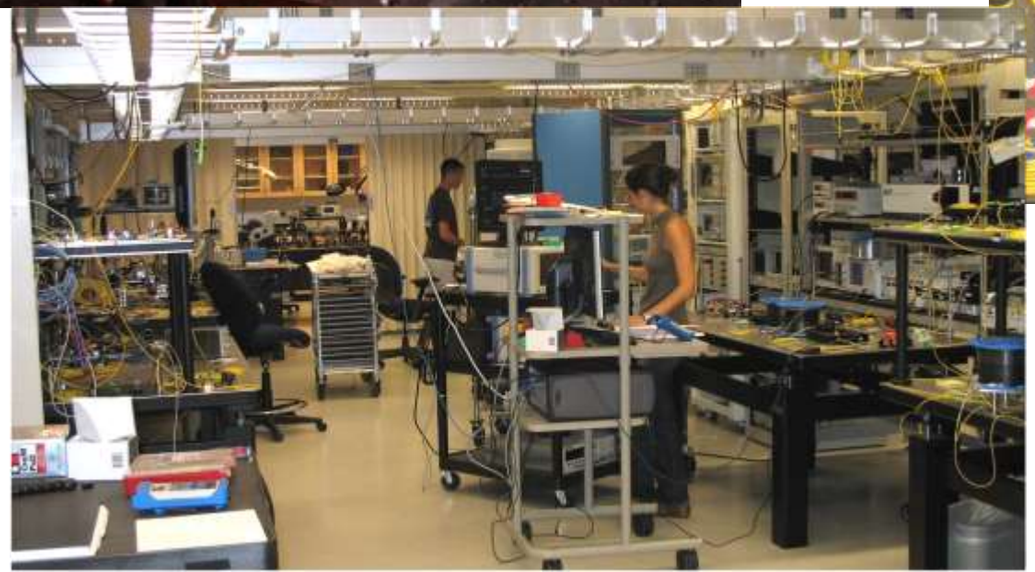
Similar Clean Rooms at UCI

Source: Bernd Fruhberger, Calit2

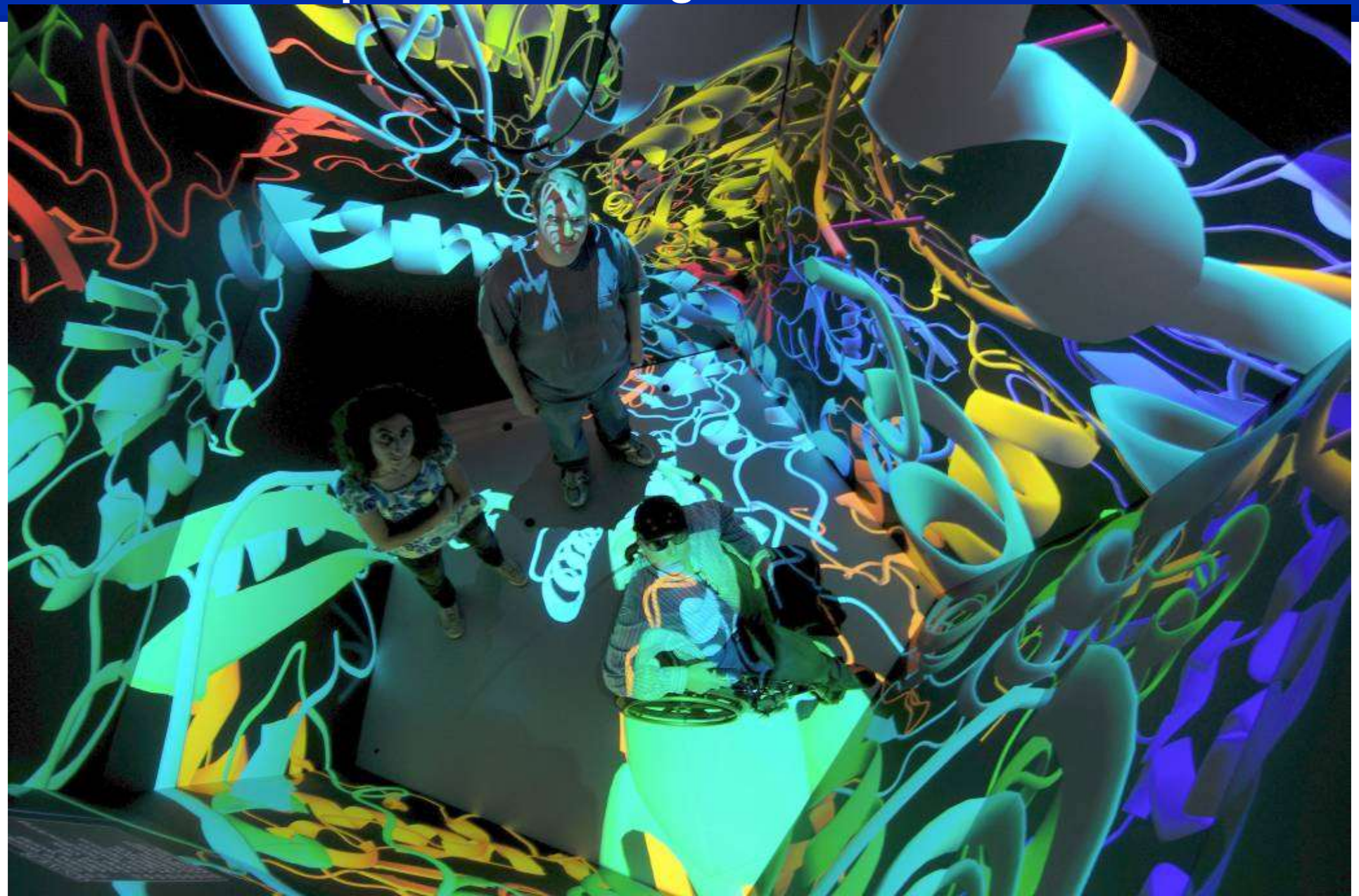
One of the Most Advanced Photonics Systems Labs in the World







