Calit2:
a SoCal UC Infrastructure for Innovation

Overview

Diamond Consultants

April 22, 2009

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

UCSD

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Calit2--A Systems Approach to the Future of the Internet and its Transformation of Our Society

Calit2 Has Assembled a Complex Social Network
of Over 350 UC San Diego & UC Irvine Faculty
From Two Dozen Departments
Working in Multidisciplinary Teams
With Staff, Students, Industry, and the Community



Integrating Technology Consumers and Producers
Into “Living Laboratories”

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www.calit2.net

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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



Preparing for a World in Which Distance is Eliminated…

www.calit2.net

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$100M From State for New Facilities

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Calit2 Has Sought to Increase the Entrepreneurial Culture on Both Campuses

IGNITING TECHNOLOGY

Knobbe Martens Olson & Bear LLP
Intellectual Property Law

Calit2

VON LIEBIG CENTER

Accelerating Innovation Advisory services and seed funding to advance commercialization of Jacobs School discoveries



Presenters (from left) Perry, Johnsson, Scacchi and Tomlinson are joined by Calit2's Korean partners via high-speed video teleconferencing.

VentureForth @ UCSD

5th Annual Entrepreneurship Conference

Nov 17, 2007 @ CALIT2 UCSD

Entrepreneurs Forum

OCTANe@UCI

TECH COAST ANGELS

TechTIPS UCSD

So You Want to Form a Startup?

Guest Speaker: Alvin Viray
senior licensing officer, UCI Office of Technology Alliances

OCVG

UCSD STARTUP BOOTCAMP:

A 'How'd They Do That?' on Forming Companies

Tuesday, May 9th, 2006
9 am - 5 pm
UCSD Atkinson Auditorium

CONNECT®
Accelerating Innovation in San Diego

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Calit2 Industrial Partners
Team with Academic Research and Education

- Joint Support of Centers (CWC, CITA, CNS…)
- Using Calit2 Facilities
- Funding Joint Research Projects
- Commercialization of Faculty/Staff/Student Research
- Joining on Federal Grants
- Providing Equipment to Calit2 Projects
- Sending Staff to Live at Calit2
- Supporting Graduate/Undergraduate Fellows
- Granting Access to Industry Facilities
- Endowing Chaired Professorships
- Co-Sponsoring Workshops/Conferences
- Hosting Seminars or Lectures

$93 Million from Industrial Partners Since 2000

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Calit2 UCSD Affiliated Centers
Loci for Innovation















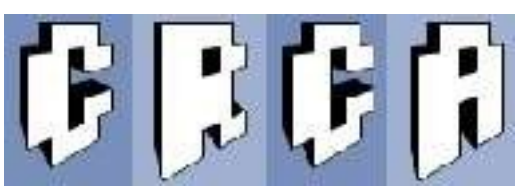
Microelectronic Embedded Systems Laboratory



















Calit2 UCI Affiliated Centers
Loci for Innovation



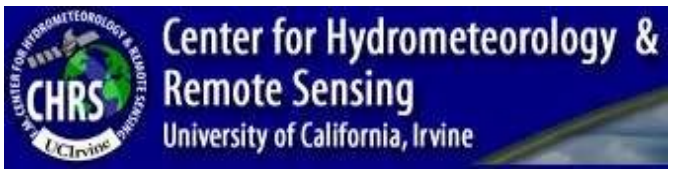








































Machine Learning and Robotics: The Machine Perception Lab and Sony Electronics

RUBI Interacting with Children



Sony Shutter Smile Technology



- **The MPL (a Calit2 Affiliated Research Group Housed in Calit2) Partnered with Sony Electronics Through the UC Discovery Program to Create Socially Perceptive Appliances**
- **The MPL Developed a Social Robot (RUBI) Which Interacted With Infants**
  - **Smile Detection was Identified as a Key Indicator of Social Interaction**
- **The MPL RUBI Work Led to the Creation of a Smile-Learning Algorithm Which was Trained With a Data Set of Over 100,000 Individuals**
- **Sony Used This Technology as the Basis for the Sony Shutter Smile Technology Found in Their Latest Generation of Consumer Digital Camera Products**

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Source: Javier Movellan Institute for Neural Computation

New Industrial Partners Using Calit2@UCSD Cleanrooms

nano3 SCIENCE ENGINEERING MEDICINE

ACULON Surface. Science. Solutions.

celula™

Maxwell TECHNOLOGIES

Nanotrope

Parker

Sun microsystems

CORNERSTONE sensors®

nativis a life sciences company

Plus >75 Faculty!

aguila RADIATION DETECTORS & ELECTRONIC SYSTEMS

Creative Electron

SYMMUNITY

RF Nano Corporation™

AMCC

CYMER

Seashell Technology

TCZ A Joint Venture of Cymer and Carl Zeiss SMT

CUBIC CORPORATION

SAIC From Science to Solutions

THE SCRIPPS RESEARCH INSTITUTE

INNOVATIVE autosplice INTERCONNECTIONS

CROSSFIBER

FAVRILLE Cancer treatment—we make it personal

Separation Systems Technology

GENERAL ATOMICS AND AFFILIATED COMPANIES

BIOSITE NEW DIMENSIONS IN DIAGNOSIS

Hi-Z TECHNOLOGY, INC.

