

Birds Of a Feather Meeting

SC 2011

Agenda

- Introductions
- SAGE Overview
- SAGE User Community Updates
- SAGE Developments
- SAGE Next



Introductions

- SAGE Research and Development Team


Jason Leigh


Luc Renambot


Maxine Brown


Sungwon Nam


Arthur Nishimoto

- SAGE Audience Participants
  (have audience introduce themselves)

What is SAGE?

- SAGE – Scalable Adaptive Graphics Environment
- Operating System software for organizing visualizations and information on scalable display walls to help researchers deal with problems of scale and complexity in their research.
- Specializes in streaming visualizations from remote rendering servers / supercomputers.
- Originally began with an NSF ITR grant (The OptIPuter) in 2003.

SAGE User Community

78 Sites (38 U.S. and 40 Global)

SAGE User Sites 2011

Australia
- AARNet
- Australian National University
- CSIRO Discovery Center
- CSIRO Information and Communication Technologies, Marsfield
- Monash University – Caulfield
- Monash University – Clayton
- University of Melbourne
- University of Queensland

Brazil
- University of Sao Paulo, Laboratory of Computer Architecture and Networks

Canada
- Ciena Networks
- Communications Research Centre
- Simon Fraser University

China
- Beihang University, State Key Lab of Software Environment Dev.
- Chinese Academy of Sciences, Computer Network Information Center

Czech Republic
- Masaryk University, Laboratory of Advanced Networking Technologies (2)

Germany
- Braunschweig University of Technology, Institute of Computer and Network Engineering

India
- Monsanto Research Centre

Japan
- Cybernet Systems Co., Inc.
- Kyoto University
- National Institute of Advanced Industrial Science and Technology (AIST)
- National Institute of Information and Communications Technology (NICT), Koganei, Japan (3)
- NICT, Keihanna Research Center, Kyoto
- NTT Network Innovation Laboratories, Yokosuka
- NTT Advanced Technologies
- Osaka University, CyberMedia Center

Korea
- Gwangju Institute of Science and Technology (GIST)
- Korea Institute of Science and Technology Information (KISTI)

Mexico
- Ensenada Center for Scientific Research and Higher Education (CICESE)

Netherlands
- SARA Computing & Networking Services
- University of Amsterdam, System and Network Engineering Research Group
- University of Amsterdam, e-BioScience Laboratory

New Zealand
- Victoria University of Wellington

Poland
- Poznan Supercomputing and Networking Center

Russia
- Russian Academy of Sciences, Science and Innovation Center
- Russian Academy of Sciences, Space Research Institute

Saudi Arabia
- King Abdullah University for Science and Technology (KAUST)

Taiwan
- National Center for High-performance Computing (NCHC)

United States
- Adler Planetarium & Astronomy Museum
- Argonne National Laboratory, Center for Nanoscale Materials
- Argonne National Laboratory, Math and Computer Science
- Argonne National Laboratory, Nuclear Engineering Division
- Argonne National Laboratory, Transportation Research and Analysis Computing Center
- Calit2/U California, Irvine
- Calit2/U California, San Diego (5)
- Casa Familiar
- Extreme Networks
- Florida International University, Center for Internet Augmented Research & Assessment (CIARA)
- Louisiana State University, Center for Computation and Technology
- Monsanto
- NASA Ames Research Center, Lunar Science Institute
- NASA Goddard Space Flight Center, Space Visualization Studio
- Northwestern University, International Center for Advanced Internet Research (iCAIR)
- Purdue University, Envision Center for Data Perceptualization
- Rincon Research Corporation
- Sharp Laboratories of America
- South Metro Career Center
- Texas A&M University, Computer Science
- United States Geological Survey (USGS) Earth Resources Observation and Science
- UCSD-National Center for Microscopy and Imaging Research
- UCSD-Scripps Institution of Oceanography
- University of Hawaii, Center for Microbial Oceanography: Research and Education (2)
- University of Illinois at Chicago, ACM Student Chapter
- University of Illinois at Chicago, Electronic Visualization Lab (EVL), Cyber-Commons
- University of Illinois at Chicago, EVL, Cyber-Commons 3D
- University of Illinois at Urbana-Champaign/National Center for Supercomputing Applications
- University of Michigan-Department of Atmospheric, Oceanic & Space Sciences
- University of Michigan, Digital Media Commons
- University of Michigan, School of Information
- University of Texas at Austin, Texas Advanced Computing Center (TACC)
- University of Washington

SAGE New Users 2010-2011

20 Additional Sites (10 U.S. and 10 Global)

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- Russian Academy of Sciences, Space Research Institute

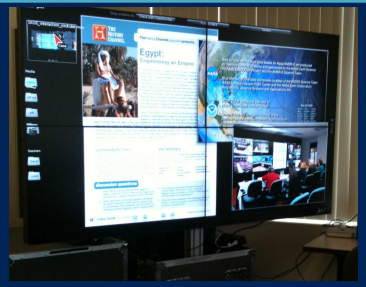
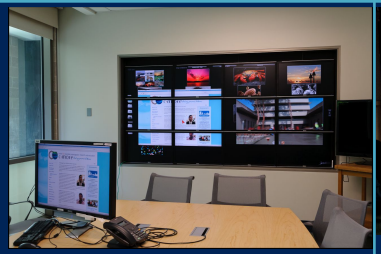
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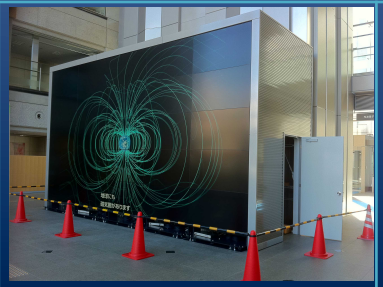
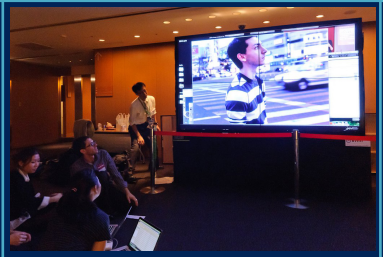
SAGE New Users 2010-2011

U.S. Locations

PHOTO NOT AVAILABLE	UNDER CONSTRUCTION		UNDER CONSTRUCTION	
Argonne National Laboratory, Math and Computer Science	Argonne National Laboratory, Nuclear Engineering Division	Casa Familiar	Extreme Networks	Monsanto
				
NASA Ames Research Center, Lunar Science Institute	South Metro Career Center	U Hawaii, Center for Microbial Oceanography: Research and Education (Ampitheater)	U Hawaii, Center for Microbial Oceanography: Research and Education (Meeting Room)	UIC Electronic Visualization Laboratory, Cyber-Commons 3D

SAGE New Users 2010-2011

International Locations

				
University of Sao Paulo, Laboratory of Computer Architecture and Networks, BRAZIL	Communications Research Centre, CANADA	Beihang University, State Key Lab of Software Environment Development, CHINA	National Institute of Info. And Communications (NICT), Koganei (Exterior), JAPAN	National Institute of Info. And Communications (NICT), Koganei (5th Bldg), JAPAN
		PHOTO NOT AVAILABLE		
National Institute of Info. And Communications (NICT), Koganei (6th Bldg), JAPAN	National Institute of Info. And Communications (NICT), Keihanna Research Center, Kyoto, JAPAN	NTT Network Innovation Laboratories, Yokosuka, JAPAN	NTT Advanced Technologies, JAPAN	Poznan Supercomputing and Networking Center, POLAND

