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 data.
- Specializes in streaming visualizations from remote rendering servers / supercomputers.
The SAGE Team

Electronic Visualization Laboratory, University of Illinois at Chicago
Funding

• Began with NSF ITR (OptIPuter) grant in 2002.
• Supported with NSF STCI grant 2009-2013.
• New support with NSF SI2-SSI grant 2013-2018.
• Additional support from NTT Network Innovation Laboratories, Argonne National Lab, King Abdullah University for Science and Technology, Sharp Lab of America and Monsanto Research.
Agenda

• SAGE Update
• SAGE Applications in Research and Education
• SAGE Future Plans
• SAGE Commercialization
SAGE Update
# SAGE User Community

Over 107 Sites (58 U.S. and 49 Global)

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<thead>
<tr>
<th>Australia</th>
<th>Japan</th>
<th>Saudi Arabia</th>
<th>United States</th>
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<td>• AARNet</td>
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<td>• United States Geological Survey</td>
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<td>• University of Melbourne</td>
<td>• NTT Network Innovation Laboratories, Yokosuka</td>
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<td>• Univ California, Davis, Institute for Ultra-Scale Visualization</td>
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<td>• University of Queensland</td>
<td>• Osaka University, CyberMedia Center</td>
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<td>• Univ California, San Diego Nat'l Ctr for Microscopy and Imaging Rsrh</td>
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| • Katholieke Universiteit Leuven, IBBT | • Gwangju Institute of Science and Technology (GIST) | • National Central University, GeoComputing Laboratory | Taiwan

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**SAGE User Sites 2013**

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- **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 (2), Argonne National Laboratory, Math and Computer Science, Argonne National Laboratory, Transportation Research and Analysis Computing Center, Calit2/U California, Irvine, Calit2-Qi/U California, San Diego (7), Casa Familiar, Case Western Reserve University, Kelvin Smith Library, Extreme Networks, Florida International University, Center for Internet Augmented Research & Assessment (CIARA), Lakota Technical Solutions Inc, Louisiana State University, Center for Computation and Technology, Lucasfilm, Information Technology, Michigan Technological University, Computer Science, Monsanto (3), NASA Ames Research Center, Lunar Science Institute, NASA Goddard Space Flight Center, Space Visualization Studio, Naval Postgraduate School (7), Northwestern University, Int’l Center for Advanced Internet Research (iCAIR)
- **Over 107 Sites (58 U.S. and 49 Global)**

**SAGE User Community**

- BoF 2013

[www.sagecommons.org](http://www.sagecommons.org)
New Comprehensive Documentation

• PDF file on SAGE site
• Overview
  – What is SAGE
  – User guide
  – Configuration
  – Developers
  – Troubleshooting
Improved Document Sharing Over Distance

• **Document Sharing**
  – Drag-and-drop documents between walls

• **Copy the document to the remote wall**
  – Start the application remotely:
    • Movies, Images, PDF: viewer launched
    • VNC: tries to connect to the laptop
    • Pixel-based apps: application will replicate pixels

• **Support multiple destination**
  – Sync’d playback prototype
Making Audio a First Class Citizen for Applications with Audio

- SAM: the Streaming Audio Manager
  - [https://code.google.com/p/streaming-audio/](https://code.google.com/p/streaming-audio/)
  - Michelle Daniels
    - Sonic Arts R&D at UC San Diego CalIT2

- One server per site
- RTP streams from an arbitrary number of clients
- Control data is exchanged via SAM and clients using Open Sound Control (OSC)
Support for Stereo 3D Animations

• New pixel format : PIXFMT_RGBS3D
• Left and right pixel next to each other
  – 6-byte format RGB: R1G1B1R2G2B2
• View
  – images3d [-lr|rl] <side-by-side-image>
    • Script to convert MPO, JPS, PNS, ...
    • Container in file library
  – mplayer -vo sage:stereo <side-by-side-movie>
    • Scaling options for ‘youtube’ or ‘double-width’ files
SAGE Applications in Research and Education
NASA ENDURANCE

Environmentally Non-Disturbing Under-ice Robotic ANtarctiC Explorer
Class in CAVE2
4K 3D Movies Streamed from Poland to Chicago
US Ignite Application Summit in Chicago, June 25, 2013

- Poznan Supercomputing and Networking Center (PSNC) streamed 3D-interleaved 4K movies to EVL over the GLIF infrastructure.
- UltraGrid (CESNET and Masaryk University, Czech Republic) used to do the streaming. Streams averaged 3.4Gbps.
- SAGE used to push the movie frames onto 3D tiled display wall and open additional windows with supporting information.
UltraGrid

- www.ultragrid.cz, part of SAGE distribution
- HD/4K/8K video support, audio support
- Multi-channel audio/video support
- Uncompressed video/audio transmission
- Compression support:
  - CUDA-based GPU JPEG (http://sourceforge.net/projects/gpujpeg/)
  - low-latency H.264 (GPL, based on X264)
  - SILK for audio
- Wide range of capture/display options (HDMI/HD-SDI/OpenGL), including desktop capture for visualization apps
What’s new in UltraGrid 1.2

- Record/playback capability (file-based I/O)
- Software deinterlacer
- Full support for MS Windows, incl. DirectShow capture
- GPUJPEG performance optimizations
- Video4Linux2 capture module
- Software video mixer
- Recompression support in UDP packet reflector
- Support for image anonymization (blanking parts of image for medical apps)
- Control channel – e.g., for integration with CoUniverse and Bandwidth-on-Demand services (shown at AIST booth)
- Support for SAGE as a transport protocol (uv --sage -t <dev> <fsManager>)
Shinji Shimojo

Osaka University and National Institute of Information and Communication Technology (NICT)
Vislab Osaka at Knowledge Capital

Visit OsakaU (#2538) and NICT (#4341) booth!
• Goal: dynamic flow control of multiple network streams from multiple sites for smooth user-interaction & visualization

• Approach: having SAGE interact with OpenFlow controller as a software program that controls the whole network against network parameters resulted from user interaction.