Menon & Associates Innovation in Sensors

freescale semiconductor

WORLD MINERALS

BURNHAM INSTITUTE for MEDICAL RESEARCH From Research, the Power to Cure

J. Craig Venter INSTITUTE

QLP™

XCOM

life technologies™

Lightwave Photonics

Quik-Pak™ IC Packages, Assembly & Prototype Services

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Leading Edge Photonics Systems Laboratory Has Been Created in the Calit2@UCSD Building

- **Networking "Living Lab" Testbed Core**
  - Terabit Networking
  - Micro LIDAR/Spectroscopy
  - Silicon Frequency Conversion
  - 320Gbps Real Time Processing
  - Advanced Transmission Coding

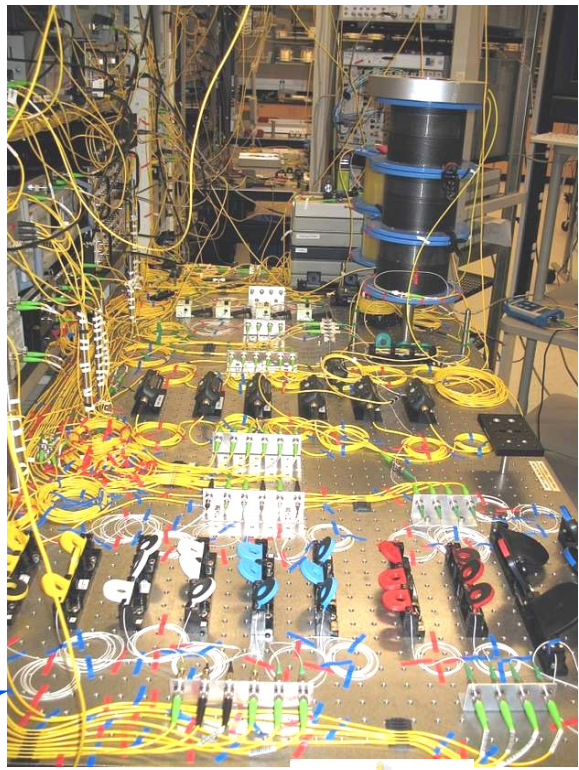
Alcatel·Lucent

AVANEX

ofs
A Furukawa Company

SUMITOMO ELECTRIC
LIGHTWAVE

LOCKHEED MARTIN



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.



NSF

POPS
PARAMETRIC OPTICAL PROCESSES & SYSTEMS

MTO DARPA
MICROSYSTEMS TECHNOLOGY OFFICE

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UCSD Photonics

Cooperative Test Beds Funded by Industry Partners
Calit2@UCSD's Wireless Power Amplifier Lab