SAGE User Community Updates



Thomas A. DeFanti

Calit2, University of California San Diego

OptIPortables at SIGGRAPH'11



Calit2 NSF MSI-CIEC Workshop Sept 16, 2011



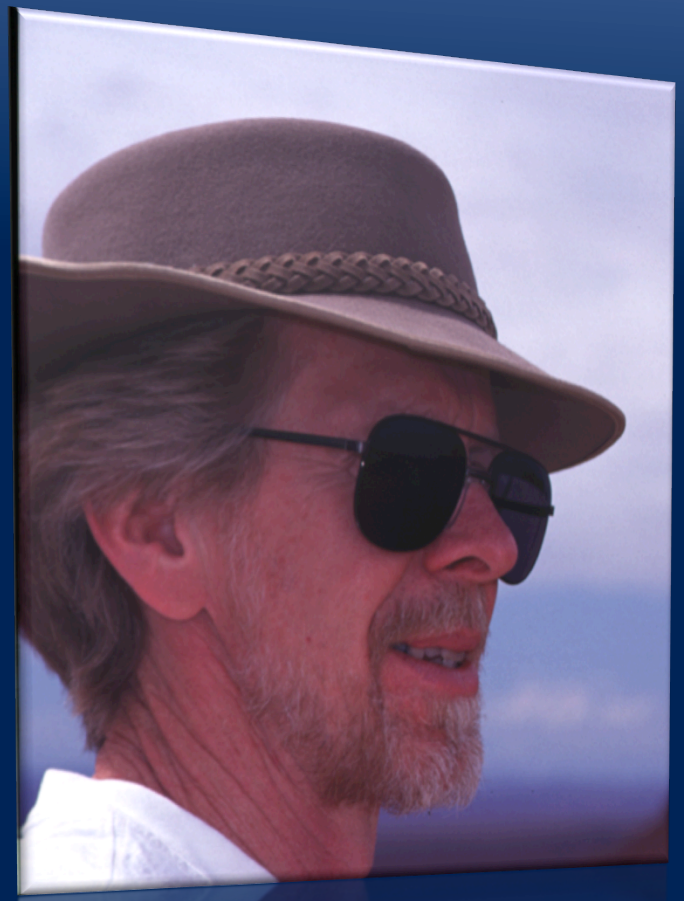
Calit2 Archeology Users with SAGE



Calit2 OptIPortal Community Project



SAGE User Community Updates



Bernard Pailthorpe

University of Queensland, Australia

OptIPortals - SAGE:

visualisation for scientific applications

Bernard Pailthorpe, Research Computing Centre & Vislab, U Qld. Australia
with **Chris Willing**, Richard Hammond, Nick Hamilton, Michael Pheasant, Nicole Bordes.
bap@uq.edu.au **vislab.uq.edu.au** **qcif.edu.au**

- **Integrate Scientific applications:**
  - **porting to Optiportal / SAGE environment**
  - **general: Matlab, Paraview**
    & bio-imaging: *iCluster, UCSC Genome Browser*

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

www.sagecommons.org

OptiPortal Display at UQ VisLab (50 MegaPixel)



Tiled 4 x 5 24'' LCD display
7680 x 6000 pixels
Cluster, Cent-OS ROCKS
SAGE, CGLX

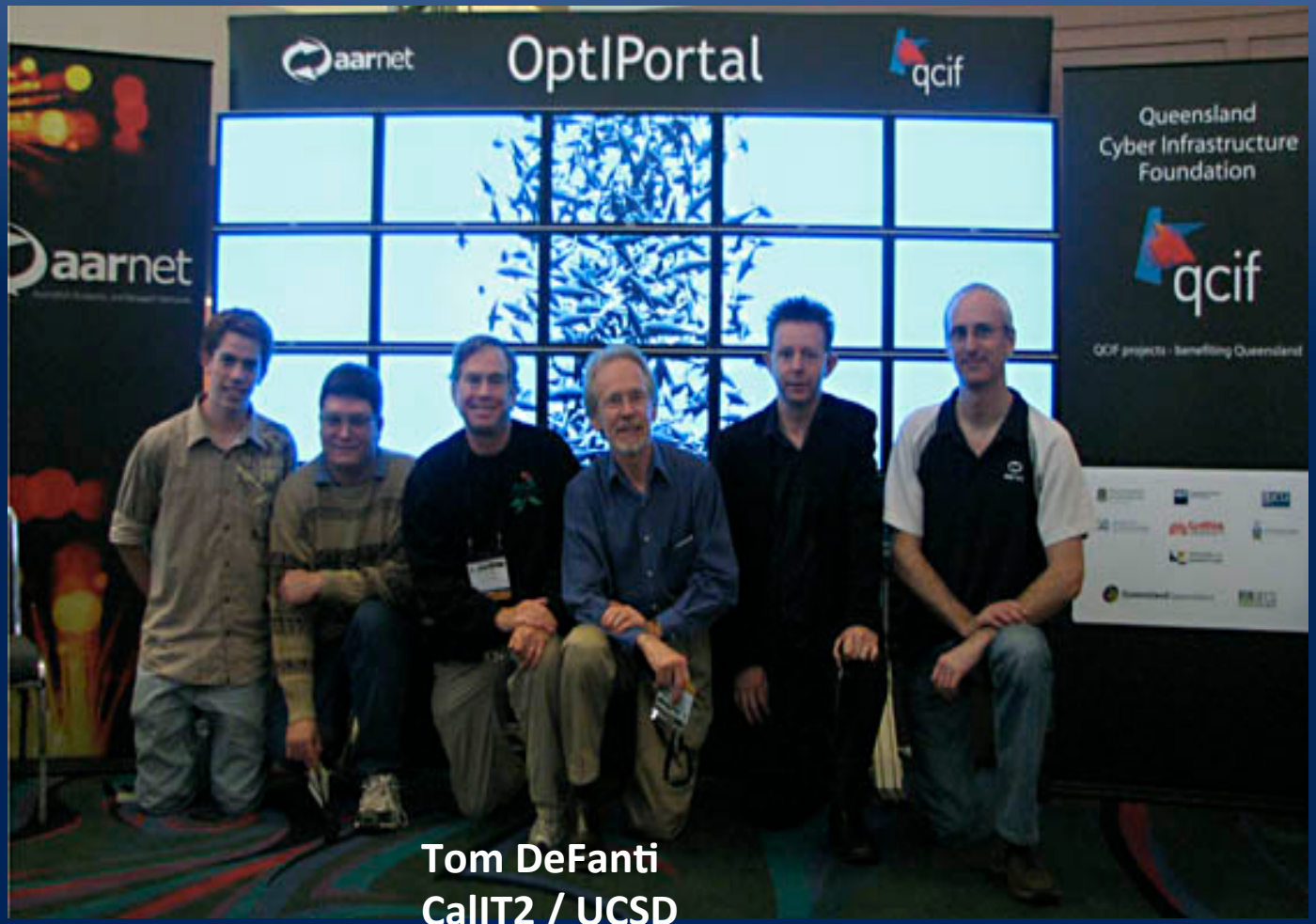
~ A$50k for 50 Mpx



Constructed by Chris Willing, Jonathon White, Imran Syed (Dec 2007)

www.vislab.uq.edu.au/research/optiputer/
www.sagecommons.org

OptI*Portable*: UQ, QCIF & AARNet - at *QuestNet-08*



Tom DeFanti
CalIT2 / UCSD
2008 Keynote

National Exposure:
Touring conferences & events
(AALD, Educause..)

Porting scientific apps to the OptIPortal – demo at *QuestNet-09*



i -Cluster: **Nick Hamilton (IMB), R Hammond, Chris Willing & B Pailthorpe**

iCluster
- IMB, UQ

Classify 100s-1000s of cell images on the fly, with humans in the loop

Run "natively" in OptIPortal

… breaking out of desktop limitations

Processing
*** java - SAGE**

Joggle – to OpenGL

Paraview in SAGE on AARNet's OptiPortable display

- following Byongil (was TACC)





Chris Willing presenting to CalIT2's Jurgen Schultze and CSIRO's Justin Baker
- at ***IEEE e-Science* 2010**, QUT, Brisbane Dec 2010;
- paraview rendering in mpi-mode across the optiportal cluster

Web Browsers in SAGE OptiPortal displays

Chris Willing



Professors Tom Defanti (Calit2, EVL) and Bernard Pailthorpe (UQVislab) viewing an unscaled 5760x4000 Google map of



Detail of the unscaled 5760x4000 Google map of Brisbane

- Execute app inside a large X virtual frame buffer
  eg. *Xvfb :1 -screen 0 5760x4000x24*
  - large network load: degrades performance
- Use *screamer (SCReen strEAMER)* – to SAGE & synthesize pointer events – interactivity