Calit2 3D Immersive StarCAVE OptIPortal: Enables Exploration of High Resolution Simulations



Calit2 is Experimenting with Open Reconfigurable Work Spaces to Enhance Collaboration

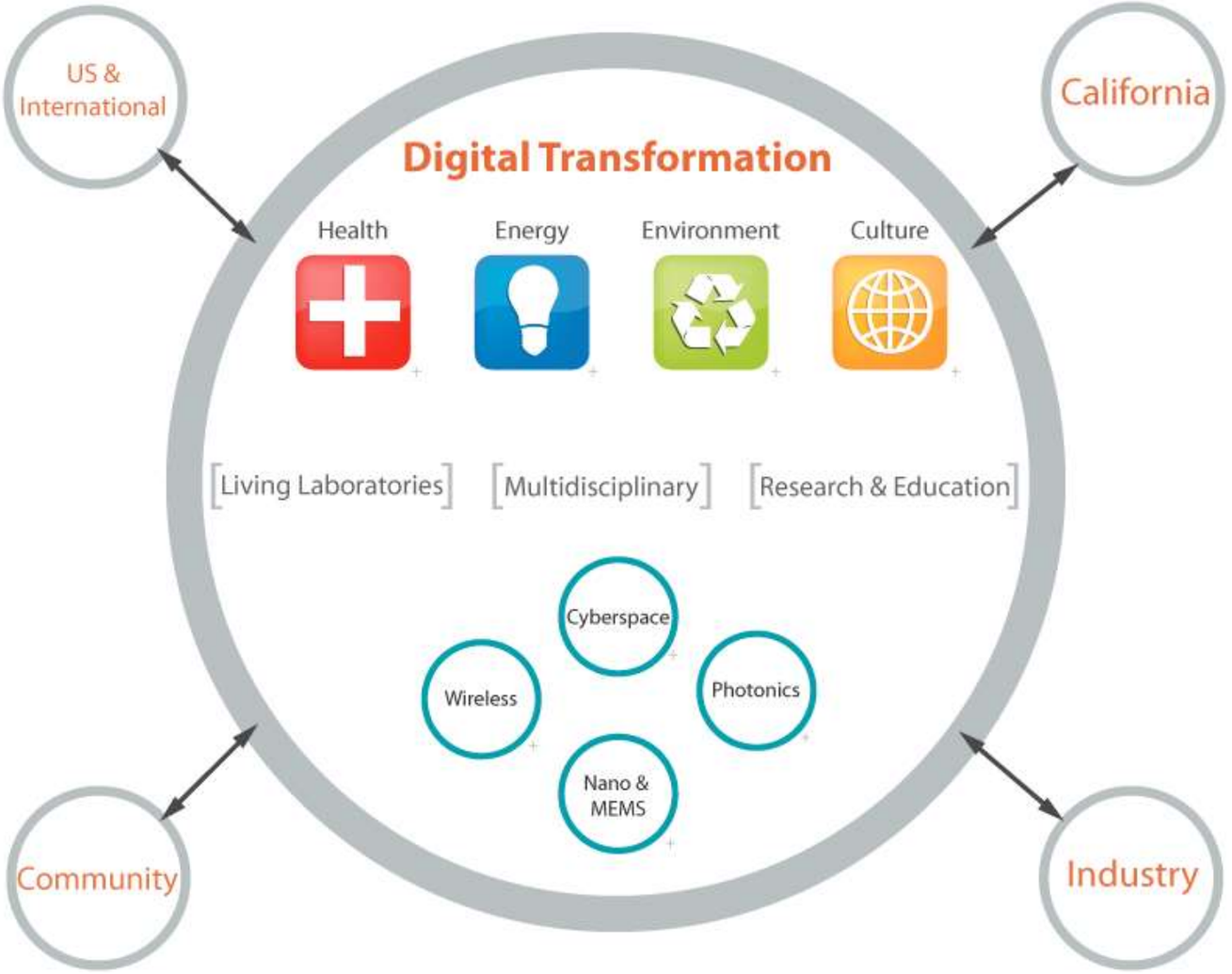




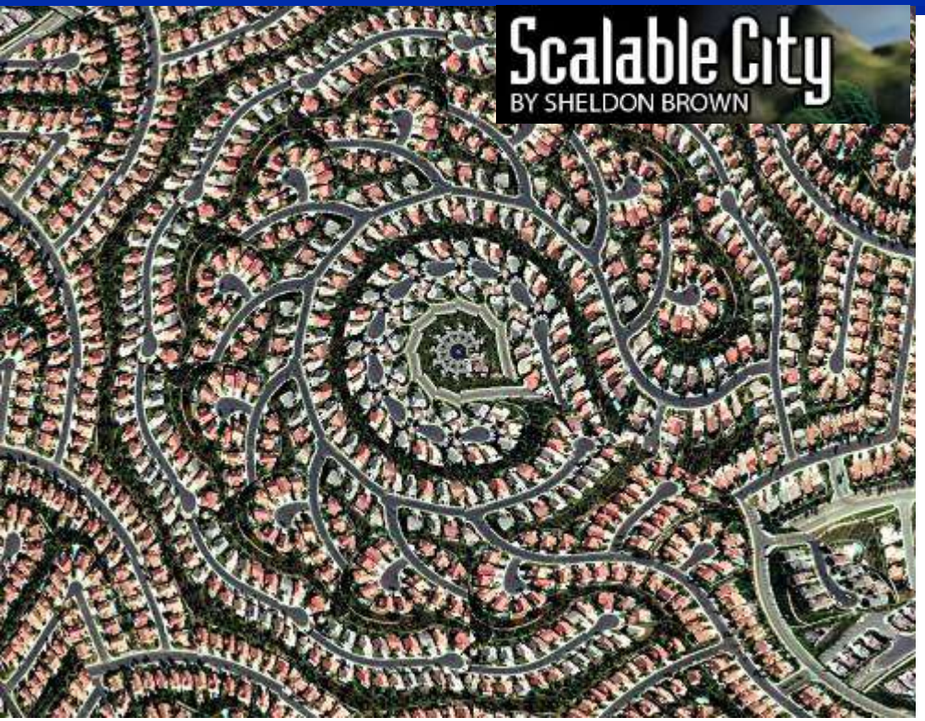


Re-Branding: Calit2 is a Framework for “Living in the Future” of the Digital Transformation of Society

