Visualization

Pire Workshop 2014
University of Amsterdam

NAVAL POSTGRADUATE SCHOOL

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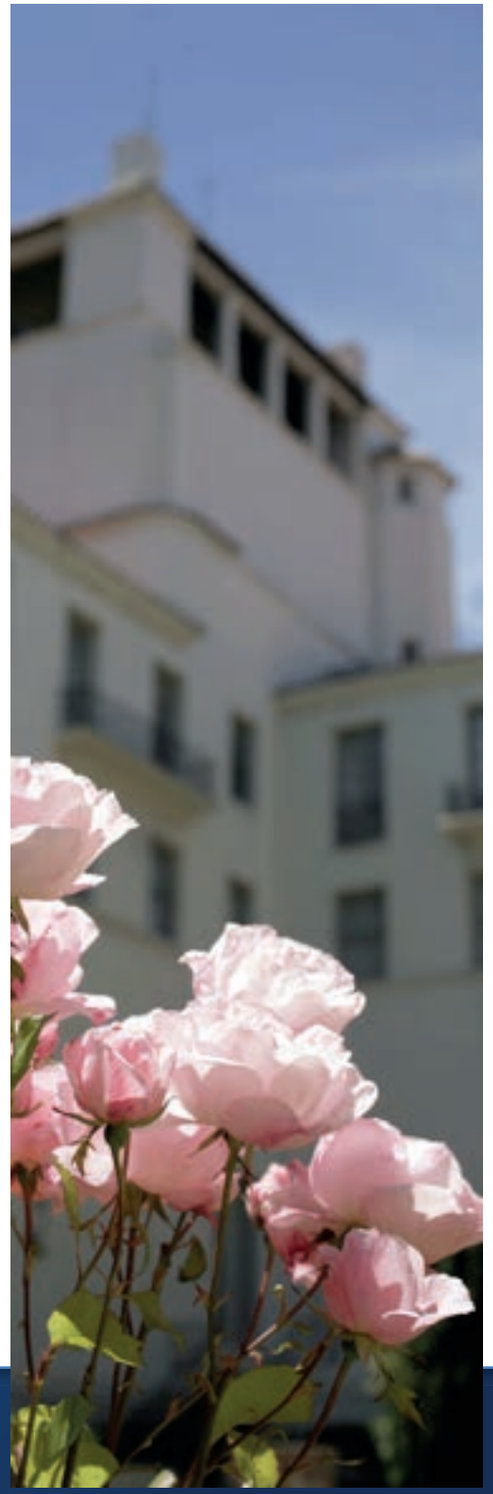
NPS is a graduate-level research university, applying academic rigor to a defined niche.

- Responds to joint, interagency, emerging needs and coalition requirements of the Departments of Navy, Defense, Homeland Security and more
- Defends the nation, leading and transforming the DOD
- Fosters a multi-service, interagency, coalition learning environment
- Prepares the joint intellectual leaders for tomorrow's joint forces



NPS fulfills the graduate education needs of the Department of Defense.

- Master's Degrees, Ph.D., Engineer, MBA, EMBA, more
- Accelerated, defense-focused degree programs unique in academia
- Interdisciplinary, relevant, agile – from expressed need to delivered program with an extremely quick turnaround.
- Biennial program reviews by flag-level sponsors

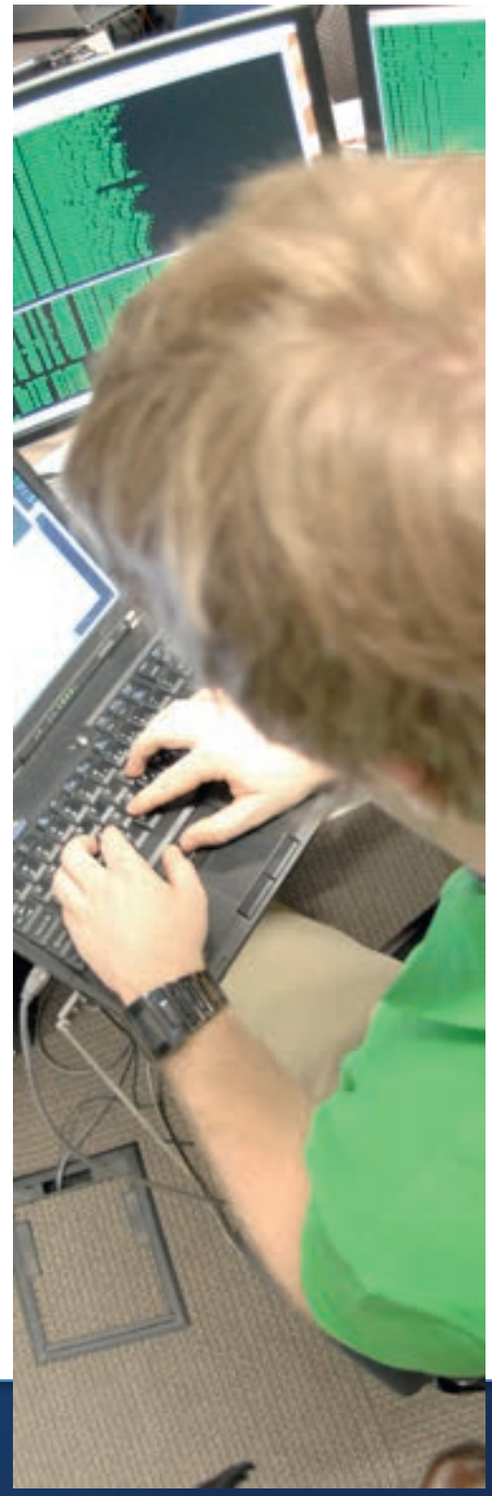
The Graduate School of Engineering and Applied Sciences develops leading-edge technological advancements with strict applications to DOD's needs.