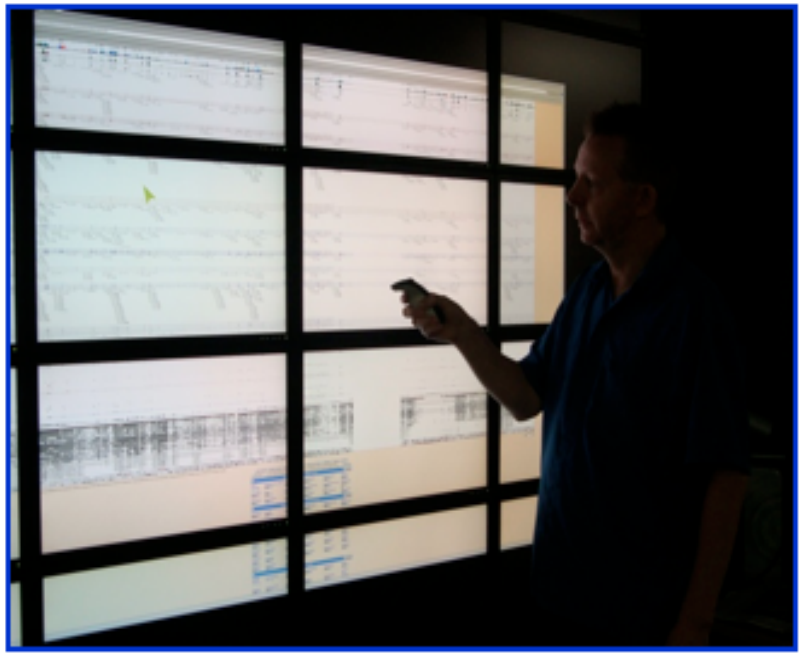
- no keyboard events (in SAGE)
  eg. to enter URL

- apps needs a DISPLAY option

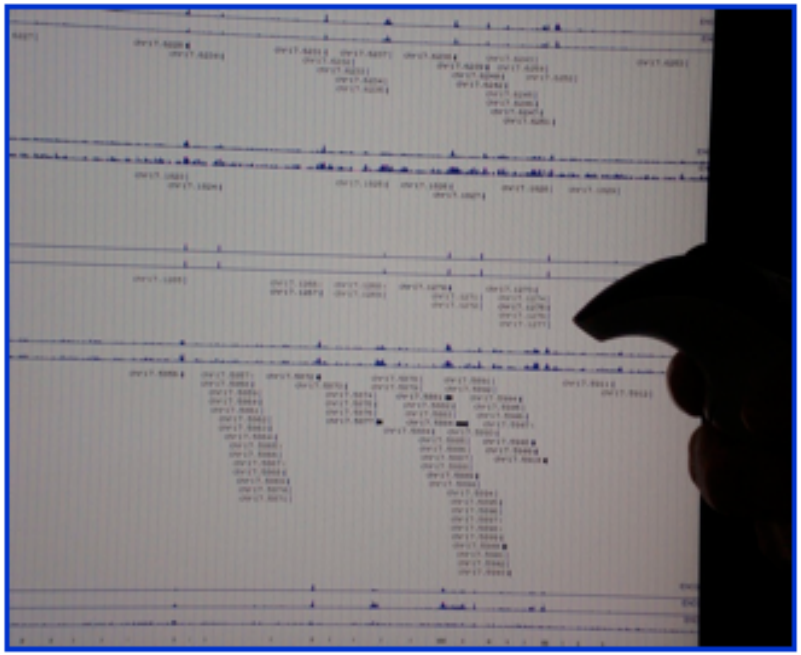
www.vislab.uq.edu.au/research/optiportal/software/browser/

UCSC **Genome Browser** in SAGE OptiPortal displays

Chris Willing



Using a 3D wireless mouse to interact with a 5760x4000 genome browser

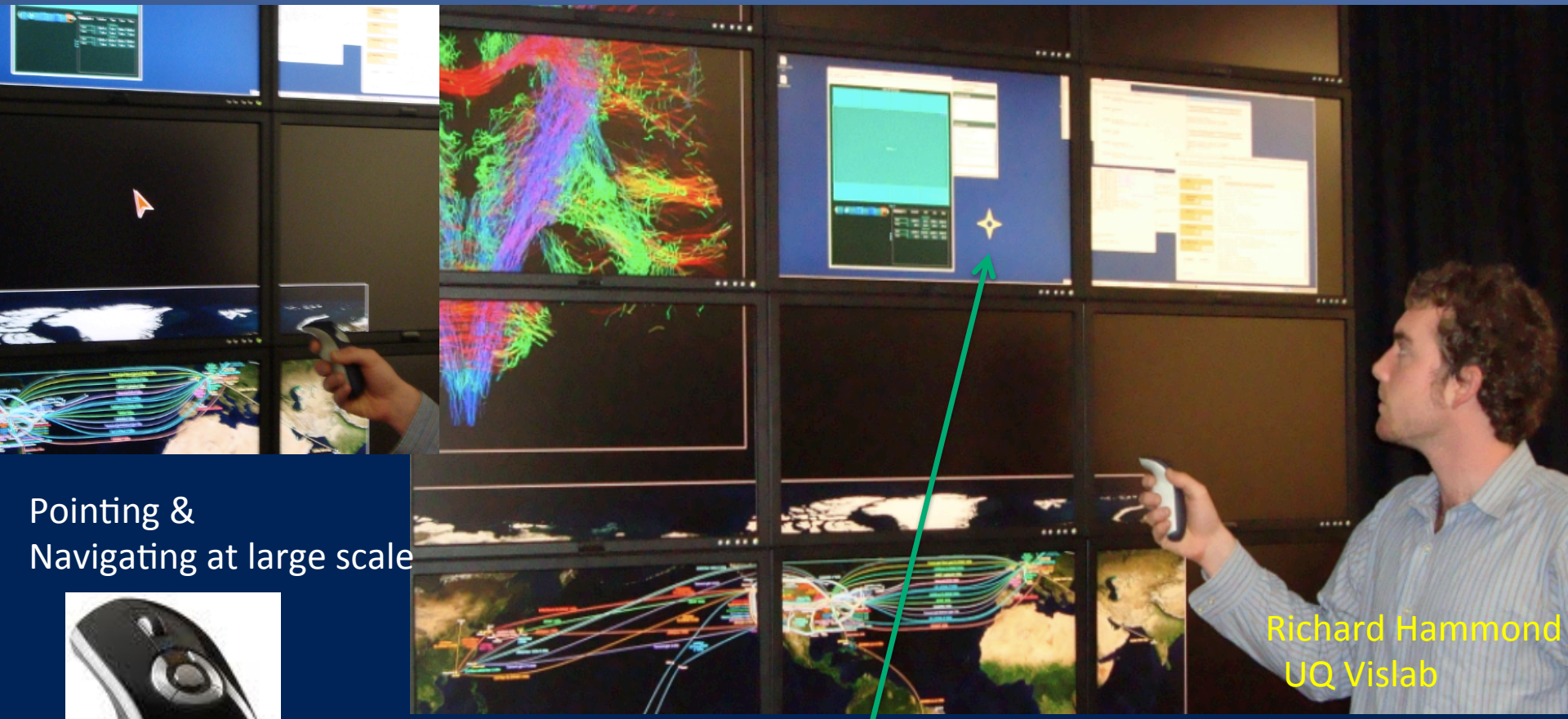


Detail of 5760x4000 genome browser. Many of the genome features are themselves links which can be followed by clicking with the 3D mouse.

Genome (re) assembly – very wide browser interface to codes, very large data

www.vislab.uq.edu.au/research/optiportal/software/browser/

3D Interaction with the OptIPortal, SAGE & apps: **Input**



Pointing &
Navigating at large scale



3D gyro mouse
www.gyration.com

Input. Activating menu control buttons in app's window
(copied from head Node) – separate from 3D navigation.

