Digital Cinema and New Media Arts at Calit2

Keynote

Retreat of the Interdisciplinary Film and Digital Media Program

University of New Mexico

Albuquerque, NM

May 1, 2008

Dr. Larry Smarr

Director, California Institute for Telecommunications and Information Technology

Harry E. Gruber Professor,

Dept. of Computer Science and Engineering

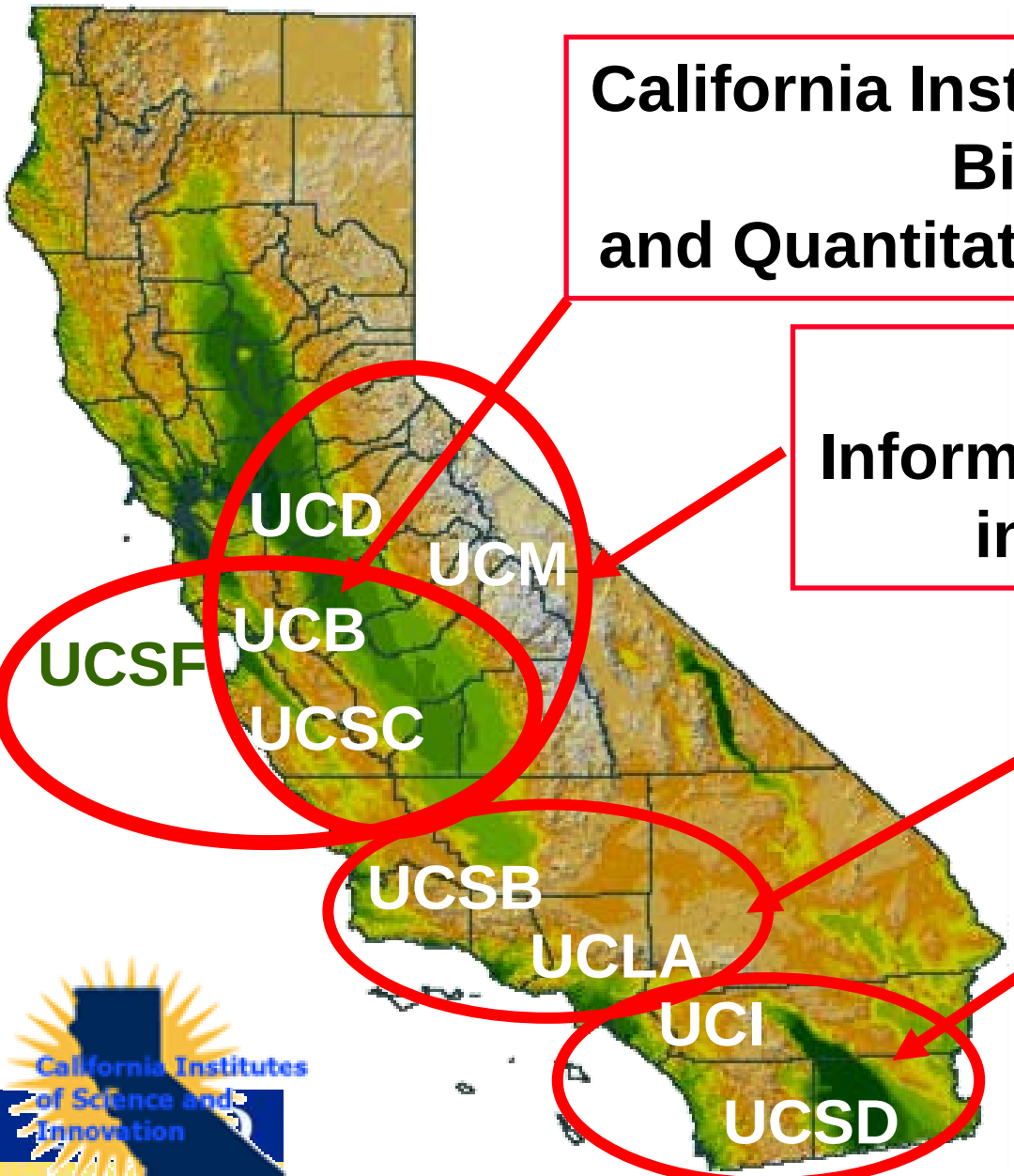
Jacobs School of Engineering, UCSD

UCSD

UCIrvine

it²

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



California Institute for Bioengineering, Biotechnology, and Quantitative Biomedical Research

Center for Information Technology Research in the Interest of Society

California NanoSystems Institute

California Institute for Telecommunications and Information Technology

California Institutes of Science and Innovation

UCHVR

www.ucop.edu/california-institutes

it²

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



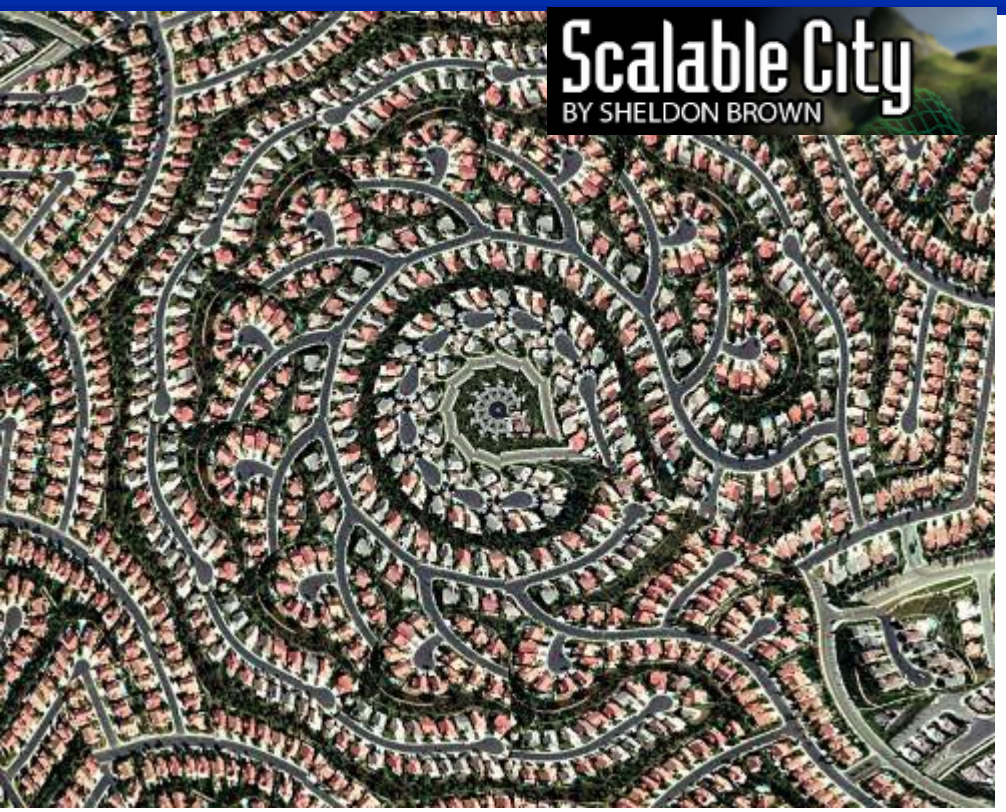
Integrating Technology Consumers and Producers Into "Living Laboratories"

UCSD
UCIrvine

Over 300 Grants and 200 Companies

it²

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



Bill Tomlinson, Lynn Carpenter UCI "EcoRaft"



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

By John Markoff
NYTimes November 5, 2005

SPECFLIC 1.0 – A Speculative Distributed Social Cinema by Adrienne Jenik



Two New Calit2 Buildings Provide 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

it²

Calit2 is Experimenting with Open Reconfigurable Work Spaces to Enhance Collaboration





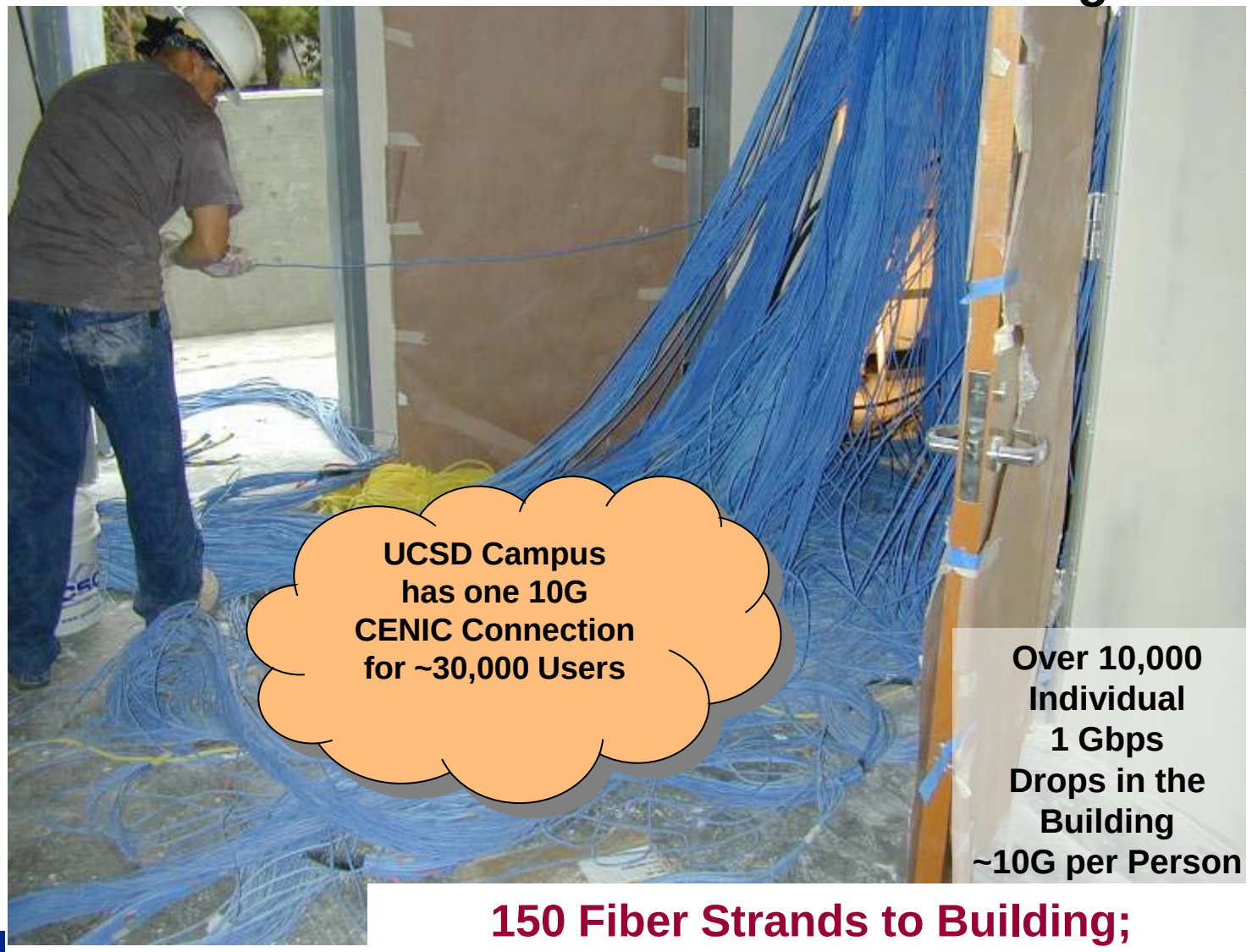


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Photos by John Durant; Barbara Haynor, Calit2

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

1.8 Million Feet of Cat6 Ethernet Cabling



24 Fiber Pairs to Each Lab

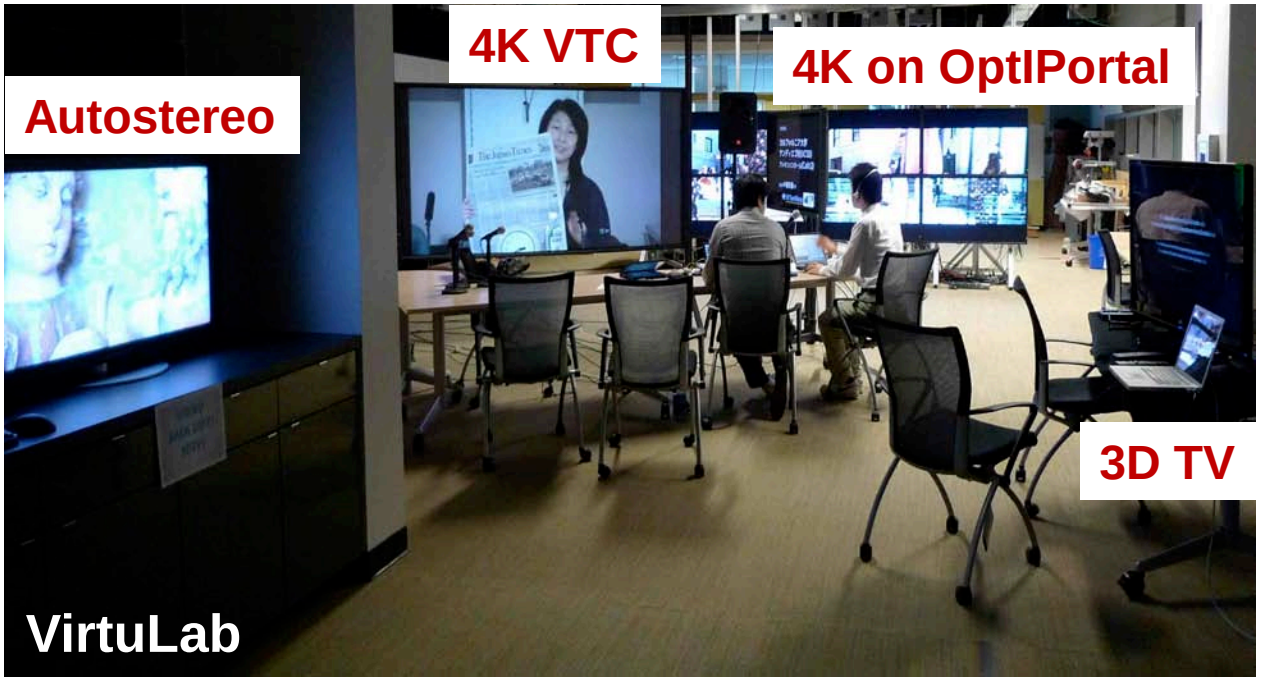
150 Fiber Strands to Building;
Experimental Roof Radio Antenna Farm
Ubiquitous WiFi

