Building CineGrid on GLIF

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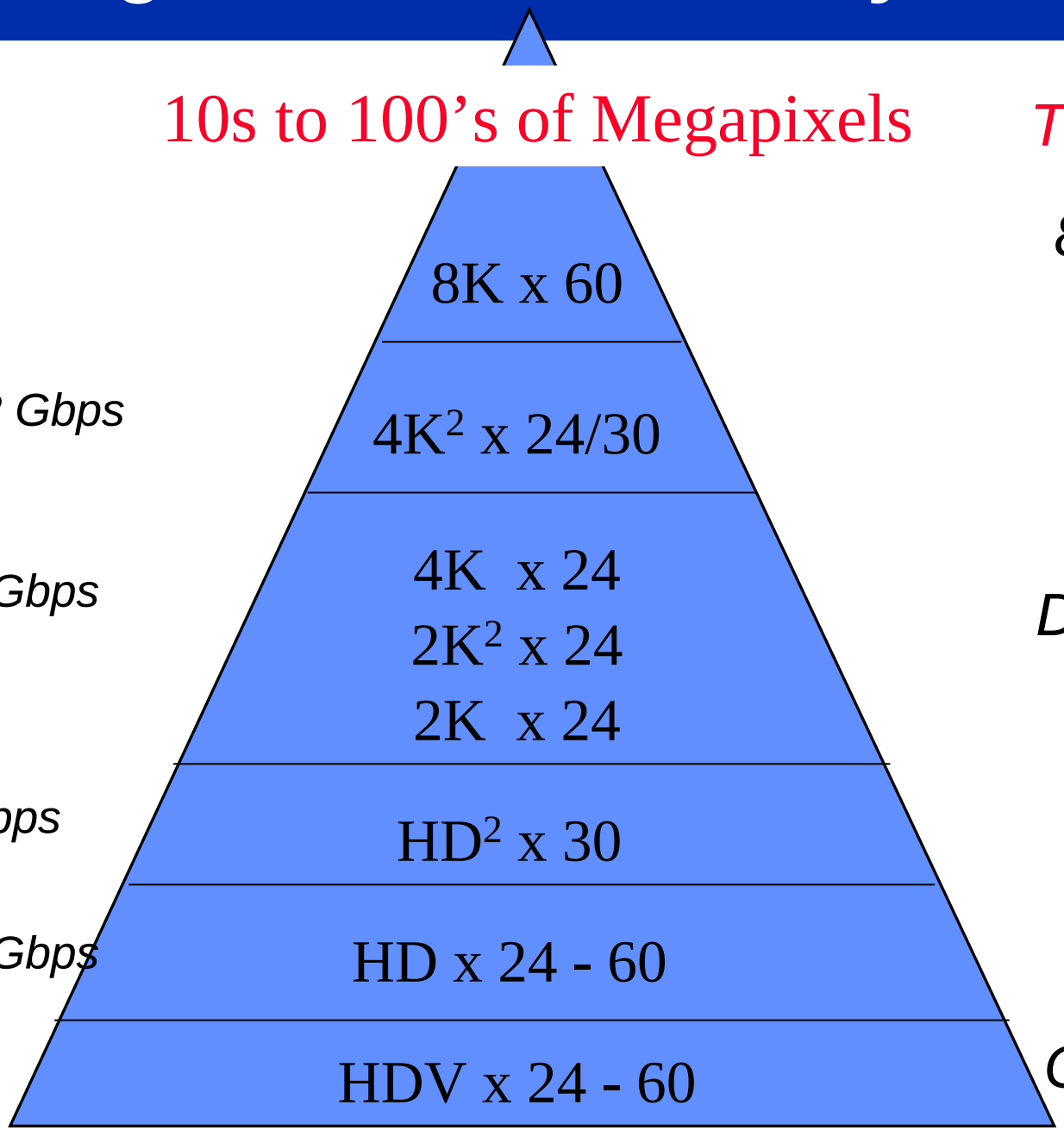
Founding GLIF and CineGrid Member

Digital Movies and Beyond



10 - 100's Gbps — *Tiled Displays*

1 - 24 Gbps — *8K (projector)*

500 Mbps - 15.2 Gbps — *Stereo 4K*

250 Mbps - 7.6 Gbps — *Digital Cinema*

200 Mbps - 3 Gbps — *Stereo HD*

100 Mbps - 1.5 Gbps — *HDTV*

25 Mbps — *Consumer HD*

Source: Laurin Herr

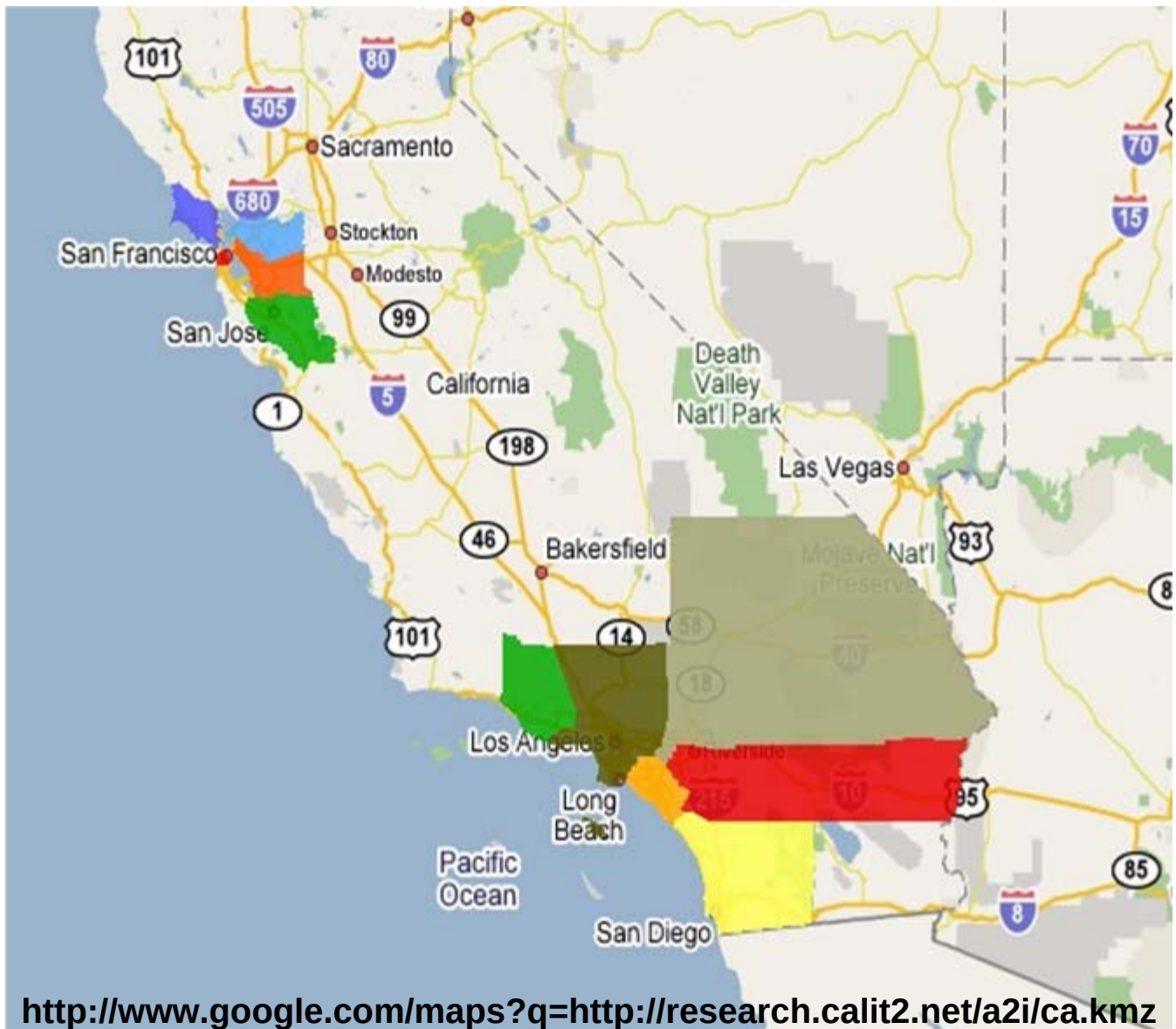
Economic Impact of Cinema in California

Major Employment from Movie Industry in California by County

In 2005, movie production provided employment for over 245,000 Californians, with an associated payroll of more than $17 billion