freescale semiconductor

Power Transistor Tradeoffs

Si-LDMOS, GaN, & GaAs

Price & Performance

Eudyna

TriQuint SEMICONDUCTOR

Power Amplifier Tradeoffs

WiMAX & 3.9GPP LTE

Efficiency & Linearity

STMicroelectronics

HUAWEI

NOKIA

ERICSSON

Digital Signal Processing Tradeoffs

Pre-Distortion, Memory Effects & Power Control

MIPS & Memory

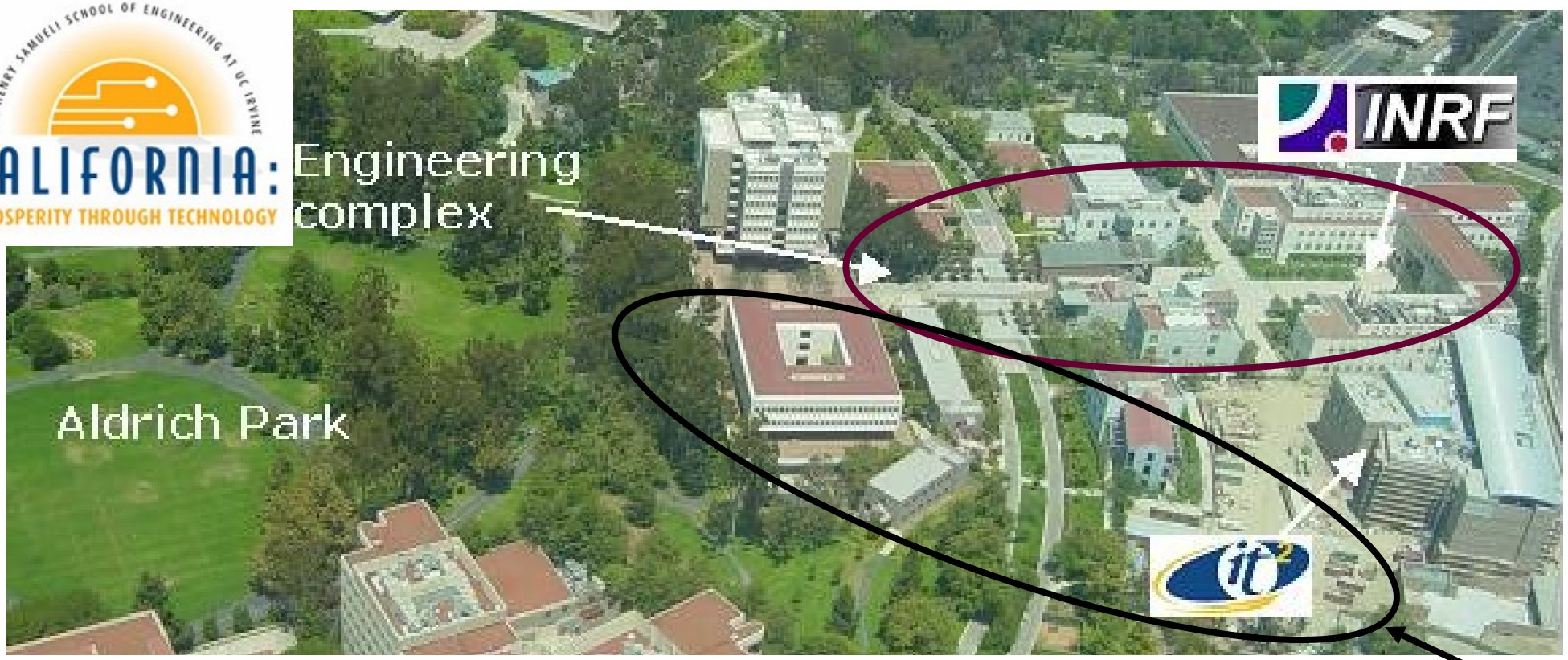
QUALCOMM

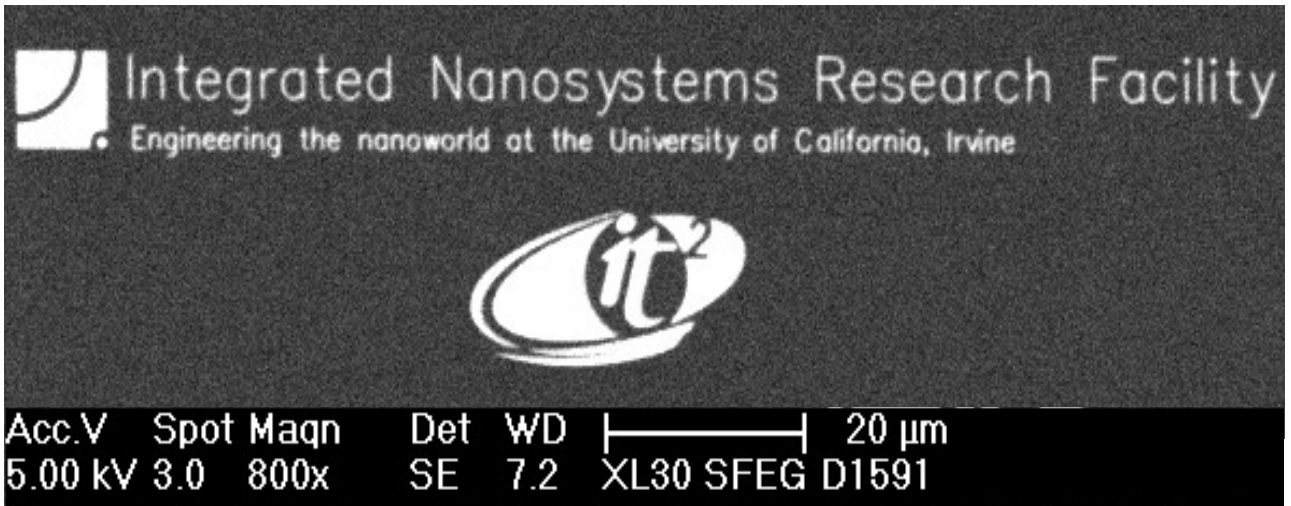
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Calit2 is Creating a Nano-Bio-Info Innovation Laboratory





Donald Bren School of Information and Computer Science

INRF Partners Companies with University Researchers: 70 Past and Current Collaborating Companies



