

Collaboration on Large Displays using Web Technologies

Electronic Visualization Laboratory

University of Illinois at Chicago

www.evl.uic.edu

LUC RENAMBOT

Electronic Visualization Laboratory

- Established in 1973 as a joint effort of the College of Engineering and School of Art and Design
- Funding from Federal agencies, industry and non-profit institutions
- Fostering early adoption by supporting user communities
- Providing educational experiences to students, who receive jobs upon graduation



EVL's Visualization and Virtual Reality Collaboration Hardware and Software Help Teams Manage "Big Data"



"Star Wars" 1977



CAVE 1992



TacTile 2008



SAGE (2004-2014) and SAGE2 (2014-present)



CAVE2 2012

Visualization Devices



Hybrid Reality Environment

Electronic Visualization Laboratory
University of Illinois at Chicago

October 1, 2012



Node.js in Enterprise

–GoDaddy, Netflix, Capital One, ...

Node.js Examples - How Enterprises use Node in 2016

 8 days ago

 Node.js · enterprise · godaddy · netflix · node.js examples · capital one · use case

Node.js had an extraordinary year so far: npm already hit 4 million users and processes a billion downloads a week, while major enterprises adopt the language as the main production framework day by day.

Space suits at NASA



Benjamin Coe @BenjaminCoe · Jun 3

@CollinEstes I heard a rumor that NASA uses Node.js for space-suits. I'm curious, do you use the npm ecosystem to develop these apps?



63



72



Collin Estes @CollinEstes · Jun 3

@BenjaminCoe You heard correctly, and yes we do.



38



82



Benjamin Coe @BenjaminCoe · Jun 3

@CollinEstes that's amazing, and I'm proud to help people to do such amazing work :)



1



11



Collin Estes

@CollinEstes

Follow

@BenjaminCoe Absolutely, you can say you are helping build the present and future systems supporting spacesuit operations and development.