Output. Atlantis, Paraview - mpi distributed across cluster

SAGE User Community Updates

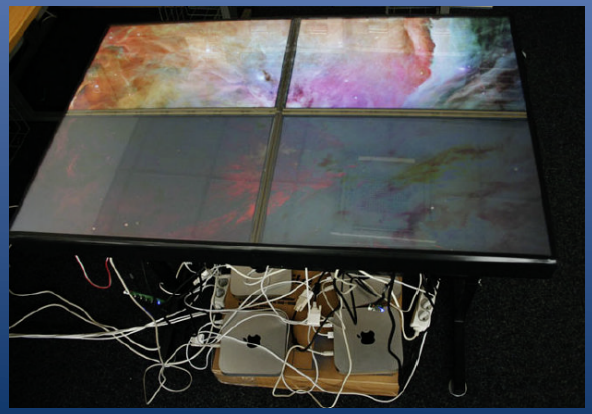


Petr Holub

Masaryk University

Czech Republic





MUSE: Multi-Sensor Framework

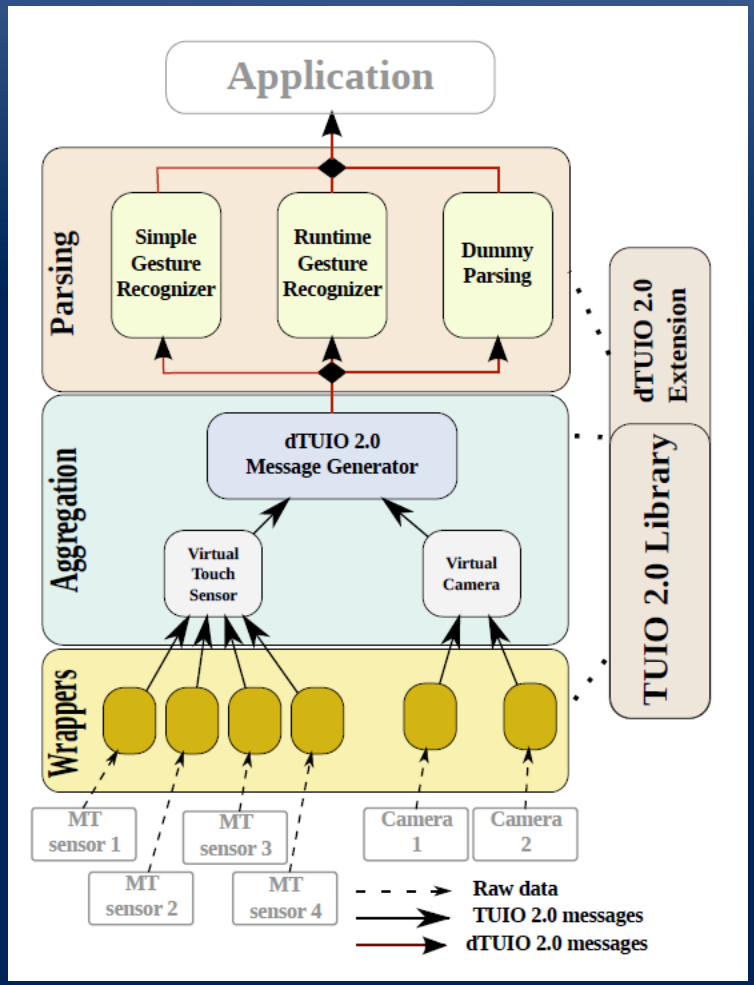
Vít Rusňák, Lukáš Ručka, Petr Holub

MUSE – Multi-Sensor Framework

- Areas of interest
  - group-to-group interaction
  - support for distributed sensors (tiled screens, arrays of sensors)
  - gesture recognition
  - distinguishing users interacting with the system
- Research issues
  - algorithms for coupling information from several sensor types
  - utilization of low-latency high-speed network to couple information from the sensors of the same type

MUSE – Multi-Sensor Framework

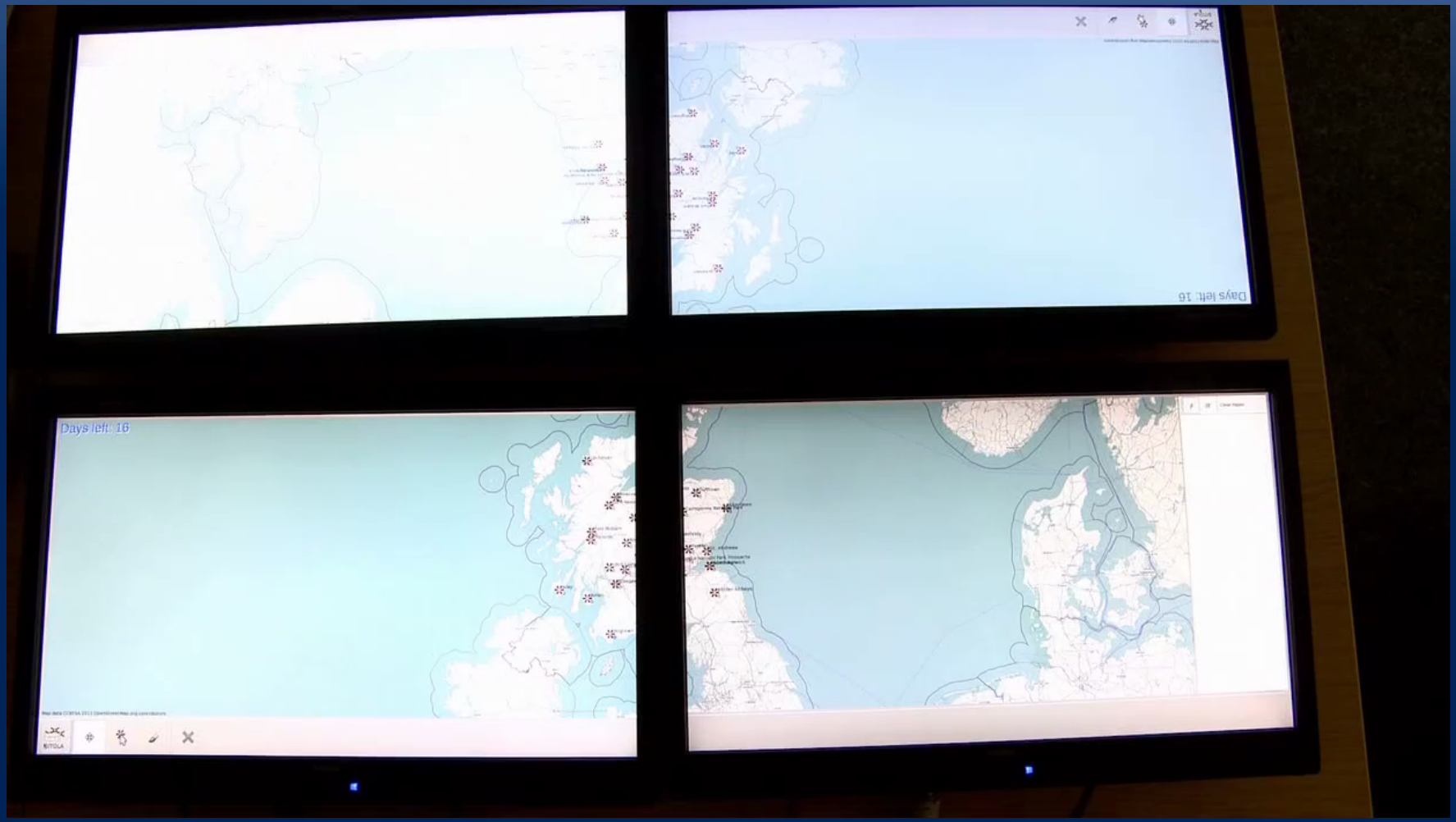
- Universal open-source multi-sensor framework
- Support for off-the-shelf sensors
- Introduces TUIO 2.0 to SAGE
  - http://www.tuio.org/?tuio20
- Gesture recognition
  - c.f. SAGE Direct Interaction Manager



MUSE – Multi-Sensor Framework

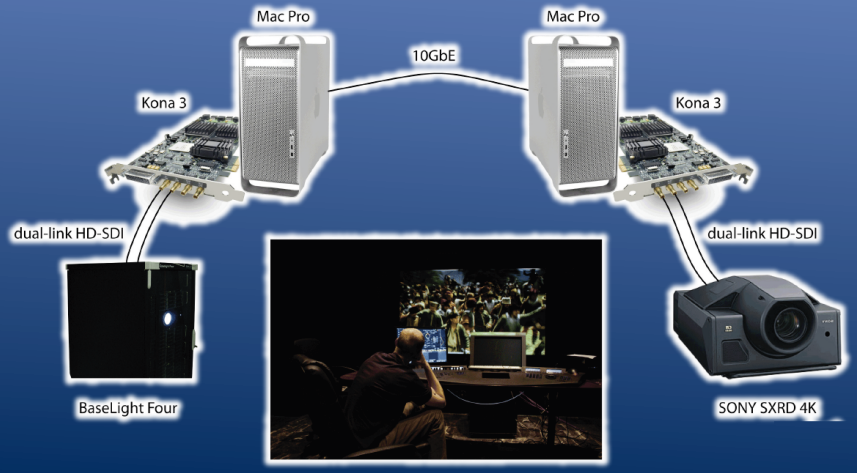
- Timeline
  - 12/2011: wrappers for MS Kinect, Wii Remote, webcams
  - 03/2012: multi-sensor data coupling
  - 07/2012: gesture recognition modules
- Availability
  - https://seth.ics.muni.cz/cgi-bin/gitweb.cgi?p=touch.git;a=summary
- Other SAGE-related development
  - TUIO 2.0 C++ interface, SAGE-enabled Celestia space simulator, partial SAGE buffer update, SAGE UI for tablets

TUIO: Shared Maps



Acknowledgements

MSMT LM2010005
MSM 0021622419



UltraGrid Streaming to SAGE

Martin Pulec, Jiří Matela, Petr Holub,
et al.