2010



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



The New York Times

Business Day

Technology

WORLD | U.S. | N.Y. / REGION | BUSINESS | TECHNOLOGY | SCIENCE | HEALTH | SPORTS | OPINIO

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

By JOHN MARKOFF
Published: November 5, 2005

SPECFLIC 1.0 – A Speculative Distributed Social Cinema by Adrienne Jenik



Bill Tomlinson, Lynn Carpenter UCI "EcoRaft"



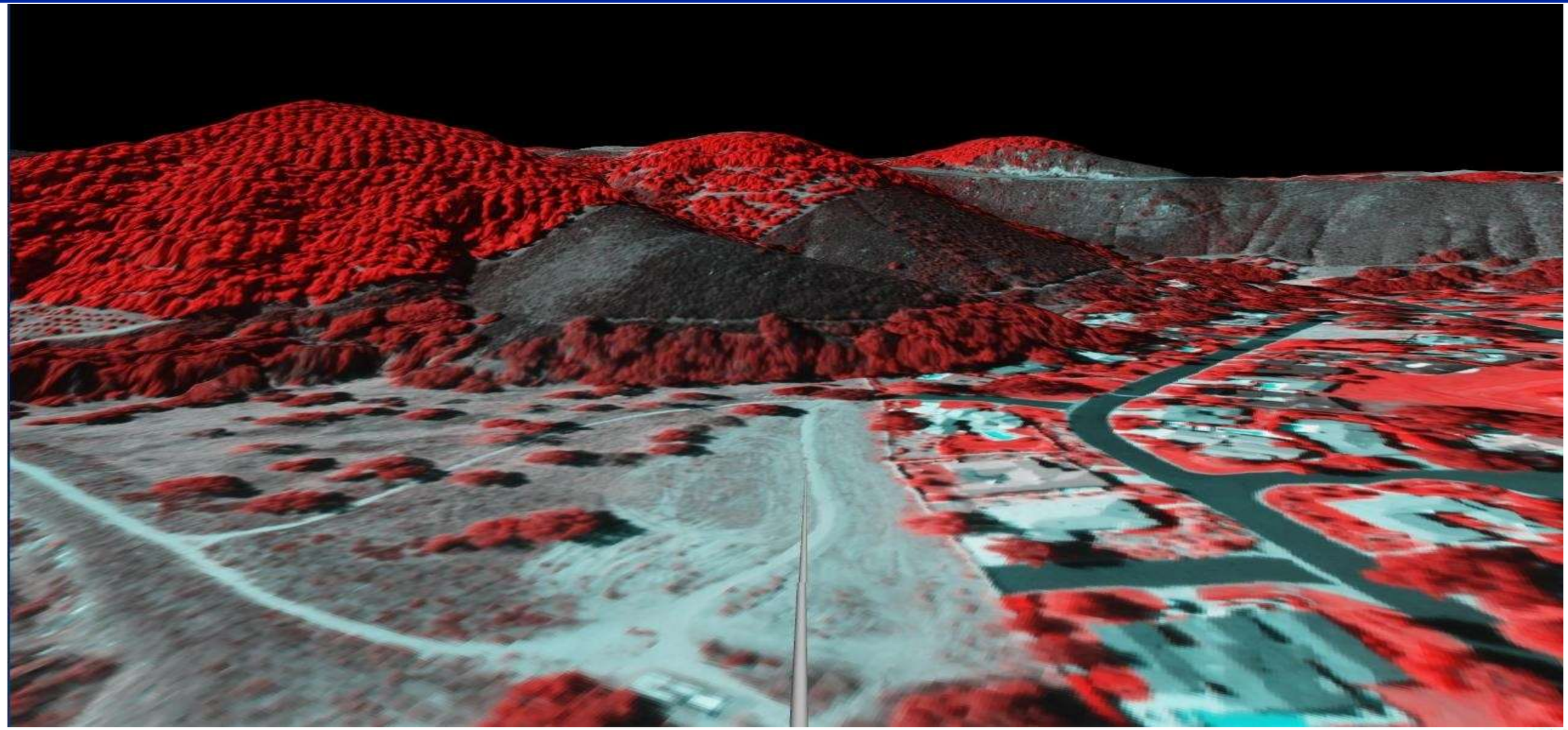


Virtual Jazz-Coupling UCI with UCSD



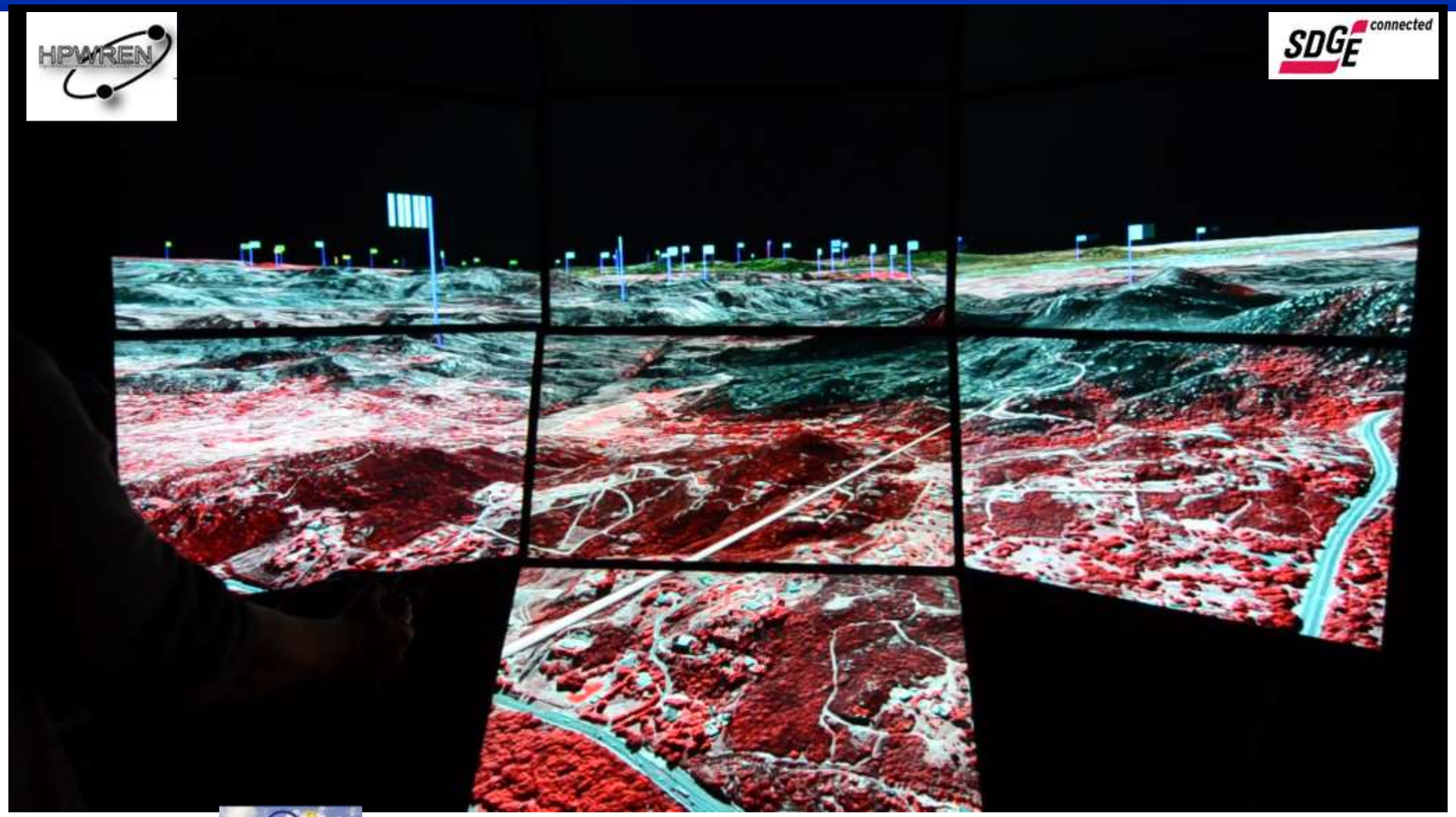