Government: Chicago.opengrid.io



Chicago/opengrid: A user

GitHub, Inc. [US] <https://github.com/Chicago/opengrid>



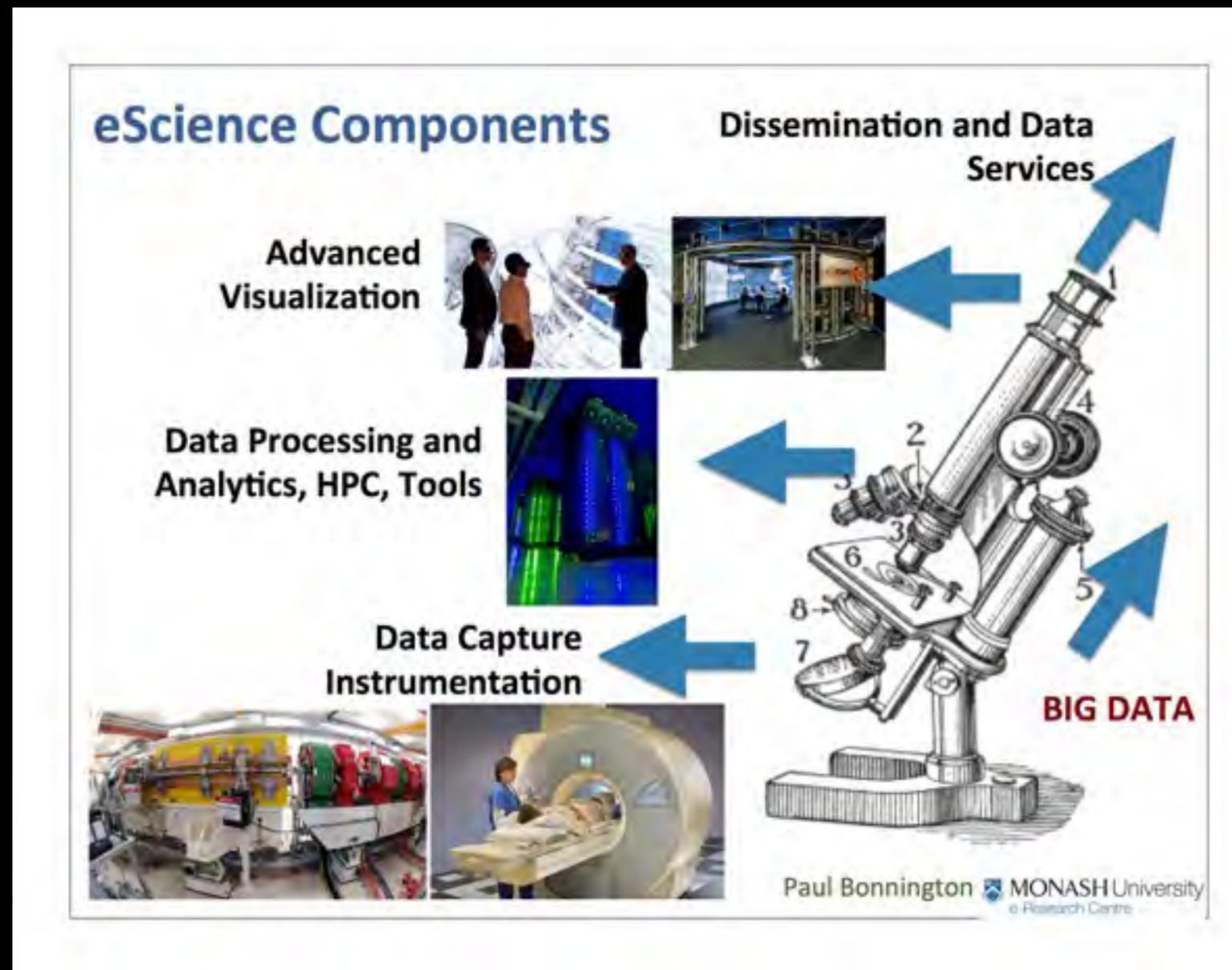
OpenGrid

Linux build **passing** Windows build **passing** coverage **unknown** node **0.10.x** dependencies **up-to-date** devDependencies **out-of-date**

OpenGrid an open-source, interactive map platform that allows users to explore multiple data sources in an easy-to-use interface. Developed to support situational awareness, incident monitoring and responses, historical data retrieval, and real-time advanced analytics. Users can perform advanced queries to filter data, search within custom boundaries, or based on the users location. Other GIS data, such as weather and Shapefiles can be overlaid on the map with other data. OpenGrid is natively compatible with desktops and mobile devices.

Node.js in Science

- Similar problems compared to enterprise world
- Access to data
 - authentication
 - browse
 - retrieval
 - sharing
- Cloud-based
- REST API for most new “instruments”