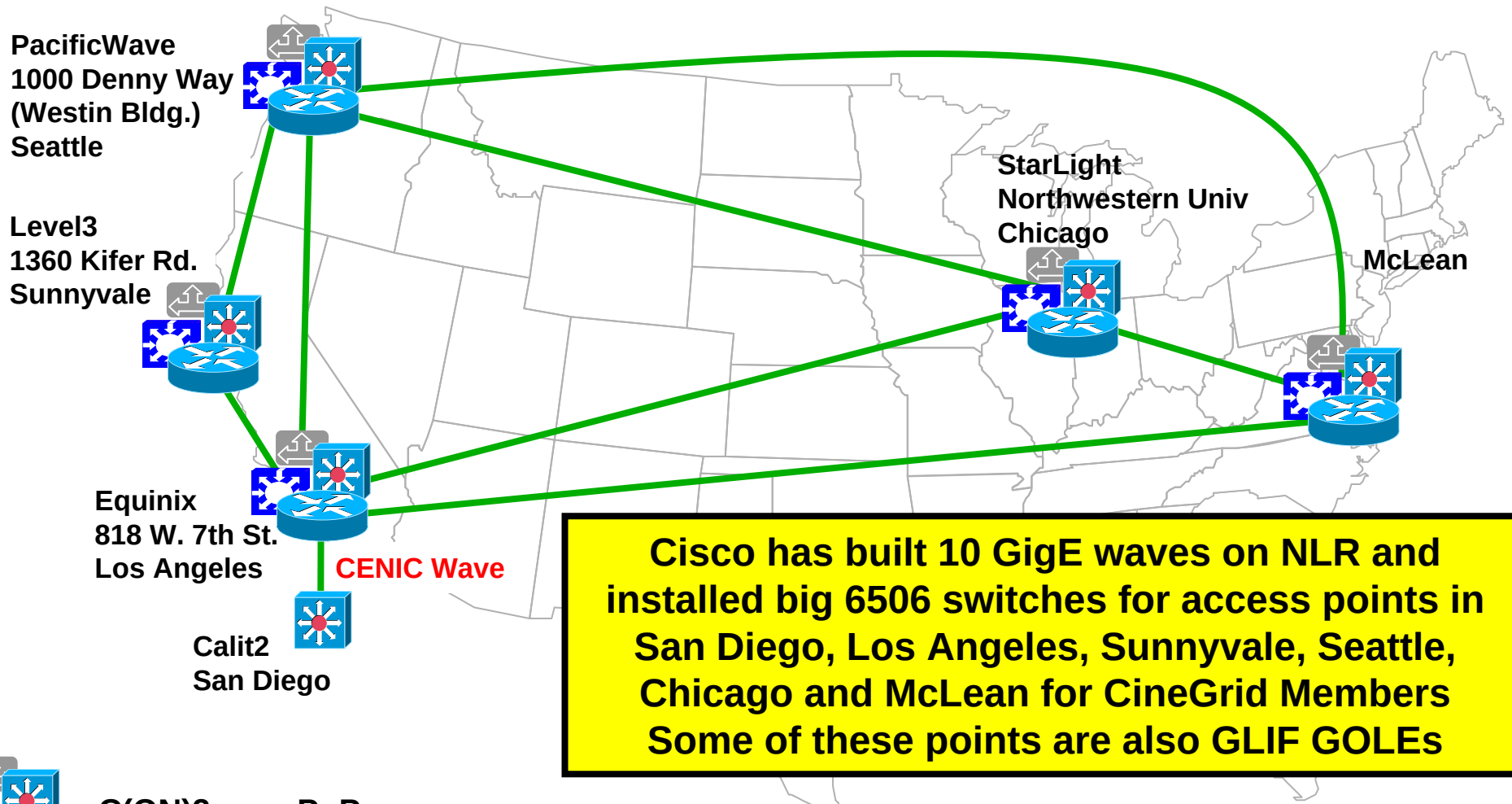
A 2-hour movie digitally scanned and compressed at 500Mb/s takes 450 GBytes

Hollywood alone makes 250 movies a year



Source: Laurin Herr and Jerry Sheehan

Cisco CWave: New Capacity for CineGrid Members



Cisco has built 10 GigE waves on NLR and installed big 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

C(ON)2 core PoP

10GE waves on NLR and CENIC (LA to SD)

Source: John (JJ) Jamison

What is CineGrid?

CineGrid is a non-profit international membership organization established in 2007 based on collaborative efforts, since iGrid 2002 in Amsterdam, of leaders in the fields of advanced networking and digital media technology from Japan, America, Canada, and Europe.

CineGrid is building an interdisciplinary community for the research, development, and demonstration of networked collaborative tools to enable the production, use, and exchange of very high-quality digital media over photonic networks.

CineGrid is built on GLIF links by GLIF members.

CineGrid organizes major demonstrations with many GLIF users.

Historic Convergence Motivates CineGrid

- State of the art of visualization is always driven by three communities
  - **Entertainment, media, art and culture**
  - **Science, medicine, education and research**
  - **Military, intelligence, security and police**
- All three communities are converting to digital media with converging requirements
  - **Fast networking with similar profiles**
  - **Access shared instruments, specialized computers and massive storage**
  - **Collaboration tools for distributed, remote teams**
  - **Robust security for their intellectual property**
  - **Upgraded systems to allow higher visual quality, greater speed, more distributed applications**
  - **A next generation of trained professionals**

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

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 and education

CineGrid Institutional Members

- California Academy of Sciences
- Dark Strand
- JVC America
- Louisiana State University CCT
- Nortel Networks
- Renaissance Computing Institute (RENCI)
- Sharp Labs USA
- Sharp Corporation
- Tohoku University/Kawamata Laboratory
- Waag Society

CineGrid members operate their own digital media facilities and cyberinfrastructure for digital cinema and HDTV production, post-production, distribution and exhibition distributed on a global scale, as well as for telepresence, distance learning and scientific visualization.