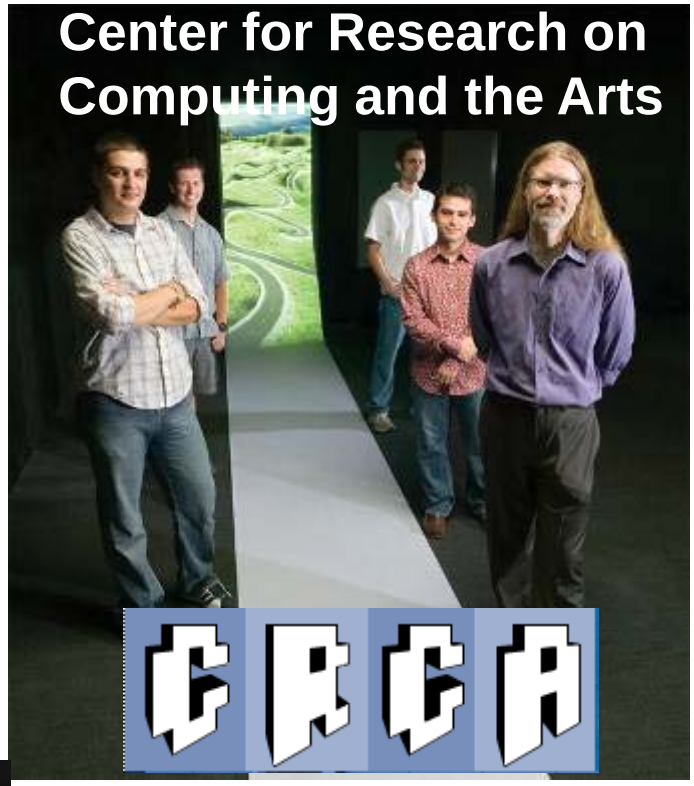
Photo: Tim Beach, Calit2

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Calit2 Was Designed with Advanced Multimedia Facilities



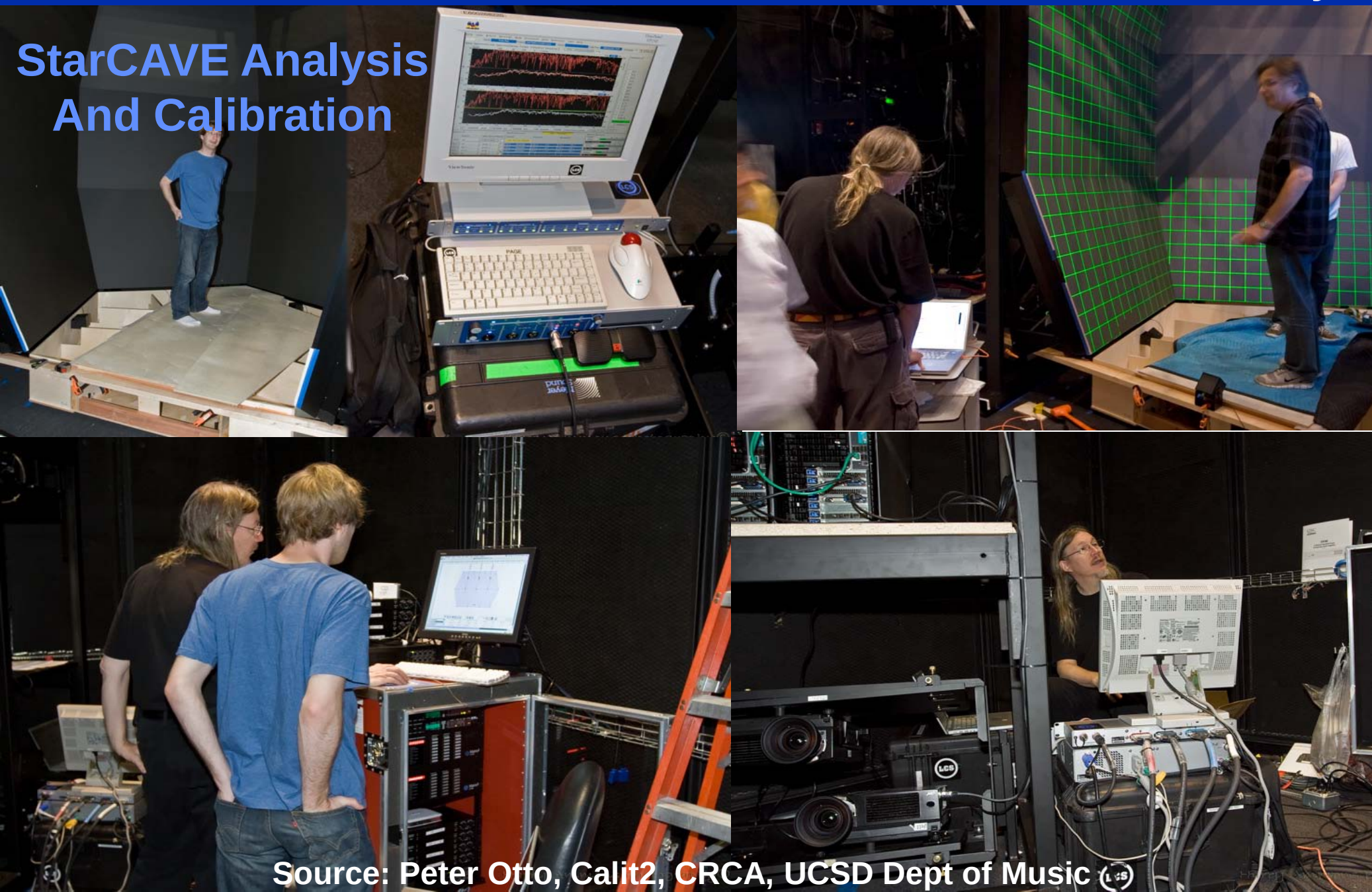




- Audio Spatialization
- Motion Capture
- Gaming Lab

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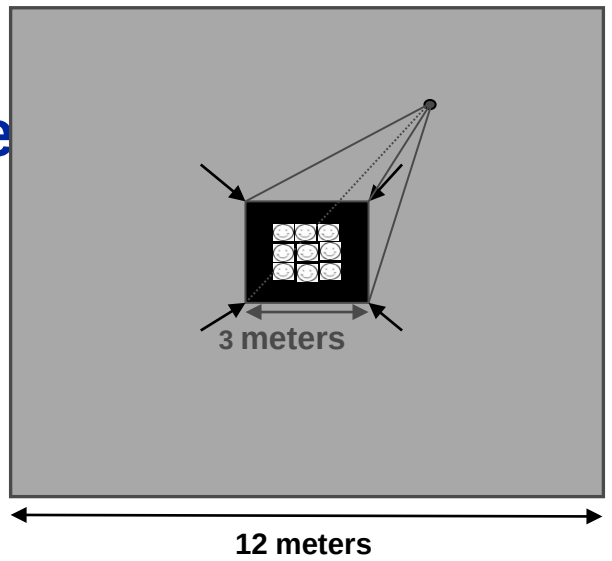
Meyer Sound - Calit2 Partnership:
StarCAVE Audio Hardware, Acoustical Analysis,
State-of-the-Art Sound for Cinema and Scientific Visualization Syst



Source: Peter Otto, Calit2, CRCA, UCSD Dept of Music

Virtual Audio Environment Research:
A General Model for 3D Spatial Processing of Sound Sources

- **Objectives**
  - Accurate and Convincing Sound Source Localization using Loudspeakers
  - Acoustical Space Modeling
- **Two Nested rooms**
  - Listening Room as the Inner Room
  - Virtual Acoustic Space as the Outer Room
  - Speakers as Openings on the Perimeter of the Inner Room
- **Processing Per Audio Sample ~44,100 times a second**
  - 2D spatial Processing/Sample (4 Speakers Each Order)
    - 1 Direct, 4 First order Reflection, 12 Second Order
  - 3D spatial Processing/Sample (8 Speakers Each Order)
    - 1 Direct, 6 First Order Reflection, 30 Second Order



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Shahrokh Yadegari, UCSD Dept. of Theatre and Dance, CRCA
it²

Calit2 Has a Variety of Computationally Controlled Sculpture Machines











Sculptures created from a variety of computer controlled modeling and fabrication processes. They each begin with the same seed of 3D object data that is transformed by a variety of algorithmic and modeling manipulations. The resulting sculptures are the intersection between material properties, object data space and constructive processes.

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Calit2 New Media Arts Gallery: A Space for Interactive Exhibits



UPCOMING EXHIBIT

ANTI-PERSONNEL MINES PROJECT

Installations by Carlos Trilnick



On April 16, the gallery@calit2 will open its spring 2009 exhibition, Anti-Personnel Mines Project, by Argentine new-media artist and former UC San Diego visiting professor Carlos Trilnick. The work consists of two installations – the core interactive exhibit in the gallery itself, and a landscape portion that will take place only during the first week of the exhibition, in the Engineering Courtyard off Warren Mall on UCSD's La Jolla campus. The public is invited to attend an opening reception and panel discussion featuring the artist and policy experts about the long-term devastation that land mines produce – even decades after an armed conflict has ended.

Special Event



Violence, Technology and Public Intervention

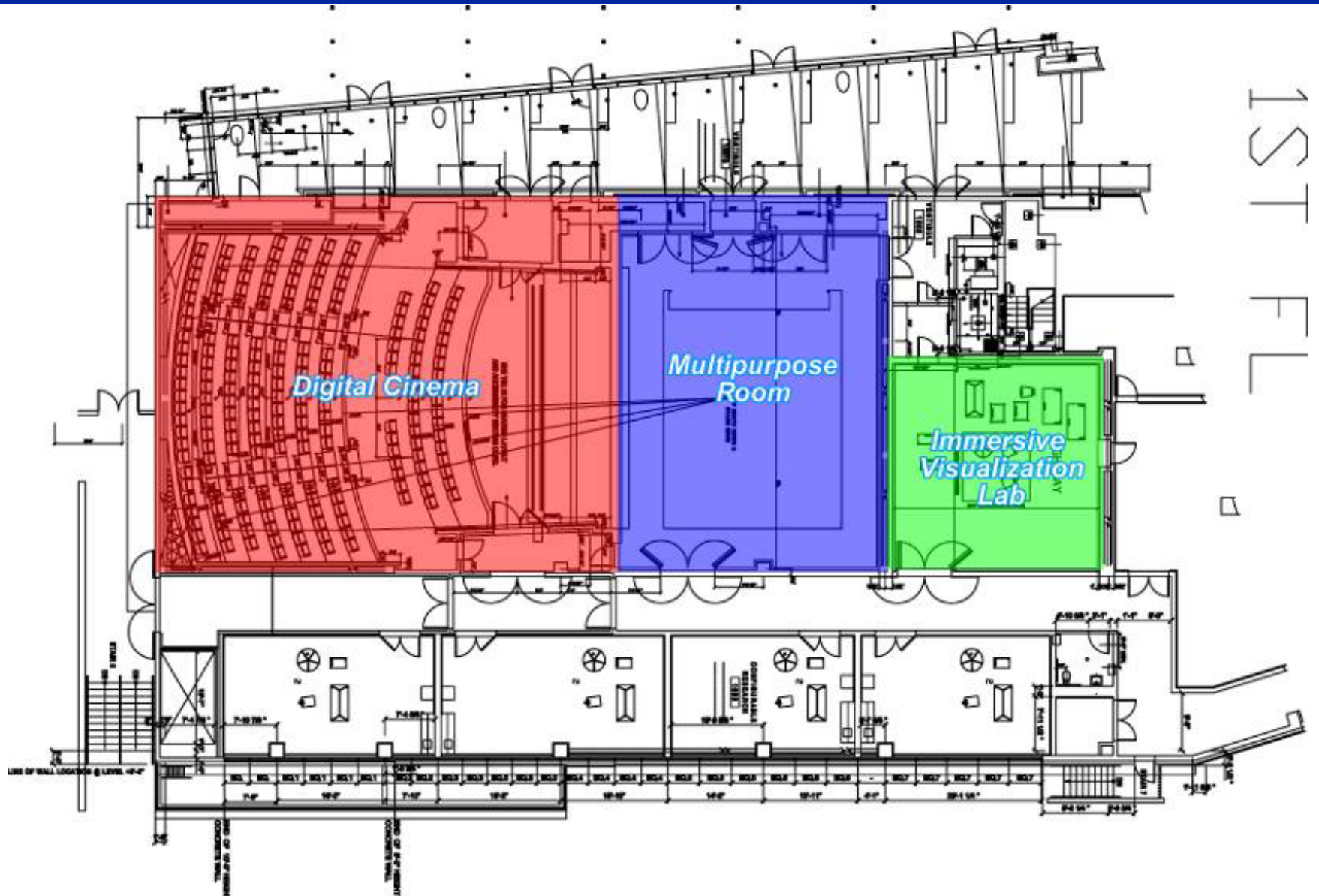
Keynote Speaker:
Carlos Trilnick

Date: April 24, 2009
Time: Noon - 5:00pm
Location: Calit2 Theater, Atkinson Hall, UC San Diego

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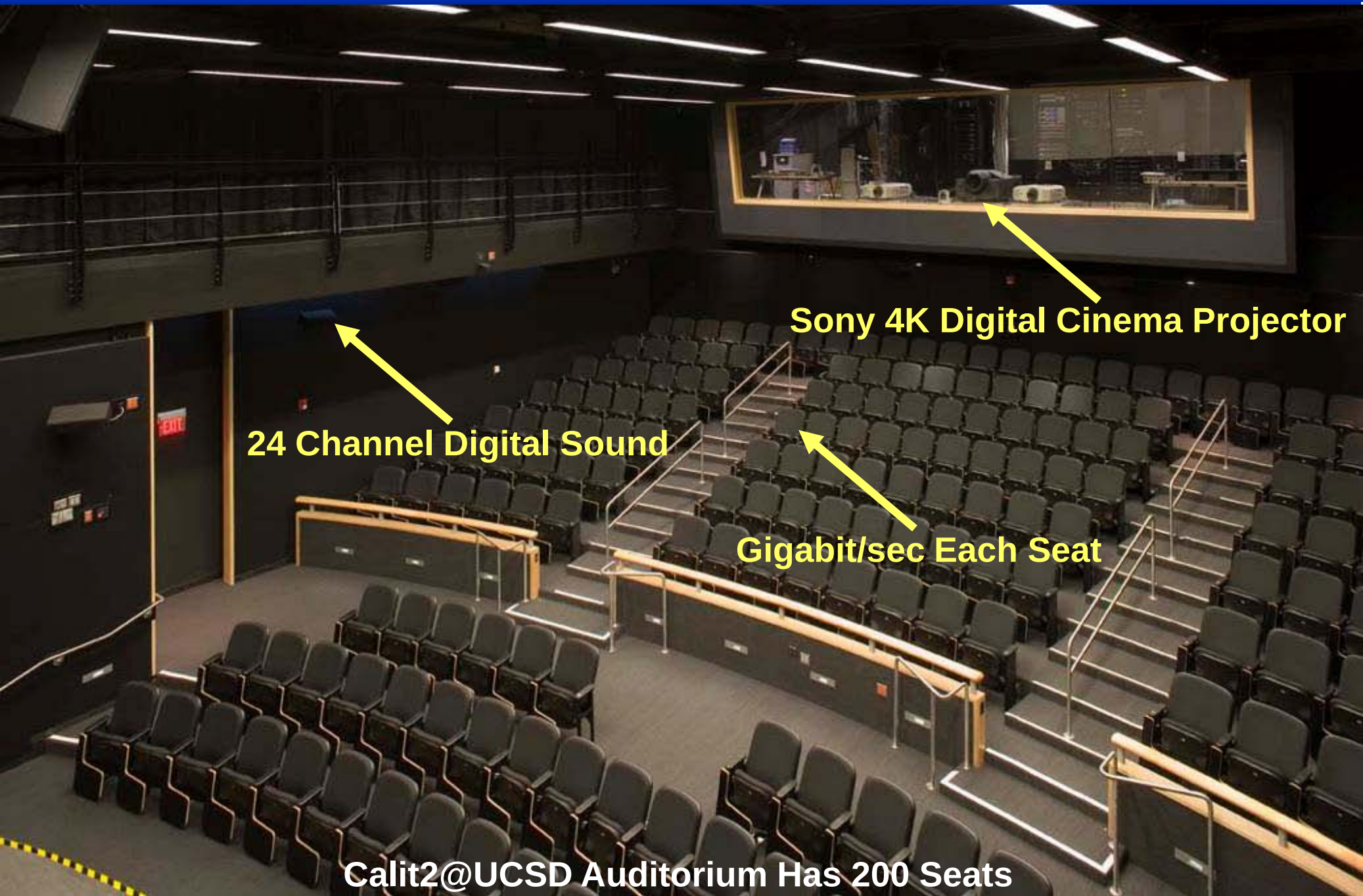
http://gallery.calit2.net