Egypt’s Luxor in the StarCAVE

Community Outreach:
Interactive Virtual Reality of San Diego County



0.5 meter image resolution.
2meter resolution elevation

All Meteorological Stations Are Represented in Realtime: Wind Direction, Velocity, and Temperature





Source: Jessica Block, Calit2

Using Calit2's Qualcomm Institute NexCAVE for CAL FIRE Research and Planning



Source: Jessica Block, Calit2

HPWREN Real-Time Network Cameras on Mountains for Environmental Observations and Fires



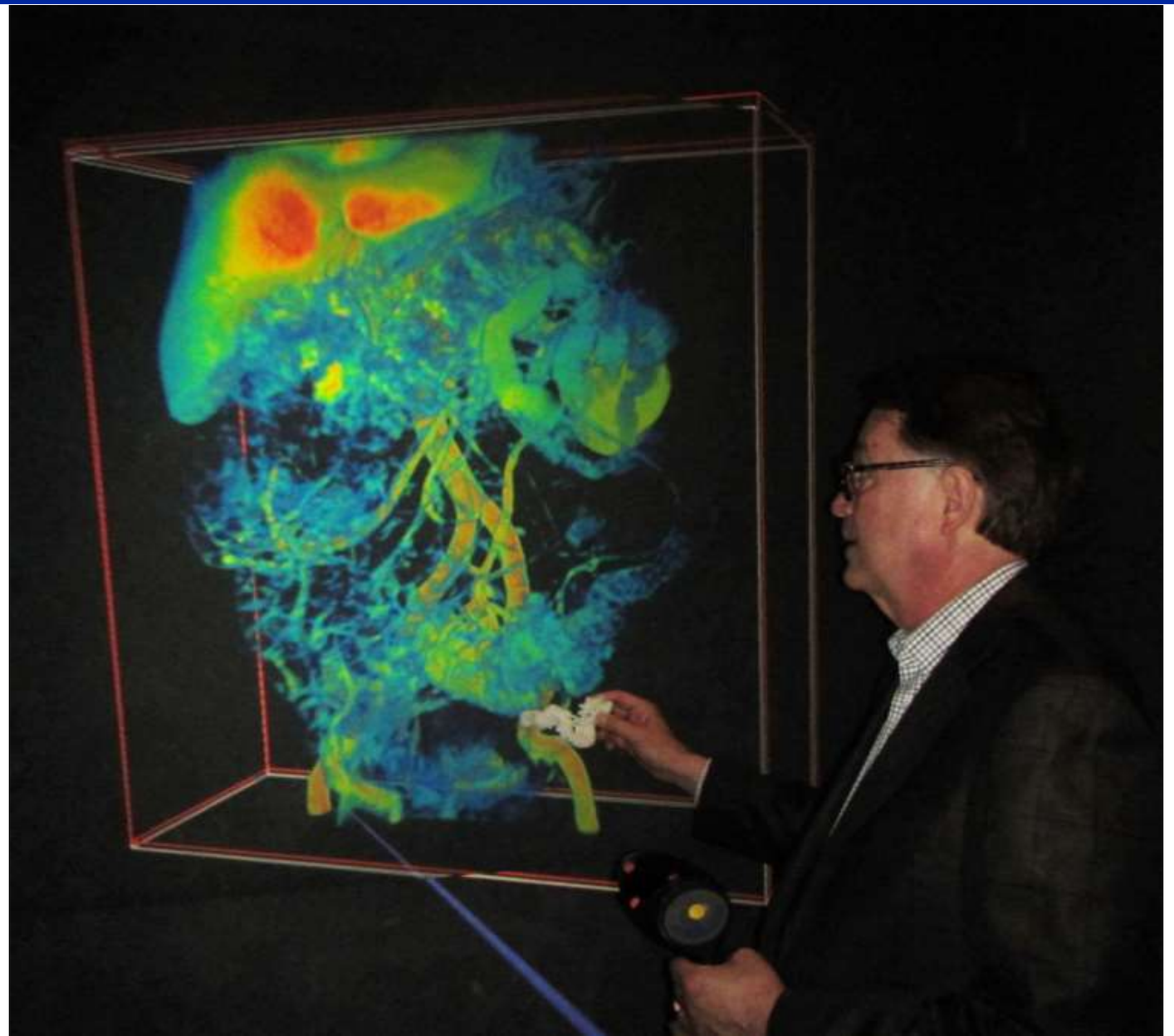
San Diego County Red Mountain Fire Cameras