- Applied Mathematics
- Combat Systems Science and Technology
- Electronic Systems Engineering (resident and DL)
- Mechanical and Aerospace Engineering
- Mechanical Engineering for Nuclear Trained Officers (DL)
- Meteorology and Oceanography
- Meteorology
- Oceanography
- Operational Oceanography
- Reactors/Mechanical Engineering
- Space Systems Engineering
- Space Systems Operations (with GSOIS) (resident and DL)
- Systems Engineering (resident & DL)
- Systems Engineering Management (DL)
- Undersea Warfare (domestic and international)
- Underwater Acoustic Systems (DL)

NAVAL POSTGRADUATE SCHOOL

The Graduate School of Operational and Information Sciences is the Navy's path to Information Dominance.

- Computer Science (Res & DL)
- Computer Technology (DL)
- Cost Estimating & Analysis (DL)
- Electronic Warfare Systems
- Human Systems Integration
- Identity Management and Cyber Security (Resident & DL)
- Information Sciences
- Information Systems & Operations
- Information Systems & Technology
- Information Warfare
- Joint C4I Systems
- Joint Information Operations
- Joint Operational Logistics
- Modeling, Virtual Environments, and Simulation
- Operations Analysis
- Remote Sensing
- Software Engineering (Resident & DL)
- Special Operations
- Systems Analysis (DL)



Motivation

Given that we live in an era where data are ubiquitous, our ability to process them, understand them, visualize them and to use these data effectively is a complimentary SCARCE resource.

Enabling Knowledge Accidents

Proper Preprocessing with Careful Filtering
Meaningful Representations
Appropriate Media
Intelligent Interactivity
Validity


BBC FOUR
lifespan
75 years
50 years
25 years
0:39 / 4:47

What is Visualization?

a few key meanings...

Visualization is any technique for creating images, diagrams or animations to communicate a message.

Visualization today has ever-expanding applications in science, education, engineering (e.g., product visualization), interactive multimedia (games), medicine