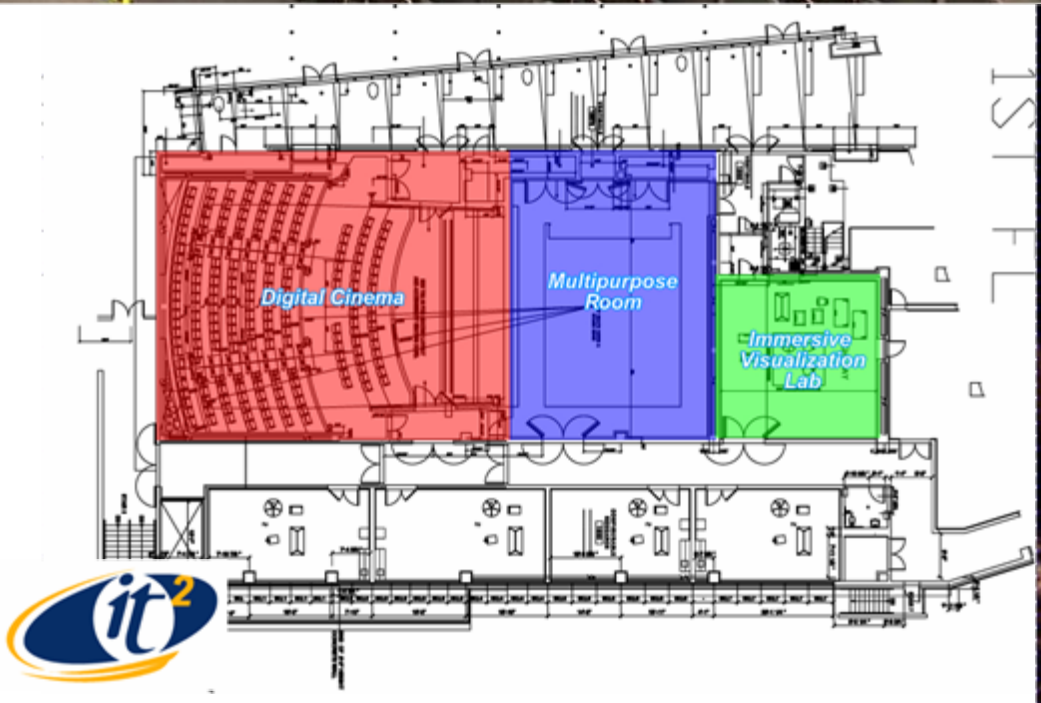
CineGrid Network / Exchange Members

- CANARIE
- CENIC
- CESNET
- CzechLight
- Japan Gigabit Network 2
- National LambdaRail
- NetherLight
- PacificWave
- Pacific North West GigaPOP
- StarLight
- SURFnet
- WIDE

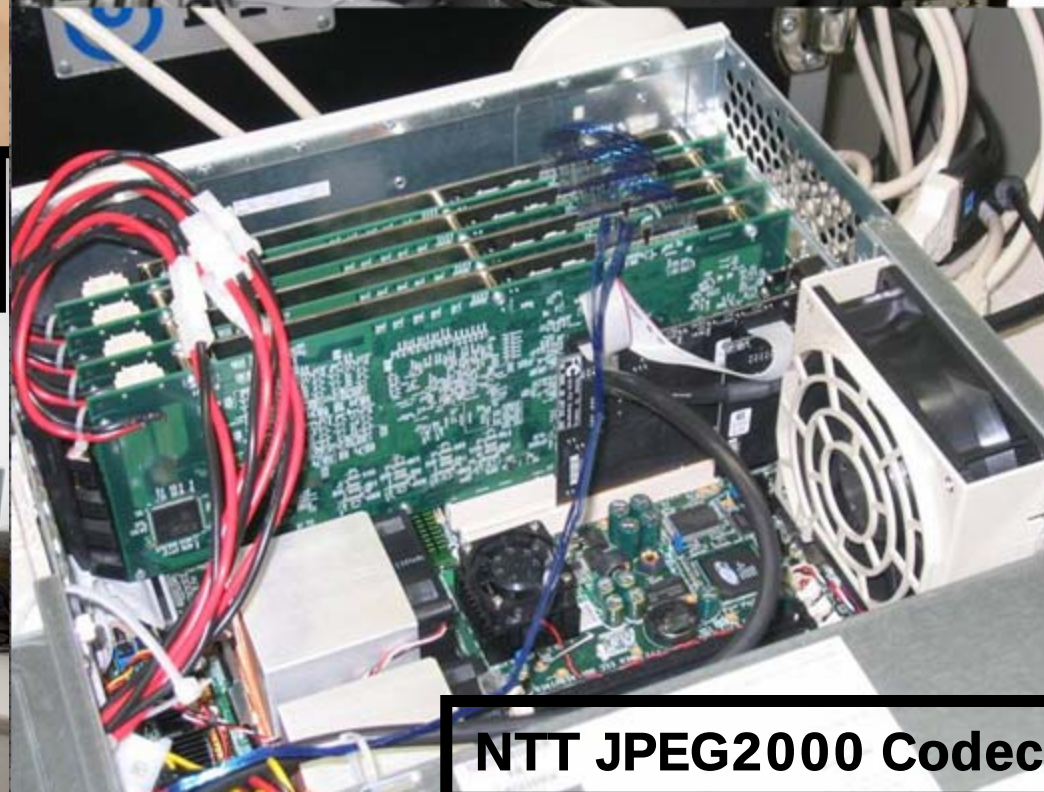
CineGrid Network/Exchange Members are GLIF Members too

Digital Cinema at Calit2

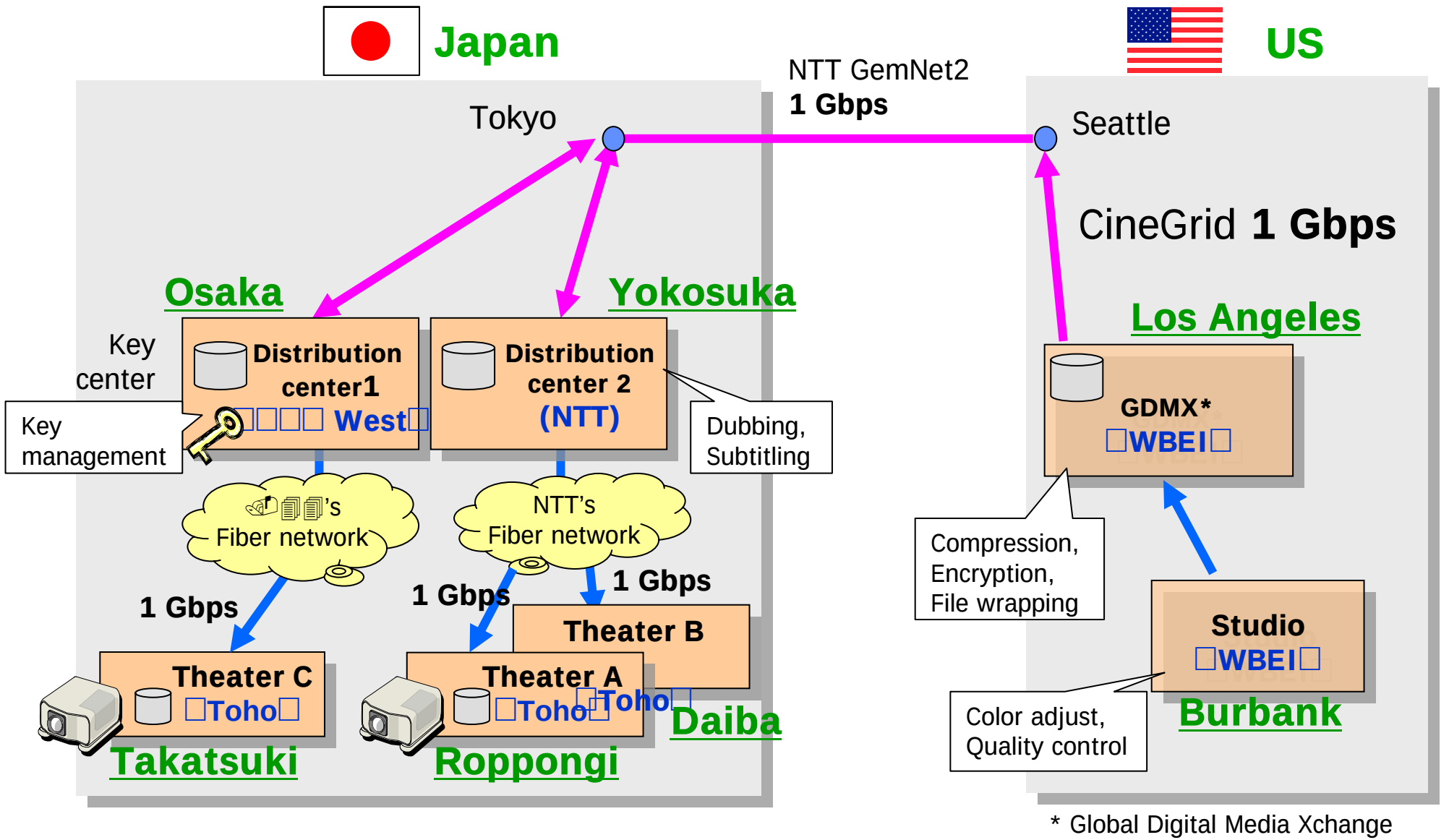
- ✓ 200 seats
- ✓ 1GE to every seat
- ✓ 4K 10000-lumen Sony SXRD
- ✓ 10.2 sound
- ✓ 10GE networking to the projector servers:
  - ✓ NTT JPEG2000
  - ✓ Zaxel Zaxstar
  - ✓ Dell/Nvidia graphics