40 UCI Faculty from a Dozen Departments

- Advanced Customs Sensors Inc.
- Agilient
- Alpha Industry/Network Device Inc.
- AXT/Alpha Photonics Incorporated
- Alpine Microsystems Incorporated
- Auxora, Inc.
- Bethel Material Research
- Broadcom
- Broadley-James Corp.
- Cito Optronics, Inc.
- Coherent, Inc.
- Conexant
- Coventor
- DRS Sensors
- Endevco
- Friends USA
- General Monitors
- Global Communication Semiconductor
- Hewlett Packard
- Hitachi Chemical Research
- IJ Research
- Impco Technology
- Intelligent Epitaxy Incorporated
- International Technology Works
- IOS
- Irvine Sensors
- Jazz Semiconductor
- Linfinity Microelectronics
- Maxwell Sensors
- Metrolaser Incorporated
- Microtek Lab Incorporated
- MicroWave Technology
- Moog, Inc.
- Network Device
- Newport Opticom
- NexGen Research Corporation
- Northrop Grumman Corporation
- Numerical Technologies
- Ormet Corp.
- Oplink Communications
- Optical Crossing
- Optinetrics
- Optiswitch Technology
- Physical Optics Corp.
- Printronix
- ProComm Enterprises
- Rainbow Communications
- Raytheon Systems
- Rockwell
- RF Integrated Corp.
- Sabeus Photonics
- Saddleback Aerospace
- SAIC
- Second Sight, LLC
- Semco Laser Technology
- Sequenom
- Silicon Storage Technology, Inc.
- Simax
- Skyworks Solutions
- SVT Associates
- Tamarack Scientific, Inc.
- Tanner Research, Inc.
- Texas Instruments, Inc.
- TRW
- U Machines
- Versa Technology
- VSK Photonics
- WIN Semiconductors
- Xtal Technologies
- Y Media Corporation

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Partnering with Large Companies: QUALCOMM: $22 M Innovation and Strategic Relationship With Calit2

- Chairs and Fellowships
  - Five Endowed Chairs
  - 50 Student Fellowships
- Early Access to Equipment--EVDO Base Station/BREW
- Collaborations
  - Calit2 US-India Summit:
    - Co-Chairs Paul Jacobs and Frieder Seible
  - Roberto Padovani, QUALCOMM CTO and Adjunct Professor in ECE in Residence at Calit2
- Workshop on Spectrum Allocation and Assignment
- Innovation Funds for Programs
  - Center for Information Theory and Applications
  - Summer Undergraduate Research Program
- High Risk Ventures
  - Microfluidics-Based Laparoscopic Surgery Tool
  - Digital Clinical Charts for Works of Art at the SD Museum of Art
  - Search for the Tomb of Genghis Khan Using Non-Invasive Materials Imaging

