Excursions into Blended Reality

Invited Talk
Institute for the Future
San Francisco, CA
November 18, 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

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Two 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



www.calit2.net

Preparing for a World in Which Distance is Eliminated…

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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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Examples of Blended Reality Research at Calit2

- **Practical Examples**
- **Digital Arts**
- **Global Collaboraties**

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Real World Object Localization and Recognition Using Semi-Structured Training Data

Source: Serge Belongie, CSE/Calit2@UCSD

APPLICATIONS

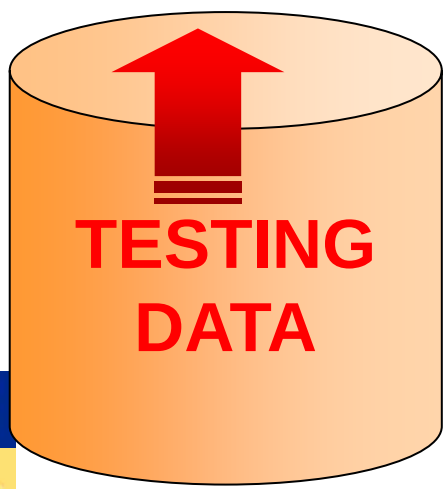
- Assistive Vision Systems for the Blind
- Mobile Rol Navigation-Interaction

Use

STATE OF THE ART OBJECT DETECTION & RECOGNITON ALGORITHMS

Get from the real world

Need





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Related Research on Object Recognition Databases

Source: Serge Belongie, CSE/Calit2@UCSD

Improvements needed*:



- PASCAL VOC
  - Multiple object class instances within a single image
- Caltech-101(256)
  - Single object centered
- SOIL-47
  - Variety, but little intra-class variation
- ALOI
  - Illumination & pose variability
- ETH-80
  - Exclude pre-segmented objects
- LabelMe

Training and testing data often come from the same distribution !

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* J. Ponce et al. *Dataset Issues in Object Recognition. Toward Category-Level Object Recognition*, Springer-Verlag Lecture Notes in Computer Science., 2006.

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Grozi-120
Taking Blended Reality into the Real World

- **Multimedia database of 120 grocery products**
- **e, c**
- **di**
- **ce**
- **re**
- **ata**





Source: Serge Belongie, CSE/Calit2@UCSD

Using Grozi in a Real World Blended Reality: Grocery Shopping for the Visually Impaired



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Source: Serge Belongie, CSE/Calit2@UCSD

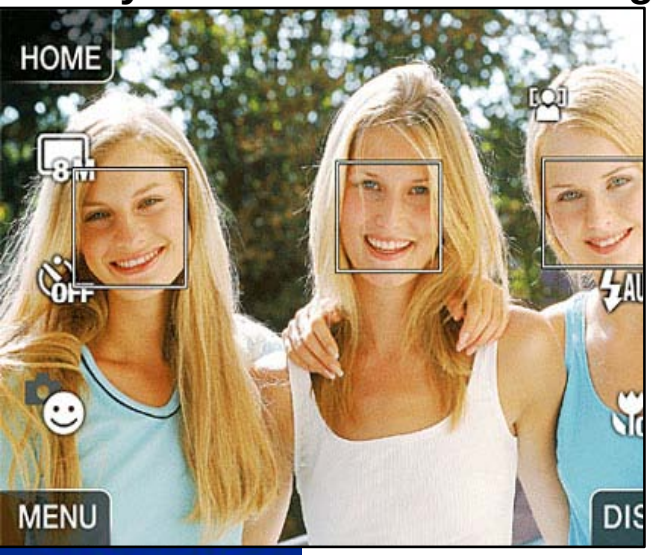
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Machine Learning and Robotics: The Machine Perception Lab and Sony Electronics

RUBI Interacting with Children



Sony Shutter Smile Technology

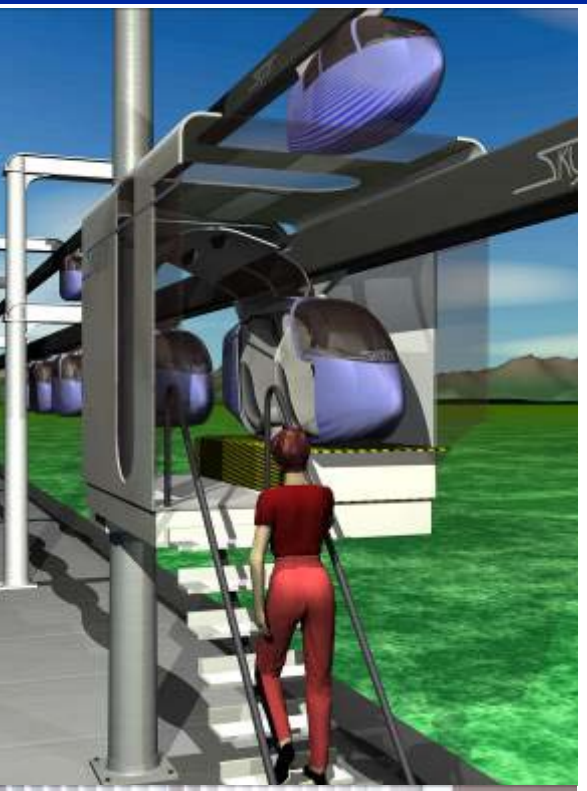


- The MPL (a Calit2 Affiliated Research Group Housed in Calit2) Partnered with Sony Electronics Through the UC Discovery Program to Create Socially Perceptive Appliances
- The MPL Developed a Social Robot (RUBI) Which Interacted With Infants
  - Smile Detection was Identified as a Key Indicator of Social 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