Understanding how TDWs begin used.

Planning network flows

Information Exchange

Freespace manager

OpenFlow Controller

SAGE Receiver

SAGE Receiver

SAGE Receiver

Application source 1

Wide-area OpenFlow

How efficiently can we use network?

Visit OsakaU (#2538) and NICT (#4341)
Paul Bonnington
eResearch Centre, Monash University, Australia

Components

KNOWLEDGE: Dissemination

INSIGHT: Lens/Viewfinder

ANALYSIS TOOLS: Filters, Adjustments

CAPTURE: Light Source, Samples

DATA

MONASH University e-Research Centre
e-Components

Dissemination and Data Services

Immersive Visualisation

Data Processing and Analytics, HPC, Tools

Data Capture Instrumentation

BIG DATA
• Video: Synchrotron Mouse
• Video: 4D heart
MASSIVE Interactive Desktop

- Characterisation and Visualisation tools:
  - Paraview
  - Amira
  - Drishti
  - ImageJ
  - Seg3D
  - VolView
  - MayaVi
  - Etc.

MASSIVE: Multi-modal Australian Science Imaging and Visualisation Environment
Future Plans
New SAGE Grant

• Address Community requests:

• Leverage emerging technologies:
  – Cloud Services, Hybrid Reality Environments, Software Defined Networks.
1. Greater Reliability

- Partnership with Vadiza to dramatically improve reliability, including 24/7 phone and online support.
- Refactor SAGE framework for future expansion.
- Vadiza will provide turnkey solutions for end-users.
2. Greater Integration with External Applications

• Power of SAGE comes from being able to bring many visualization products together to see the BIG PICTURE.

• New focus is to create a light weight and open framework that will make it easier to integrate existing and new applications- both remotely streamed and native.

• Integrate with Cloud Computing services.
3. Enhanced Collaboration

• A wholly new interaction paradigm for distance collaboration between walls of different shapes and sizes.

• Integration with Software Defined Networking capabilities to improve data streaming such as synchronization between distributed sites.

• Leverage GLIF community efforts and infrastructures with partners.
4. New User Interface

• Redesign of User Interface for:
  – better managing large numbers of visualization products.
  – Supporting multiple collaboration teams.

• Intelligent support for 2D and 3D rendering in emerging Hybrid Reality Environments
SAGE Commercialization

John Thompson
Software, Appliances & Services for Visualization & Collaboration Environments
Agenda

• Company Purpose
• What have we done?
• What are we planning?
• Development Direction
• Our offer to you
• Summary
Company Purpose

- Provide **technical support services** to the global SAGE user base

- Publish & fulfill a development roadmap to achieve an
  - enterprise version of SAGE
  - satisfy commercial requirements

- Design & Sell **integrated appliances with** leading edge hardware & software

- Offer professional services for **design, installation & implementation**

- Facilitate a recognized global SAGE community of users, contributors and experts
What Have We Done?

- Licensed SAGE.
- Transferred knowledge & info about bugs, function & feature requests.
- Planned development for next 18 months.
- Started developing software.
- Negotiated deals with hardware suppliers.
- Setup tech support call center.
- Calling SAGE installations now.
- Quoting appliances & support contracts now.
What We are Planning

Vadiza Software + SAGE + Platform = Vadiza Appliances

**Vadiza Software**
- Enterprise SAGE
  - System Management
  - Performance
  - Connectivity
  - Ease of Use
  - Security

**SAGE**
- Visualization/Collaboration
  - Platform & Middleware
  - Pixel Streaming
  - Session Management
  - Touch, 2D & 3D Displays
  - Continued Innovation

**Platform**
- PreIntegrated
- Optimized
- Tested
- Single Source Support

**Vadiza Appliances**
- HW/SW Environment
  - PreIntegrated
  - Optimized
  - Tested
  - Single Source Support

- Vadiza branded appliances – leading edge hardware/software integrated for a reliable, high quality experience every time.
- Vadiza Software – commercially focused on market driven needs & innovations: connectivity, cloud storage, native browser, security, etc.
- Global Community – An annual event, social sites, open source support.
Development Direction

- Remote updates to software
- Crash/Dump file creation and download
- Internal API Documentation

May 2014
V1.4

Nov 2014
V1.5

May 2015
V1.6

Nov 2015
V1.7

- Cloud Storage
- Document Version Control
- Document Merge
- User management console

- Vadiza directory service
- Native browser
- Dashboard

- Alternative UI library (Java, REST or C#)
Our Offer to You

- Try Vadiza Tech Support for Free
- Call (855) 344-8400 or e-mail support@vadiza.com between now and January 1, 2014 for any Tech Support issue.
- Our team will assist you and your team for free.
- We will follow up to see:
  - How well we did
  - If we can help in the future
Software, Appliances & Services for Visualization & Collaboration Environments
Jason’s New Digs

LABORATORY FOR ADVANCED VISUALIZATION & APPLICATIONS

BOF 2013
Thank You

Please Evaluate this BOF


VisTech Workshop at SC: Fri 8:30 in 205
Kelly Gaither, Jason Leigh, Eric Wernert, Falko Kuester