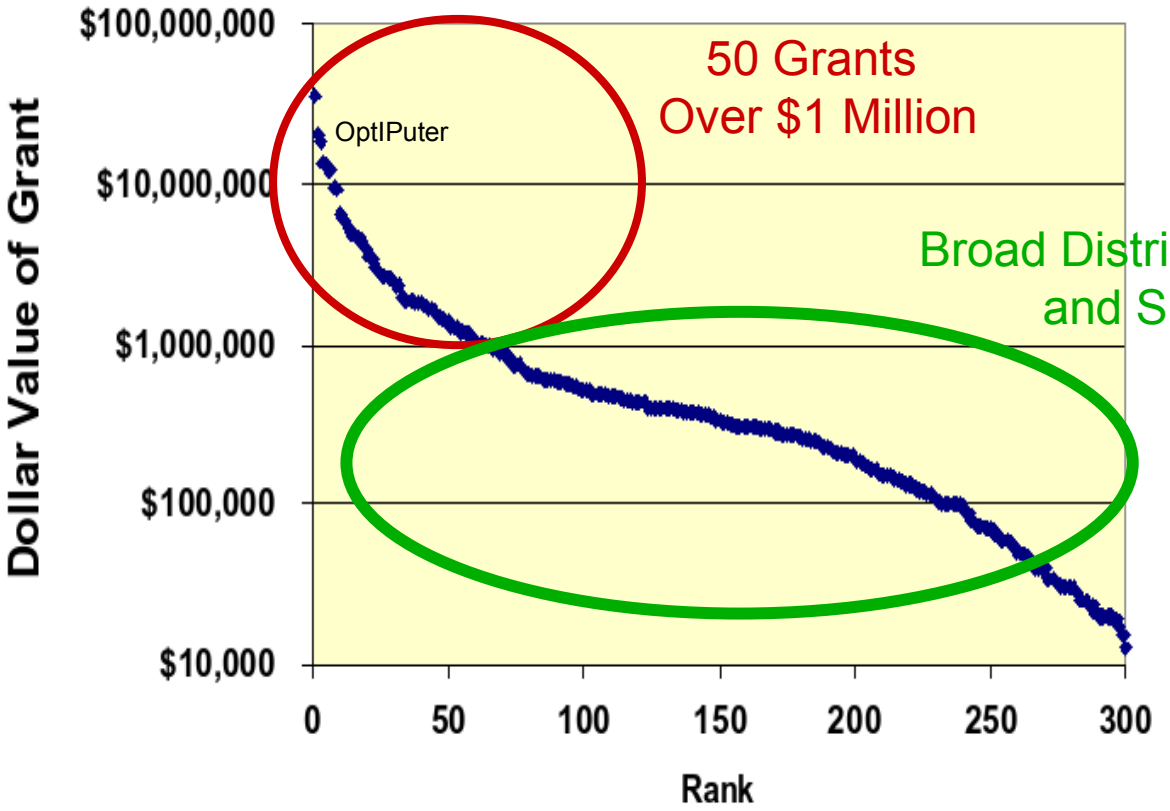


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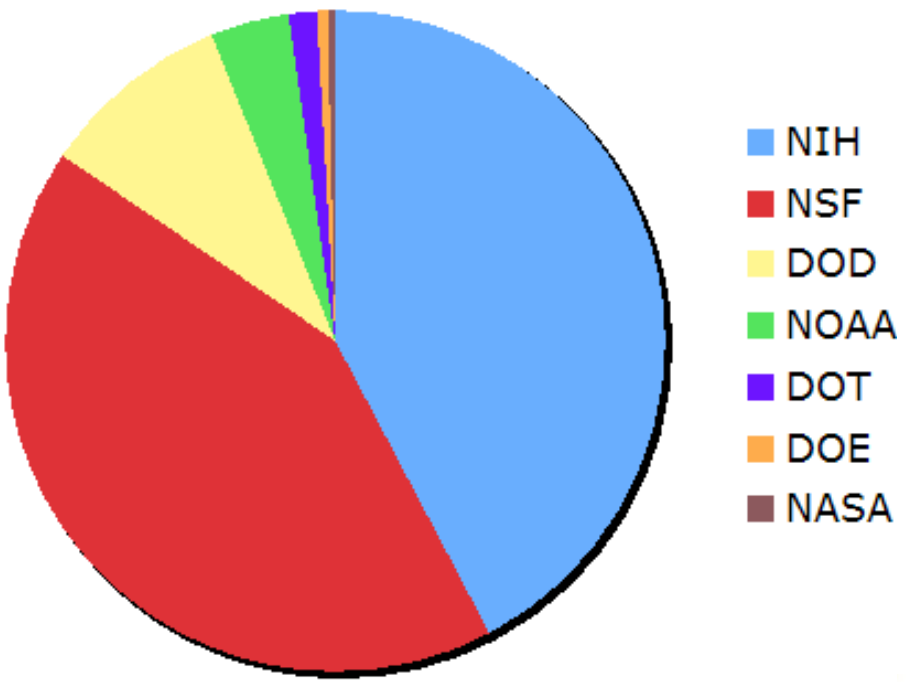
UCSD Jacobs School of Engineering

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Federal Agencies Have Funded Over $400 Million to Over 300 Calit2 Affiliated Grants



Plus $50M From Foundations



Federal Agency
Source of Funds

Creating a Rich Ecology of Basic Research

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Calit2 Review Report p.4,21

Calit2 Has Introduced Innovative Wireless Systems to Support SoCal First Responders























Aug. 22, 2006 MMST Disaster Drill at Calit2@UCSD Involved Over 200 First Responders

Emergency Management

rescue — Responding to Crises and Unexpected Events

- **Long Beach, CA Company Original Subcontractor and Co-PI**
- **Multiple Equipment Donations**
- **Test-Bed Usage for Prototyping and Evaluation**
- **Internships and Training for Students Leading to Employment**
- **Close Alliance with First Responders, to Meet their Specific Needs**



Calit2 Irvine Engages
40+ Companies
22 Government Agencies
6 Universities
27 Investigators
70+ students



ImageCat, Inc.
5G wireless
Apani
BOEING
CONVERA — THE POWER TO DISCOVER
COX COMMUNICATIONS
D-Link — Building Networks for People
Walker Wireless
AMD
ASVACO — Assessment Software & Services
Canon
PRINTRONIX — GLOBAL PRINTING...ENABLED.
ETHERC
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Mushroom Networks: Calit2 Helping Create New Companies