Second Life Simulator for Engineering Design of Unimodal SkyTran







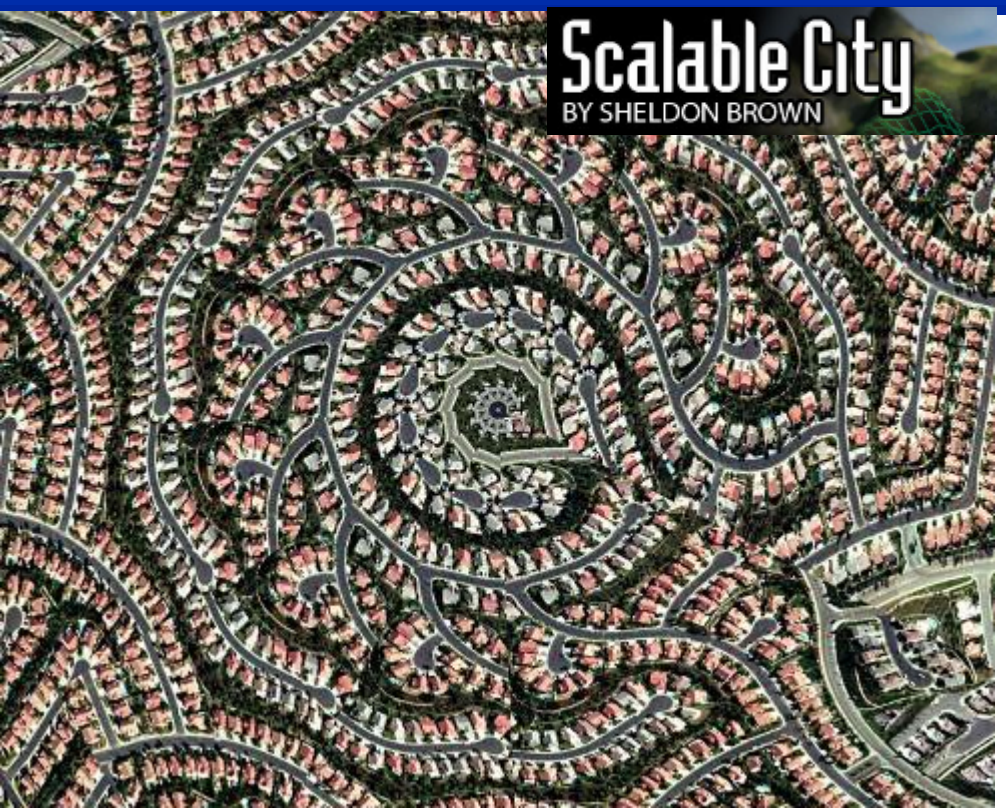
- **Unimodal Inc. – OC Based Company – Developing a Personal Rapid Transit System Called SkyTran**
  - **UniModal Needed to Develop and Test Software That will Prevent Magnetic-Levitated Vehicles from Colliding as they Merge On and Off Roadway**
- **Calit2 Research Team Created Canto Bay in Virtual World Second Life to do Simulations and Modeling**
  - **Canto Bay and Calit2 Offers Solution by Building a Simulated System in Canto Bay and Modeling the Logic-Control Layer**
- **Simulation Provides Feedback to Company Engineers About Design Decisions Before Deploying in Real World Later this Year**
- **Calit2 Research Team Gets Funding to Make Further Refinements in Simulation Research and for Student Support**

Source: Christa Lopes, ICS, UCI

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Calit2 Has Facilitated Digital Arts Blended Reality on Both Campuses



Bill Tomlinson, Lynn Carpenter UCI "EcoRaft"



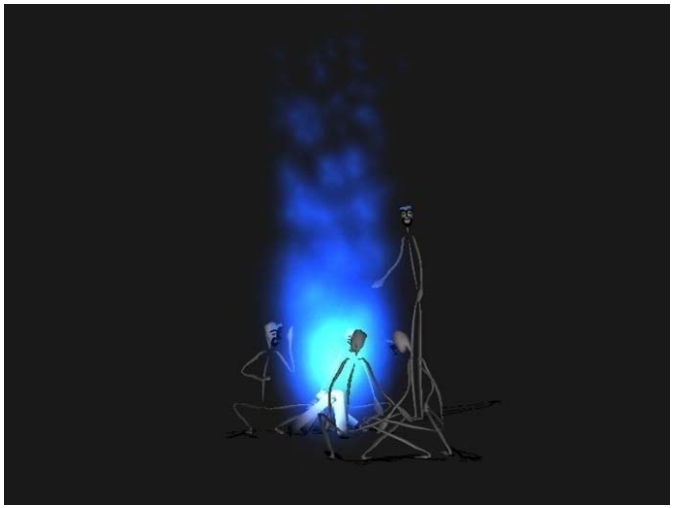
"Researchers Look to Create a Synthesis of Art and Science for the 21st Century"

By John Markoff
NYTimes November 5, 2005

SPECFLIC 1.0 – A Speculative Distributed Social Cinema by Adrienne Jenik



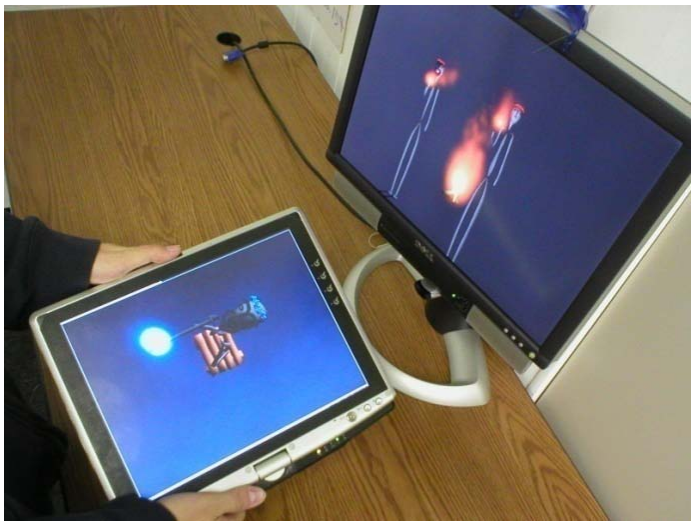
The Virtual Raft Project Uses Blended Realty to Teach Children Ecological Management



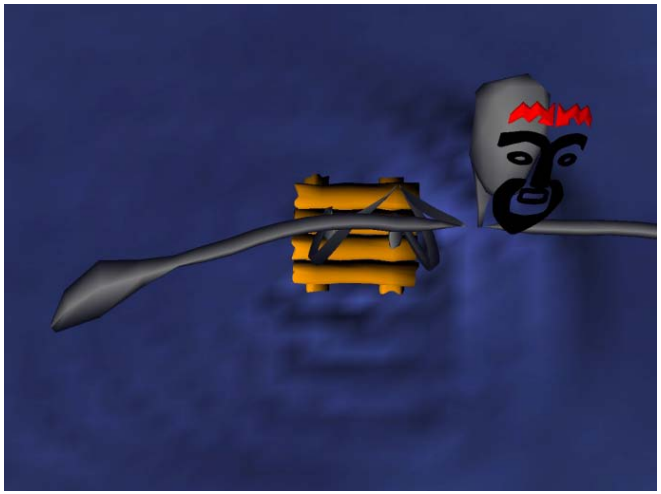
Virtual Community of Autonomous Characters