Scientific visualization

Information visualization

Software visualization

from http://en.wikipedia.org/wiki/Visualization

Visualization Principles

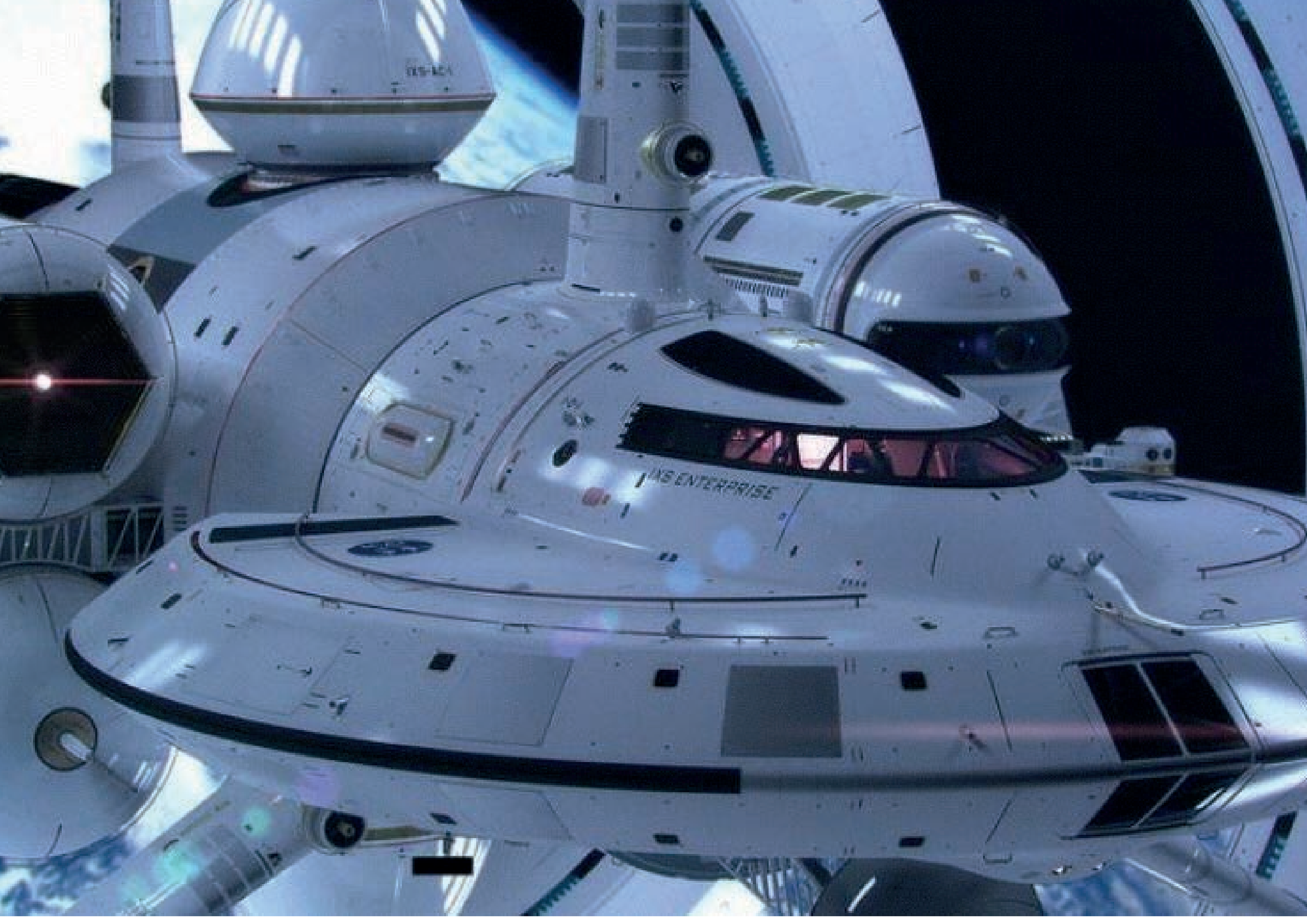
"Overview first, zoom and filter, details on demand"

(Schniederman 1996)

Van Eyck 1432

Ceci n'est pas une pipe.

Magritte


USS ENTERPRISE

Things to Remember

- All models are wrong, some are useful
- Simulation is doomed to success
- When no one has to ask what it means, the representation is correct
- The more money spent on a simulation, the less likely it is to work