Programming for Science

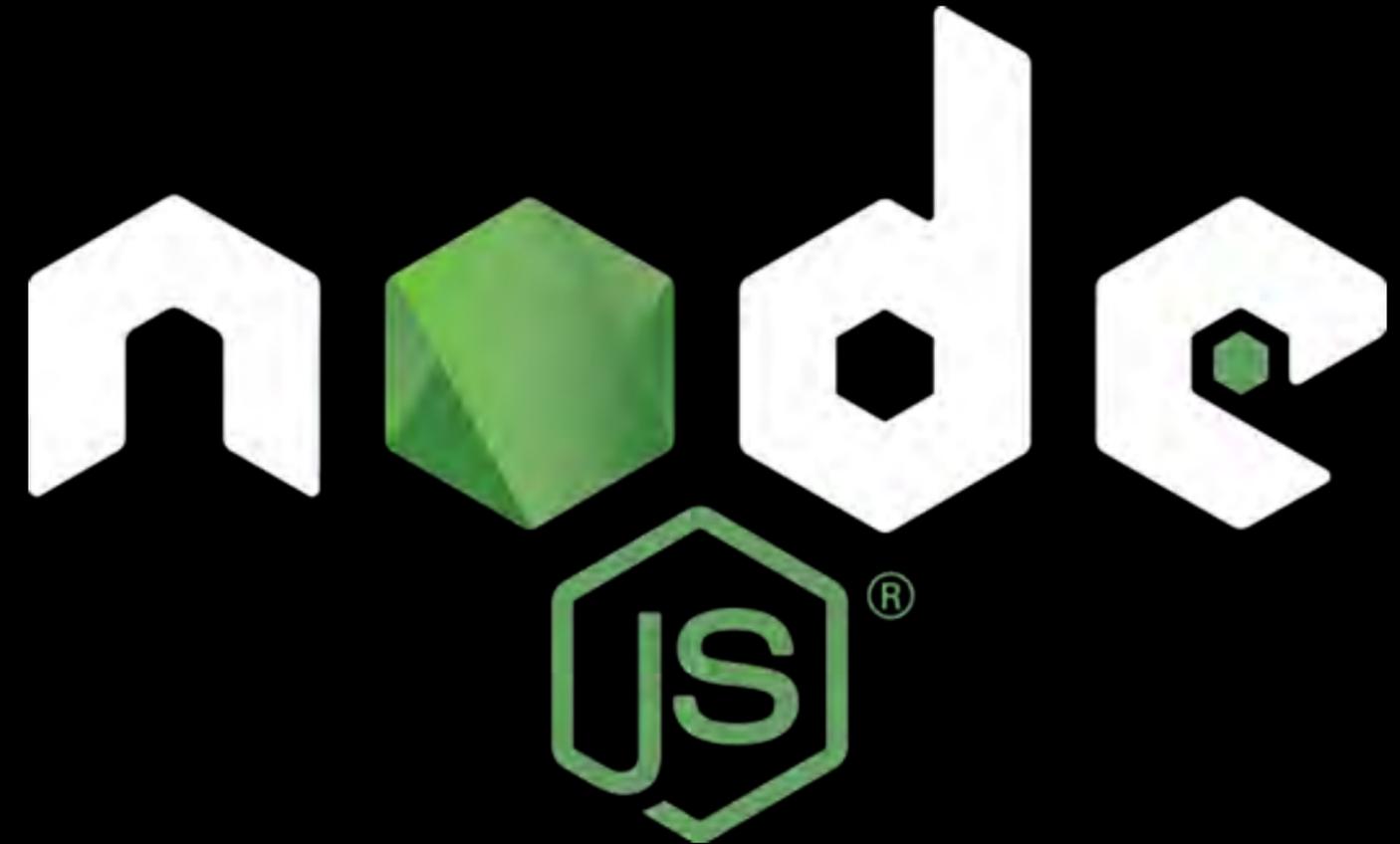
- Python has been used a lot
 - scripting simulation
 - software glue
 - wrapping C/C++ API
 - easier for domain scientist
- SciPy.org
 - NumPy, SciPy, IPython, Matplotlib
- **Jupyter**



The Jupyter Notebook is a web application that allows you to create and share documents that contain live code, equations, visualizations and explanatory text.

Node.js

- Node.js and front-end Javascript
 - same language and similar skills
- Quick prototypes
- Leveraging REST API everywhere
 - Mashups



Node.js for Science

- NPM explosive growth
 - a package for everything
- Node.js add-ons (modules)
 - Add-ons are dynamically linked shared objects
 - They can provide glue to C and C++ libraries
 - libraries, simulation, old code, ...
 - NAN (Native Abstractions for Node.js)

Node.js for Science

–Numbers.js

- provides substantial math functionality for server-side use

–node-lapack

- node.js wrapper for the high-performance LAPACK linear algebra library

–node-opencv

- OpenCV bindings for Node.js. OpenCV is the defacto computer vision library

– Cylon.js

- robotics, physical computing, and the Internet of Things. Command robots and devices

–node-rio

- RIO, R Input Output, allows other programs to use facilities of R.

–Many IoT projects...

SAGE2 Project



Laboratory for Advanced Visualization & Applications
University of Hawai'i at Mānoa

Support from NSF SI2-SSI grant 2013-2018
Academy for Creative Media,
University of Hawaii system

Electronic Visualization Laboratory
University of Illinois at Chicago



SAGE2™

SCALABLE AMPLIFIED GROUP ENVIRONMENT

SAGE2: Scalable Amplified Group Environment

- Middleware to access, display, and share high-resolution digital media on scalable resolution display environments
- Based on web technologies
- Multi-user interactions
- PDF, movies, images, screen sharing and apps
- Javascript API for apps