Calit2@UCSD Designed Three Experimental New Media Arts Spaces into Atkinson Hall



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Digital Auditorium:
Building a Global Collaboratorium



Borderless Collaboration
Between Global University Research Centers at 10Gbps

Maxine Brown, Tom DeFanti, Co-Chairs

iGrid 2005

THE GLOBAL LAMBDA INTEGRATED FACILITY

www.igrid2005.org

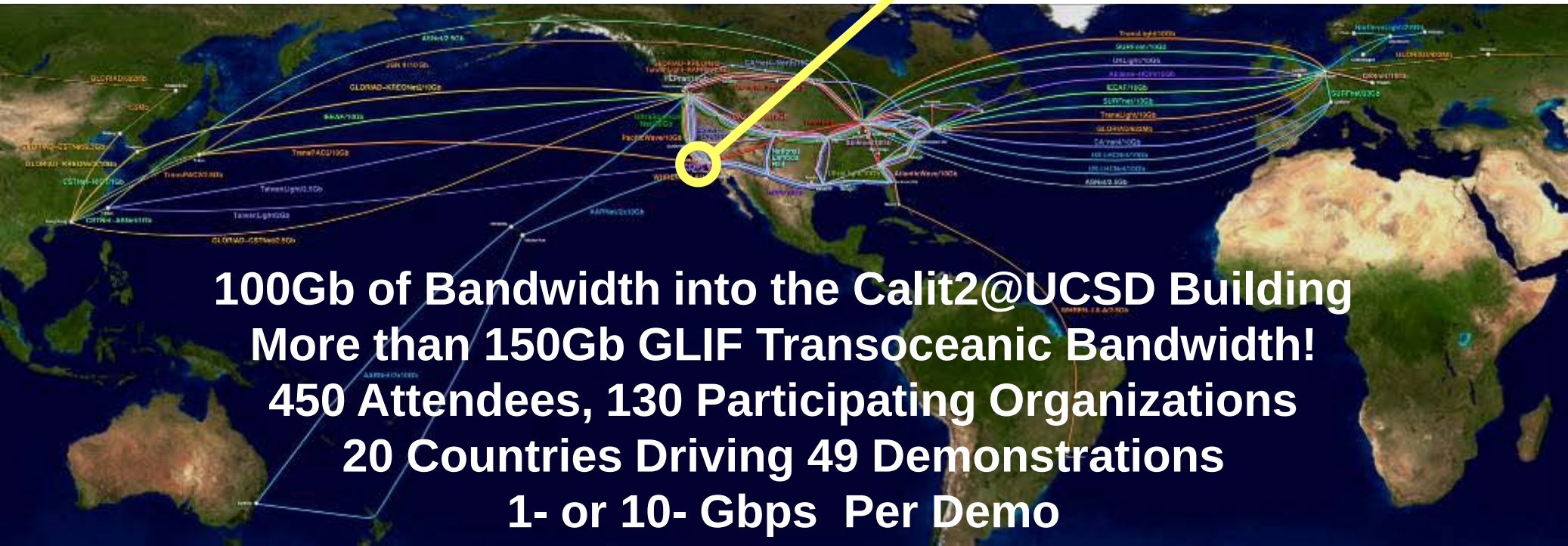


the UC Discovery Grant

September 26-30, 2005

Calit2 @ University of California, San Diego

California Institute for Telecommunications and Information Technology



100Gb of Bandwidth into the Calit2@UCSD Building

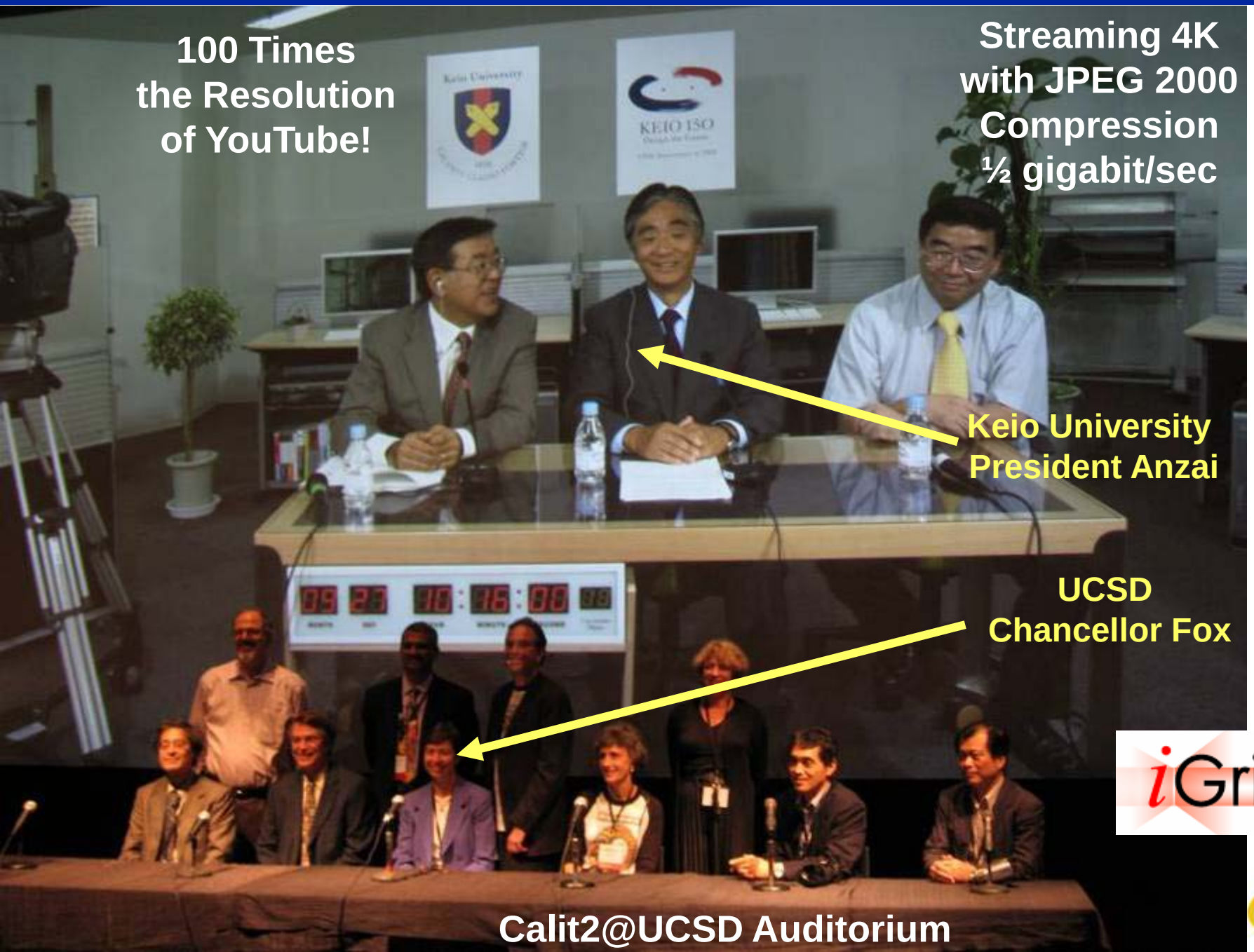
More than 150Gb GLIF Transoceanic Bandwidth!

450 Attendees, 130 Participating Organizations

20 Countries Driving 49 Demonstrations

1- or 10- Gbps Per Demo

First Trans-Pacific Super High Definition Telepresence Meeting Using Digital Cinema 4K Streams



CineGrid™

Lays Technical Basis for Global Digital Cinema

Sony
NTT
SGI

iGrid2005

it²

Calit2@UCSD Multipurpose Room—
A “Black Box” Theatre Space



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UCIrvine

- 100-seat Reconfigurable Space
- Performances/Seminars

it²



The Salk Institute in La Jolla, CA
on October 11, 2008

Pulitzer Prize-Winning Roger Reynolds: Calit2 Composer-in-Residence *Sanctuary* Project

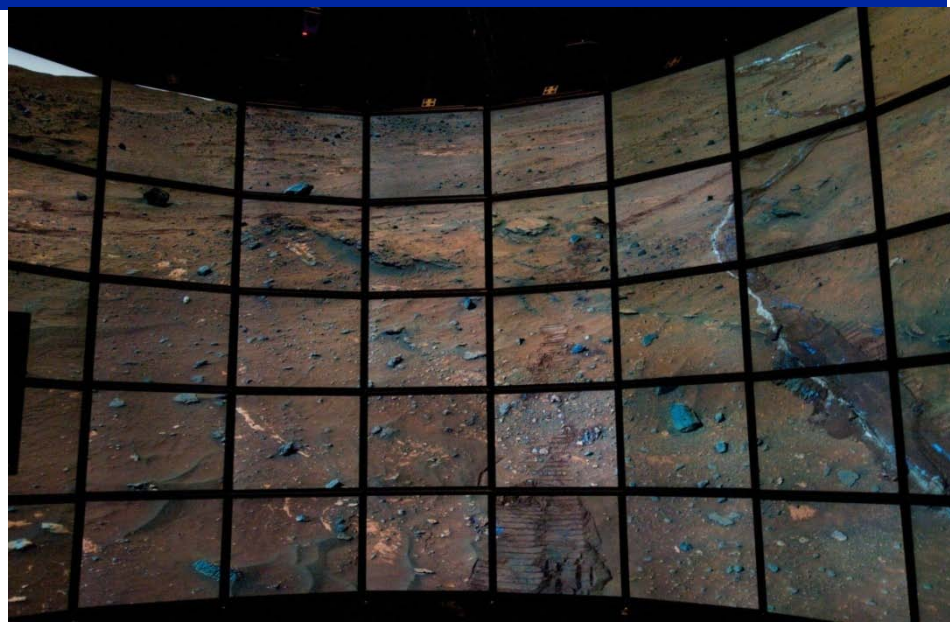


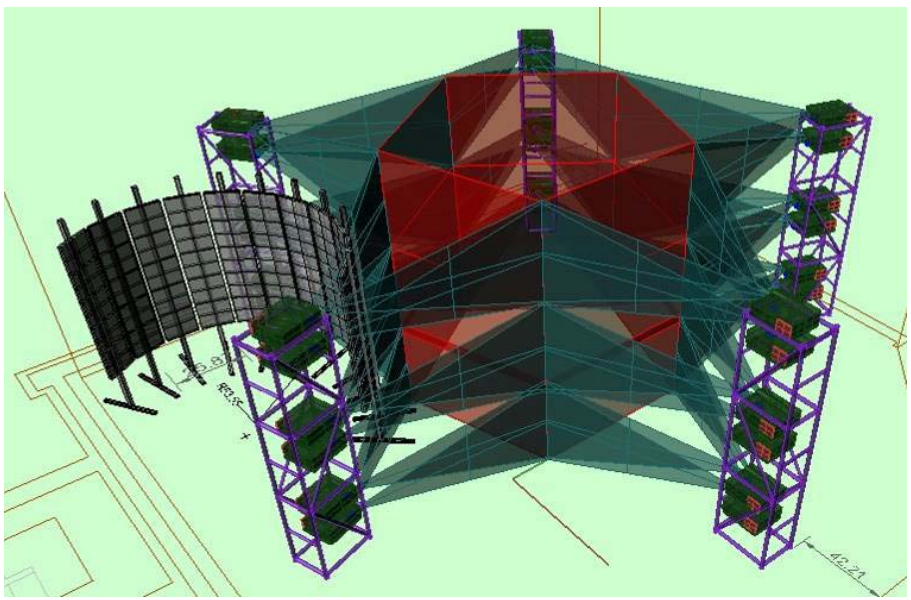


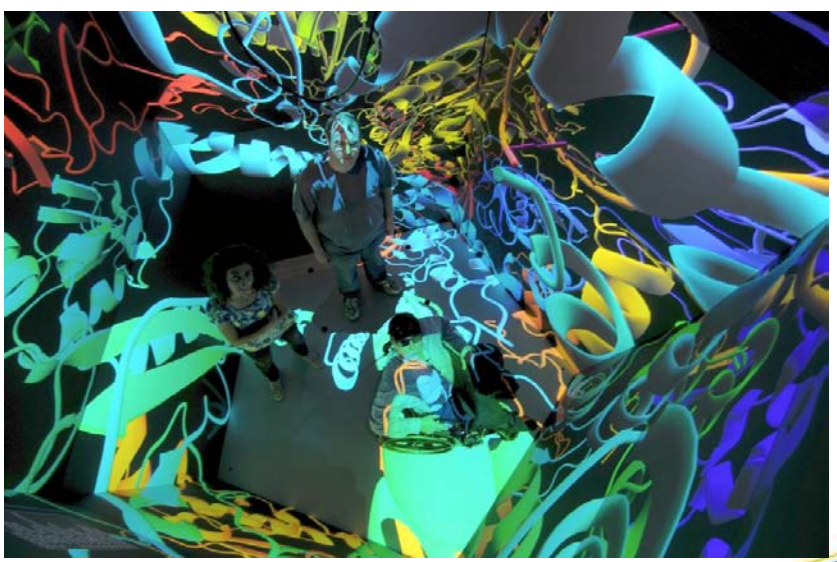
Source: Peter Otto, Calit2, CRCA, UCSD Dept of Music