Information Channels in Visualization

Size

Glyph

Color

Scale

Shape

Clustering

Position

Contrast

G

L

Y

P

H


A


B


B


C


D


E


F


G


H


H


I


J


K


L


M


N


N


O


P


Q


R


S


T


T


U


V

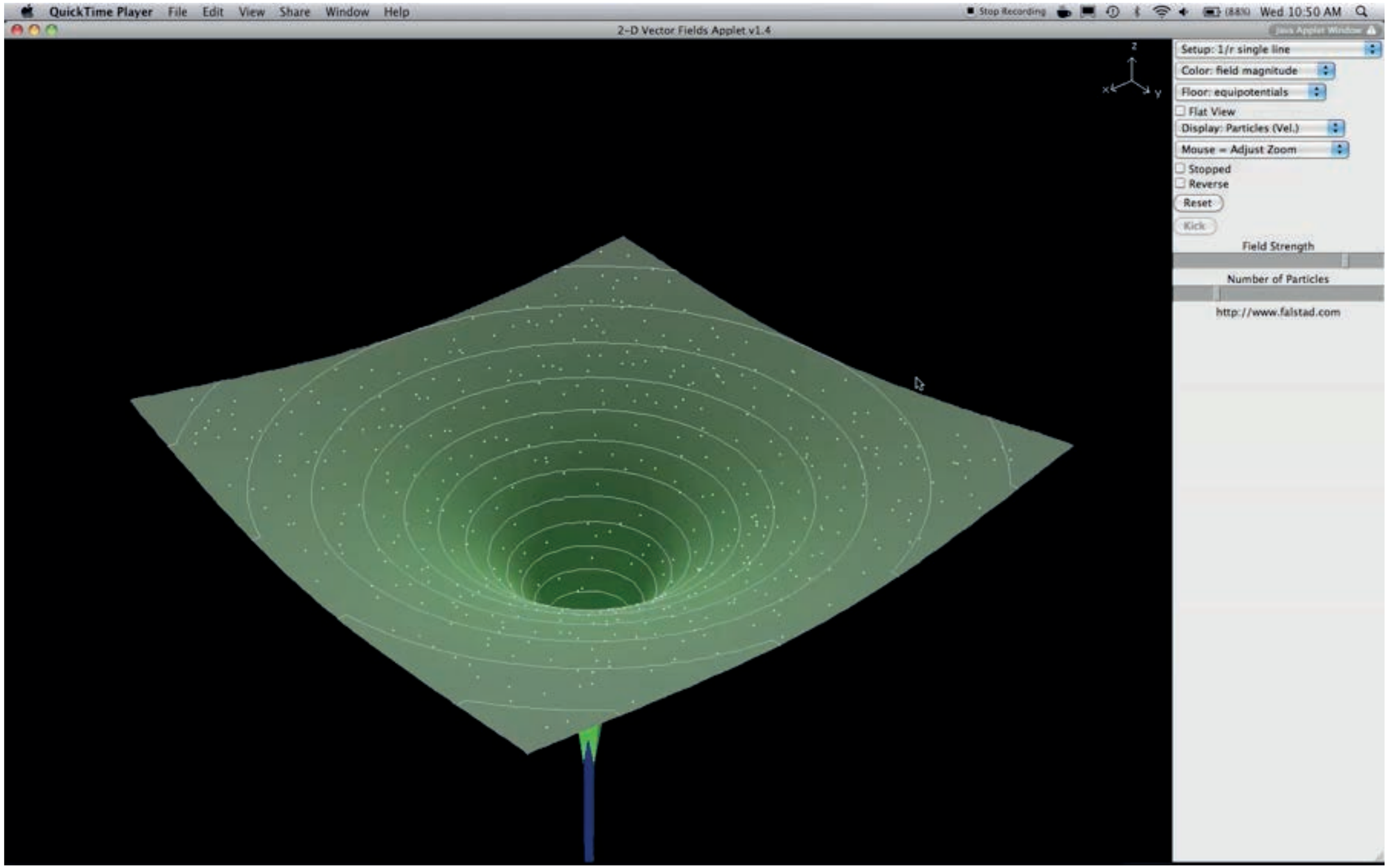

W


X


Y


Z

2D vs 3D Vector Field



Available Products

- ASBS Data
- Automated Shore Stations
- Bathymetry
- Gliders
- Harbors