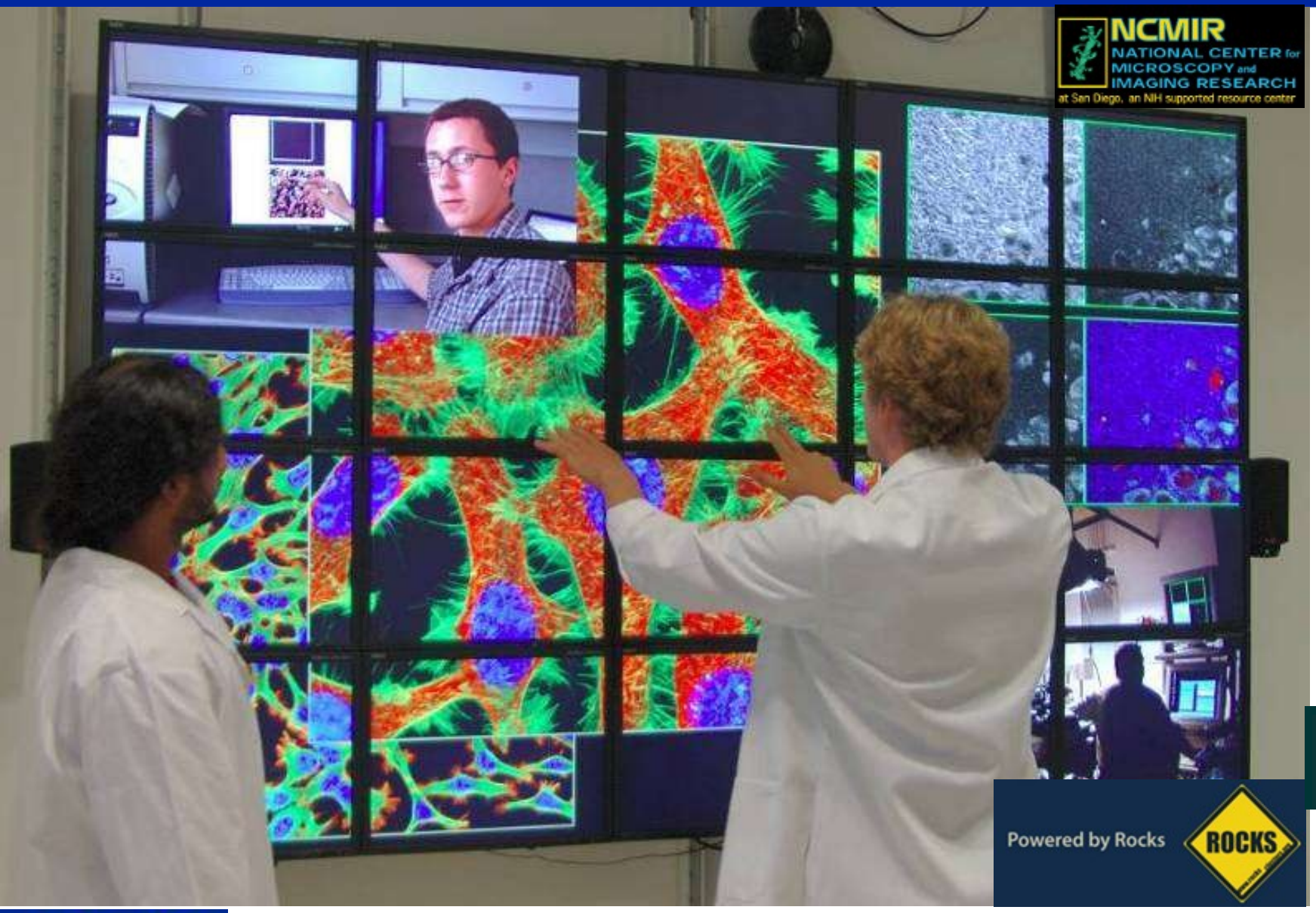
- **UCSD Start-up Founded in 2004 by ECE faculty (R. Cruz) and Calit2 Engineer (C. Akin).**
  - **Now has 25 Employees, Series A Funding**
- **Ericsson Researcher (R. Mishra)**
  - **"Lived" at Calit2 One Year**
  - **Hired by Calit2 One Year**
  - **Then Moved to Mushroom**
- **Full Circle: Mushroom and Calit2 Joint Applicants for the Navy's Small Business Technology Transfer (STTR) Funding**
- **First Product Shipped Feb, 2008: TRUFFLE**
  - **Used in Broadcast of Obama Historic Train Ride from Philadelphia to Washington DC**



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www.mushroomnetworks.com

NSF's OptIPuter Project: Using Supernetworks to Meet the Needs of Data-Intensive Researchers