UltraGrid Platform

- High-quality low-latency video transmissions
  - HD, 2K, 4K, targeting sub-100ms end-to-end latency
  - includes audio support
  - multi-point data distribution with UDP packet reflectors (or multicast)
- Focus on commodity hardware
  - Linux PC and Mac OS X
  - GPUs
- SAGE backend
  - UltraGrid receiver passes the data to the SAGE cluster
  - can stream directly from a UltraGrid sender to SAGE using embedded receiver
- BSD-Licensed Open Source
- Available for download from
  - http://ultragrid.sitola.cz

UltraGrid - Compressions

- Focus on GPU-based compression/decompression
  - affordable high-throughput processing
- DXT1
  - 250 Mbps for 1080p60
  - GPU in shaders, 7.9ms for HD@(33dB PSNR, 1:6), 30ms for HD@(36dB PSNR, 1:6),
  - CPU based on FastDXT library
- DXT5 YCoCg
  - 500 Mbps for 1080p60
  - GPU in shaders, 8.8ms for HD@(39dB PSNR, 1:3), 34ms for 4K@(42dB PSNR, 1:3)
- MJPEG
  - user-settable bit rate
  - CUDA-based, 7.6/11ms for HD@(40dB PSNR, 1:5), 29ms/24ms 4K@(42dB PSNR, 1:6.5) on 1GPU (compression/decompression)
- MJPEG2000
  - only compression so far, 17.5ms for HD@(42dB PSNR, 1:10), 38.5ms for 4K@(42dB PSNR, 1:20)

UltraGrid Demos at SC'11

- With EVL team at KAUST booth
  - DXT1 CPU/DXT1 GPU/DXT5 GPU
  - RGB DXT1 (GPU implementation) can be displayed directly by SAGE
- At LSU booth
  - stereo HD in a loopback mode