Scalable Displays

–from Raspberry-PI to clusters

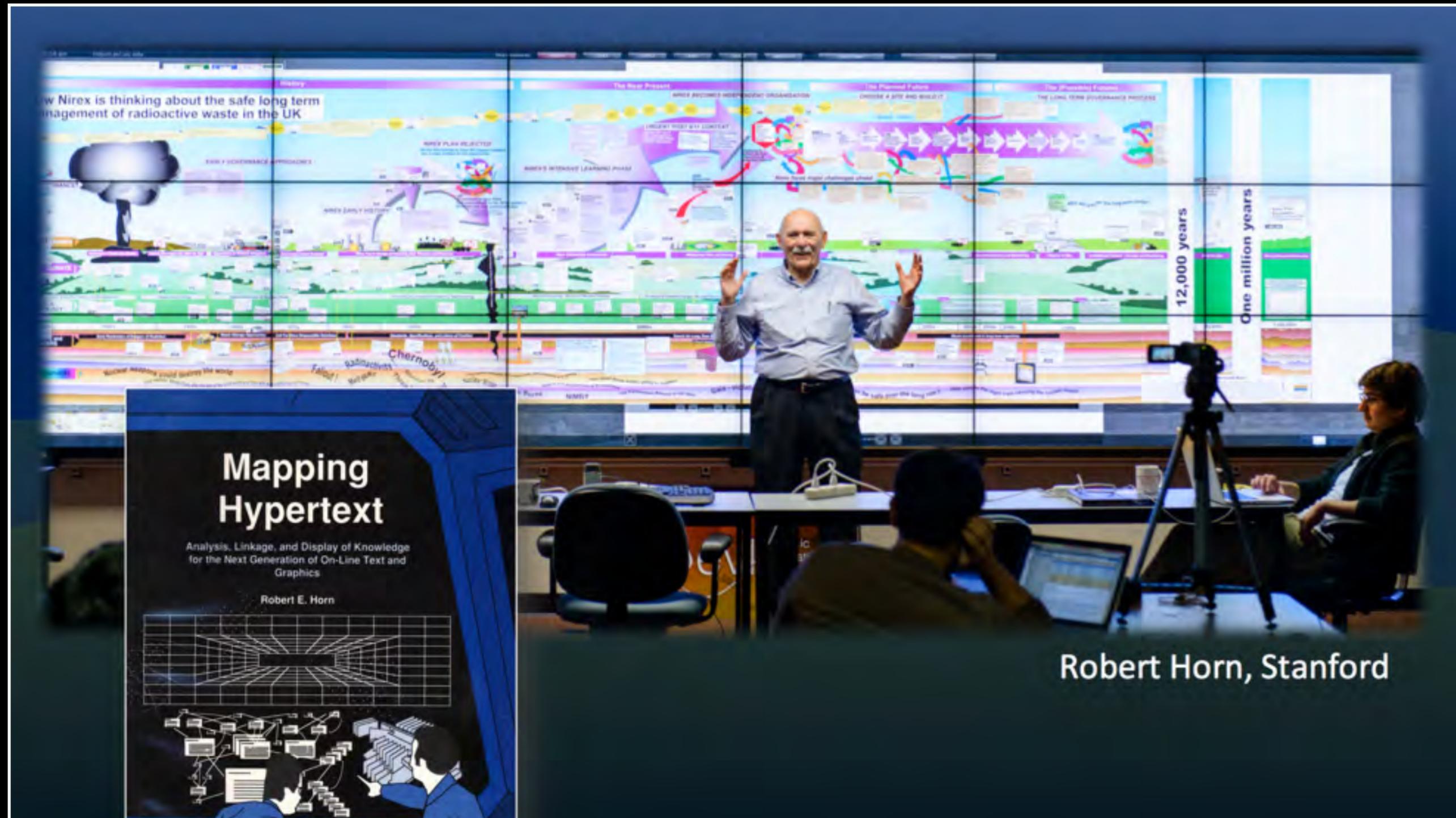


SAGE Walls Are Great For...