- Harmful Algae & Red Tides
- Manual Shore Stations
- Meteorological Observations
- Moorings
- Plume Tracking
- ROMS Model Output
  - Recent Model Runs
  - Virtual Moorings
  - Drifter Trajectory
- Satellite Imagery
- Ship Tracking (AIS)
- Ship Casts
- Surface Current Mapping
- Wave Conditions (CDIP)

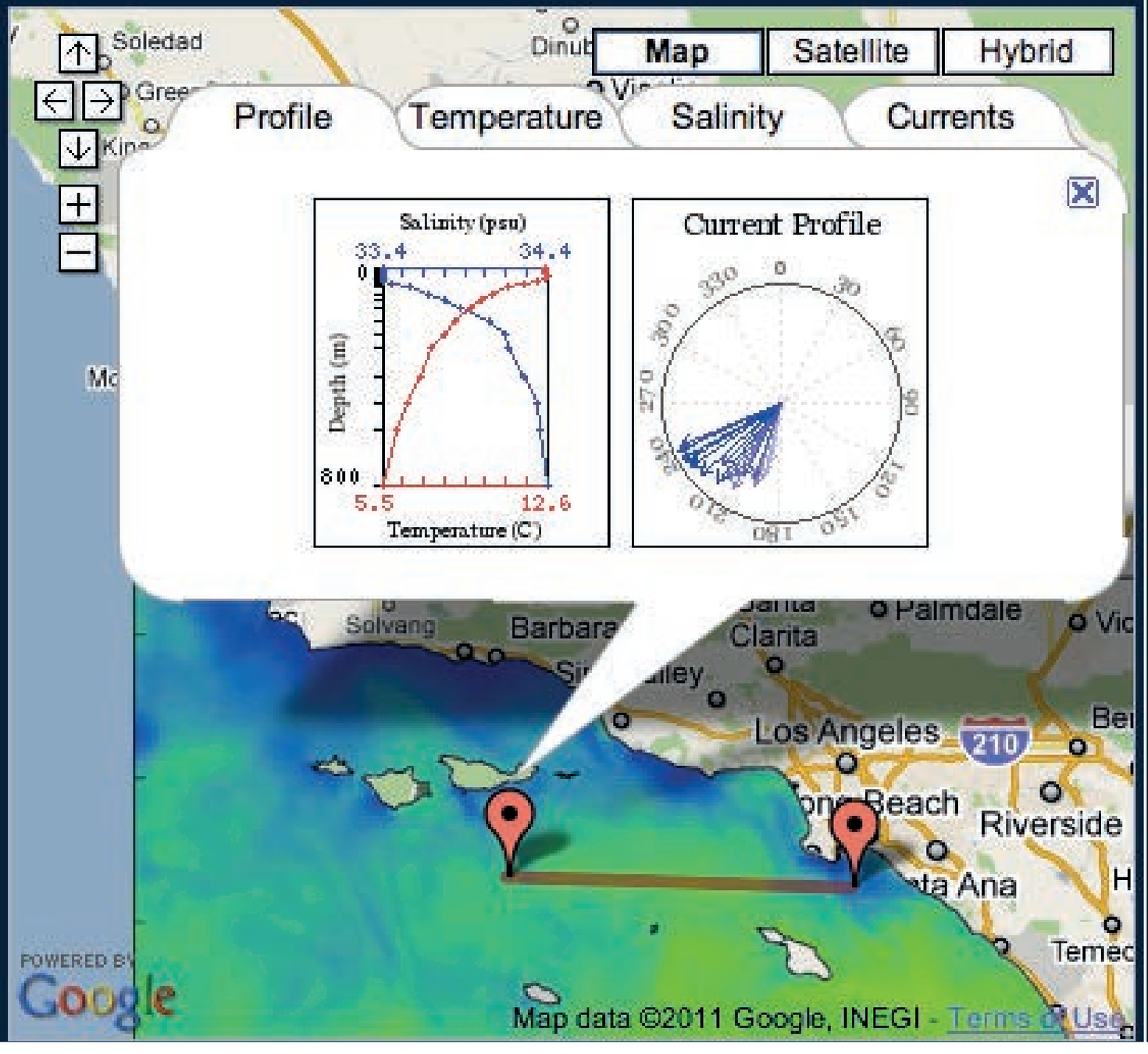
UTC Time: 2011-03-09 19:10:59
Local Time: 2011-03-09 11:10:59