Source: Bill Tomlinson, ICS, Calit2@UCI





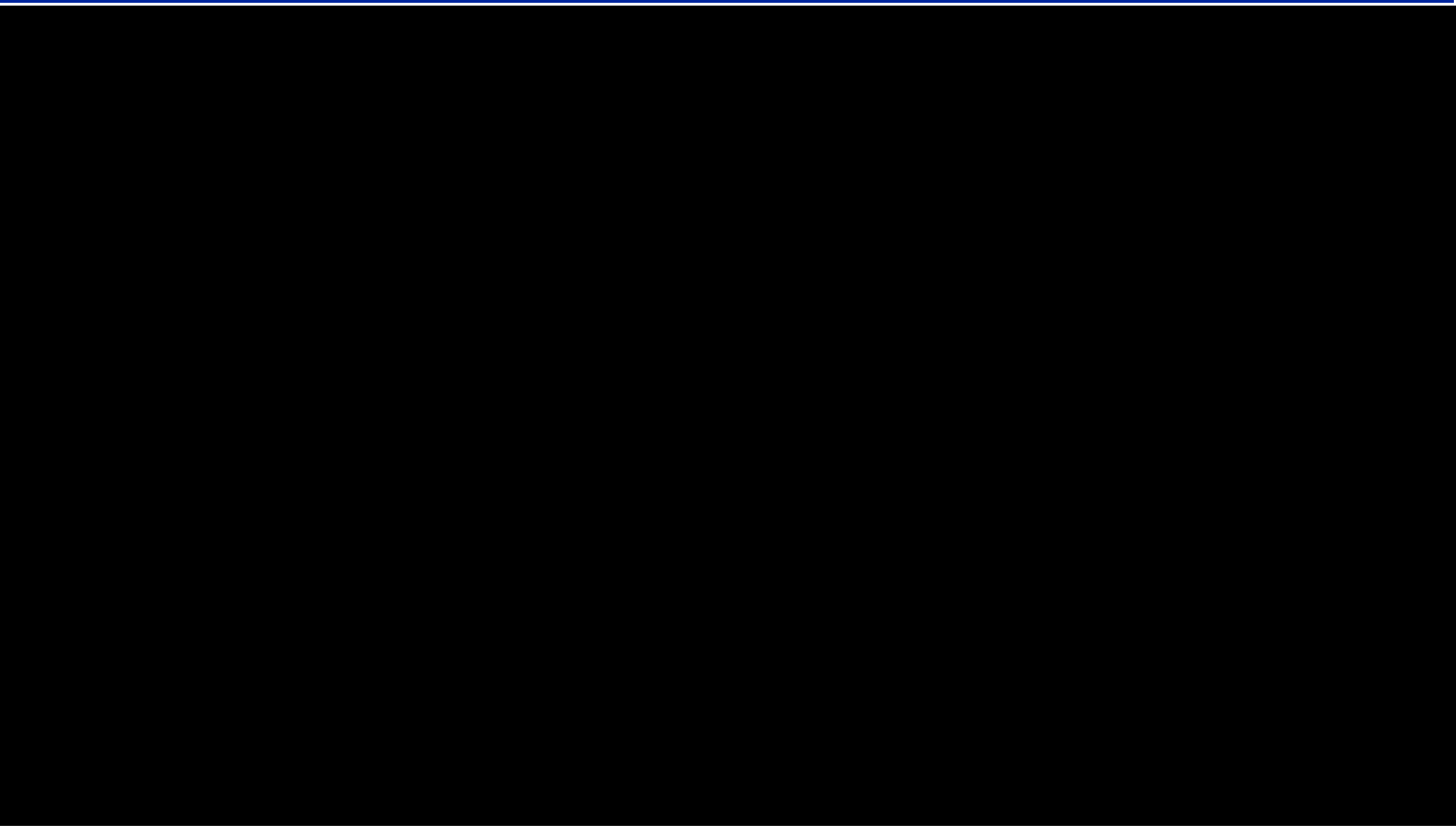
A "Virtual Raft" on a Physical Tablet Computer is Brought Up to a "Virtual Island"



When The Physical Raft is Tipped, the Virtual Character Needs to Try to Keep its Balance

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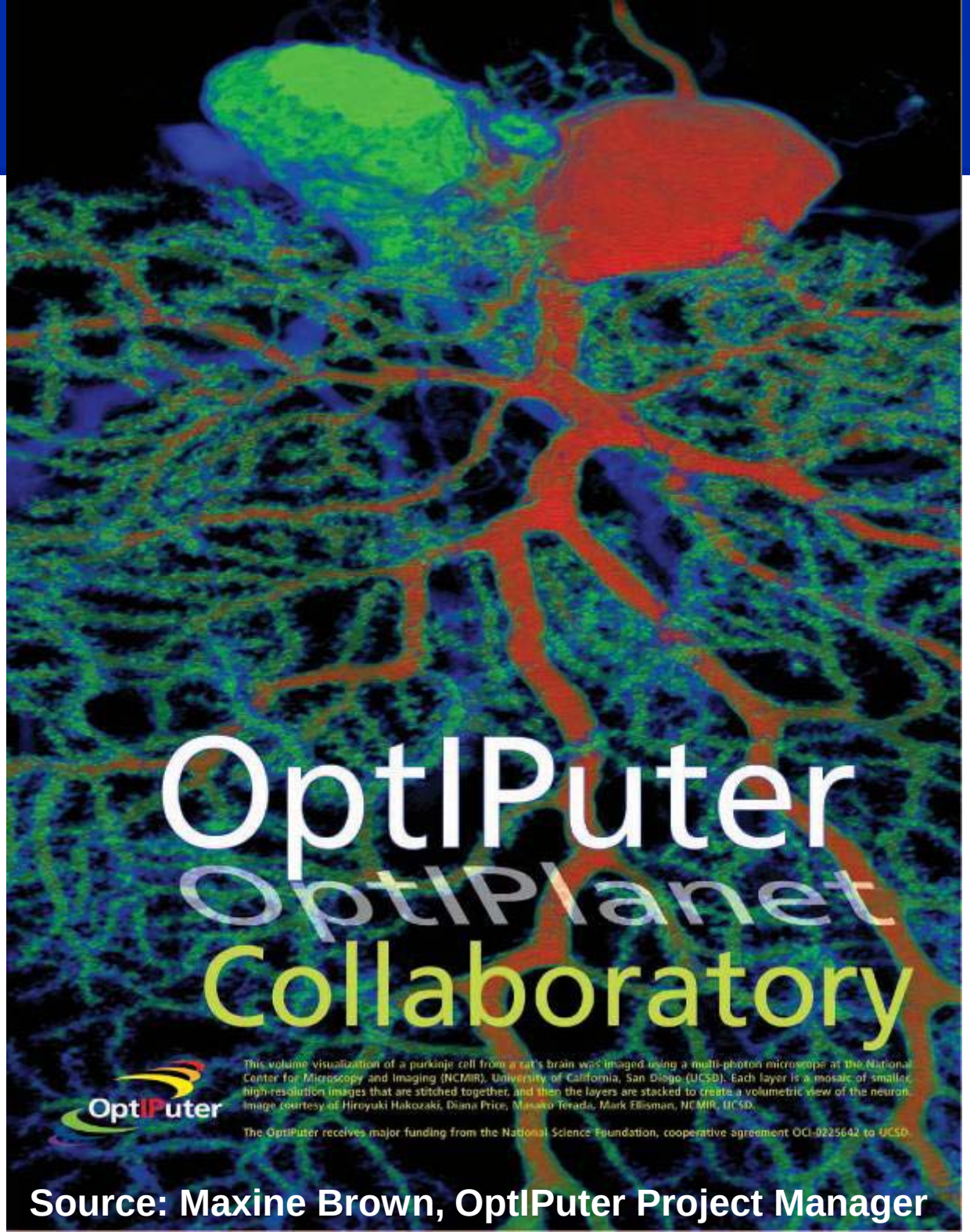
Scalable City:
A Blended Reality Digital Arts Project