CineGrid Node at Keio University/DMC, Tokyo

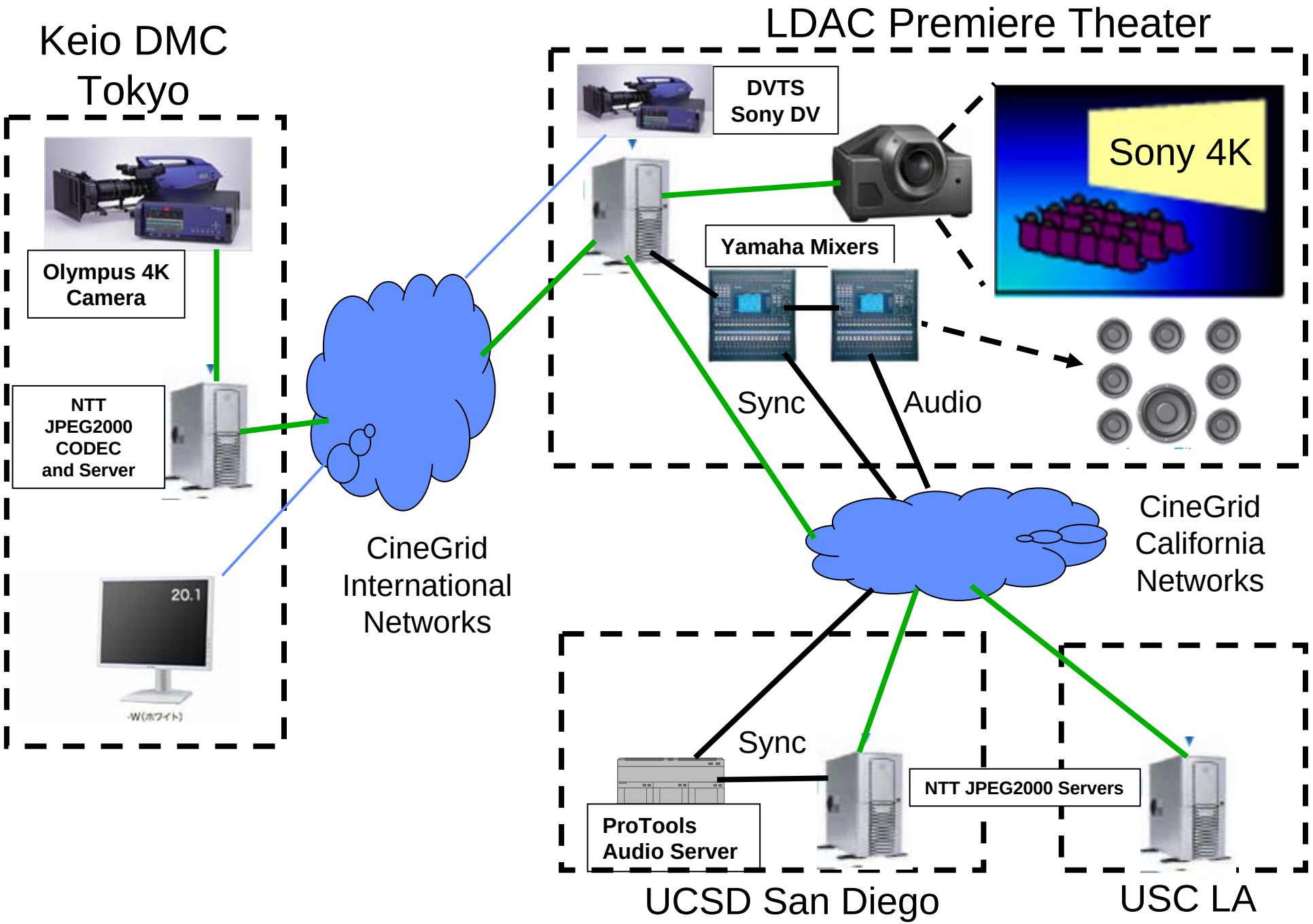


4K Pure Cinema Joint Field Trial 2005
WB-NTT-TOHO via CineGrid



* Global Digital Media Xchange

CineGrid@AES October 2006



CineGrid @ AES 2006
Keio Wagner Society String Ensemble

CineGrid Members' Research

- **Live performance streaming/video conferencing in 4K and HD with multi-channel sound, point-to-point, one-to-many, and many-to-one**

- **Remote recording of uncompressed 4K camera output in real-time**
- **Stereoscopic motion pictures - acquisition, computer generation and display**

- **Networked multi-channel audio solutions with low latency, accurate sync**
- **Remote collaboration workflows and interactive creative tools**

- **Use of dynamic optical networks**
- **Collaboration on tiled displays to 100s of megapixels**

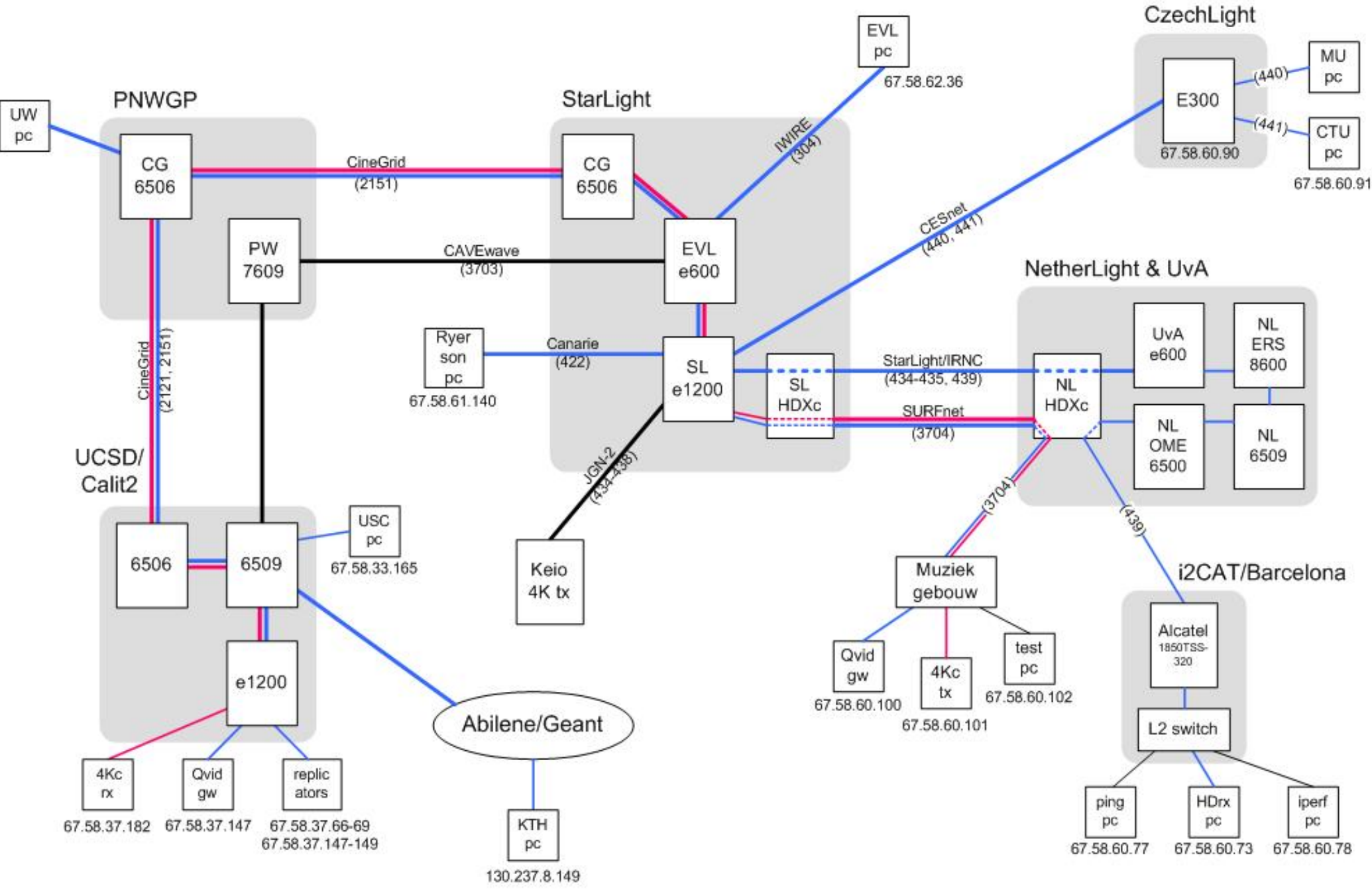
- **Digital archiving, long-term preservation, and secure distribution**
- **Digital media format conversion, compression and enhancement**
- **Digital film restoration using distributed cluster computing resources**