Supporting Data Rich Collaboration Integrating Disparate Pieces of Evidence



Telling Stories About the Data



NASA ENDURANCE: Under-ice Robot



Environmentally Non-Disturbing Under-ice Robotic ANtarctic Explorer

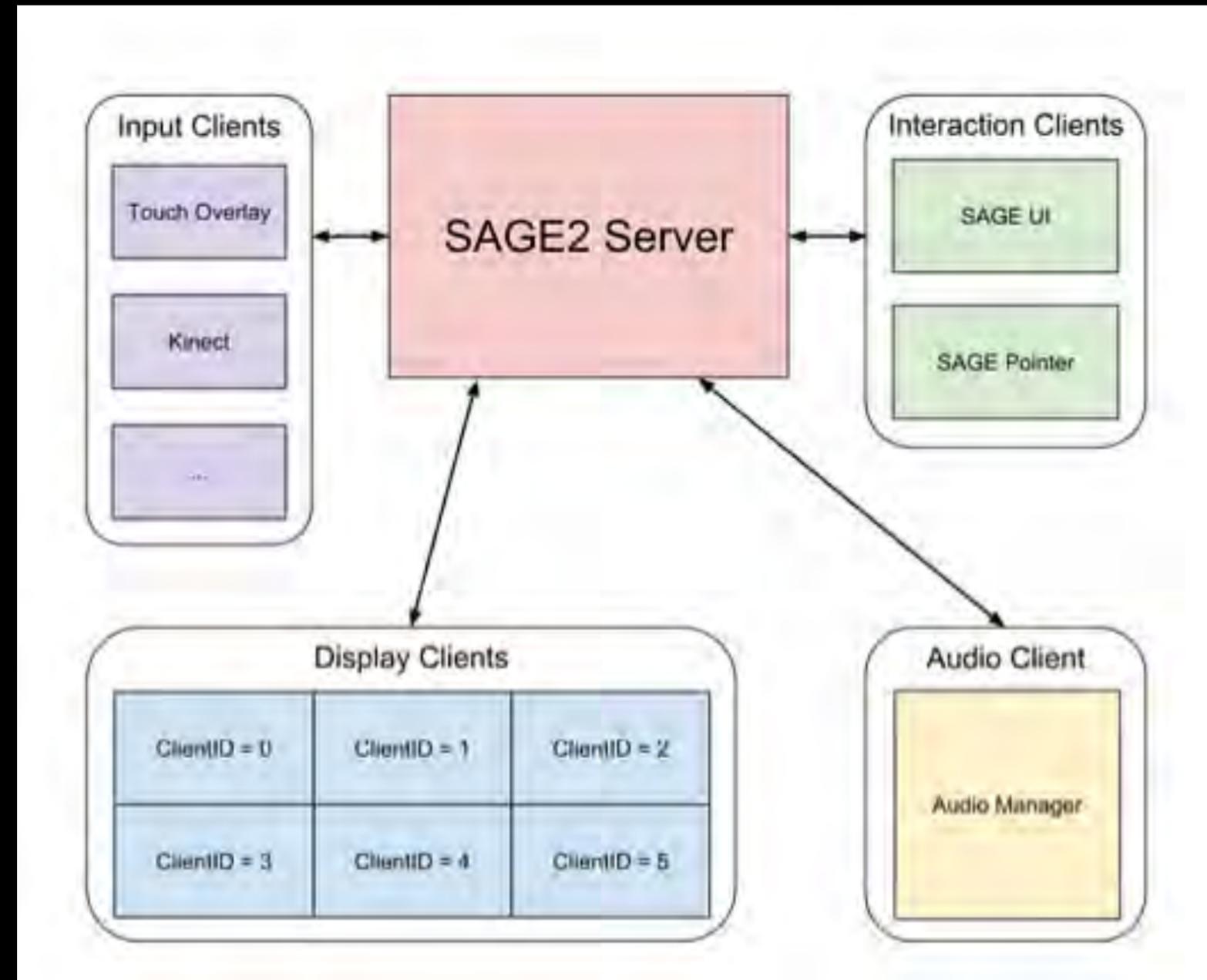


Class in CAVE2



SAGE2 Architecture

- Node.js server
 - HTTP and HTTPS
 - WebSocket: ws and wss
- Clients are web-browsers (Chrome, Firefox, Electron, ...)
- Manage users and applications
 - asset managements
 - synchronization
 - messaging



Modules developed

–node-demux

- package that decodes video files into raw frames in real-time, using FFmpeg. This is useful for creating a video player.
- <https://github.com/tmarrinan/node-demux>

–websocketio

- WebSocket high-level abstraction
- Similar programming style to socket.io
- Send JSON objects as Strings or Binary data as ArrayBuffers
- Support for external applications (Python, C++)
- Fast streaming for high-performance networking

Node.js “pet peeves”

–NPM and dependencies

- 26 packages + 18 dev packages
- 2794 directories
- 19987 files
- 167MB installed

–Binary packages are still a pain

- Windows, Mac, Linux

–Distribution of an application

- binary package

–HTTPS setup

- takes a while to get an “A” with SSLabs
- <https://www.ssllabs.com/ssltest>



Thanks

renambot@uic.edu

@renambot

github.com/renambot-uic

evtube (youtube)



<http://sage2.sagecommons.org>

<https://bitbucket.org/sage2/sage2>

<https://groups.google.com/forum/#!forum/sage2>