Filling the 30’ x 30’ “Hole” in the Calit2 Building With Next Generation Virtual Reality

- **Varrier Autostereo Virtual Reality**
  - **High Res Stereo Without Glasses!**
  - **65 High Resolution LCD Tiles**
  - **45 Mpixels/eye of Visual Stereo**
- **StarCAVE**
  - **32 HD Projectors!**
  - **15 Meyer Sound Speakers+Subwoofer**

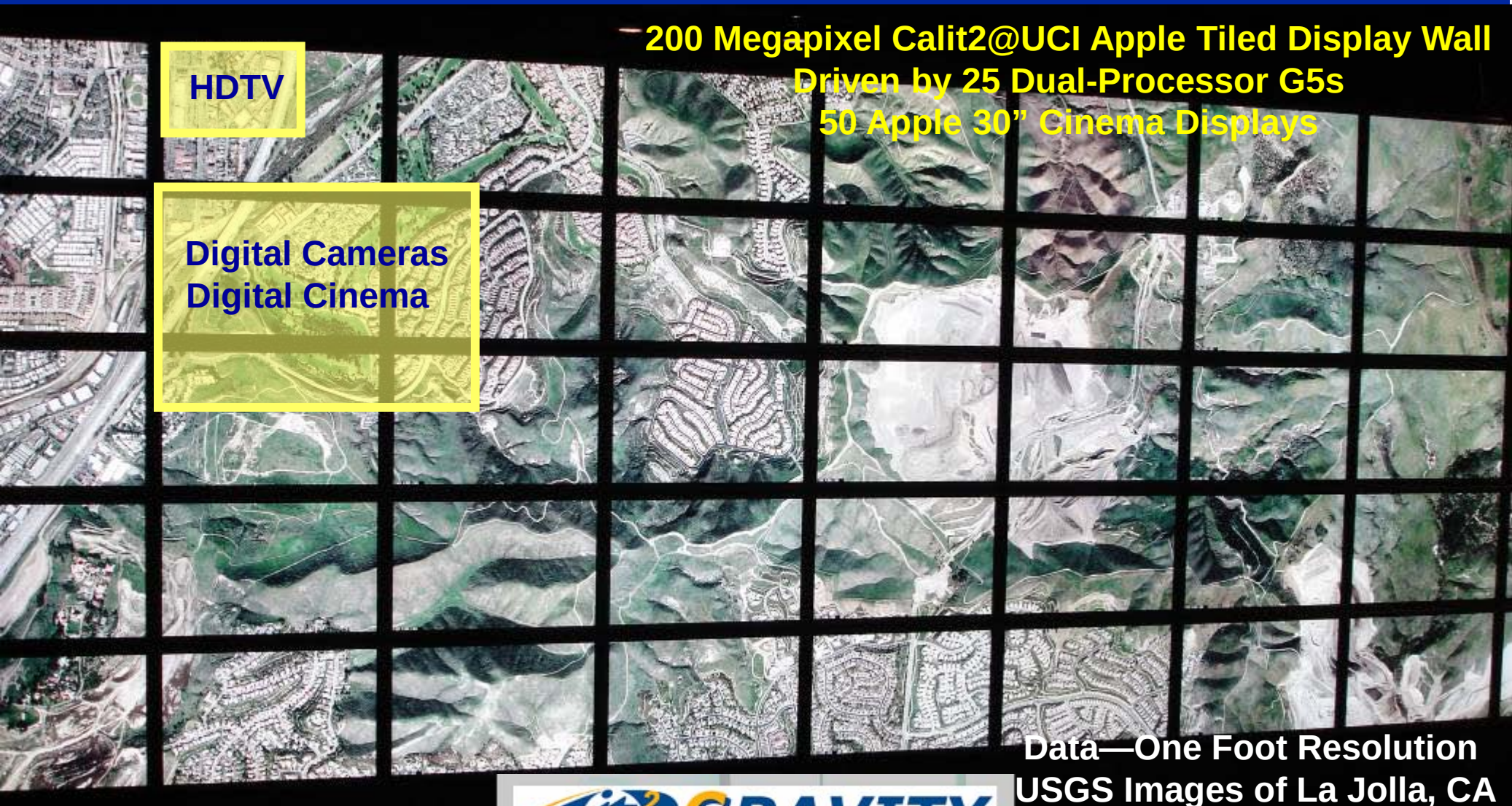






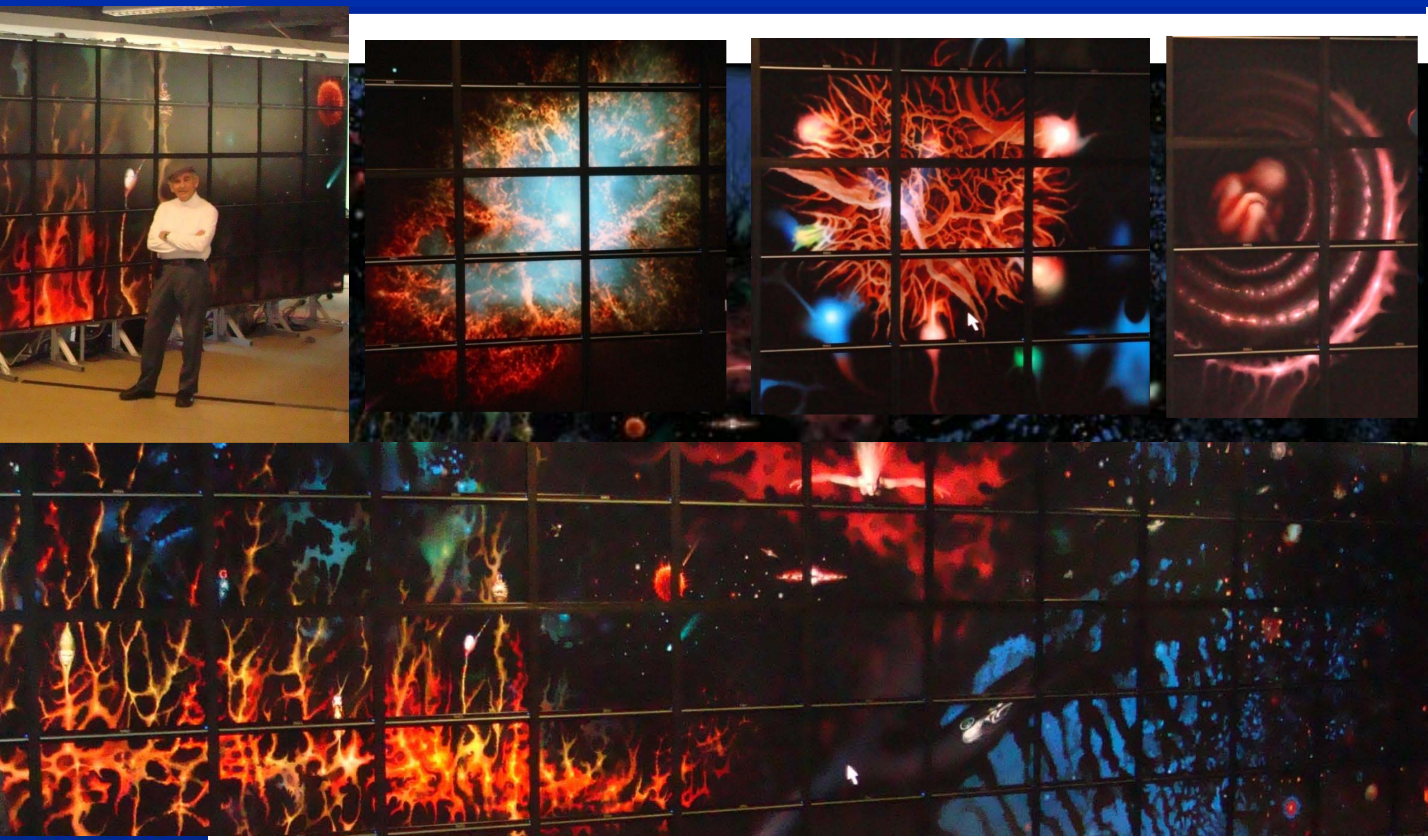
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OptIPortals: Toward Gigapixel Tiled Display Walls Providing Scalable Digital Interactive Pixel Spaces



Source: Falko Kuester, Steve Jenks, Calit2@UCI
NSF Infrastructure Grant

High Resolution Digital Media for Art Creation: Tree of Life by Roger Ferragallo (546 Megapixel)



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www.ferragallo.com/digitalpaintings.html

Source: Falko Kuester, HiPerSpace, Calit2@UCSD

it²

UCSD is Pioneering the Fusion of Engineering with the Arts

CISA3

DAH UCSD Jacobs Calit2

Center of Interdisciplinary Science for Art, Architecture, and Archaeology

UC San Diego Division, California Institute for Telecommunications and Information Technology





"As Dan Brown wrote in his blockbuster novel, *The DaVinci Code*, Italian art dagnostician Maurizio Seracini had unveiled the unsettling truth."

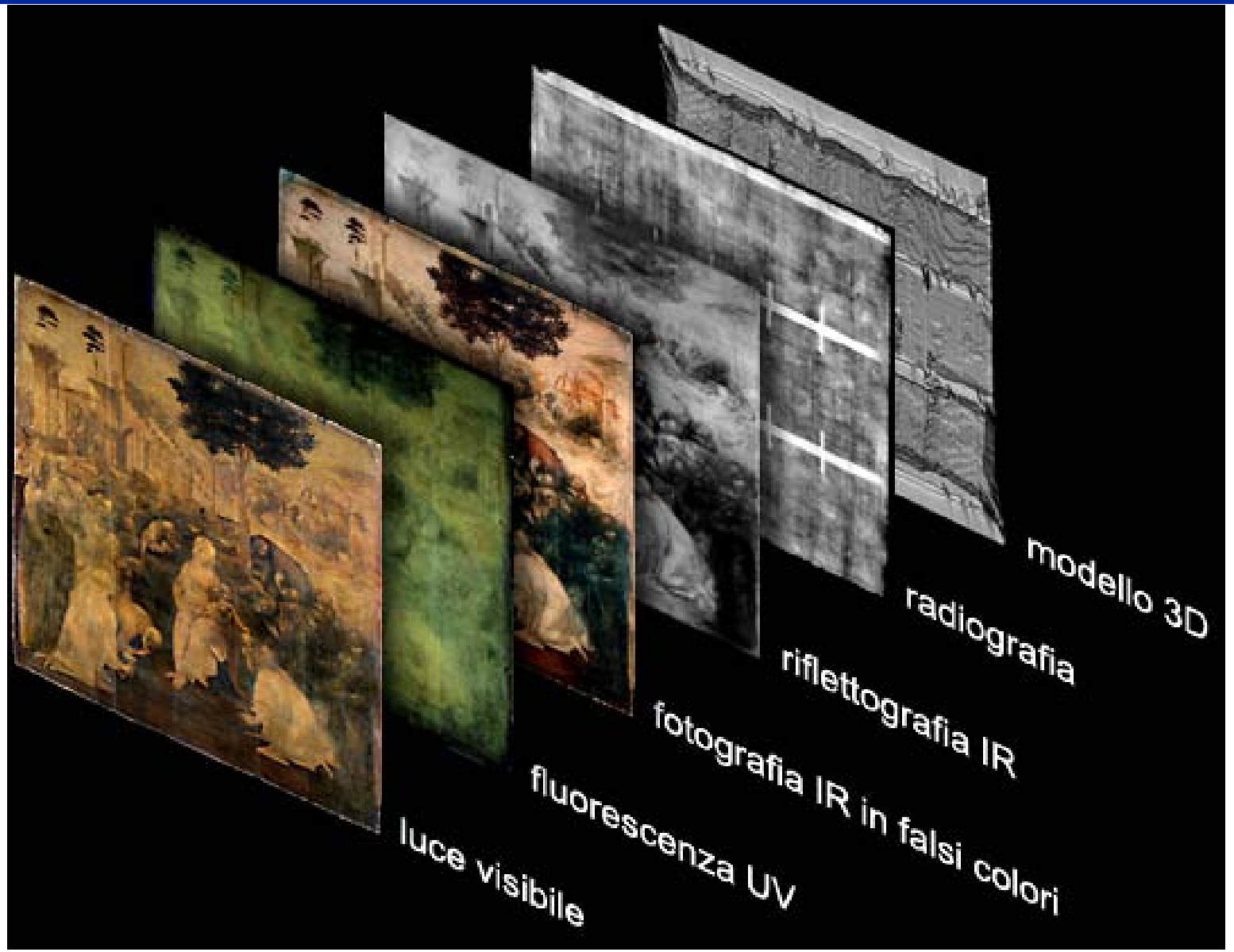
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Arts and Humanities

UCSD Jacobs School of Engineering

it2

Multi-Spectral Imaging Diagnostics: Discovering the "Painting Behind the Painting"