- **Training and methodologies for next generation media professionals**

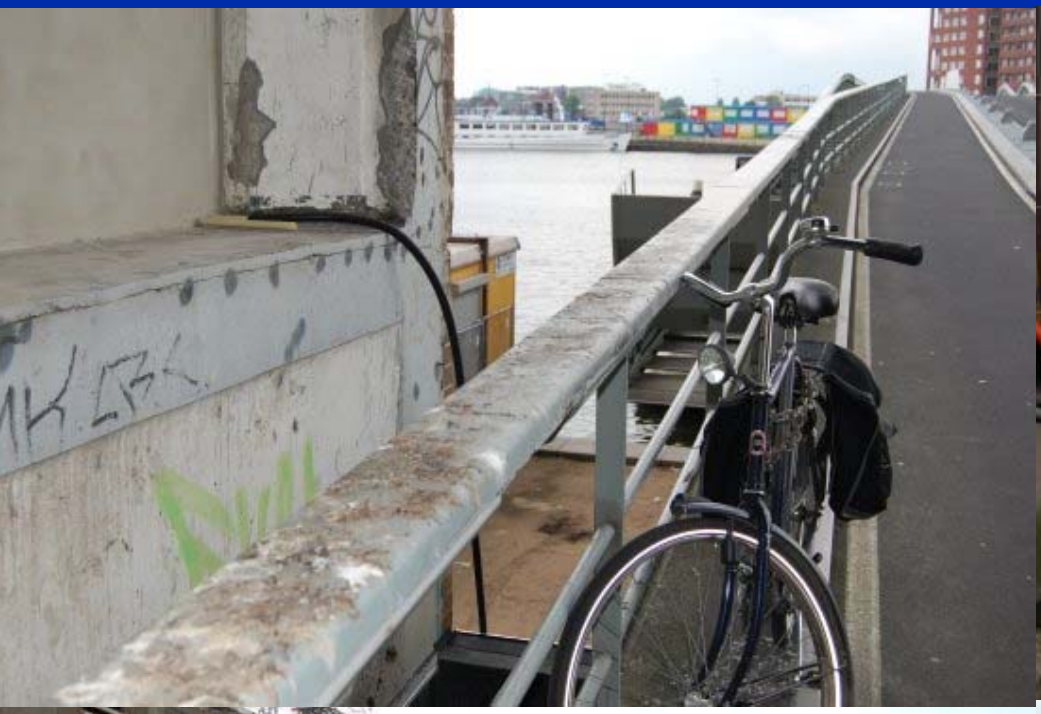
Holland Fest (6/20-22/08) on CineGrid

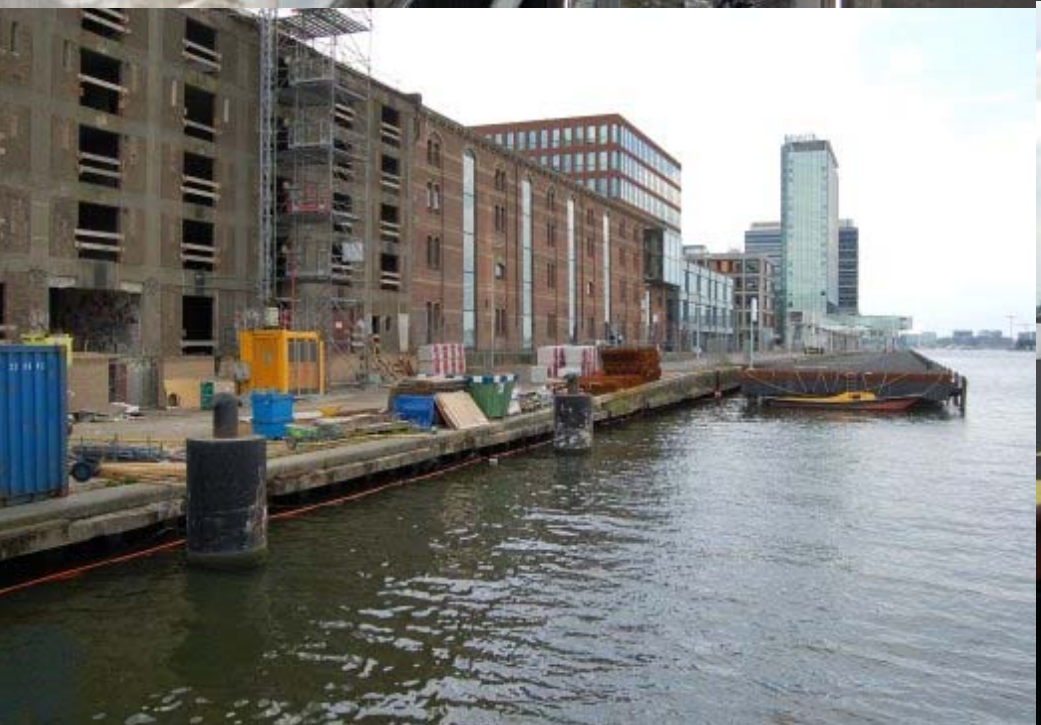
- **“ERA LA NOTTE”** Star soprano Anna Maria Antonacci sang solo madrigals from the Italian baroque in the setting of a theatrical concert (http://www.hollandfestival.nl/#festival/voorstelling/9043)
- 4K transmission
  - JPEG2000 Compressed (500Mb/s) via IRNC/C(ON)2/CAVEwave to Calit2 on Wednesday
  - Uncompressed via IRNC/JGN2 to Keio on Friday (8Mb/s)
- DVCPRO-HD transmission
  - Compressed (135MB/s) via IRNC/C(ON)2/CAVEwave to Calit2 on Thursday
  - Replicated and sent to USC, UW, UIC, Ryerson, (Stockholm), Barcelona, (Prague) as 135Mb/s streams, decoded by PCs
- All done with vlans set up in a week or so

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.