- **Southeast (left) “Highway” Fire**
- **Southwest (center rear) “Poinsettia” Fire**
- **West (right) “Tomahawk” Fire**

UC San Diego SDSC San Diego Supercomputer Center Scripps Institution of Oceanography it² Calit2 San Diego State University it²

3D Volumetric Visualization From MRI In Calit2 Virtual Reality StarCAVE

3D Volumetric Visualization Created by Calit2's Jurgen Schulze from January 2012 MRI



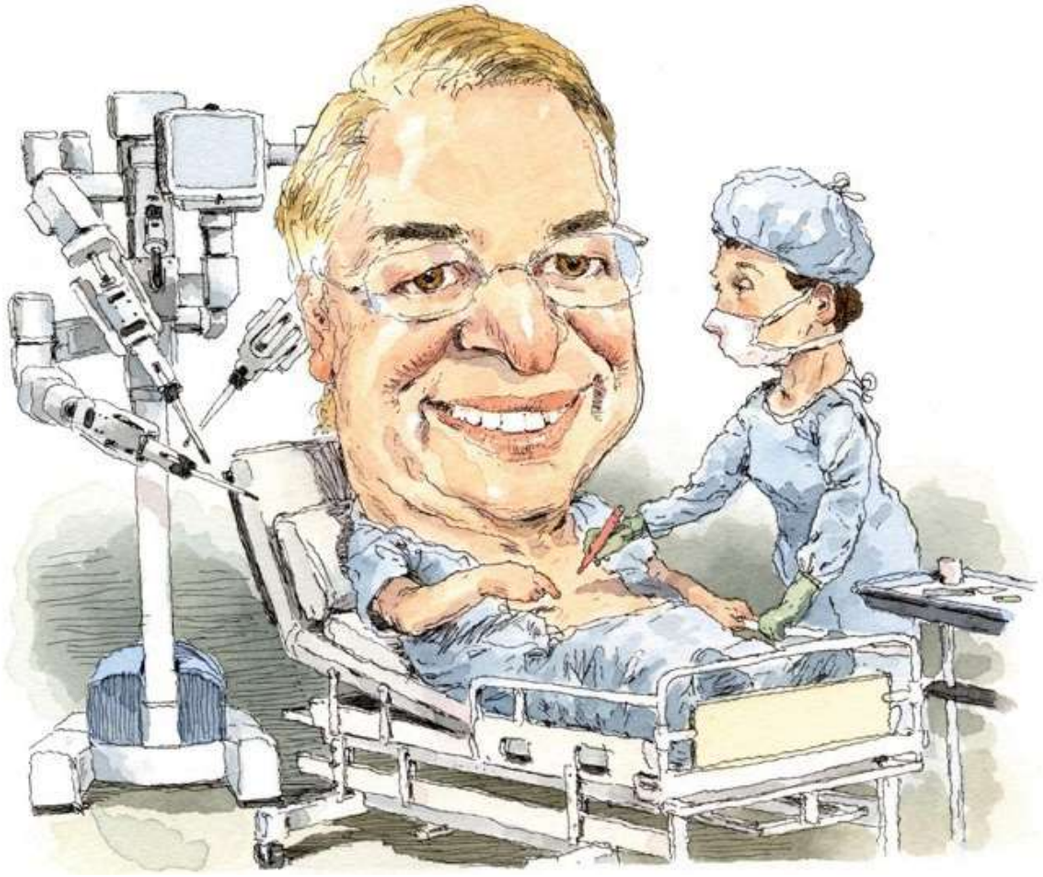
The Ability to See Inside Myself Eventually Led to My Co-Planning My Own Surgery