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Source: Maurizio Seracini, Director CISA3

it²

Digital Clinical Charts – Collaboration with the San Diego Museum of Art

Source: Maurizio Seracini, Director CISA3

Art History Research



Archive documents



Critical fortune



Iconography



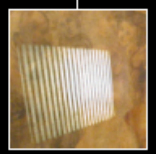
Iconology



Bibliography

DIAGNOSTIC IMAGING

Scientific Research



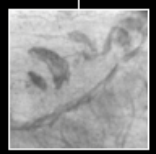
3D modelling with structured light



Photomicrography



UV fluorescence photography



Infrared reflectography



IR photography

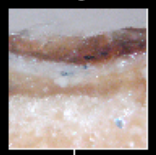


Pseudo-color IR photography

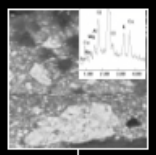


X-radiography

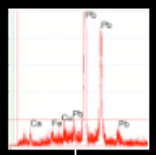
Cross section analysis



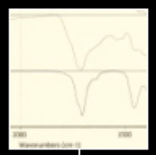
SEM-EDS



XRF



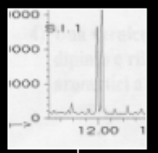
Micro FT-IR



Micro Raman

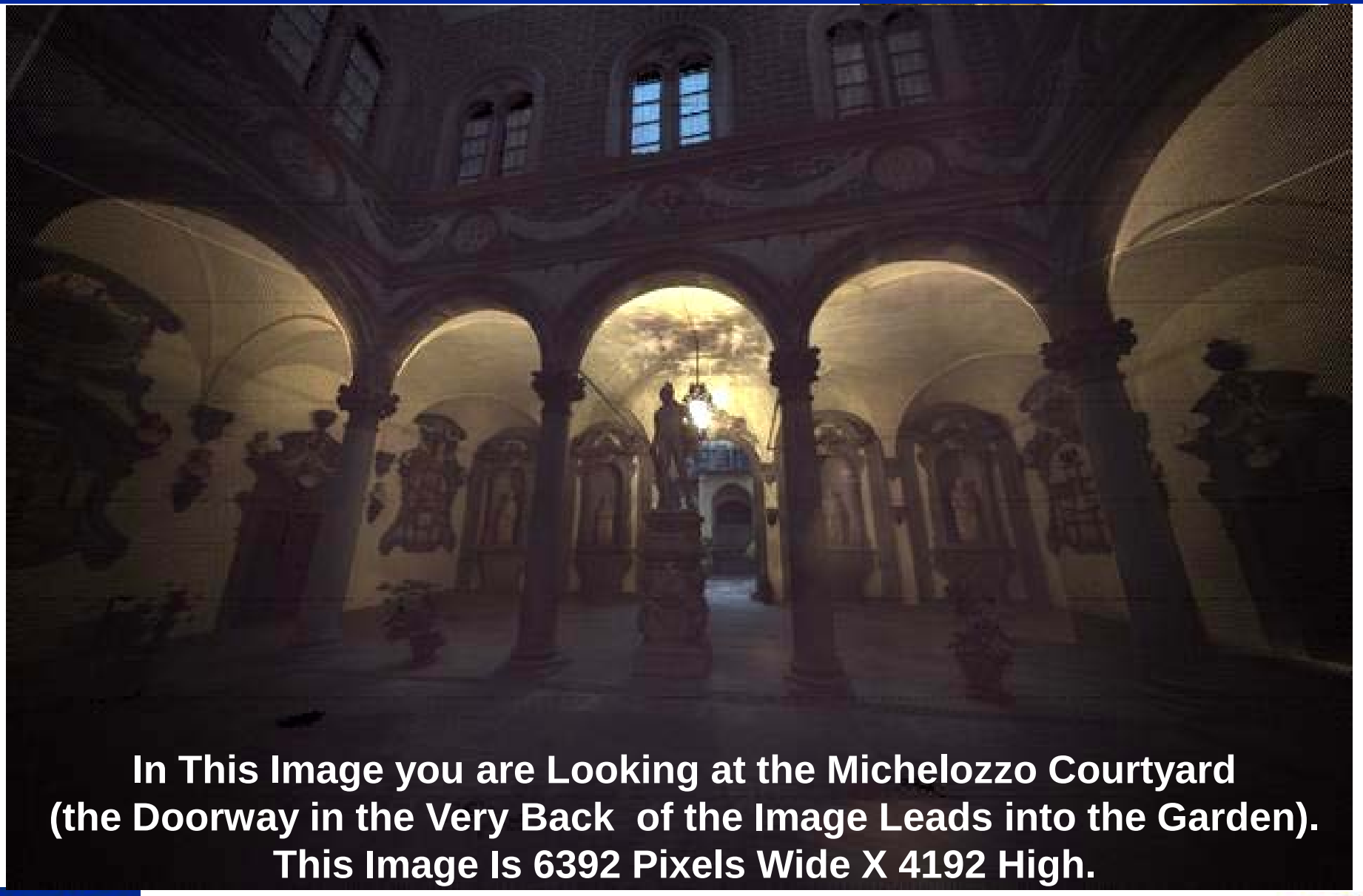


GC/MS



ANALYTICAL DIAGNOSTICS

Cultural Heritage Virtual Reality:
Photo Texture Mapping onto High Resolution Laser 3D Scanning



In This Image you are Looking at the Michelozzo Courtyard (the Doorway in the Very Back of the Image Leads into the Garden). This Image Is 6392 Pixels Wide X 4192 High.

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Source: Calit2 Team Led by Maurizio Seracini, Director CISA3

it²

Exploring Cultural Heritage Virtual Realities Using Large Scale OptIPortals

Falko Kuester and Maurizio Seracini, CISA3

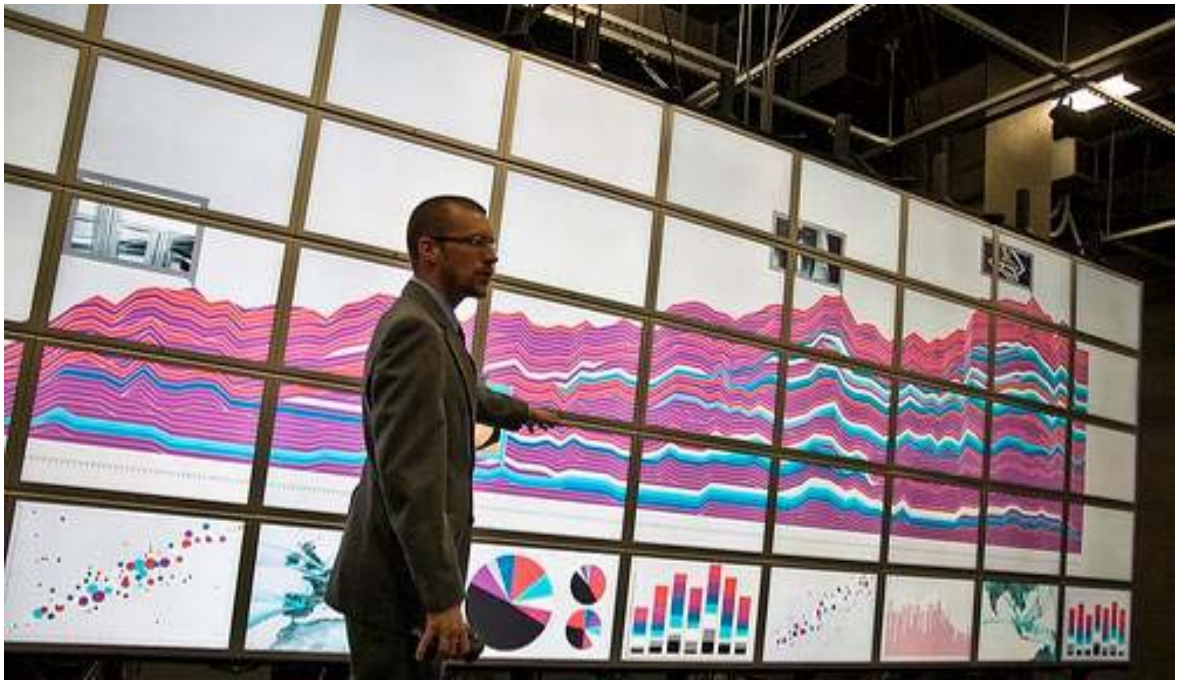


A Real-Time Rendered 3D Point Cloud Model (1 Billion Points) of Palazzo Medici Being Navigated via a Wireless Sony Game Controller

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The New Field of Scalable Cultural Analytics: Finding Patterns in Massive Amounts of Cultural Data



Calit2@UCI
200 Mpixel
HIPerWall



Software Studies Initiative, Calti2@UCSD

Interface Designs for Cultural Analytics Research Environment

Jeremy Douglass (top) & Lev Manovich (bottom)

Second Annual Meeting of the Humanities, Arts, Science, and Technology Advanced Collaboratory (HASTAC II)
UC Irvine May 23, 2008

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it2

Lev Manovich on High Performance Cultural Analytics

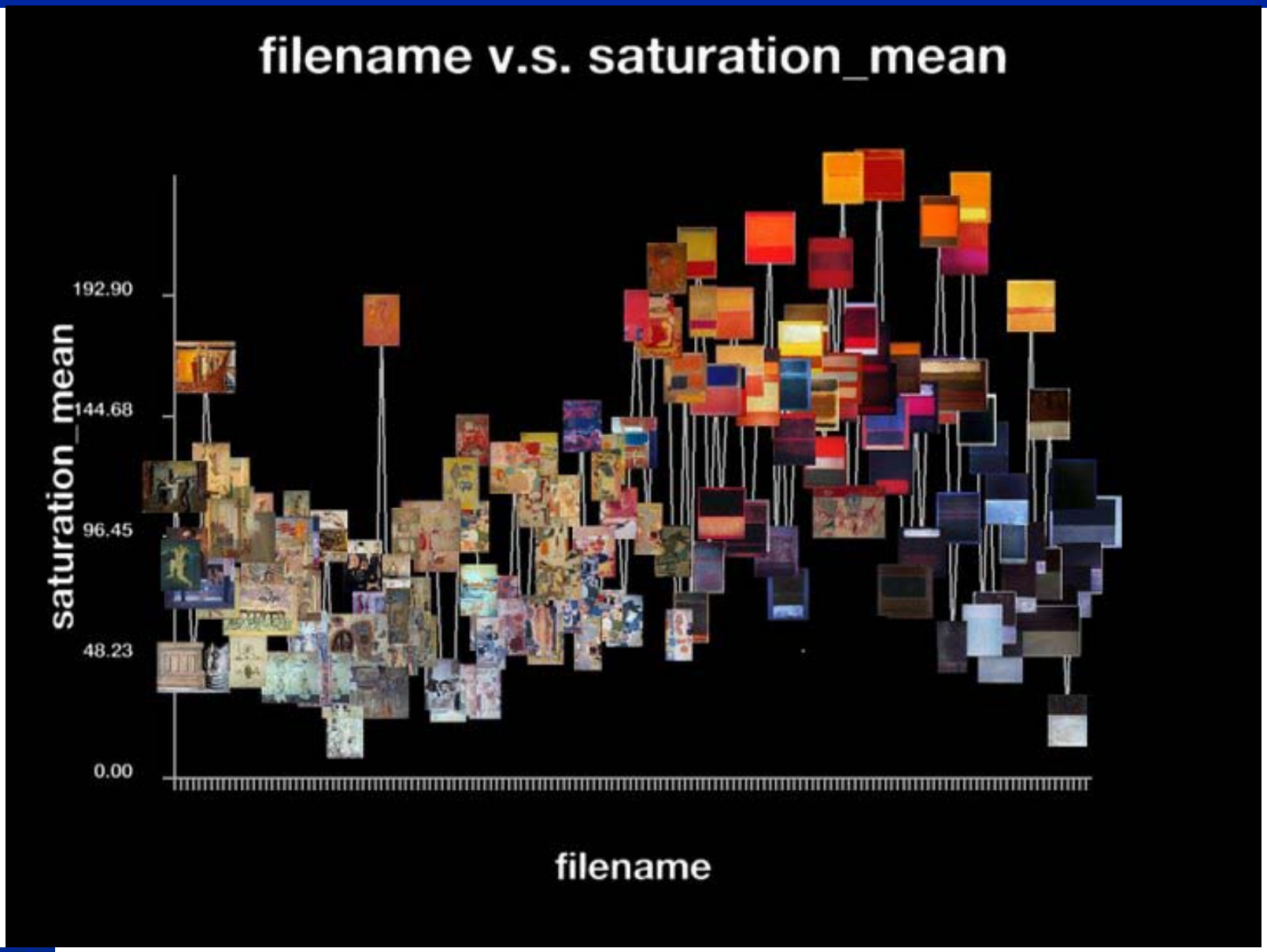


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www.youtube.com/watch?v=xtbzVuDqSas

it²

Digital Analysis of an Artist's Lifetime Production
151 Paintings by Rothko



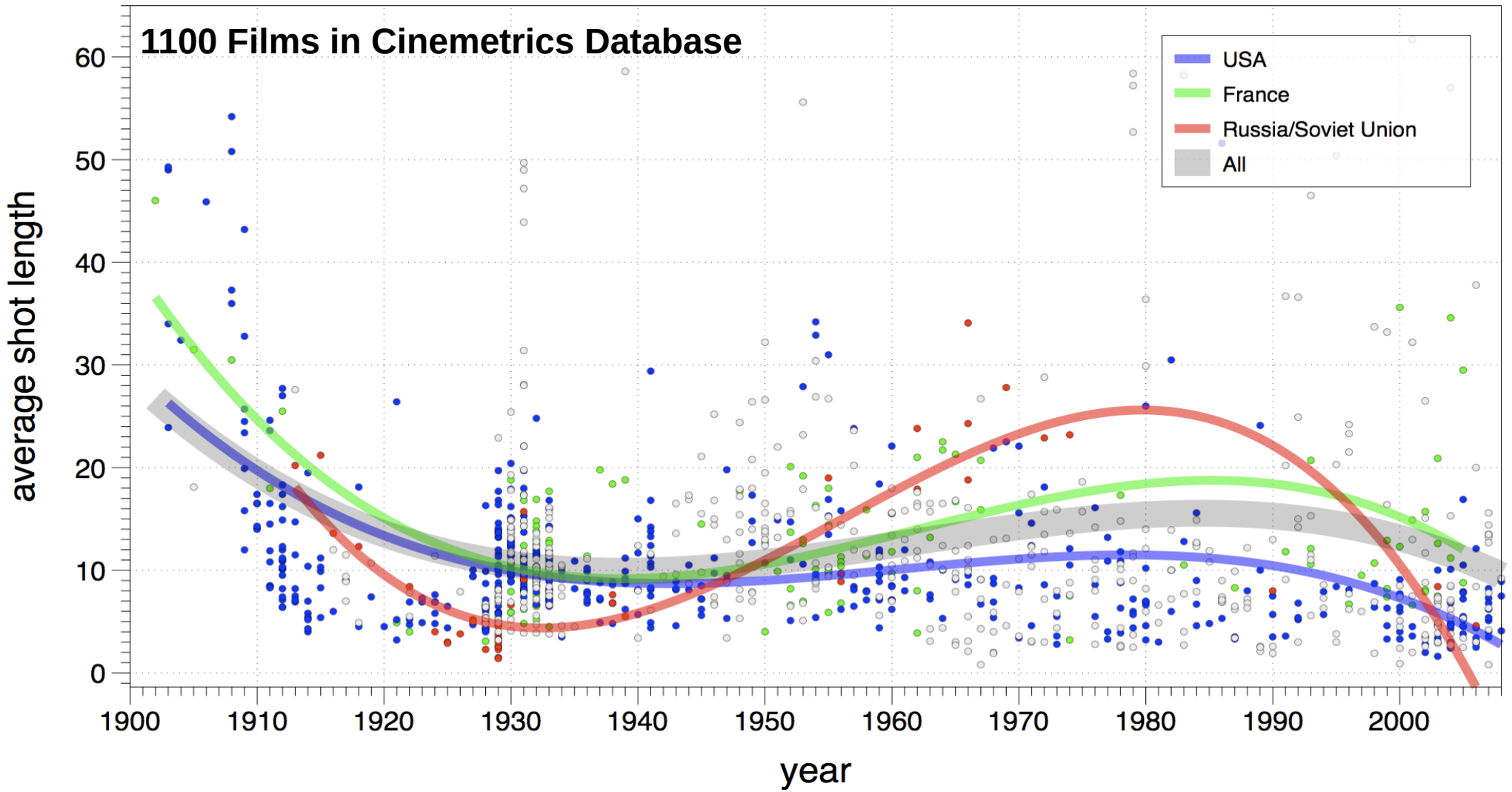
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Source: Software Studies Initiative

it²

Software Studies Initiative
FilmHistory.viz

Average shot length, feature films 1900-2008



UCSD
UCIrvine

Source: Jeremy Douglass, Lev Manovich, Calit2, UCSD

it²

CineGrid 4K Digital Cinema Projects: "Learning by Doing"