Regional Ocean Model System (ROMS) Model Output

The ROMS model is produced and distributed by NASA JPL and is available from http://ourocean.jpl.nasa.gov/SCB/.

Depth

0m | 5m | 10m | 15m | 20m | 30m | 40m | 50m | 60m | 75m | 100m | 125m | 150m | 200m | 250m | 300m | 400m | 500m | 600m | 800m | 1000m | 1200m | 1500m | 2000m



Regional Ocean Model Simulation

Vector Fields

Image courtesy of NCSA

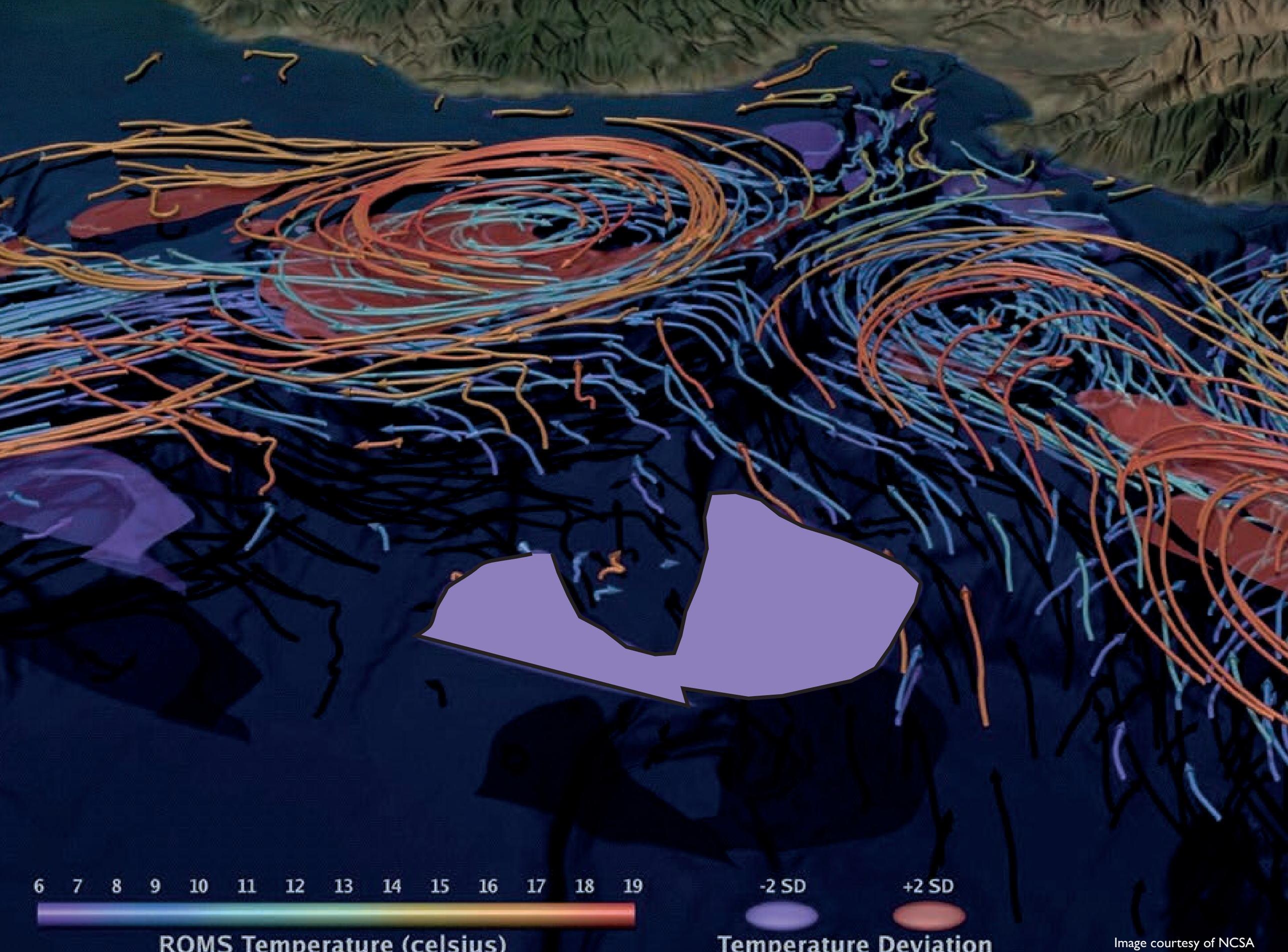
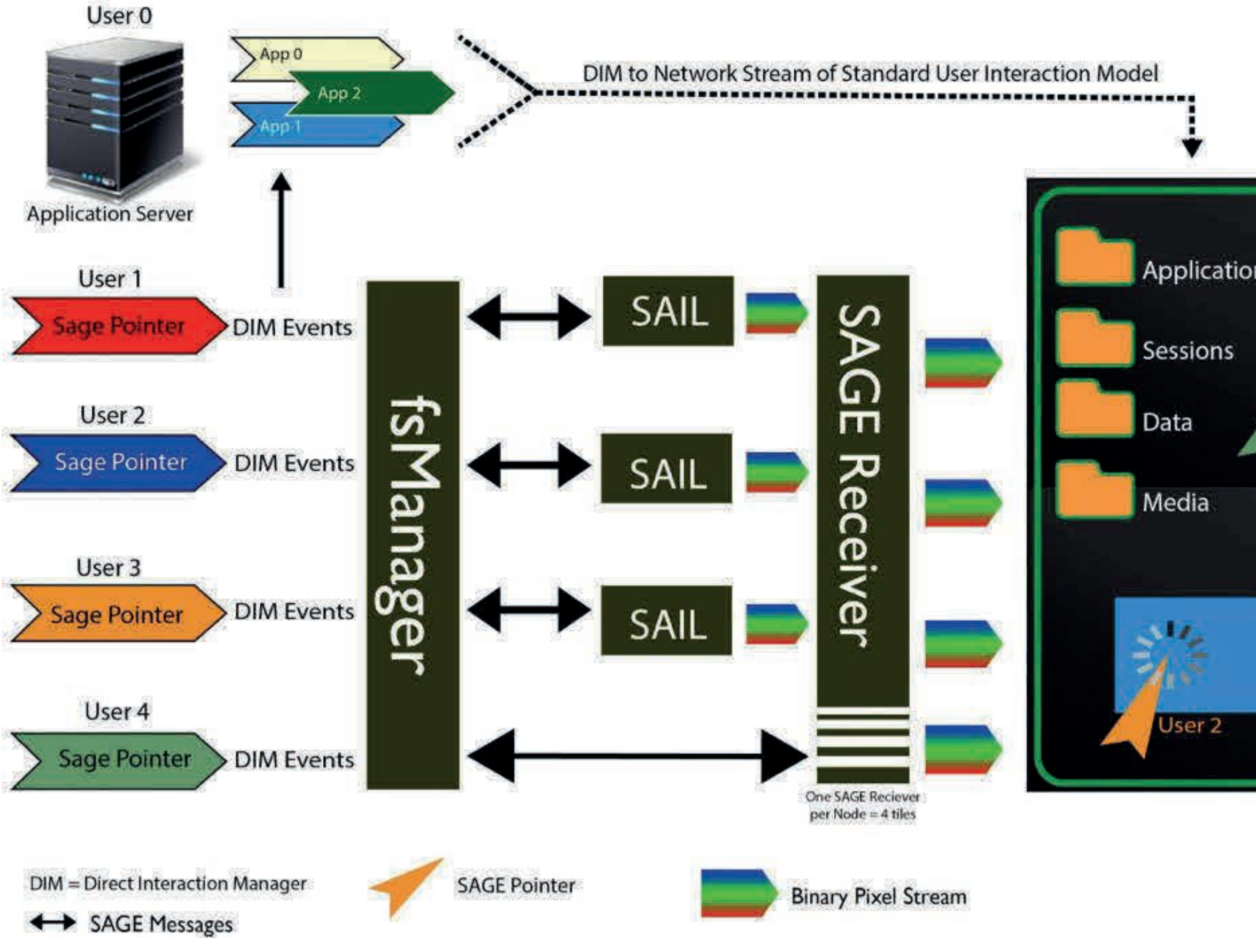