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Source: Sheldon Brown, CRCA, Calit2@UCSD

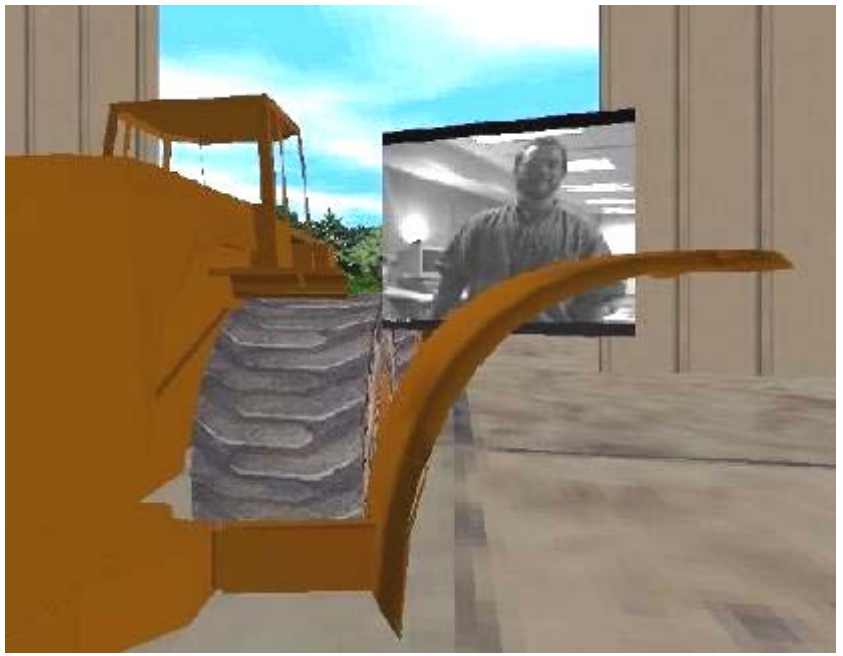
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Source: Maxine Brown, OptIPuter Project Manager

Caterpillar / NCSA: Distributed Virtual Reality for Global-Scale Collaborative Prototyping





NCSA™

Real Time Global Blended Reality
Between NCSA, Peoria, Houston, and Germany

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1996

www.sv.vt.edu/future/vt-cave/apps/CatDistVR/DVR.html

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Chesapeake Bay Simulation Collaboratory : National Scale Blended Realty

Alliance Project: Collaborative Video Production via Tele-Immersion and Virtual Director

Alliance Application Technologies
Environmental Hydrology Team

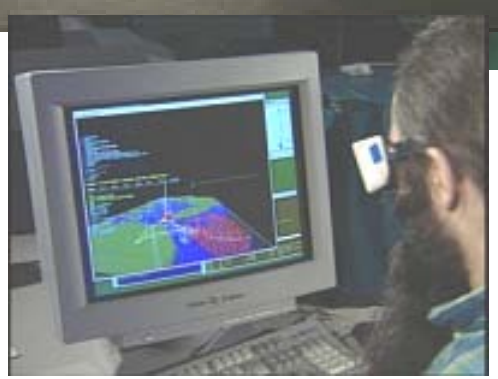




4 MPixel PowerWall



Alliance 1997





NCSA™ UIC

sgi

ALLIANCE

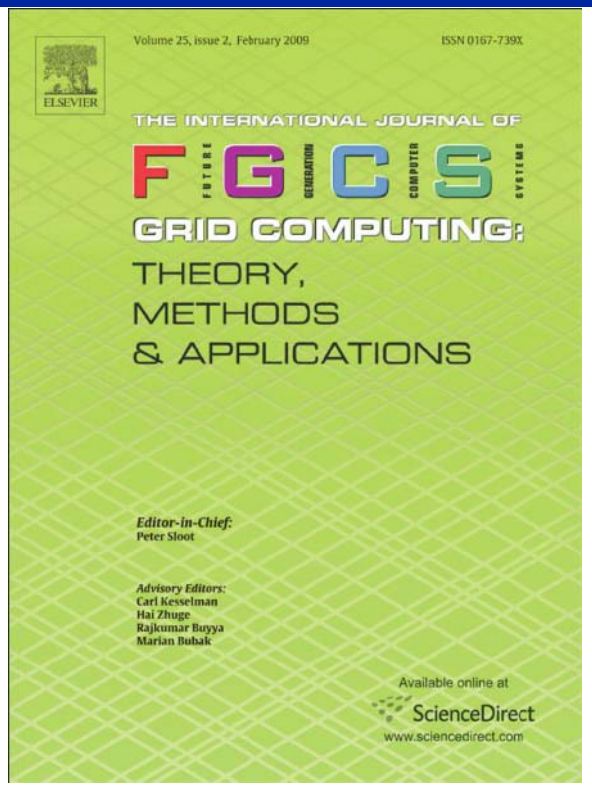
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Donna Cox, Robert Patterson, Stuart Levy, NCSA Virtual Director Team
Glenn Wheless, Old Dominion Univ.

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The OptIPuter Creates an OptIPlanet Collaboratory: Enabling Data-Intensive e-Research





SAGE software, developed by UIC/EVL for OptIPuter, Supports Global Collaboration. Five Sites Streaming *Compressed* HD Video (~600mb Per Stream) Using "SAGE Visualcasting" to Replicate Streams

***"OptIPlanet: The OptIPuter Global Collaboratory"* – Special Section of Future Generations Computer Systems, Volume 25, Issue 2, February 2009**

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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