The Atlantic

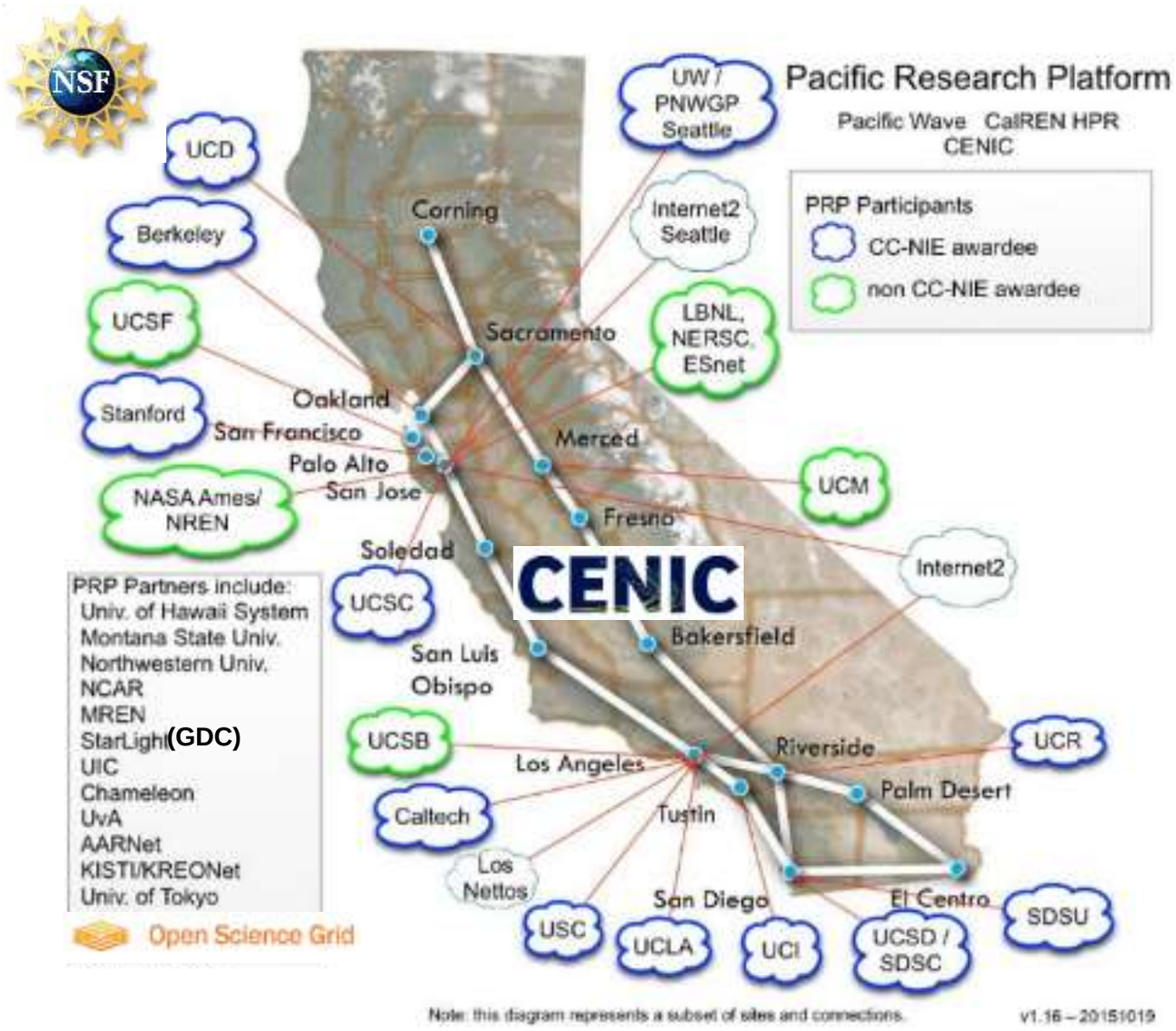
The Man Who Saw Inside Himself

For years, Larry Smarr has used a supercomputer to monitor his health and peer at his organs. Recently, he used his knowledge to help direct his own surgery.

MARK BOWDEN | MARCH 2018 ISSUE | HEALTH



The Pacific Research Platform Connects Campus "Big Data Freeways" to Create a Regional End-to-End Science-Driven "Big Data Superhighway" System



Source: John Hess, CENIC

NSF CC*DNI Grant
$6M 10/2015-10/2020

PI: Larry Smarr, UC San Diego Calit2

Co-PIs:

- **Camille Crittenden, UC Berkeley CITRIS,**
- **Tom DeFanti, UC San Diego Calit2/QI,**
- **Philip Papadopoulos, UCSD SDSC,**
- **Frank Wuerthwein, UCSD Physics and SDSC**

Letters of Commitment from:

- **50 Researchers from 15 Campuses**
- **32 IT/Network Organization Leaders**

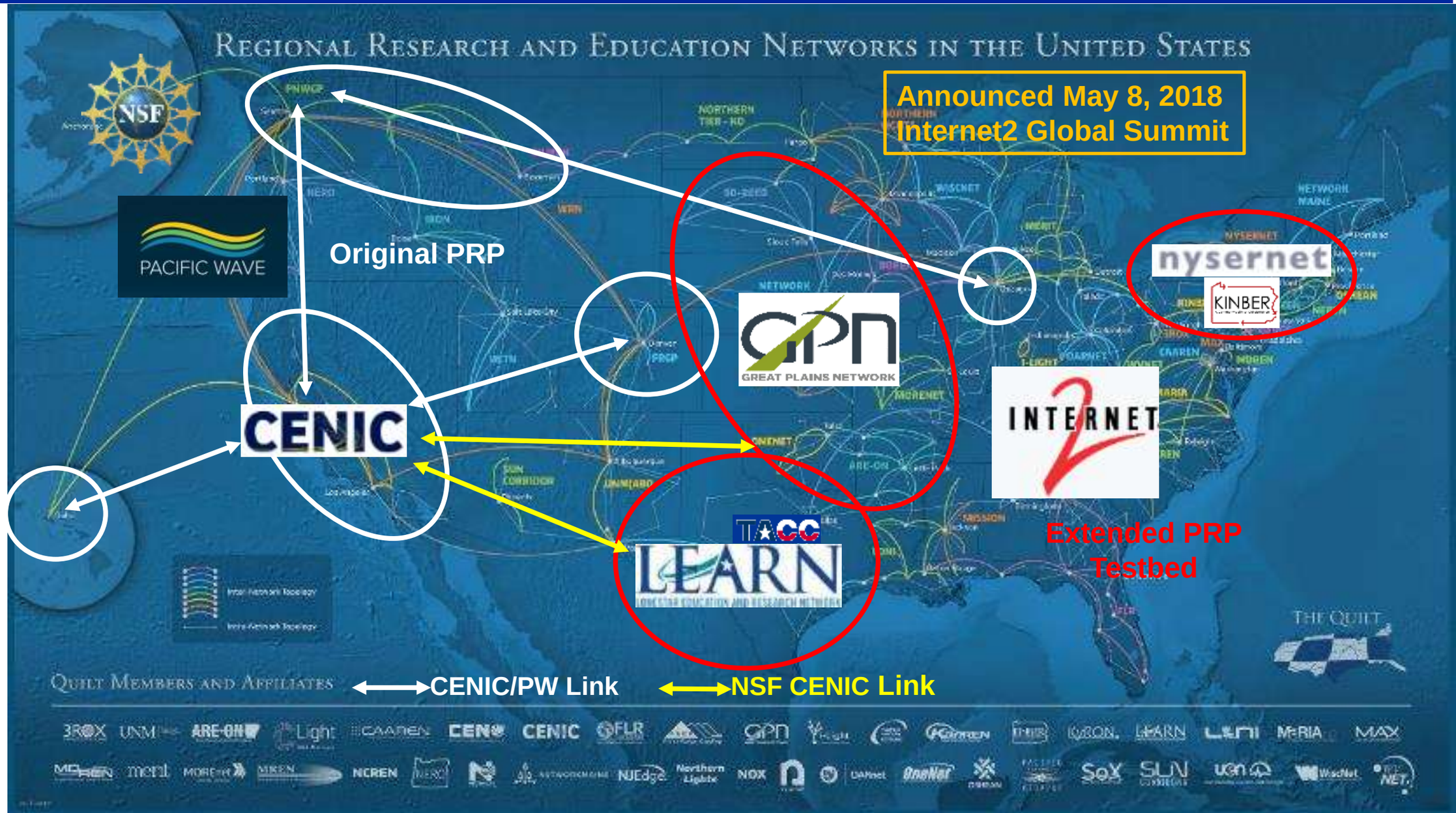
UCOP CIO Tom Andriola
Provided Funds and ITLC Support
for Using Ten UC Campuses
For Advanced Technology Testing

SDSC CITRIS BANATAO INSTITUTE it²

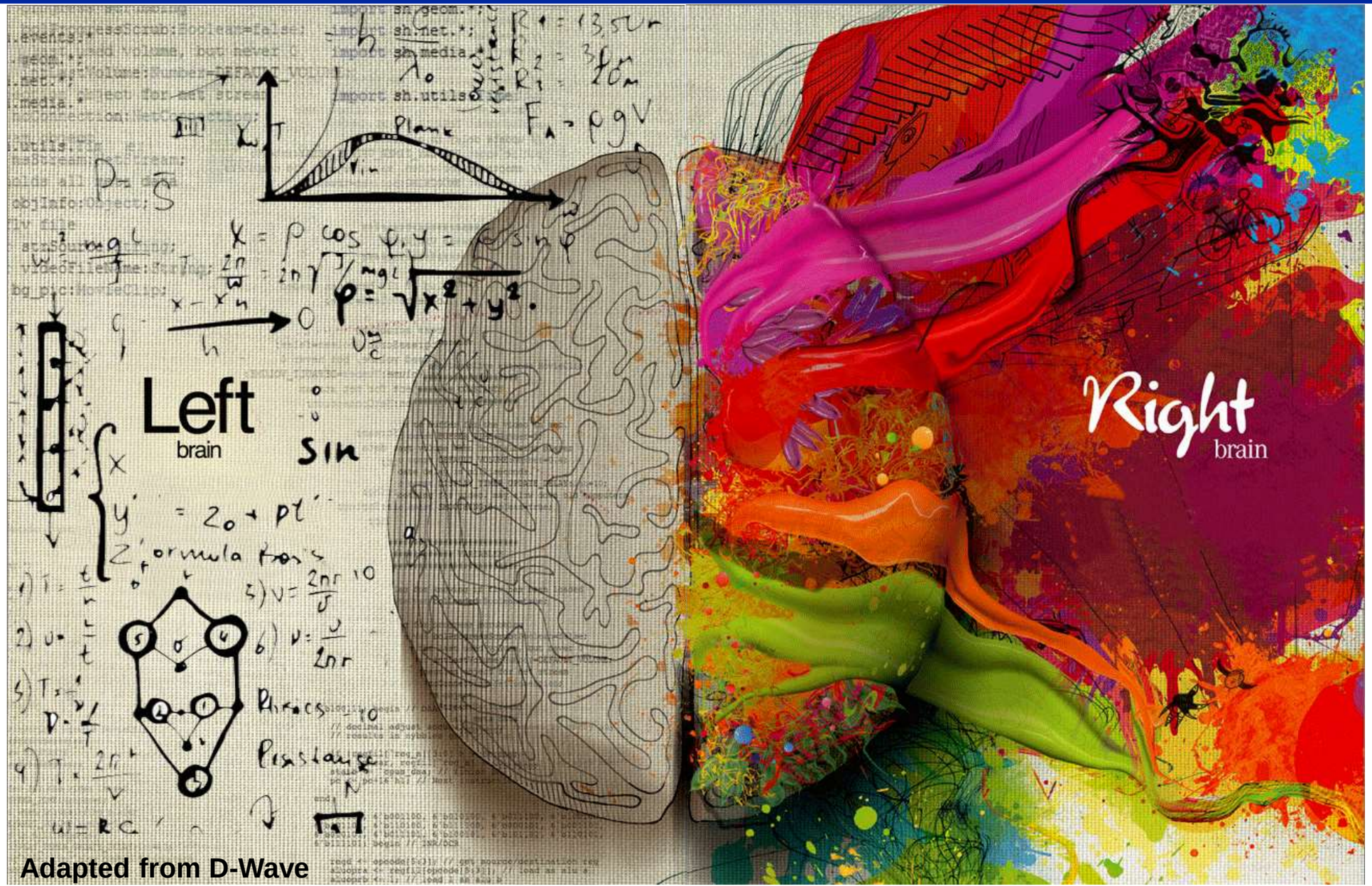
PRP National-Scale Experimental Distributed Pilot: Using CENIC & Internet2 to Connect Early-Adopter Quilt Regional R&E Networks