Image courtesy of NCSA

Steve Duenes, NY Times


User 0
App 0
App 2
App 1
DIM to Network Stream of Standard User Interaction Model
Application Server
User 1
Sage Pointer
DIM Events
User 2
Sage Pointer
DIM Events
User 3
Sage Pointer
DIM Events
User 4
Sage Pointer
DIM Events
fsManager
SAIL
SAIL
SAIL
SAGE Receiver
One SAGE Reciever
per Node = 4 tiles
Application
Sessions
Data
Media
User 2
DIM = Direct Interaction Manager
SAGE Messages
SAGE Pointer
Binary Pixel Stream

8K Telemecine - Remote Collaborative High-resolution Dermatology Exam at 8K

REANNZ / NPS 100g GLIF Demonstration

GLIF Venue (Location 3)

Pacific Wave
Landing Point

GLIF Audience

REANNZ:
New Zealand National Research & Education Network

100g Southern Cross

Naval Postgraduate School, MOVES Institute

Location 1

Decklink Media
Capture Station

Quadlink HD-SDI

4K Push
to SAGE

Panasonic Lumix
GH-4K Camera

4K Video + Audio

NPS SAGE OptIPortal (6x1K)

Non-Expert
Dermatological Scan

10/100g Switch

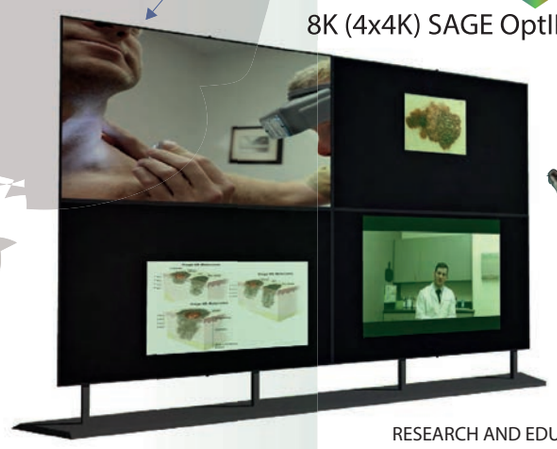
100g Switch

Decklink Media
Capture Station

HD Push
to SAGE

HD-SDI

8K (4x4K) SAGE OptIPortal



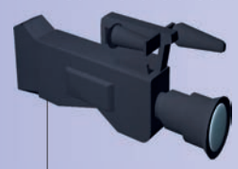
HD Camera Stream

Consulting NZ
Dermatologist

RESEARCH AND EDUCATION ADVANCED NETWORK NEW ZEALAND

Location 2

HD Camera Stream



Outside Expert

HD-SDI

Decklink Media
Capture Station

HD Push
to SAGE

4K (4x1K) SAGE OptIPortal

Naval Postgraduate School, MOVES Institute

THE MOVES INSTITUTE

REANNZ

CineGrid

ciena

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Digital Video as "Big Data"

Challenges associated with Video

Video is about x30-60 harder than still imagery

But motion provides some interesting possibilities

Just like Everybody's Dog is Special

Everybody's Data is Big

My Data *is* Really Big

- 60fps 24-bit HD Video 2.98 Gbit/s
- 60fps 24-bit 4K Video 11.92 Gbit/s
- 60fps 48-bit 4K Video 23.94 Gbit/s
- 30fps 24-bit 8K Video 47.69 Gbit/s
- 60fps 24-bit 8K Video 95.38 Gbit/s
- (Theoretical) 60fps 48-bit 8K Video 190.76 Gbit/s

5 minute 4K Movie

- 18,000 Frames
- Each Frame = 48MB (16-bit TIFF)
- Total Size ~0.86TB

5 minute 8K Movie

- 18,000 Frames
- Each Frame = 192MB (16-bit TIFF)
- Total Size ~3.44TB

Metadata

- Metadata is often decoupled from Content
- Deriving Metadata can be difficult
- Many containers vary in their capacity to carry Metadata

Meaning

- Classification is often metadata dependent
- Deriving Semantics is difficult
- Video Analysis is very difficult
- Feature Extraction and other analytical methods can be computationally costly

Sampling of SIGGRAPH 2014 Technical Papers Related to Video Analysis

Near-Regular Structure Extraction Using Linear Programming
Introducing a linear programming formulation for detecting near-regular structures and demonstration of applications in structure-preserving pattern manipulation and markerless correspondence detection.