PNWGP
StarLight
CzechLight
NetherLight & UvA
UCSD/
Calit2
i2CAT/Barcelona
UW
pc
CG
6506
CineGrid
(2151)
CG
6506
EVL
pc
67.58.62.36
IWIRE
(304)
E300
67.58.60.90
(440)
(441)
MU
pc
CTU
pc
67.58.60.91
CESnet
(440, 441)
PW
7609
CAVEwave
(3703)
EVL
e600
CineGrid
(2121, 2151)
Ryer
son
pc
67.58.61.140
Canarie
(422)
SL
e1200
SL
HDXc
StarLight/IRNC
(434-435, 439)
SURFnet
(3704)
NL
HDXc
UvA
e600
NL
ERS
8600
NL
OME
6500
NL
6509
JGN-2
(434-438)
6506
6509
USC
pc
67.58.33.165
Keio
4K tx
(3704)
(439)
Muziek
gebouw
Qvid
gw
67.58.60.100
4Kc
tx
67.58.60.101
test
pc
67.58.60.102
Alcatel
1850TSS-
320
L2 switch
ping
pc
67.58.60.77
HDrx
pc
67.58.60.73
iperf
pc
67.58.60.78
e1200
4Kc
rx
67.58.37.182
Qvid
gw
67.58.37.147
replic
ators
67.58.37.66-69
67.58.37.147-149
Abilene/Geant
KTH
pc
130.237.8.149
AMS -> Calit2
4K compressed
AMS -> Calit2 -> sites
HD compressed
Holland Festival
CineGrid 2007
19-21 June 2007
Drawing by Alan Verlo, et al

Swimming Fiber the Last 500m to the Muziekgebouw

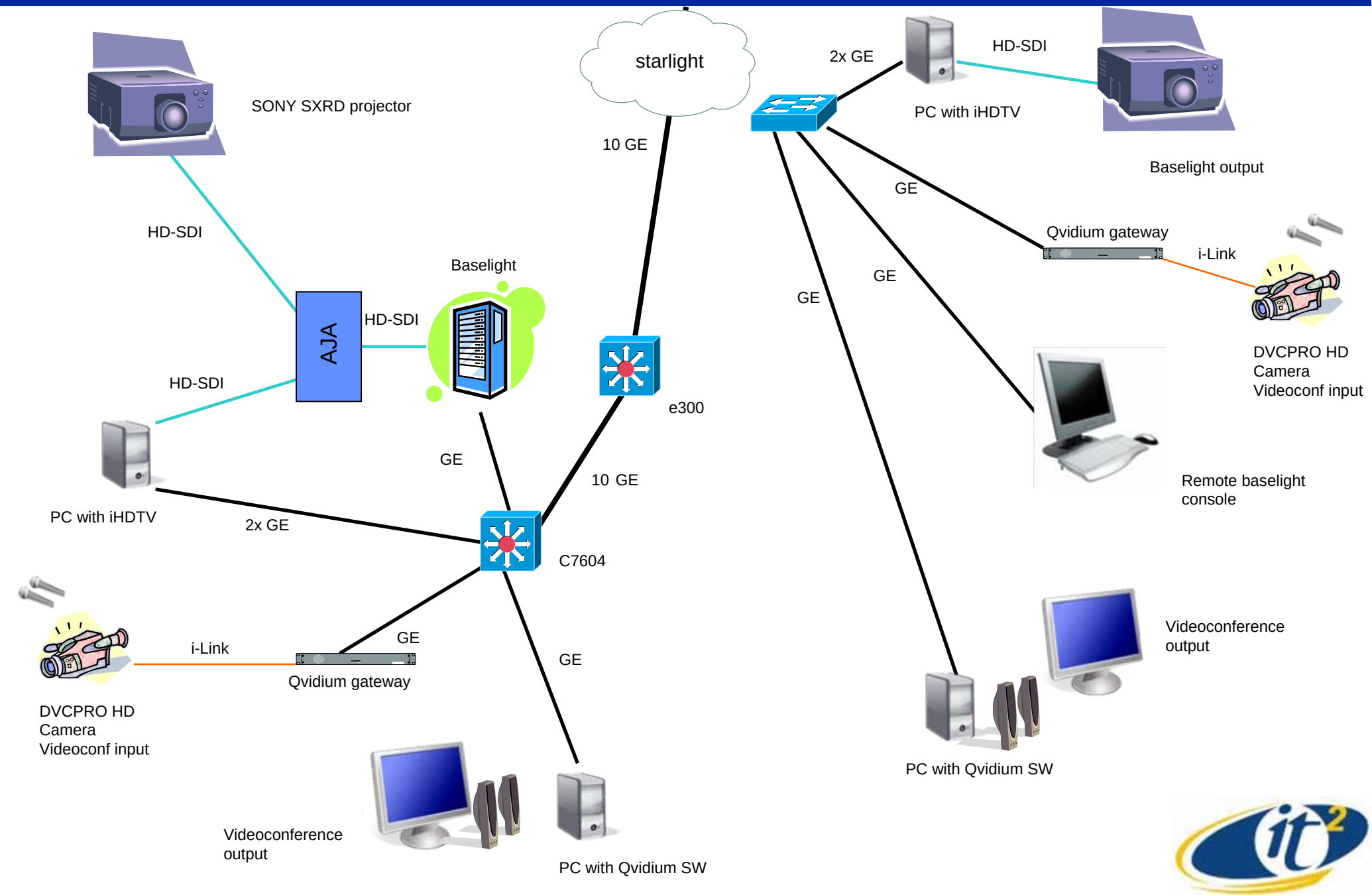




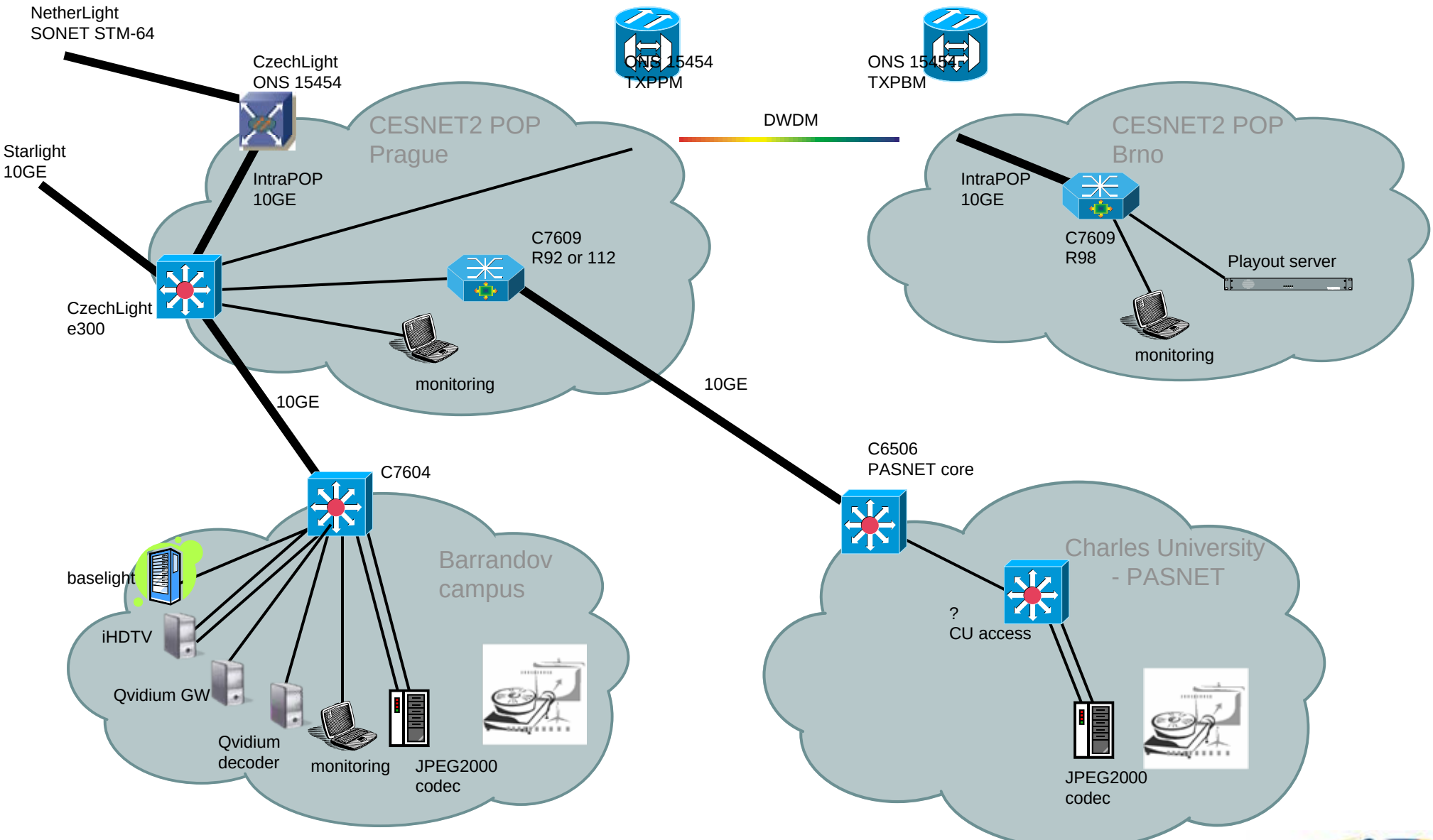
CineGRID @ GLIF demos

Laurin Herr and Michal Krsek

COLOR CORRECTION SETUP – GLIF Demo



Network within Czech Republic setup



Thin undescribed lines are 1Gb/s GE

Summary: CineGrid on GLIF

- **A new goal for GOLEs: global access to cinema production & post production**
  - **Geographic location need no longer be a barrier to your customers creating with the highest media production quality**
  - **You can bring your local talent and facilities to distant places**
  - **You can show support for your projects nationally and internationally**
  - **You will point to increased revenue and employment growth in your media industries working with world-wide collaborators, as well as observable bandwidth utilization of GLIF-style networks**