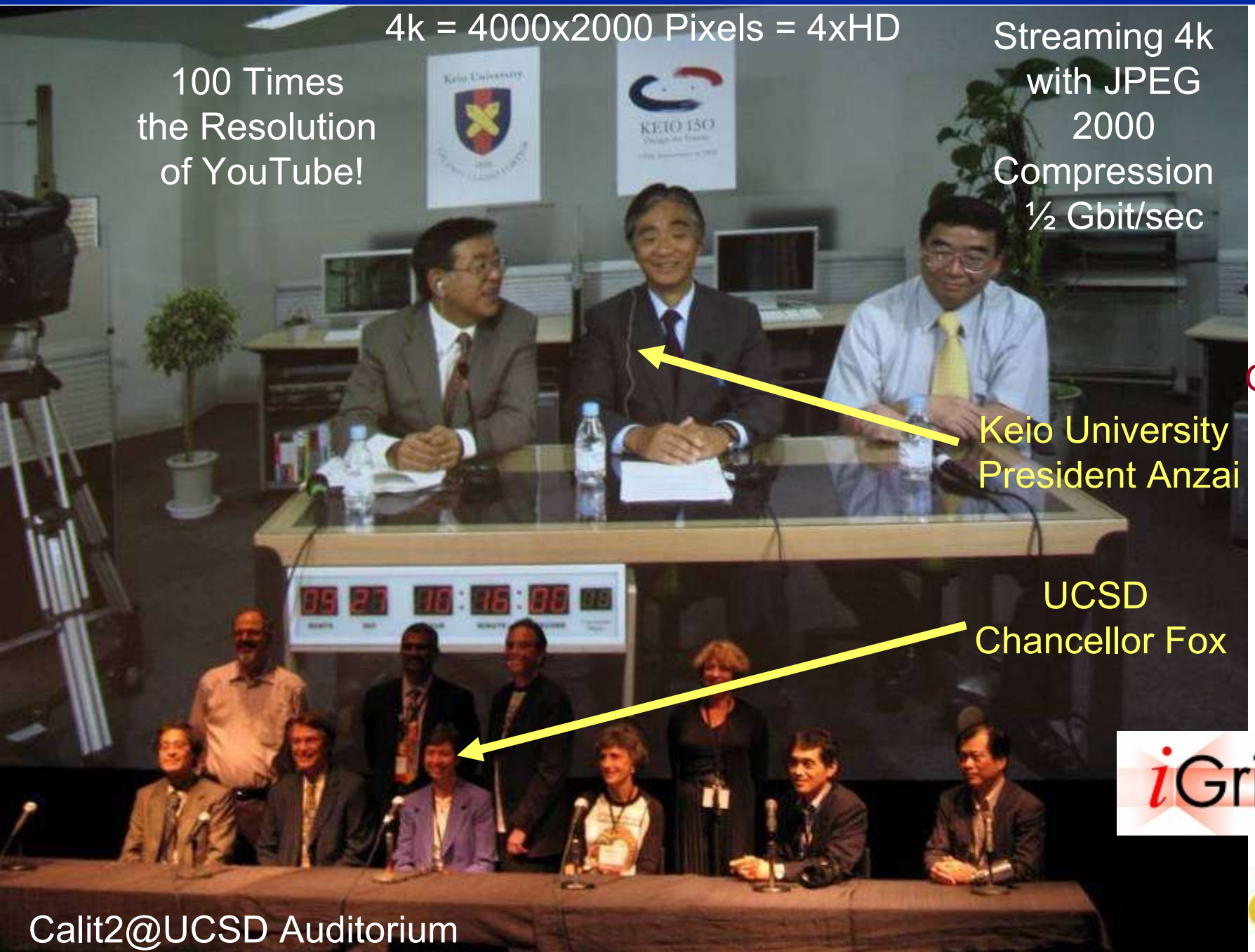


OptIPortal–Termination Device for the OptIPuter Global Backplane

Powered by Rocks

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

Telepresence Meeting
Using Digital Cinema 4k Streams



CineGrid

Lays
Technical
Basis for
Global Digita
Cinema

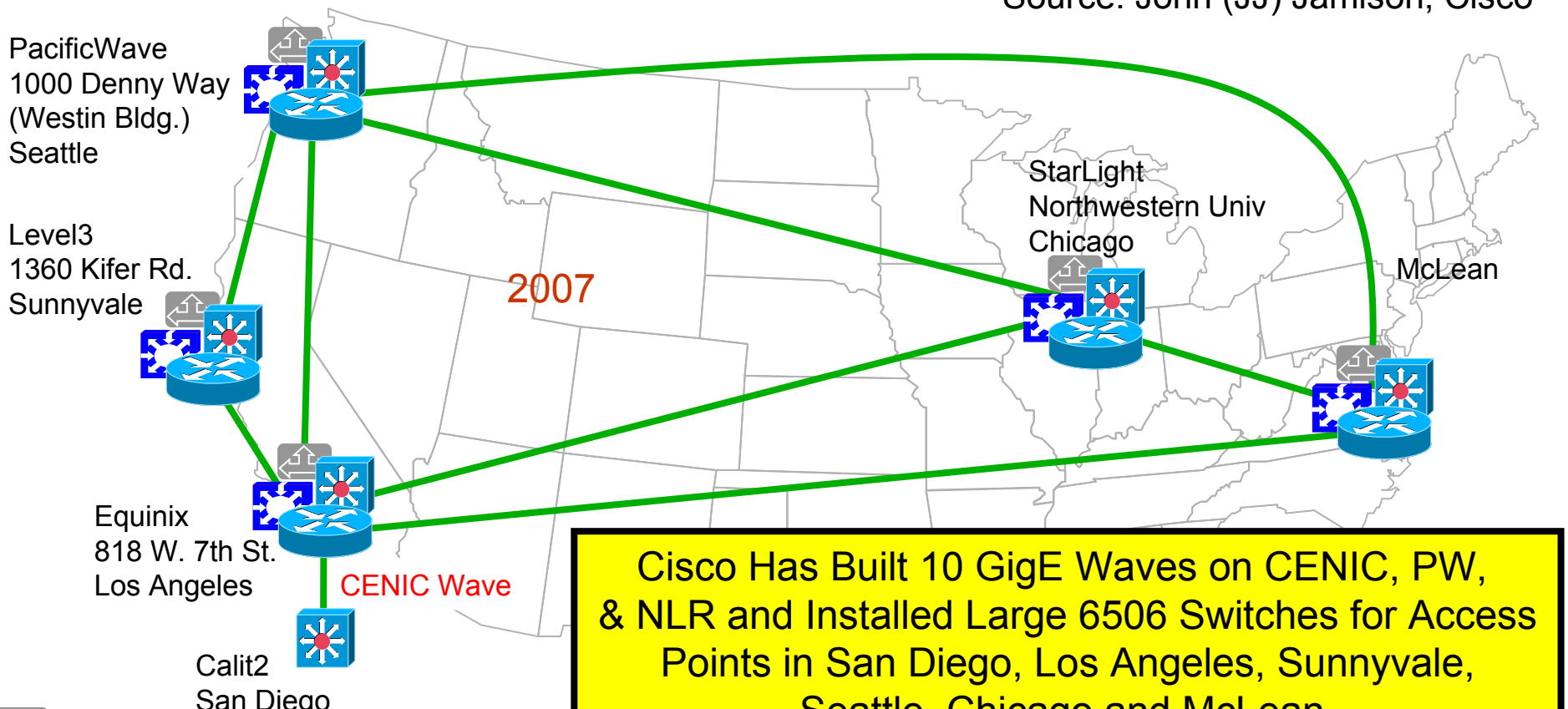
Sony
NTT
SGI

iGrid 2005

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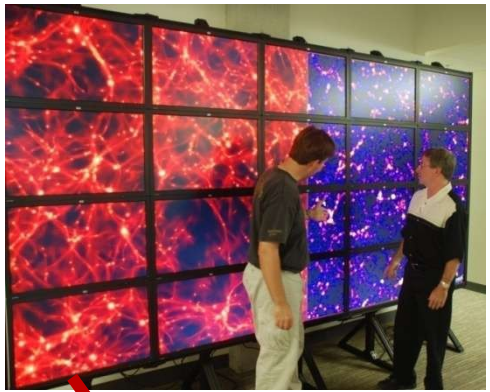
Cisco CWave for CineGrid: A New Cyberinfrastructure for High Resolution Media Streaming*

Source: John (JJ) Jamison, Cisco