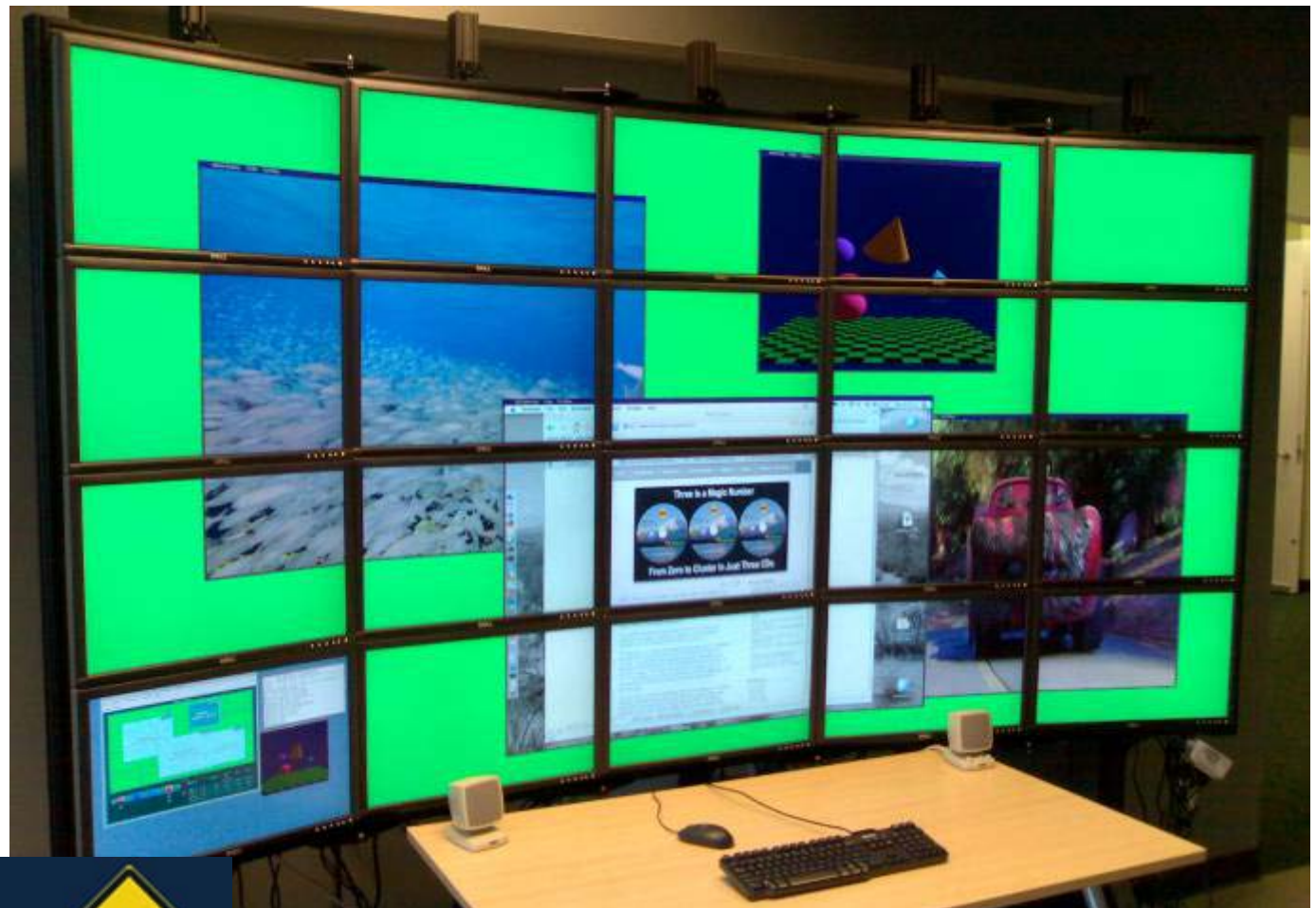
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My OptIPortal™ – Affordable Termination Device for the OptIPuter Global Backplane

- 20 Dual CPU Nodes, 20 24” Monitors, ~$50,000
- 1/4 Teraflop, 5 Terabyte Storage, 45 Mega Pixels--Nice PC!
- Scalable Adaptive Graphics Environment (SAGE) Jason Leigh, EVL-UIC

evl electronic visualization laboratory





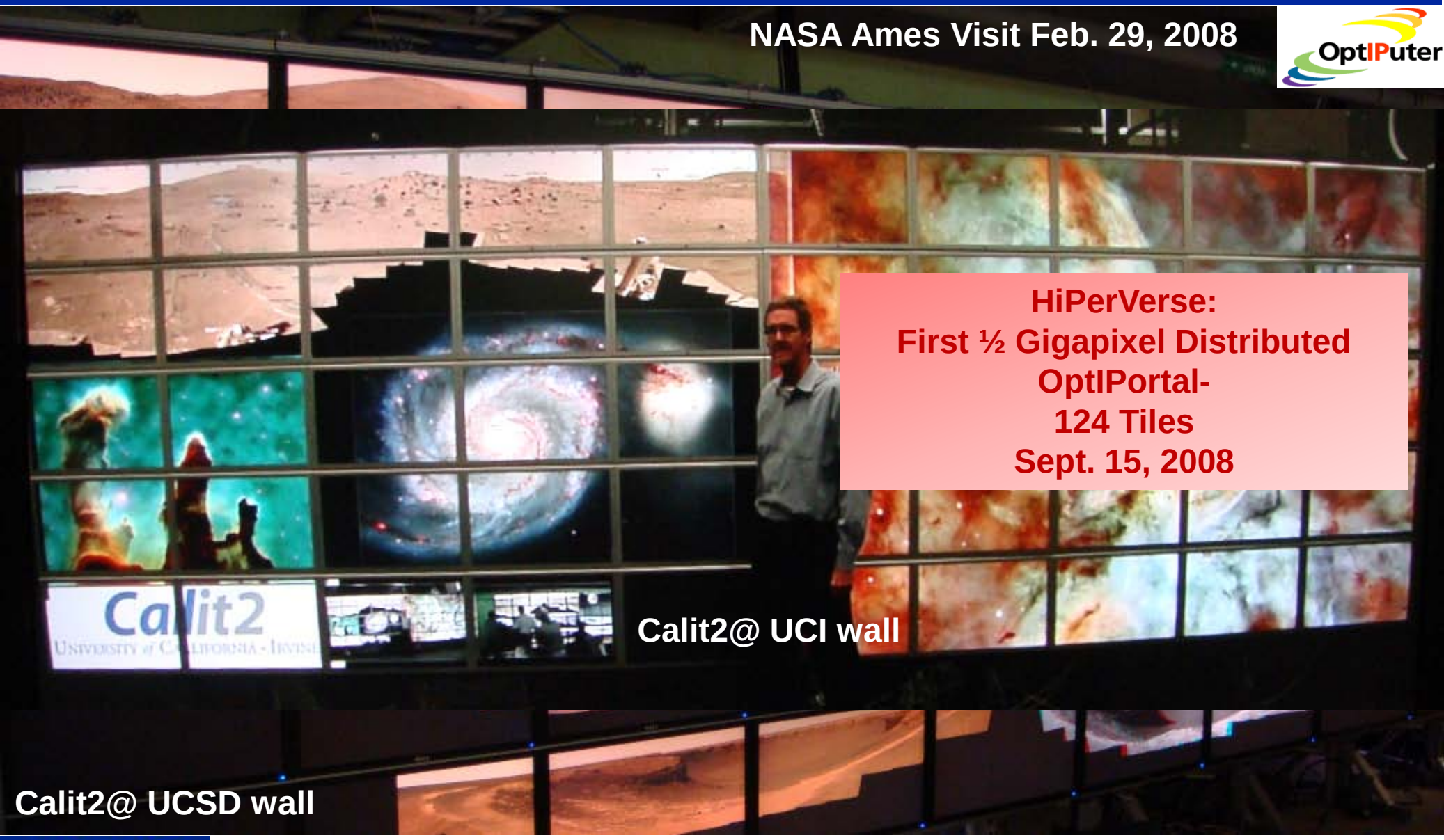
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Powered by Rocks ROCKS

Source: Phil Papadopoulos SDSC, Calit2

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The Calit2 OptIPortals at UCSD and UCI Are Joined via Gigabit/s into a Blended Reality Collaboratory