Beyond 4K Digital Cinema

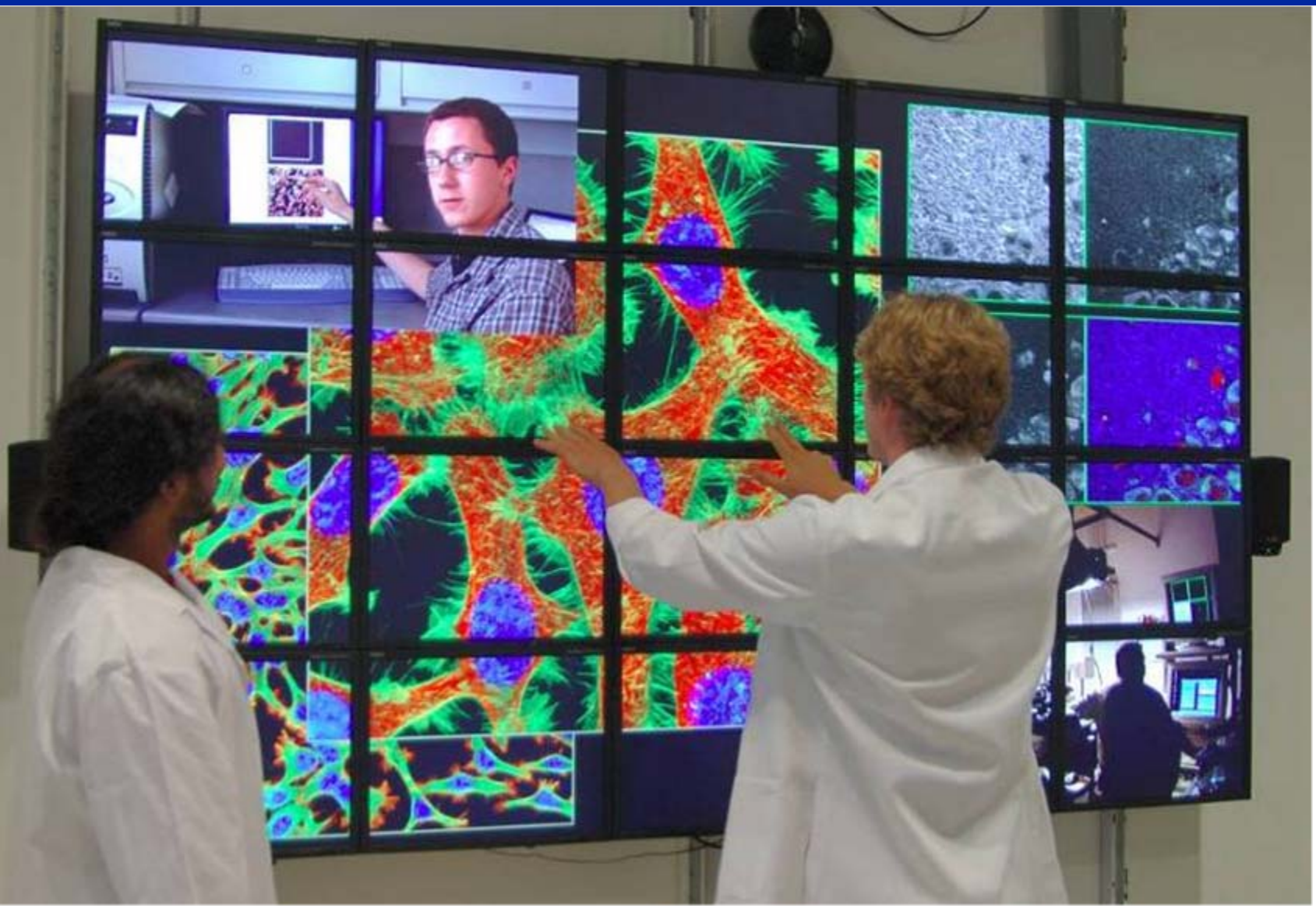
OptIPortals!

The OptIPortal:
EVL 2004: World's 1st 100 Million Pixel Display

evl electronic visualization laboratory

it²

OptIPortal–Termination Device for Dedicated 1 & 10 Gigabit/sec Lightpaths



Integration of High Definition Video Streams with Large Scale Image Display Tiled Walls

Using Scalable Adaptive Graphics Environment (SAGE) and Rocks

evl electronic visualization laboratory

evl electronic visualization laboratory

Photo Source: David Lee, Mark Ellisman NCMIR, UCSD

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

it2

OptIPortal Always-on Video Conferencing: Here using DVCPRO-HD Streaming

EVL Weekly Meetings Using OptIPortals□□

Source: Luc Renambot, EVL

HyperWall at UCSD >200 Megapixels

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

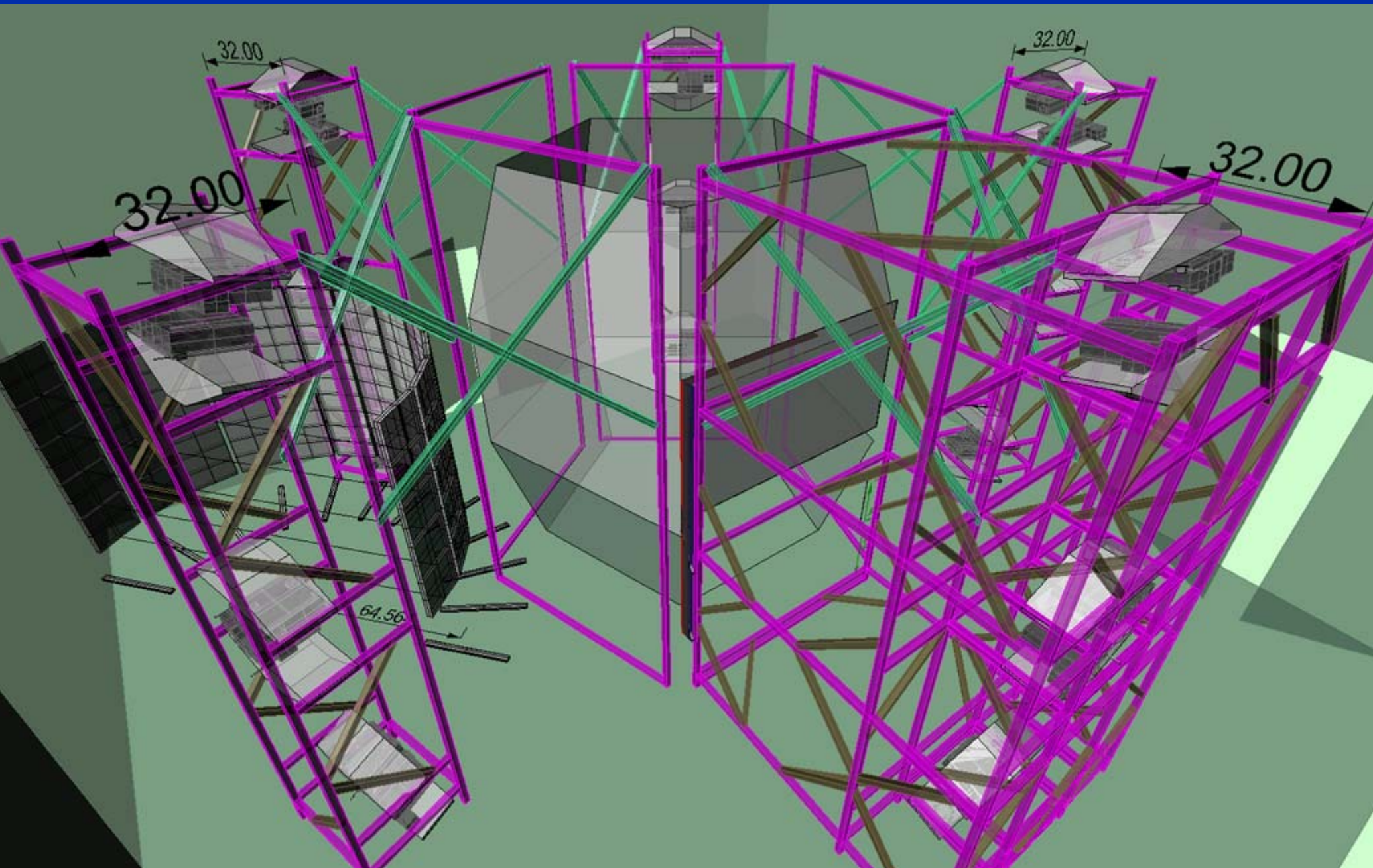
Calit2/EVL Varrier
60 Screen Stereo OptIPortal, no Glasses Needed