Acknowledgements

MSMT LM2010005
MSM 0021622419
GD 102/09/H042

SAGE User Community Updates

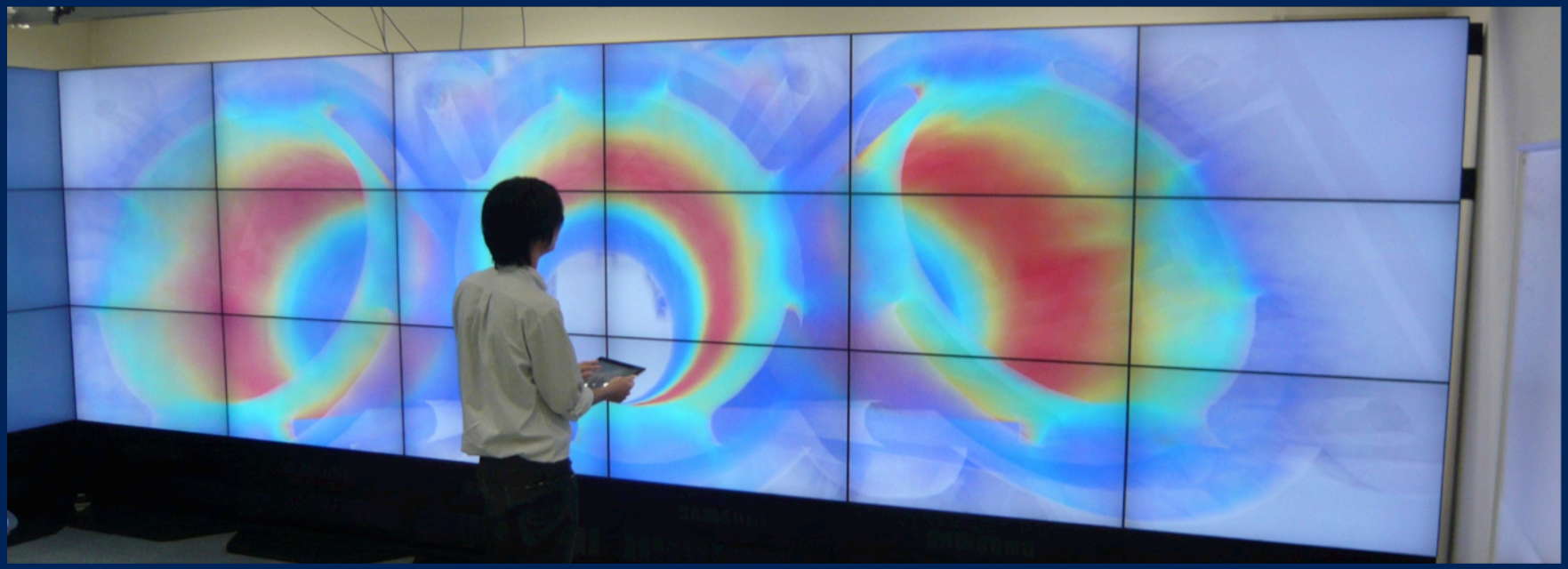


Shinji Shimojo

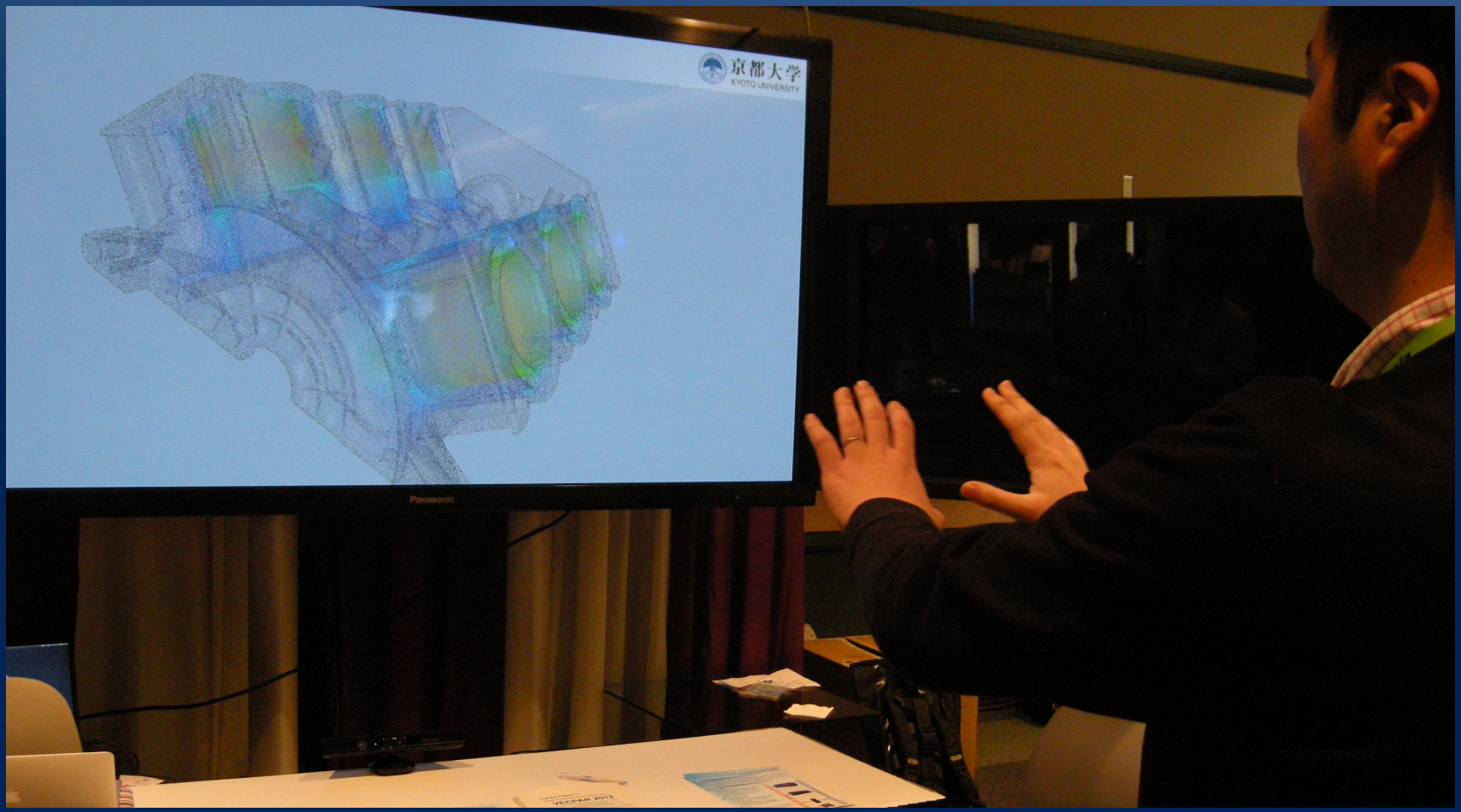
NICT and Osaka University, Japan

Tiled Display Wall

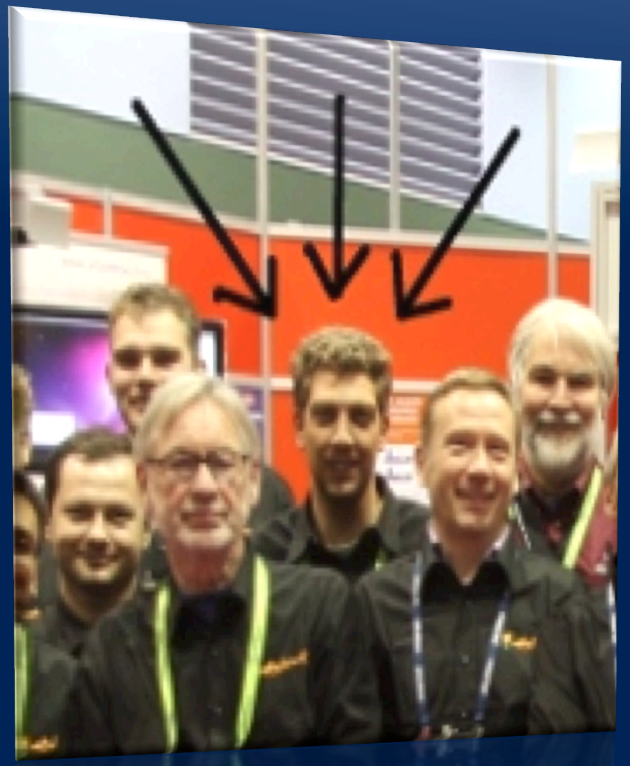
- Volume rendering technique for unstructured volume dataset on high-resolution display environment



User Interface using Kinect



SAGE User Community Updates



Paul Melis

SARA Supercomputer Center

Amsterdam

High resolution remote visualization using Paraview and SAGE over two 10Gbps transatlantic links

Paul Melis, Ronald van der Pol, Paul Wielinga
SARA

(paul.melis@sara.nl)

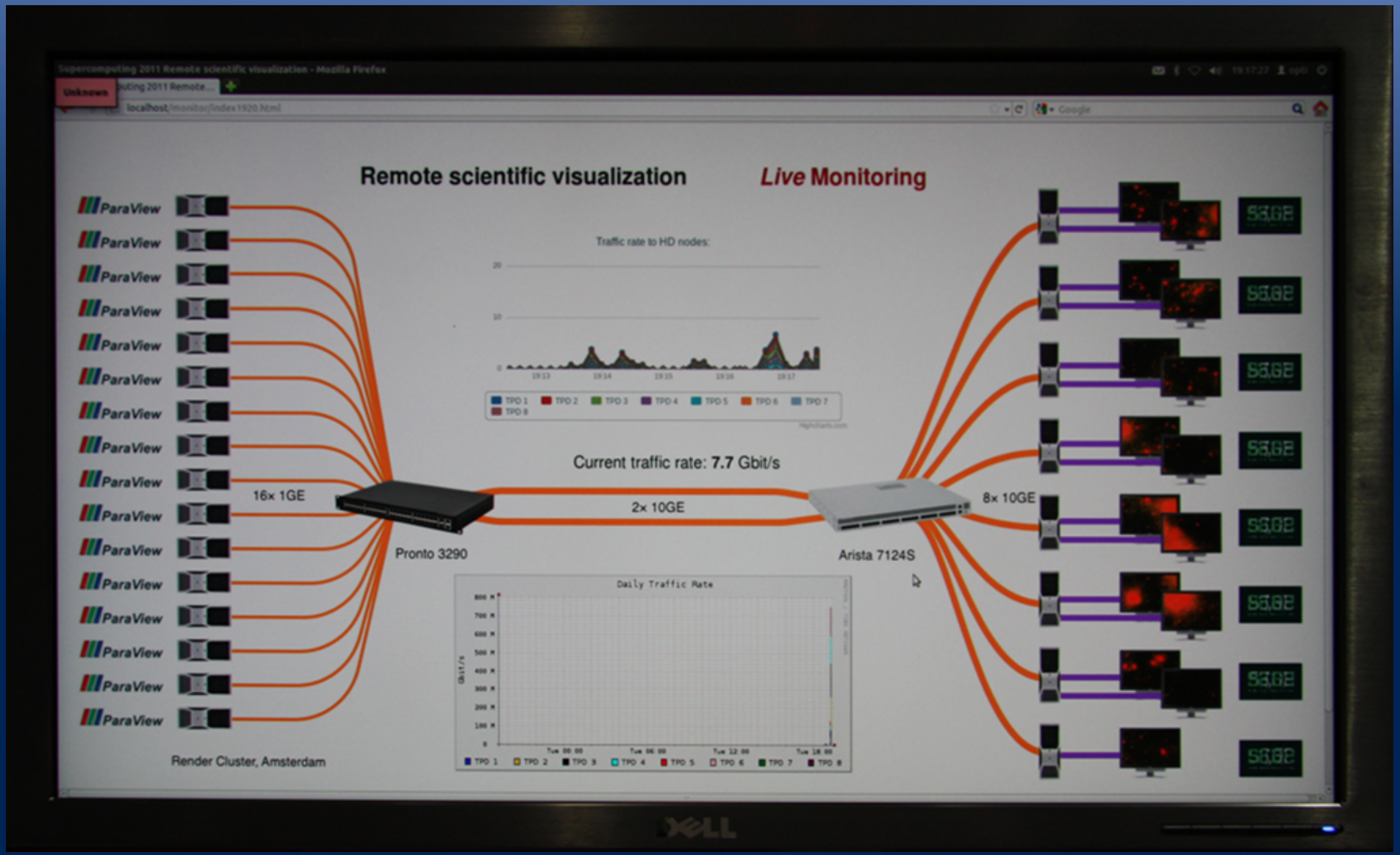


SC11 Demonstration

- Remote (scientific) visualization
  - 16-node render cluster in Amsterdam
  - SARA TPD on booth #642
  - Use two 10Gbps light paths
- Real-time & interactive
  - Based on ParaView
  - Using ParaView patches from EVL to add SAGE output
  - Some extra hacks

SC11 Demonstration

- The Plan was to use two 10GE light paths, but...
- ... only a single trans-atlantic 10G link working a.t.m. :-/
- Latency not too bad
  - Ping: 155ms
  - Quite usable when interacting with ParaView
- Will try to get second link up



www.sagecommons.org

The “Collaboratorium”

- Multi-functional board room
  - 7+ persons
  - Presentations/discussions/brainstorming...
  - High-resolution visualisations
  - Video-conferencing

Collaboratorium – video wall

- 4x2 Full-HD 55” thin-bezel screens
- Multi-touch overlay
- Separate 3D stereo projection



- Different types of usage
  - “Plug-and-plug”
    - Show laptop output (on 1x1 or 2x2 displays of choice)
    - Robust and simple operation: switching and scaling of video signals, no software required
  - More advanced usage:
    - SAGE-based (with touch interface)
    - Remote visualization using SARA render cluster
- Room scheduled to open Q1 2012

Thanks for the attention!

Come visit us
(and collect a Dutch tulip bulb)
at
booth #642



SAGE User Community Updates



Estelle Dodson

Collaborative Technologies Specialist

NASA Lunar Science Institute

NASA Activities with SAGE

- Built wall and demonstrated SAGE at NASA IT Summit, San Francisco, CA, August 14-17
- Presented “Worlds Without Walls” talk using SAGE at NASA TEDx, August 17
- Used SAGE to run science talks at the SACNAS conference in San Jose, October 28-30