CineGrid @ iGrid 2005



CineGrid @ AES 2006



CineGrid



CineGrid @ Holland Festival 2007



CineGrid @ GLIF 2007

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it²

CineGrid Founding Members

- Cisco Systems
- Keio University DMC
- Lucasfilm Ltd.
- NTT Network Innovation Laboratories
- Pacific Interface Inc.
- Ryerson University/Rogers Communications Centre
- San Francisco State University/INGI
- Sony Electronics America
- University of Amsterdam
- University of California San Diego/Calit2/CRCA
- University of Illinois Chicago/EVL
- University of Illinois at Urbana-Champaign/NCSA
- University of Southern California/School of Cinematic Arts
- University of Washington/Research Channel



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The Founding Members of CineGrid are an extraordinary mix of media arts schools, research universities, and scientific laboratories connected by 1GE and 10GE networks used for research & education



Ryerson University's Rogers Communications Centre Linking to CA*net4 and CineGrid

- **In the Heart of Toronto - Canada's Largest Media Centre**
  - **Creating Digital Cinema/Visualization Lab**
  - **School of Image Arts and School of Radio and Television Arts**
    - **1300 Undergraduate Students**

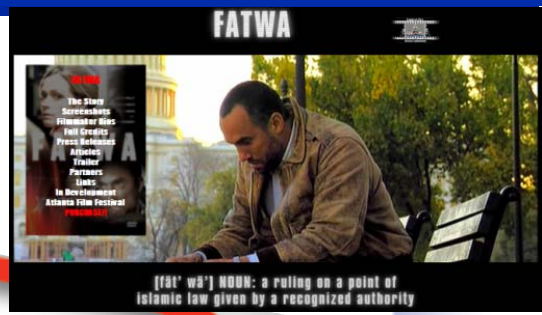


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Connection to Calit2
Achieved Dec 18, 2006!

it2

Calit2 and the Venter Institute Test CineGrid™ with HDTV Movie by Independent Film Director John Carter



10 Gbps CaveWave lambda

NLR POP (Seattle)

Pacific Ocean

Atlantic Ocean



Movie director John Carter at the Venter Institute in Maryland talking with the Calit2 audience in California over the optical link before the screening.



Calit2 Auditorium

NLR POP (McLean, VA)

DRAGON

Sony HDTV JH-3

JCVI

J. Craig Venter INSTITUTE

Rockville, MD

CineGrid™

UCSD

UCIrvine

Coast-to-Coast Screening of New HD Movie—Live Demonstration of 21st Century Entertainment Delivery (June 14, 2006)

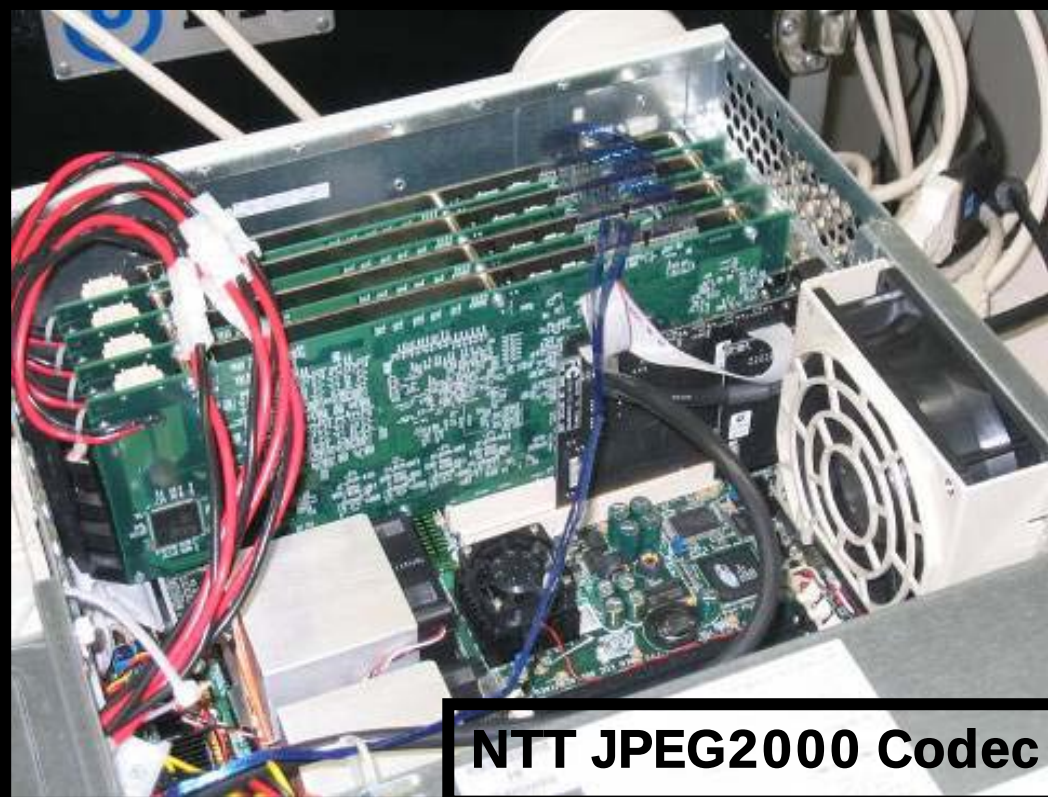
it²

The CineGrid Node at Keio University, Tokyo Japan





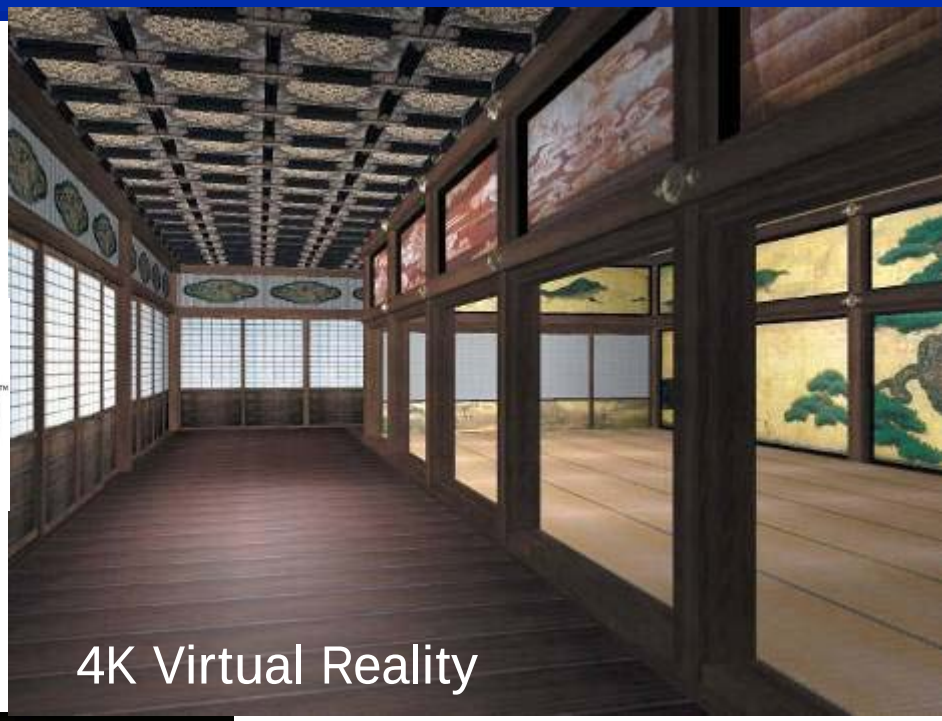




CineGrid @ iGrid2005:
Six Hours of 4K Projected in Calit2 Auditorium

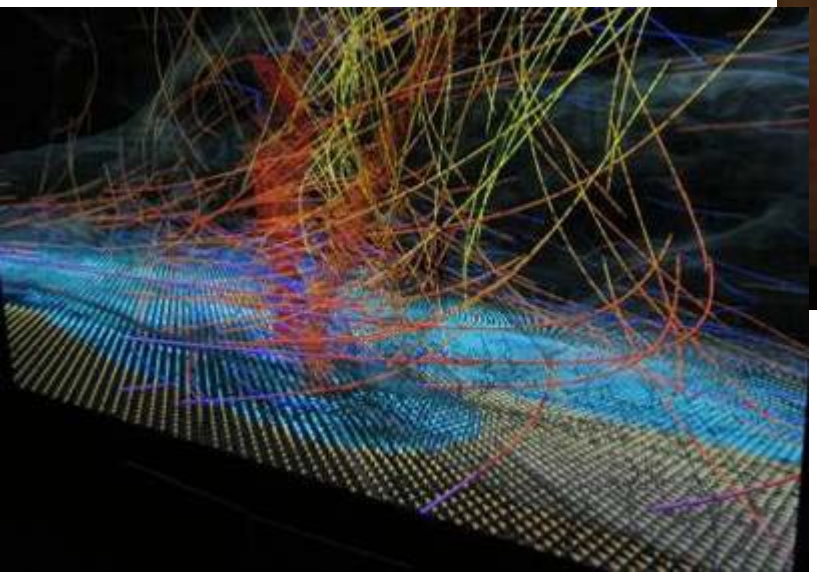
4K Distance Learning





4K Virtual Reality

4K Scientific Visualization





4K Digital Cinema

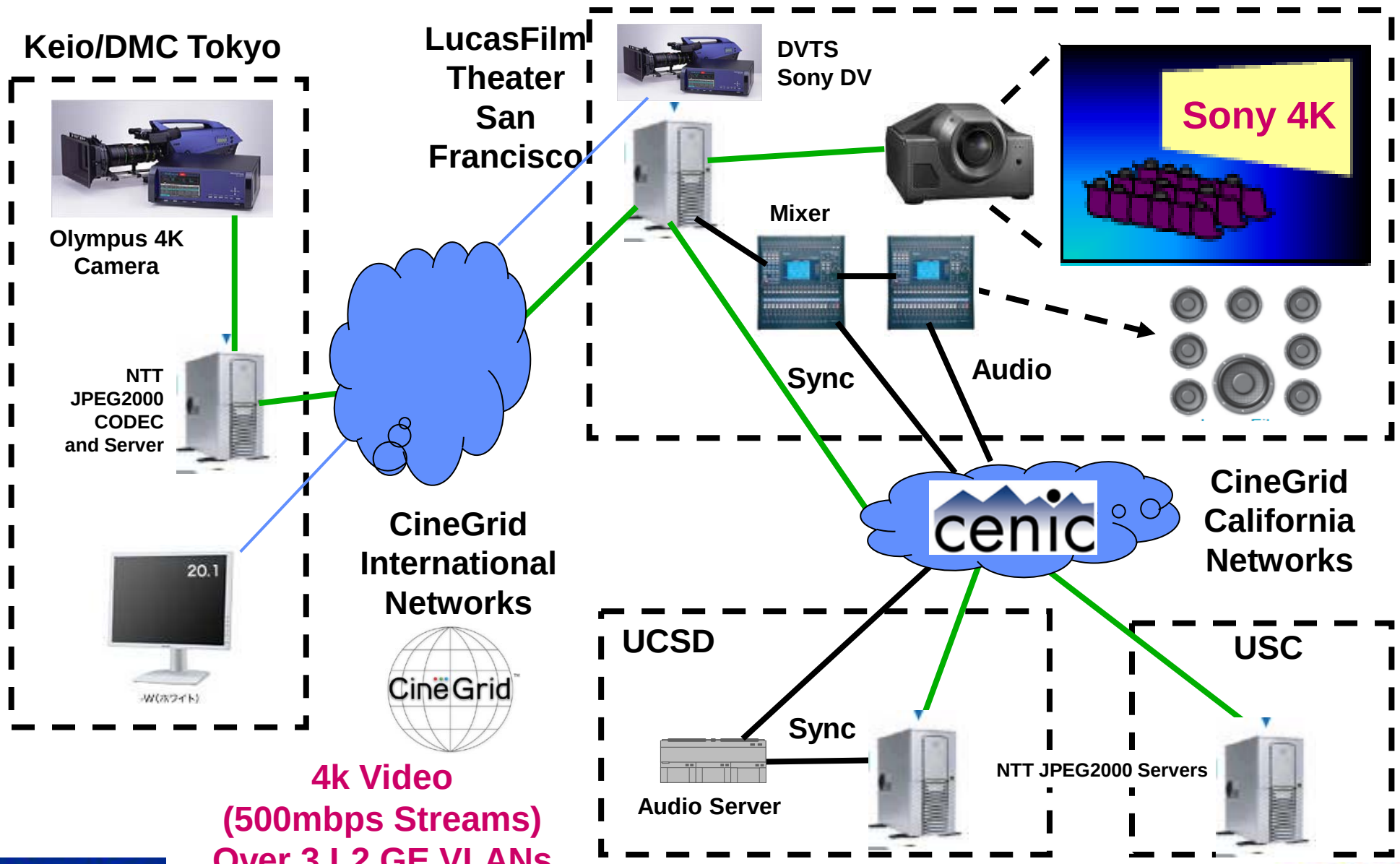
4K *Anime*



Source: Laurin Herr

Audio Engineering Society (AES)/LucasFilm

Trans-Pacific CineGrid 4K Demonstration, October 8, 2006



4k Video (500mbps Streams) Over 3 L2 GE VLANs Plus 24 Channel Audio Over Another GE

UCSD UCIrvine

Source: Peter Otto, Calit2



4K Film Shoot in the Canals of Amsterdam, CineGrid Holland Festival 2007



Swimming Fiber the Last 500m to the Muziekgebouw: CineGrid @ Holland Festival 2007