Cisco Has Built 10 GigE Waves on CENIC, PW, & NLR and Installed Large 6506 Switches for Access Points in San Diego, Los Angeles, Sunnyvale, Seattle, Chicago and McLean for CineGrid Members
Some of These Points are also GLIF GOLEs

Academic Research "OptIPlatform" Cyberinfrastructure: A 10Gbps Lightpath Cloud



End User OptIPortal



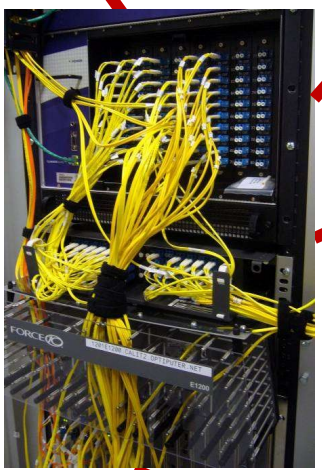
Instruments



HD/4k Telepresence

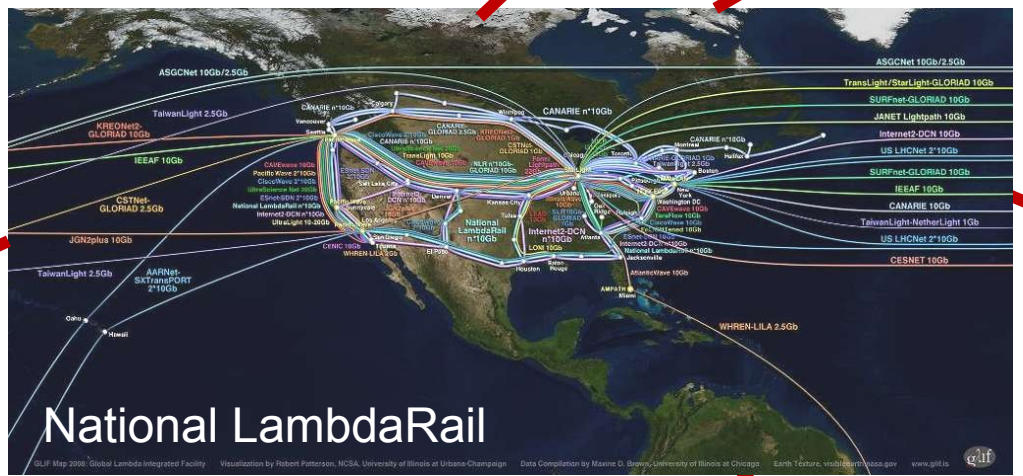


HD/4k Video Cams



Campus Optical Switch

10G Lightpath



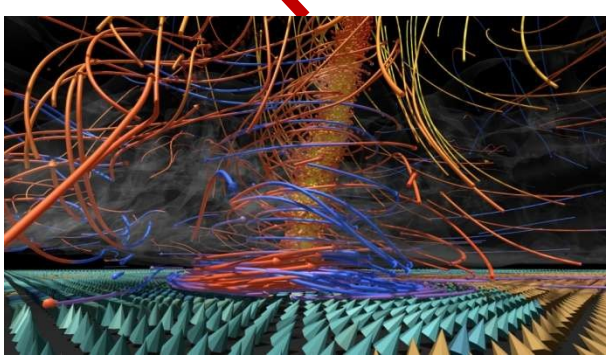
National LambdaRail

HPC

TeraGrid™



Data Repositories & Clusters



HD/4k Video Images

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