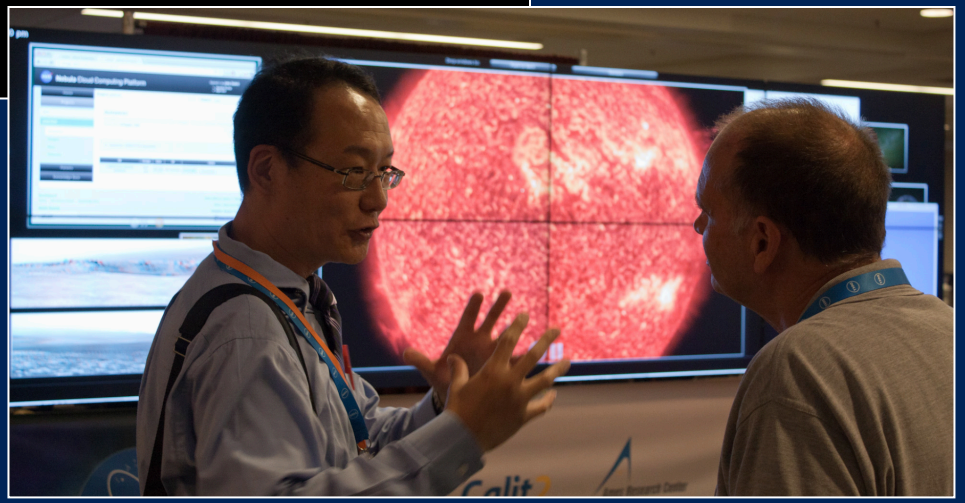












www.sagecommons.org

Outcome

- Awarded lab space in the NASA Ames Research Park (NRP)
- Connect Lab and Connect Garage





Next Steps

- Set-up Connect Lab
- Add touch and videoconferencing capabilities to the wall
- Gather NASA science and engineering content
- Install SAGE and connect to other walls at NASA and academic partners
- Establish SAGE wall as an Ames capability for team and project use

Connect Lab

- A center of excellence in pioneering collaboration as a scientific investigation integrating multiple disciplines
- Provide state of the art expertise and recommendations for projects, missions and teams doing collaborative work
- Create, implement and integrate collaborative systems, social protocols and procedures - evaluate results
- Provide open environments for the investigation, application and training of collaborative technologies

SAGE Development Update



Luc Renambot

Electronic Visualization Lab,
University of Illinois at Chicago

SAGE: Website

- *sagecommons.org*
- News and events
- Downloads
- **Forums**



SAGE: Binary Distribution

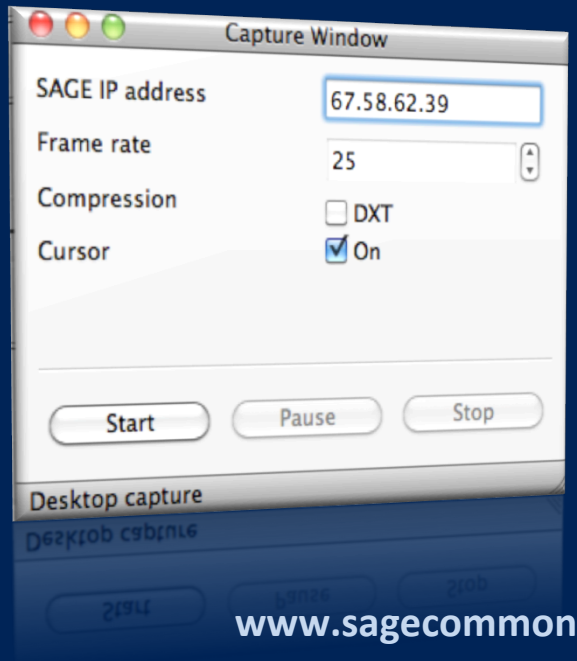
- RPM and DEB based v.3.3.4
  - 64bit versions
  - Centos 5.5
  - openSUSE 11.4
    - Version 12.1 coming (16th of November 2011)
  - Ubuntu 11.04
  - Scientific Linux (SL) 6
    - RedHat / CentOS compatible
- Make a case for other OS distribution

SAGE: Linux Distribution

- Live bootable CD base on openSUSE 11.4, containing:
  - openSUSE 11.4 distribution
  - sage v3.3-4 RPM
- all the SAGE dependencies
- an 'extras' directory containing:
  - Latest NVIDIA drivers
  - Latest Myrinet 10G ethernet drivers
  - Latest Blackmagic drivers and MediaExpress application

Improvements: Applications

- Qshare
  - ‘High-speed’ desktop sharing
  - 15 to 20 fps on laptop / mini
  - Need a gigabit (~ 800 Mbps)
  - Available binary for MacOSX
  - Coming for Linux / Windows



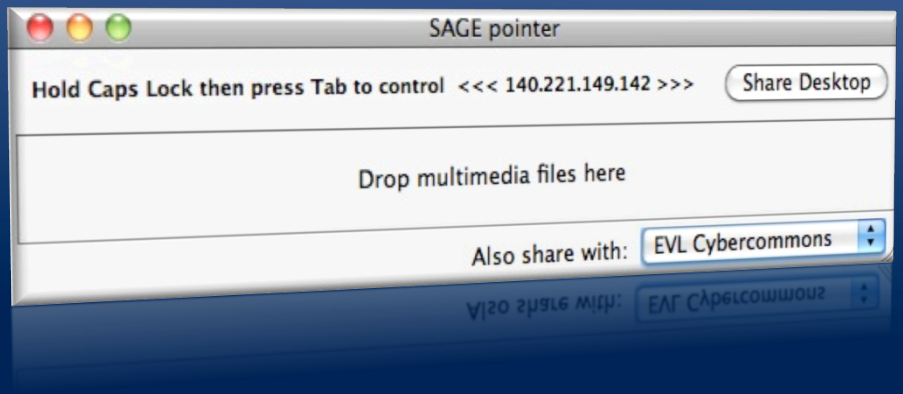
Improvements: Applications

- "Blackmagic" capture
  - Digital and analog capture
    - HDMI and HD-SDI
    - Video-conference unit
    - Laptop and console
  - YUV 422 capture
  - GPU conversion to RGB for display
  - 4K capture 'real soon now'
    - Streaming tested but card not available yet
  - ~ 4 Gbps for 30fps



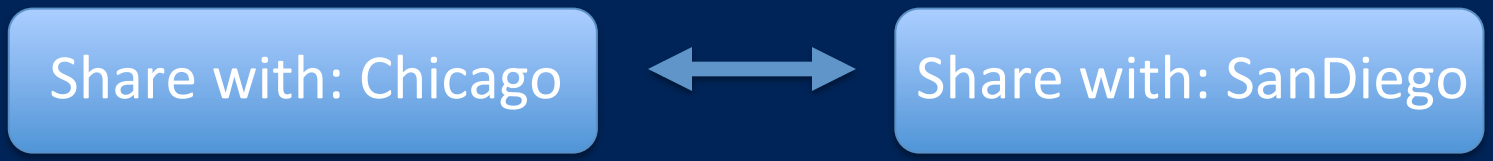
Improvements

- SAGE Pointer
  - Pointer on the wall
    - Name, color
  - Share desktop
    - Launches VNC-viewer on the wall
  - Multimedia drop-zone
    - Image, movies, PDF, …
  - Update for MacOSX Lion
    - Use full login
    - Can open new sessions



Document Sharing

- Drag-and-drop documents between walls
- Copy the document to the remote wall
- Start the application
  - Movies, Images, PDF, VNC
- *Will be extended to support multiple walls*