"Toward The NRP" Grant Now Funded by NSF $2.5M

ESnet
CENIC
SDSC
CITRIS BANATAO INSTITUTE
it²



Adding Machine Learning to PRP:
Left & Right Brain Computing: Arithmetic vs. Pattern Recognition



Adapted from D-Wave

Key Achievements: QIIS and Startups

- Launched Qualcomm Institute Innovation Space (QIIS) in late 2015
- 17 startups hosted so far in QIIS
- Pipeline generates economic value-added (as of 11/16):
  - Attracted $47MN in investments, grants
  - Booked $5.6MN in revenues
  - Funded $2MN for services of QI + $100K in rents
- Employ students as interns and eventually employees
  - 168 student interns since 2015
  - 22 interns later hired into full-time jobs at QIIS companies



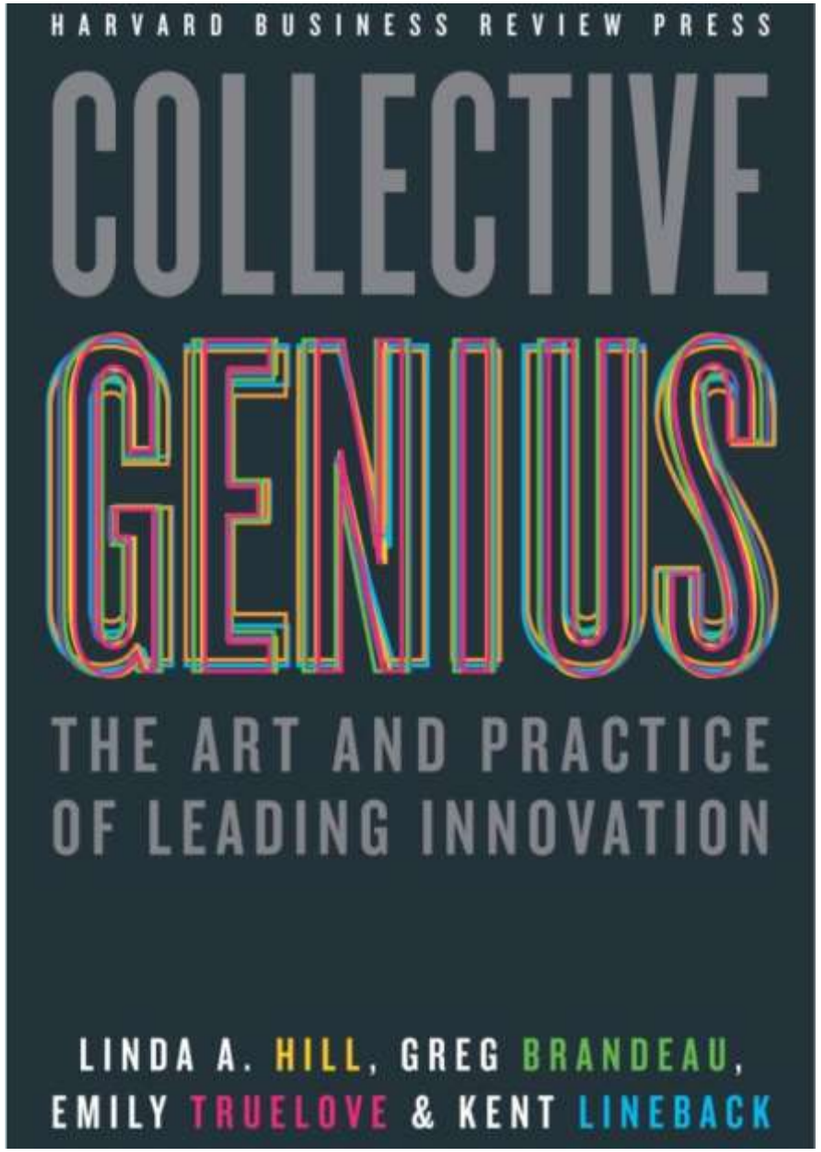


QUALCOMM INSTITUTE

UC San Diego

Global Case Studies of Leading Innovation

2014



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Larry Smarr at Calit2 and Amy Schulman at Pfizer

A Recent Profile on
Blending Technology, Disciplines, and Innovators

strategy+business

Why Larry Smarr Is Pioneering Collaborative Innovation

October 9, 2017 / Winter 2017 / Issue 89

TECHNOLOGY

Larry Smarr has become a vital conductor of innovation by insisting that scientists and researchers at the incubators he runs collaborate across the lines that separate disciplines.

by Lawrence M. Fisher



Smarr at UCSD's Machine Perception laboratory with a humanoid robot that is learning a baby's facial expressions and movements.
Photograph by Vern Evans