CineGrid™

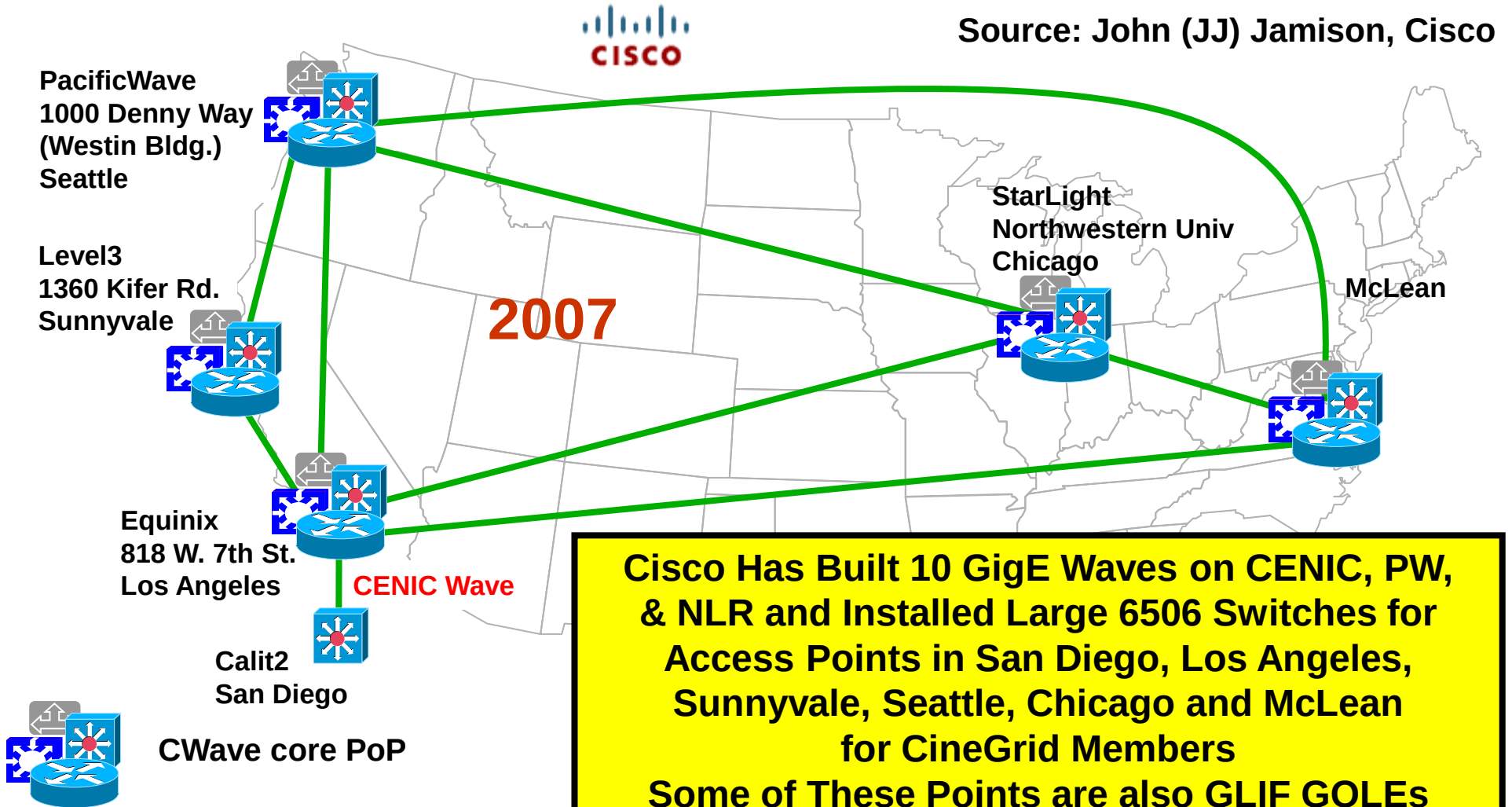
it²

CineGrid @ Holland Festival 2007
As Seen in the Calit2@UCSD Auditorium



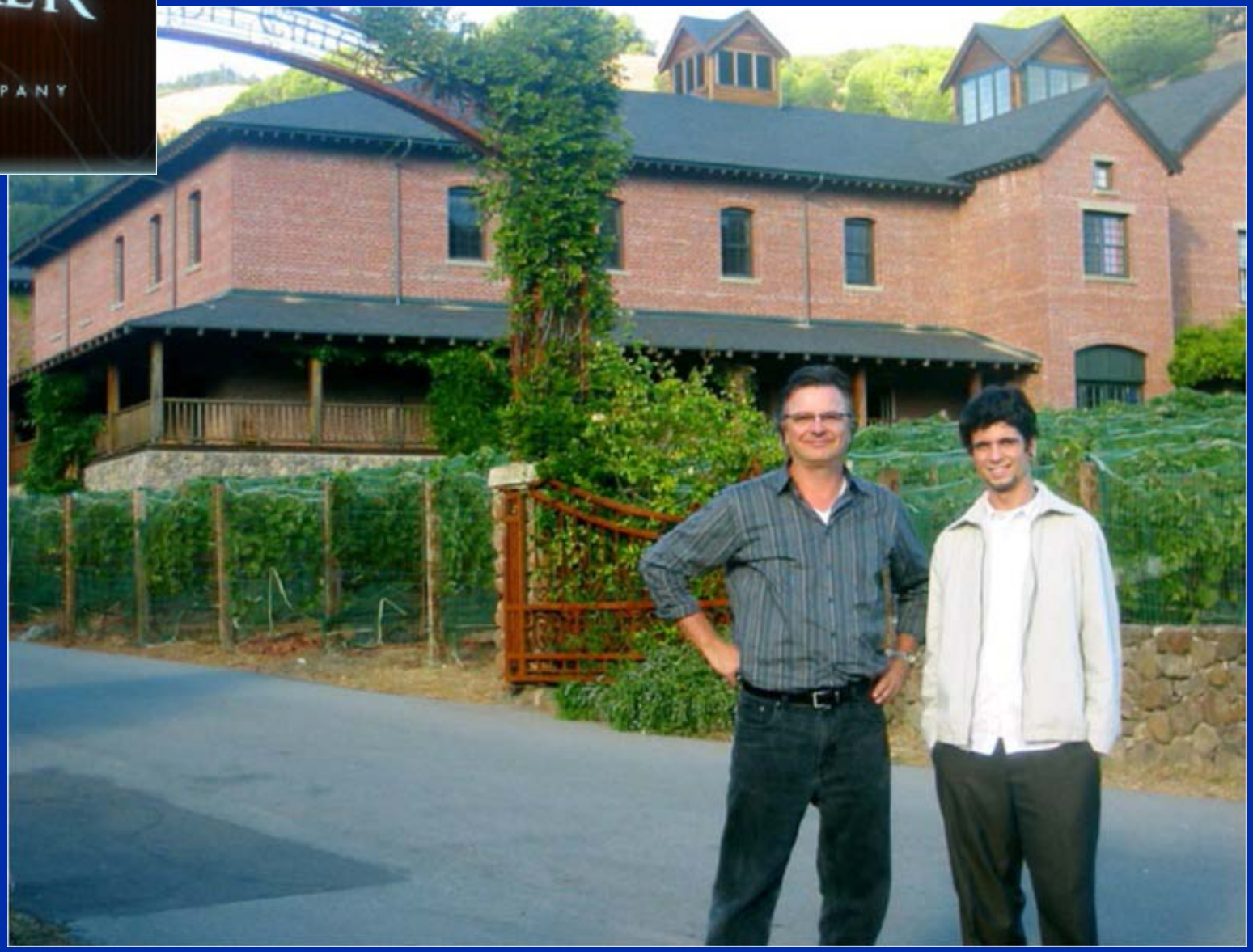
Cisco CWave for CineGrid: A New Cyberinfrastructure for High Resolution Media Streaming*

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

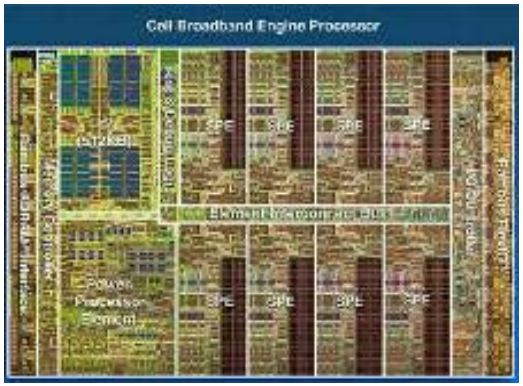
Spinoff:
Lucasfilm's Skywalker Sound Internships For UCSD Undergraduates



Source: Peter Otto, Calit2, CRCA, UCSD Dept of Music

Hybrid Computational Infrastructure for Multi-User Virtual Environments, While Deriving 4K Digital Cinema

- **Assess Impact on Understanding of the Social-Cultural Milieu**
- **Utilizing Emerging Technologies:**
  - **Intel Larrabee Multi-Core CPU,**
  - **IBM/Sony Cell processors**
  - **IBM Networked Mainframe**
- **Three Key Project Areas:**
  - **Future Cinema**
  - **Multi-User, Extensible Virtual Worlds**
  - **Assets, Dynamics and Behavior Computation for Virtual Worlds and Games**



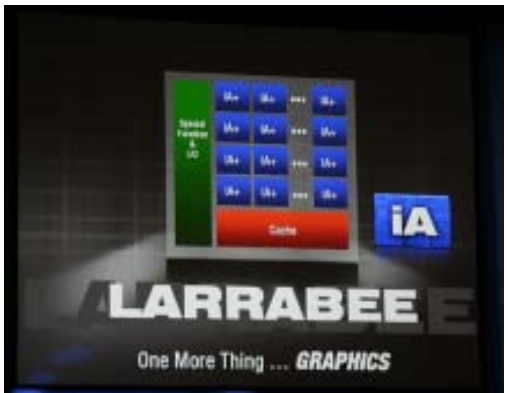


Center for Next Generation Digital Media

Sheldon Brown, Director, Also Director CRCA, Prof. Dept of Visual Arts

$2.4 Million Gift from IBM, $300K from Intel, Prototype 4K computing from Sony, National Science Foundation Node for Center for Hybrid Multicore ResearcH



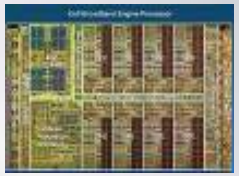


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The Scalable City Next Stage Technology Infrastructure

Source:
Sheldon Brown,
CRCA, Calit2
Dept of Visual Arts

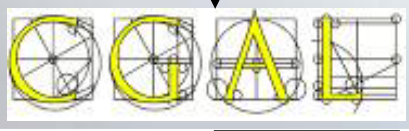


Cell Processors
Compute
Dynamic Assets

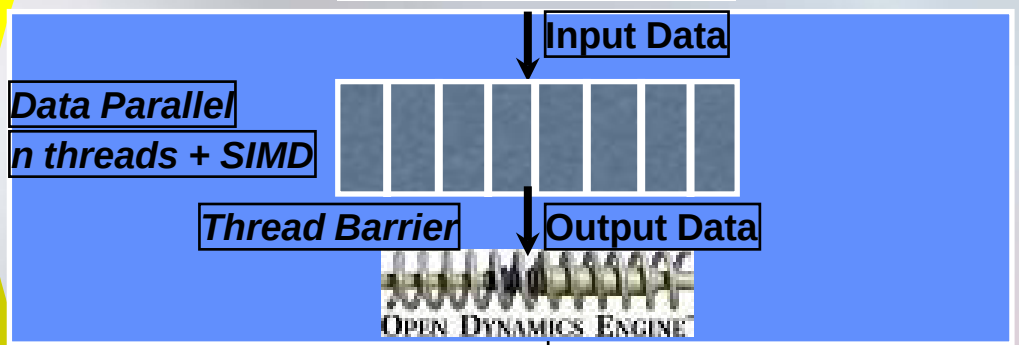


Intel OpenCV Real-Time
Computer Vision

ERSATZ
ENGINE



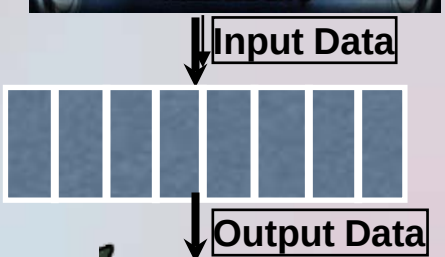
CGAL Computational Geometry Library



Abstract Physics –
Use Multiple Physics Libraries
(ODE, Bullet, etc.)
Replace Computational
Bottlenecks in these Libraries
with Data Parallel Operations



Fmod Sound Library



Convert Assets to Data Parallel Meshes After
Physics Transformation, Boosts Rendering ~33%



Ogre3D Scene graph

Open Source Libraries – Needs Work for Adding Data Level Parallelism

4K/Stereo High Resolution Cinema Development with Same Asset Pipeline as Game Environment



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Source: Sheldon Brown, CRCA, Calit2, Dept. of Visual Arts

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Calit2@UCI Game Culture & Technology Lab

- **Unique Partnership with Discovery Science Center and Santa Ana Unified School District**
- **Complementary K-8th Grade Science and Learning Games in Line with CA Teaching Standards**
- **Developed a Gaming Undergraduate Degree Concentration – Most Sought After Minor at UCI**
- **Offering "Joystick Corridor" Internships and Highly Developed Workforce**
- **International Gaming Research Partnership Developed with Daegu City, Korea**

GAME CULTURE & TECHNOLOGY LAB

Sun microsystems

SONY

sgi INNOVATION FOR RESULTS

New Start New Daegu Colorful DAEGU

DS SPATIAL

glu

DISCOVERY SCIENCE CENTER

eon reality | Experience More

NVIDIA World Leader in Visual Computing Technologies

SANTA ANA UNIFIED SCHOOL DISTRICT





DINO QUEST DISCOVERY SCIENCE CENTER

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EcoRaft-Enabling Social Change



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Bill Tomlinson, Interactive Animation Lab, Calit2@UCI

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Mixed Reality Games - Informal Science Education for K-6 Students and Families













DinoQuest Research Team and Collaboratories:
Diverse Science Role Models (ethnicity, age, gender)