evl electronic visualization laboratory

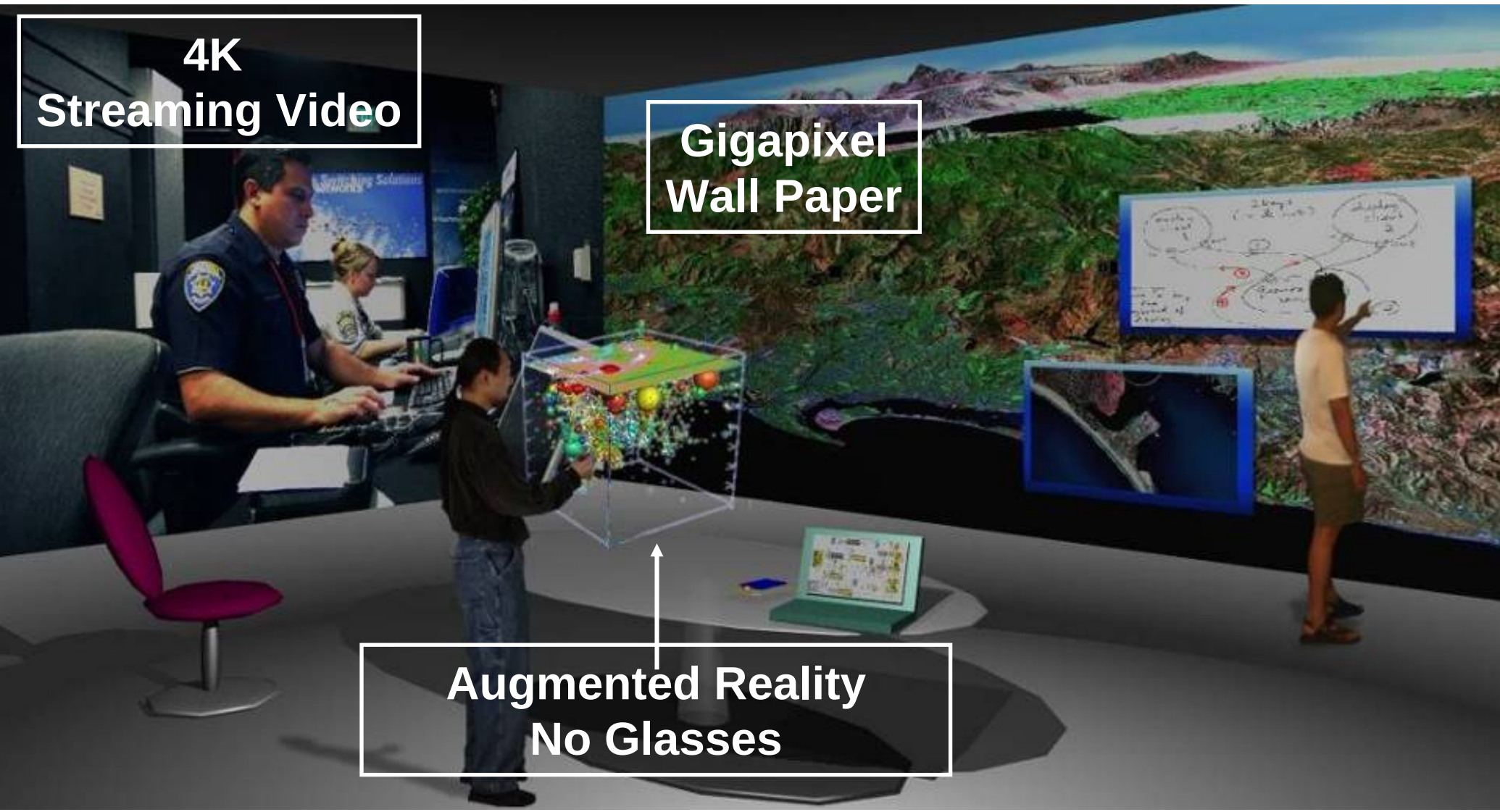
Dan Sandin, Greg Dawe, Tom Peterka, Tom DeFanti, Jason Leigh, Jinghua Ge, Javier Girado, Bob Kooima,
Todd Margolis, Lance Long, Alan Verlo, Maxine Brown, Jurgen Schulze, Qian Liu, Ian Kaufman, Bryan Glogowski

it2

StarCAVE OptIPortal
5 Columns of 3 Screens + Floor-Projected Stereo HDTV
200 Gbs connected via 1GE and 10GE



From 2004
OptIPuter Vision for the Next Decade: Gigapixels @ Terabits/sec



1 GigaPixel x 3 bytes/pixel x 8 bits/byte x 30 frames/sec ~ 1 Terabit/sec!

Source: Jason Leigh, EVL

Thank You Very Much!

- **Our planning, research, and education efforts are made possible, in major part, by funding from:**
  - US National Science Foundation (NSF) awards ANI-0225642, EIA-0115809, and SCI-0441094
  - State of California, Calit2 UCSD Division
  - State of Illinois I-WIRE Program, and major UIC cost sharing
- **Argonne National Laboratory and Northwestern University for StarLight networking and management**
- **National Lambda Rail, Pacific Wave and CENIC**
- **NTT Network Innovations Lab**
- **Cisco Systems, Inc.**
- **Pacific Interface, Inc.**

Storage and Computing: No More Computer Rooms Needed!

- **UCSD/Calit2 Blackbox Experiment**
- **Blackbox is a machine room in a shipping container from Sun Microsystems**
  - **20%-30% power savings because of very efficient cooling design**
  - **Standard Servers. Production supercomputer cluster fits in one Blackbox**
  - **Just drop it in a parking lot with enough power**
- **Sun came to UCSD to test an operational Blackbox (all 10 Tons of it) and subject it to seismic and vibration tests. 6.7 magnitude "Northridge" quake**
- **We suggested that the CAMERA portal (our computational genomics project) should run inside the container as an actual complex application.**
- **We built a scaled cluster with all GOS Data inside of the Blackbox**
  - **10 Servers + one 24TB Storage Server**
  - **Took 1.5 hours**
  - **1TB data transfer over Campus Network in 12 hours.**
  - **Identical functionality/results of Production CAMERA Portal**

Some Serious Shaking