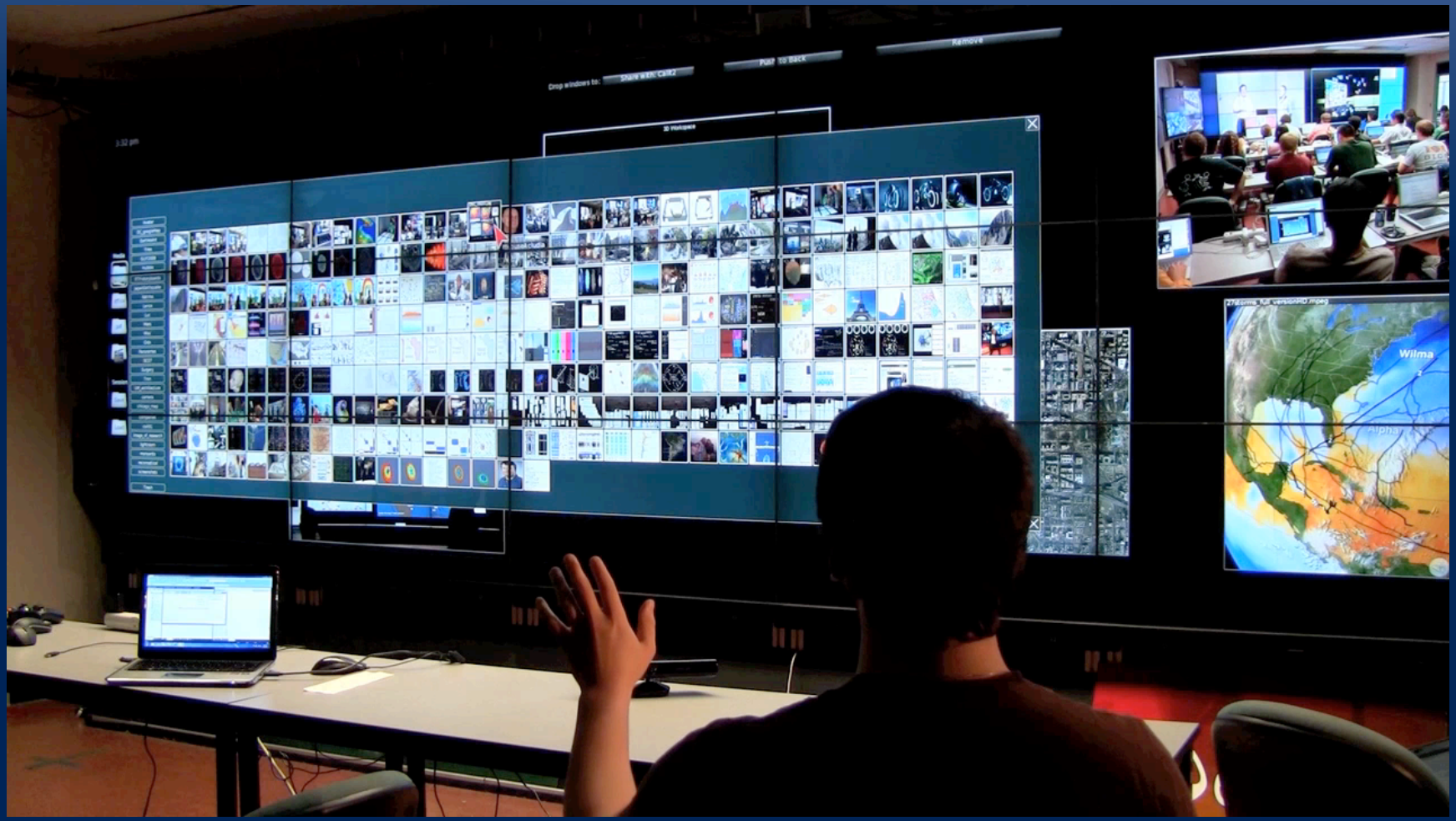
Audio work

- Application streaming audio
- Uncompressed audio
  - Stereo for a start but not a limitation
- Streaming using combination of Jack/Jacktrip software
- SAGE Audio Manager central server
- Mobile and desktop user interfaces

User Interaction

- Integrate innovative modalities
- Touchscreen
  - PQ Labs, VRPN
- User tracking
  - Kinect, Vicon tracking, …
  - TUIO (see Holub's slides)
  - Detect user presence
  - Gesture recognition
- Voice
  - 'articulate' visualization control
  - 'Siri: maximize the window – clean up the wall'

Kinect-controlled Pointer



Future work

- Integration of VisIt
- Compression
  - GPU: codec on GPU
  - WebM: low-latency video
- Cloud
  - Storage
  - Applications

SAGE*NEXT*



Sungwon Nam

Electronic Visualization Lab,
University of Illinois at Chicago

SAGE-Next

- Hardware trend towards multi-processing in a single node.
- Multi-core CPUs, multi-GPUs make single machine can drive tiled-display walls.
  - EVL's 20 foot-wide, 8K by 2K display wall is driven by a single machine.
- But OS is not designed for multi-user collaborative environments provided by large display walls.

SAGE-Next

- Optimized to run on 1 PC via multi-user, multi-core aware resource scheduling.
- Compatible with legacy SAGE streaming applications.
- Enables Cloud applications – e.g. Google services.
- Custom native applications.



One More Thing…

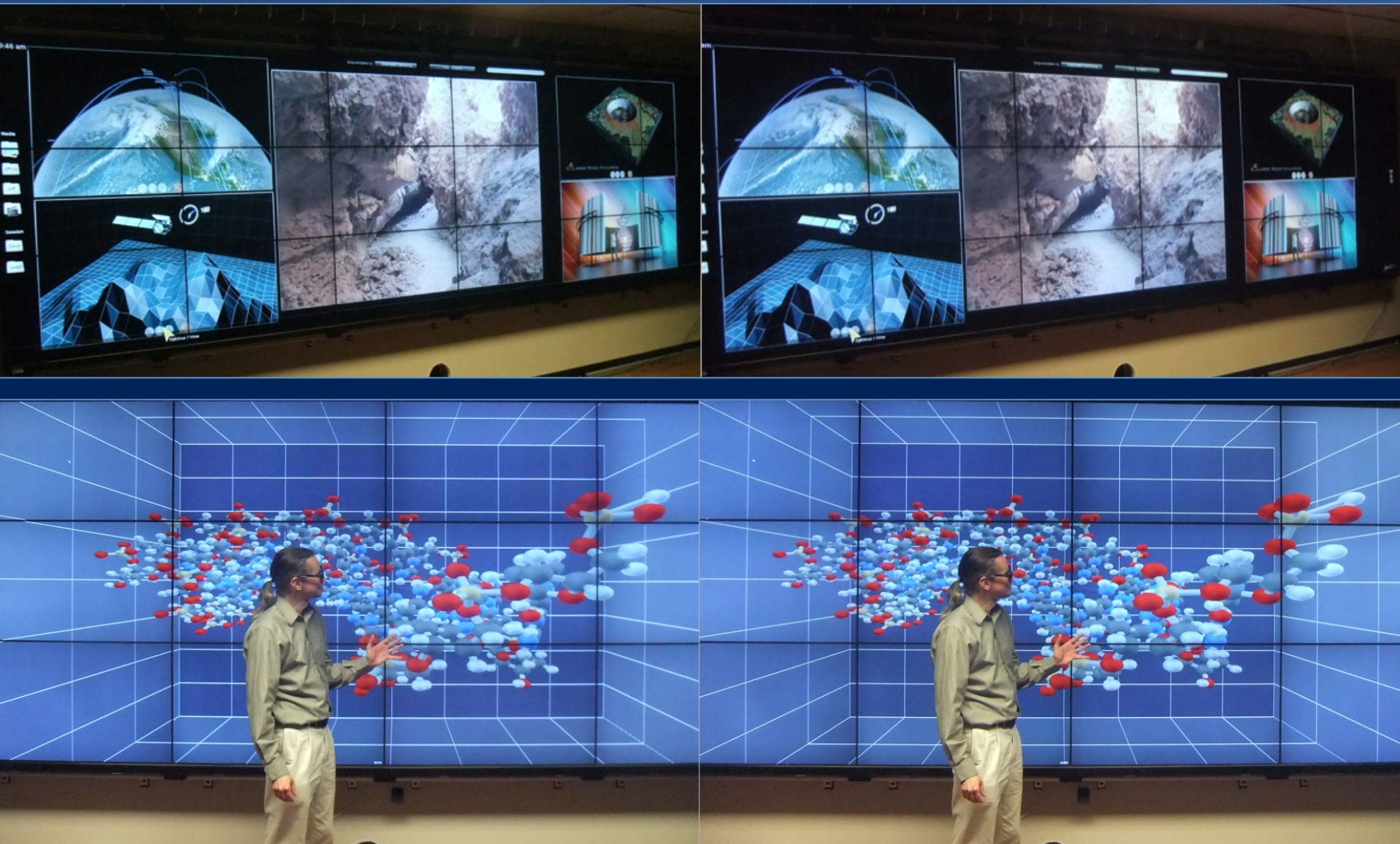
SAGE Licensing

- The University of Illinois at Chicago and NTT-AT are in the process of negotiating a non-exclusive license that will allow NTT-AT to develop and commercialize the SAGE™ tool for industry.
- NTT will help make SAGE more robust and return codes to open source community.
- NTT will develop tools and support commercial users- e.g. in Cinema, Oil & Gas etc.
- EVL will continue to develop capabilities targeted for science and HPC users & develop SAGE Next.

One More One More Thing…

Planar Systems' 3D Tileable LCDs

Cyber-Commons 3D (Electronic Visualization Lab)



Shameless Advertising

King Abdullah University of Science and Technology

Booth # 2910

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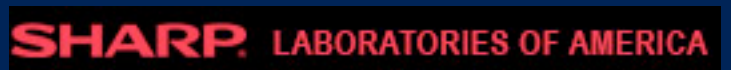
Thank You

The Electronic Visualization Laboratory (EVL) at the University of Illinois at Chicago receives major support for SAGE from the National Science Foundation, award #OCI-0943559.

EVL receives additional support from King Abdullah University for Science and Technology, NTT Network Innovation Lab, and Sharp Laboratories of America, and in-kind support from Texas Advanced Computing Center















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