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UCSD cluster: 15 x Quad core Dell XPS with Dual nVIDIA 5600s
UCI cluster: 25 x Dual Core Apple G5

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U Michigan Virtual Space Interaction Testbed (VISIT) Instrumenting OptIPortals for Social Science Research

- **Using Cameras Embedded in the Seams of Tiled Displays and Computer Vision Techniques, we can Understand how People Interact with OptIPortals**
  - **Classify Attention, Expression, Gaze**
  - **Initial Implementation Based on Attention Interaction Design Toolkit (J. Lee, MIT)**
- **Close to Producing Usable Eye/Nose Tracking Data using OpenCV**





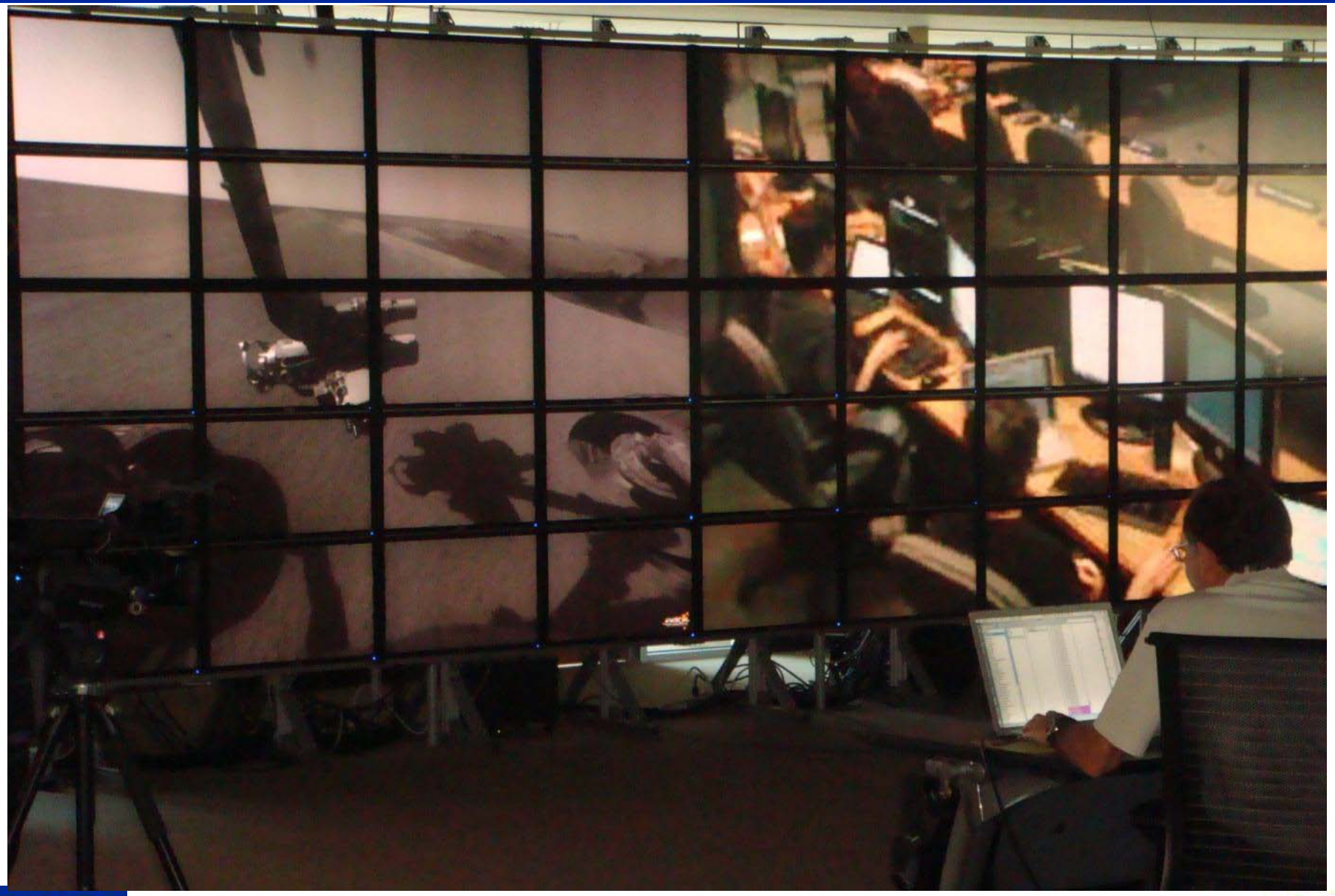
Leading U.S. Researchers on the Social Aspects of Collaboration

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Source: Erik Hofer, UMich, School of Information

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Interplanetary Command and Control: Live Session with JPL and Mars Rover from Calit2



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Source: Falko Kuester, Calit2; Michael Sims, NASA

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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

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Victoria Premier and Australian Deputy Prime Minister Asking Questions



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www.calit2.net/newsroom/release.php?id=1219

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University of Melbourne Vice Chancellor Glyn Davis in Calit2 Replies to Question from Australia