Relating Shapes Via Geometric Symmetries and Regularities
This paper examines the usage of symmetry relations for matching shapes of strongly varying geometry and shows that symmetry-based cues can help in finding correspondences in pairs of shapes that are very hard to relate with previous, geometry-based methods.

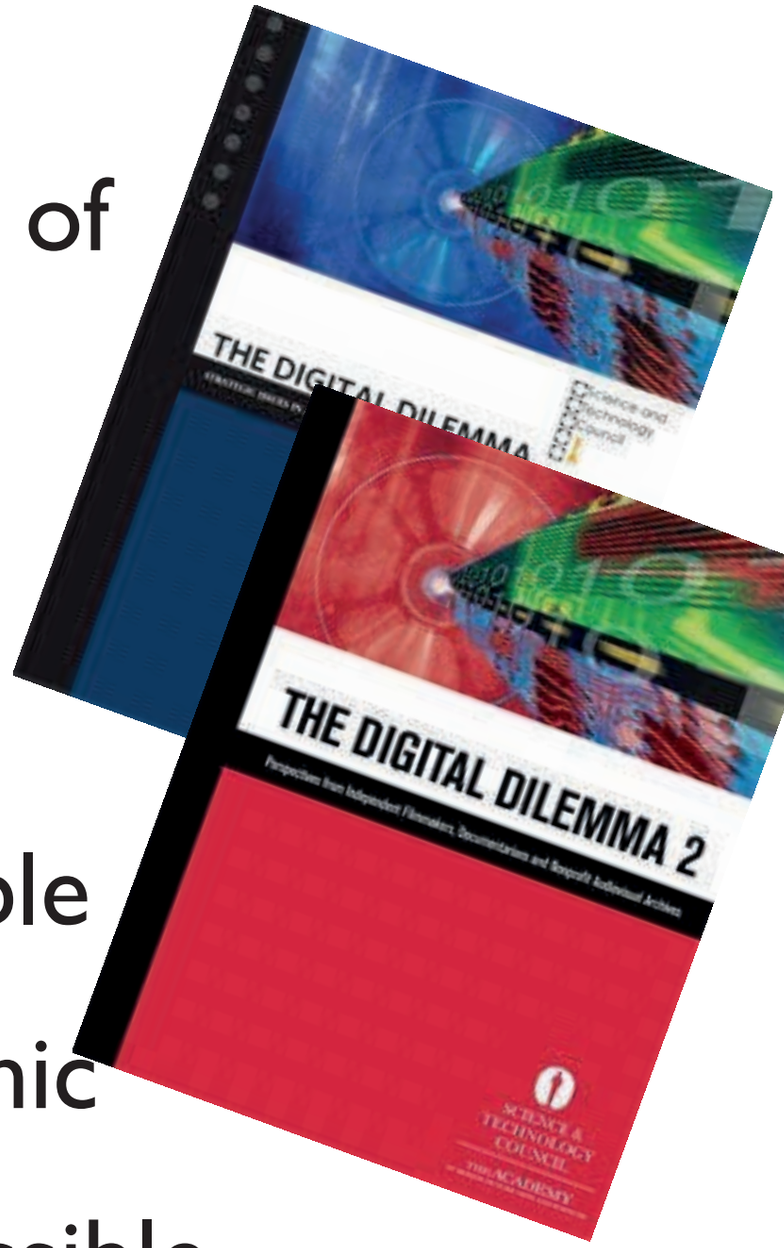
Shape2Pose: Human-Centric Shape Analysis
This algorithm for estimating the pose that a person typically would adopt when interacting with an object is used to assist several shape-analysis applications.

Mesh Saliency Via Spectral Processing
A novel method for detecting mesh saliency, a perceptually based measure of regional importance by analysing a mesh in the spectral domain.

Inverse Procedural Modeling of Façade Layouts
This paper addresses the following open research problem: How to generate a deterministic shape grammar to explain a given façade layout? The proposed solution contributes to compression of urban models, architectural analysis, and generation of shape grammars for large-scale urban modeling.

Preservation of Digital Video Materials

- Digital Migration is broken because of various factors
- Format changes every 3-5 years
- Media changes every 3-5 years
- Unlike film, digital video is inscrutable
- Minor corruption can be catastrophic
- Normal data integrity checks impossible



Questions?

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Twitter @jdweekley

Thank you

Dr. Bob Grossman, University of Chicago
Dr. Heidi Alvarez, Florida International University
Dr. Paola Grosso, University of Amsterdam
NSF PIRE Summer Fellows 2014