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DISCOVERY
SCIENCE CENTER

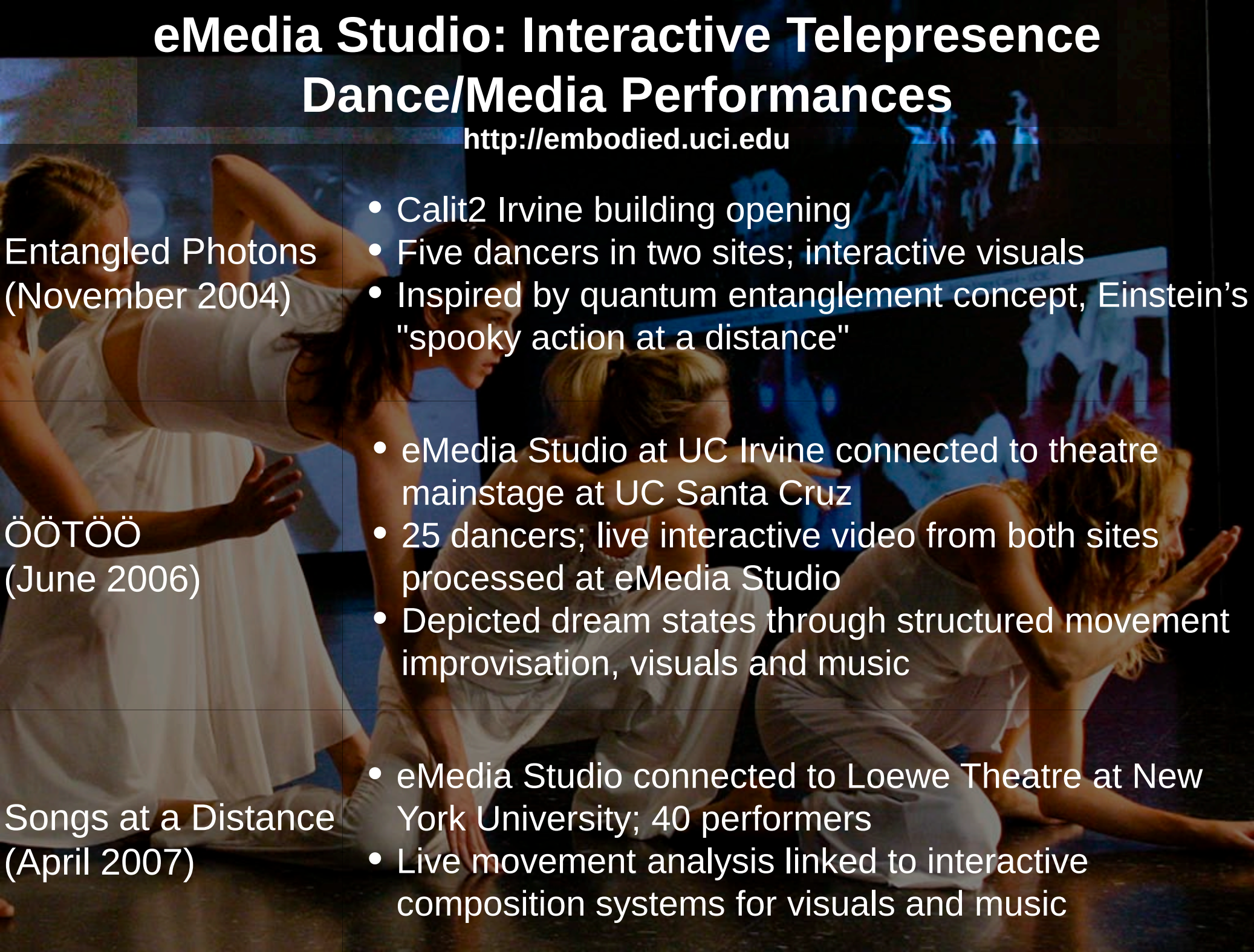
DINO QUEST
DISCOVERY SCIENCE CENTER

GAME CULTURE & TECHNOLOGY LAB

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eMedia Studio: Interactive Telepresence Dance/Media Performances

http://embodied.uci.edu



Entangled Photons (November 2004)

- Calit2 Irvine building opening
- Five dancers in two sites; interactive visuals
- Inspired by quantum entanglement concept, Einstein's "spooky action at a distance"

ÖÖTÖÖ (June 2006)

- eMedia Studio at UC Irvine connected to theatre mainstage at UC Santa Cruz
- 25 dancers; live interactive video from both sites processed at eMedia Studio
- Depicted dream states through structured movement improvisation, visuals and music

Songs at a Distance (April 2007)

- eMedia Studio connected to Loewe Theatre at New York University; 40 performers
- Live movement analysis linked to interactive composition systems for visuals and music

Becoming Dragon-A Mixed Reality, Durational Performance Combining Virtual Reality, Motion Capture, Second Life



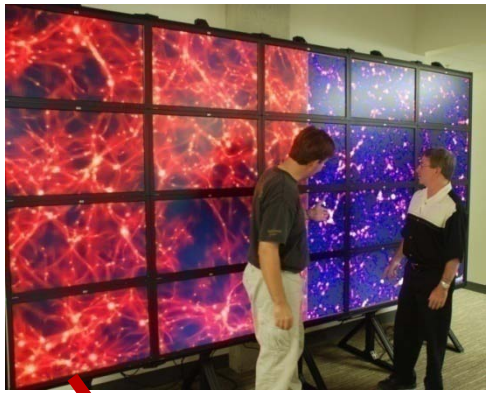
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365 hours, from December 1-17th, 2008

Source: Micha Cárdenas, CRCA, Calit2

it2

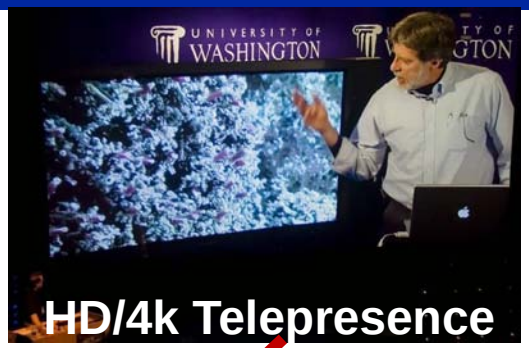
Academic Research "OptIPlatform" Cyberinfrastructure: A 10Gbps Lightpath Cloud



End User OptIPortal



Instruments



HD/4k Telepresence



HD/4k Video Cams

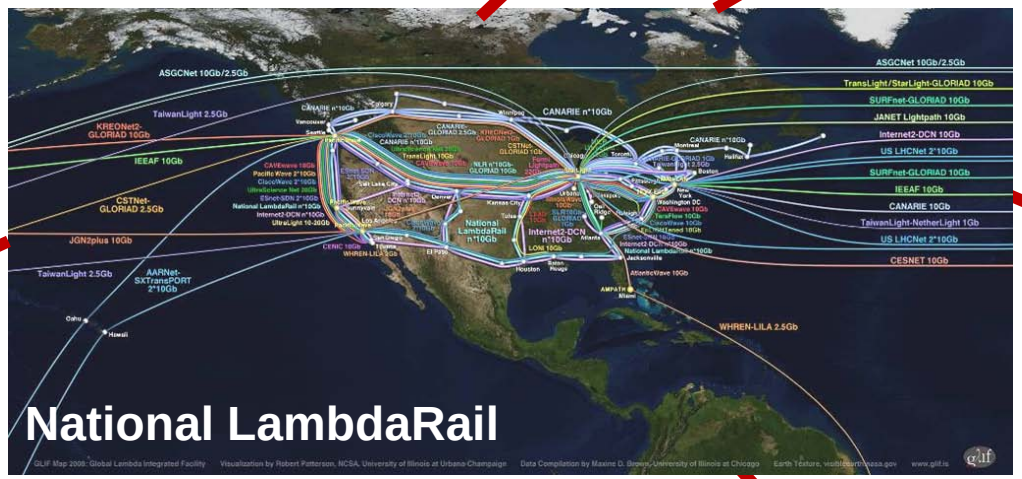
HPC



TeraGrid



10G Lightpath

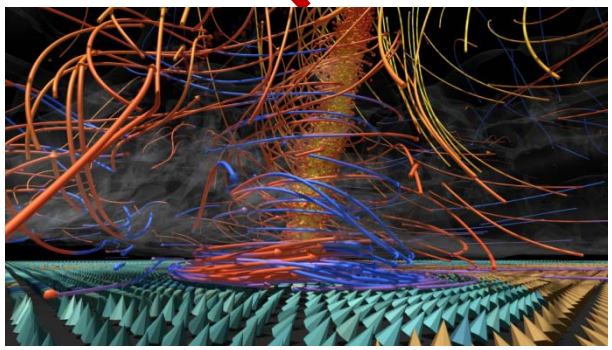


National LambdaRail

Campus Optical Switch



Data Repositories & Clusters



HD/4k Video Images

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Scalable City
on the Global OptIPuter



Calit2, UCSD ⟷ WAAG, Amsterdam

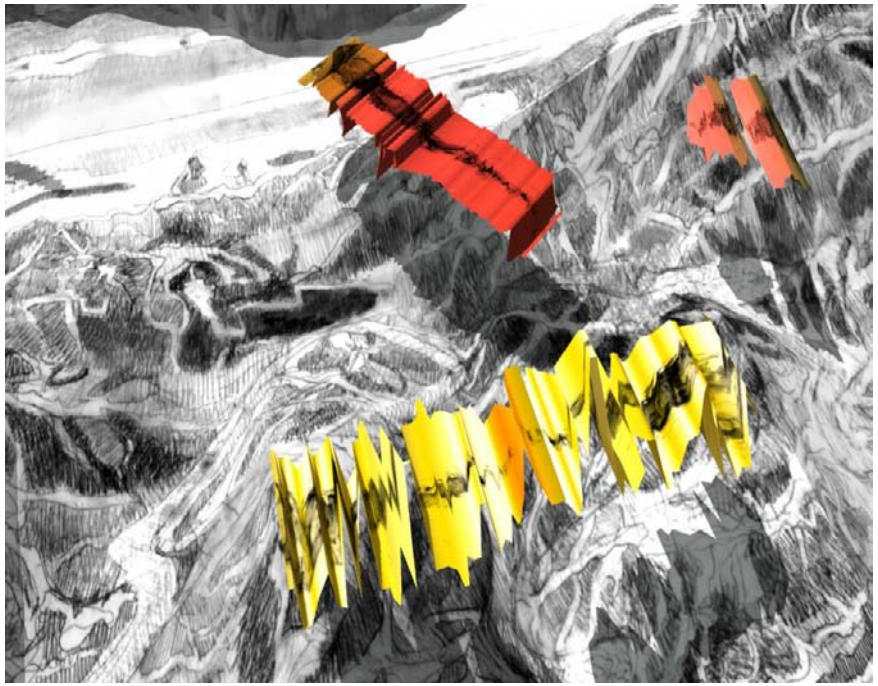


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Gridjam—Performance Art in the New World of Dedicated End-to-End Optical Networks

A Visual Artist, Composer, Musicians, Scientists and Technologists Collaborate to Produce a Real-time, Globally Distributed Performance in Virtual Space

- Visualization: Jack Ox and Dave Britton
- Music: Alvin Curran, composer and musician, Del Sol Quartet and Anthony Braxton playing.
- Organizations and Venues
  - University of New Mexico's College of Fine Arts, with resources of the Art Research Technology and Science Laboratory and the Center for High Performance Computing.
  - Calit2@UC San Diego,
  - University of Alberta,
  - University of Amsterdam in collaboration with De Waag Society,
  - The Laboratory for Creative Arts and Technologies (L-CAT) at LSU



The Desert Organ stop inside the Virtual Color Organ™ . This is the VR space where Gridjam will be visualized- Sound objects modeled by Ox of Curran's collected sound files

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Source: Jack Ox, UNM

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OptIPuter Establishes Room-to-Room Telepresence on a Global Scale



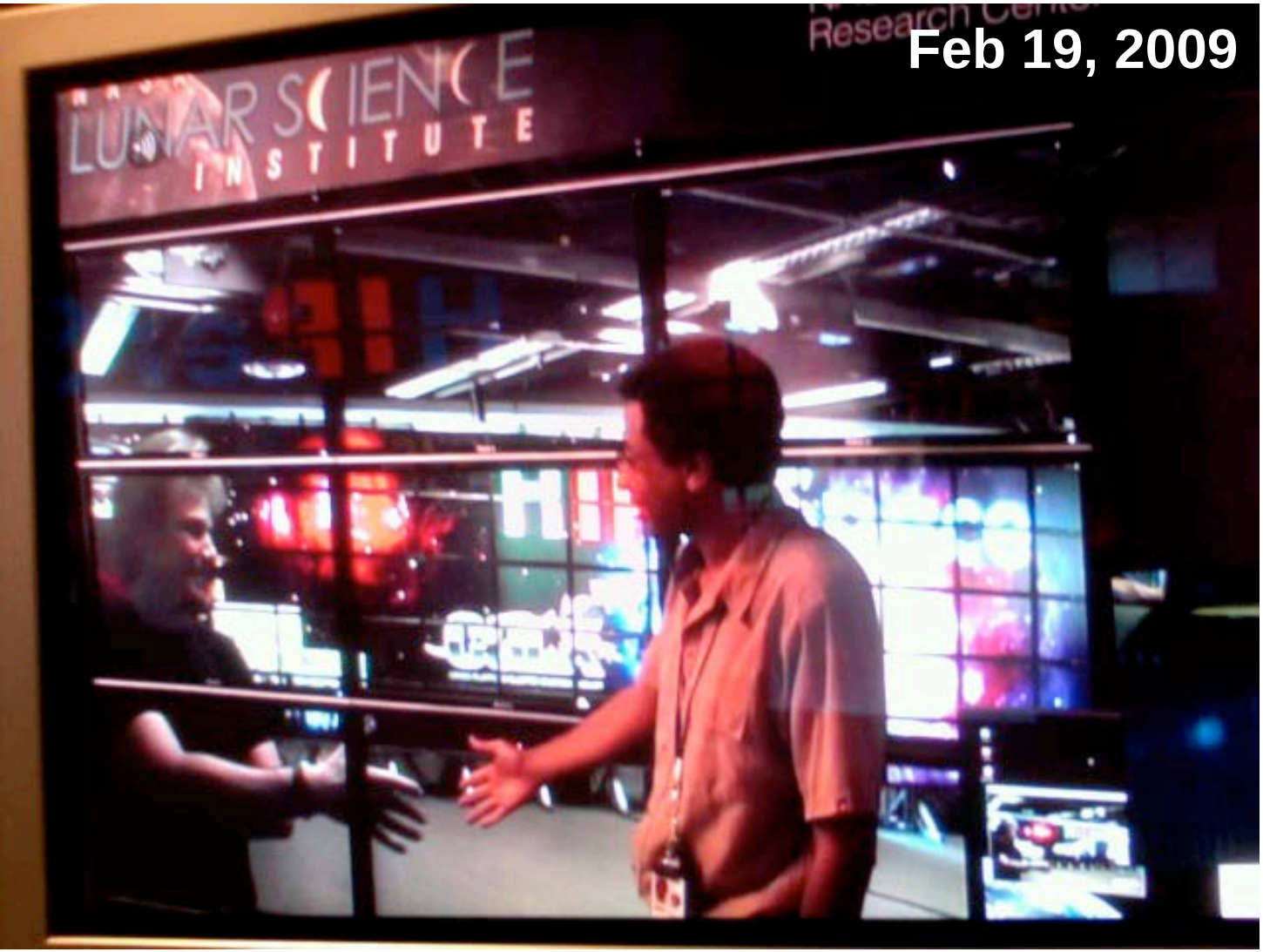
No Calit2 Person Physically Flew to Australia to Bring This Up!

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Covise, Phil Weber, Jurgen Schulze, Calit2
CGLX, Kai-Uwe Doerr , Calit2
www.calit2.net/newsroom/release.php?id=1219

it2

Just in Time OptIPlanet Collaboratory: Live Session Between NASA Ames and Calit2@UCSD



From Start to This Image in Less Than 2 Weeks!

View from NASA Ames Lunar Science Institute Mountain View, CA

Virtual Handshake

HD compressed 6:1

NASA Interest in Supporting Virtual Institutes

CGLX

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Source: Falko Kuester, Calit2; Michael Sims, NASA

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