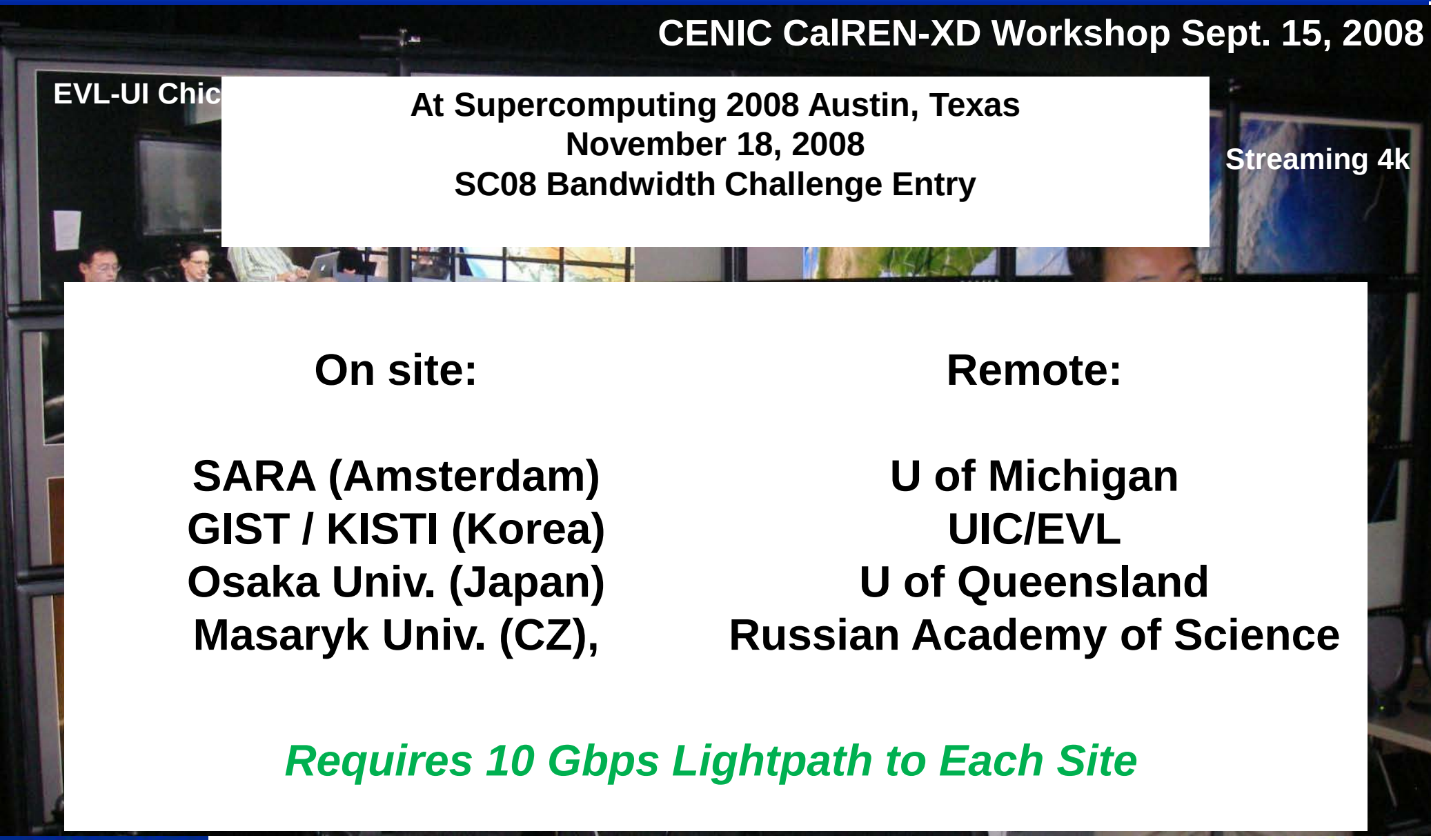


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EVL's SAGE OptIPortal VisualCasting Multi-Site OptIPuter Collaboratory

CENIC CalREN-XD Workshop Sept. 15, 2008



At Supercomputing 2008 Austin, Texas
November 18, 2008
SC08 Bandwidth Challenge Entry

On site:	Remote:
SARA (Amsterdam)	U of Michigan
GIST / KISTI (Korea)	UIC/EVL
Osaka Univ. (Japan)	U of Queensland
Masaryk Univ. (CZ),	Russian Academy of Science

Requires 10 Gbps Lightpath to Each Site

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Uncompressed High Definition Video From Each Site

Source: Jason Leigh, Luc Renambot, EVL, UI Chicago

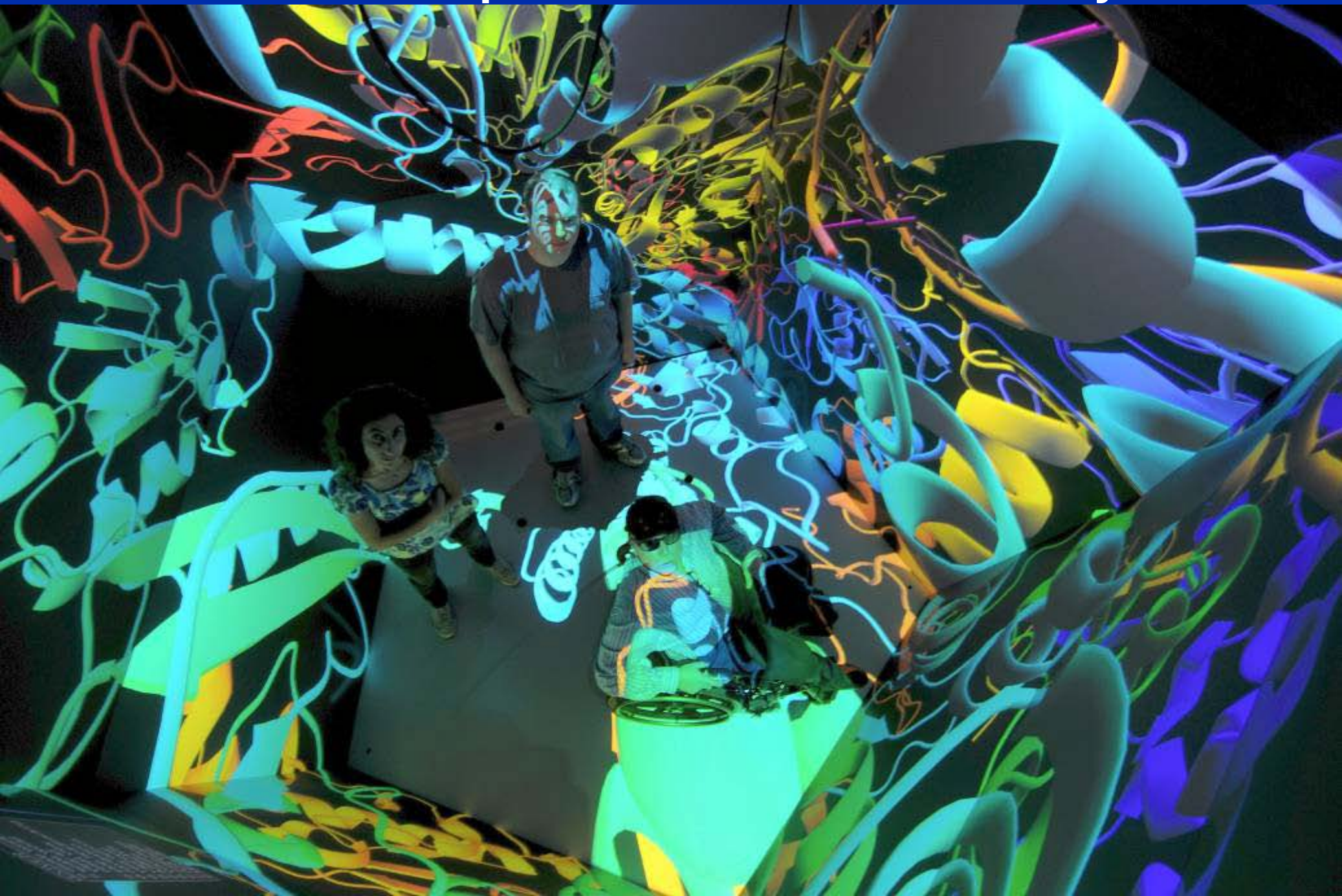
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Beyond the OptIPortal: LambdaTable, StarCAVE, and Varrier

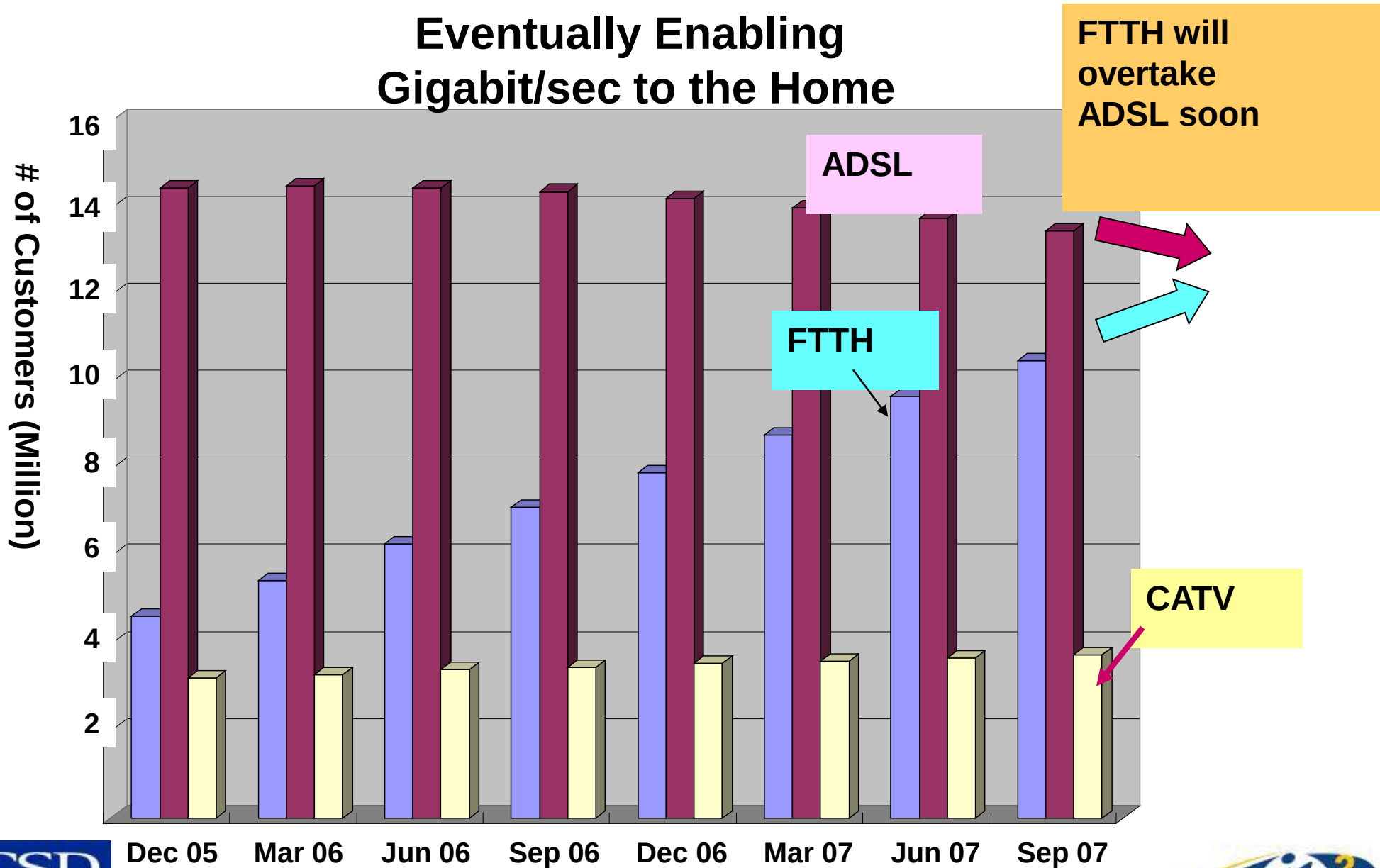


electronic visualization laboratory

Calit2 3D Immersive StarCAVE OptIPortal: Enables Exploration of Blended Reality

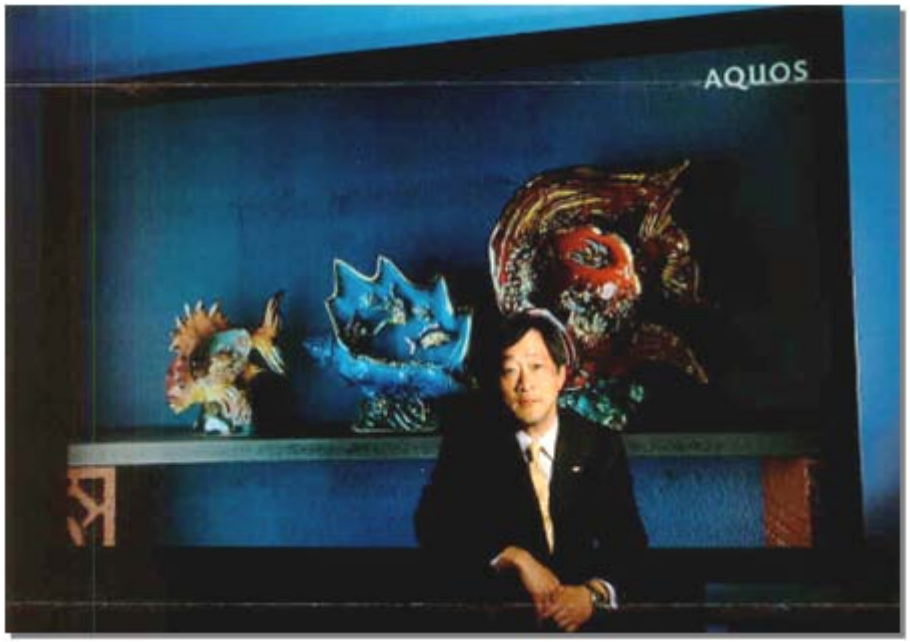


Broadband Users in Japan: Over 10 Million Homes Have Fiber Connection



Source: Takashi Shimizu, NTT Network Innovation Laboratories

In the Near Future, Walls of Homes and Offices will be Electroactive



Chairman of Sharp

“In Ten Years' Time Entire Walls Could Be Screens”

Forbes, June 4, 2007

Sharp Labs of America / EVL Public-Private Partnership



Studying User-Interaction Issues and Moving Image Synchronization Issues in Future Ultra High Resolution Environments

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electronic visualization laboratory, university of illinois at chicago

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Twitters from my Talk



SarahM: **Larry Smarr** at #blended: IT is about to pass aviation as the indusry w/biggest carbon footprint. And IT power use is doubling every 2 yrs.

about 1 hour ago · Reply · View Tweet



senatorgrant: **larry smarr**: it's happening. smell is easy to simulate now with lasers exciting particles. #blended

about 1 hour ago · Reply · View Tweet



askpang: Exponential technological changes like Moore's Law "take the impossible and turn it into the routine." (**Larry Smarr**)

about 1 hour ago · Reply · View Tweet



cascio: **Larry Smarr** is an implicit singularitarian. #blended

about 1 hour ago · Reply · View Tweet



senatorgrant: most of **larry smarr**'s examples deal with future of telepresence and telecontrol as bandwidth increases #blended

about 1 hour ago · Reply · View Tweet



senatorgrant: for some reason none of **larry smarr**'s examples are all that exciting. am i that jaded? #blended

about 1 hour ago · Reply · View Tweet



senatorgrant: next up: **larry smarr** of Cal-IT2 on changes in human experience with limitless connectivity

about 2 hours ago · Reply · View Tweet

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