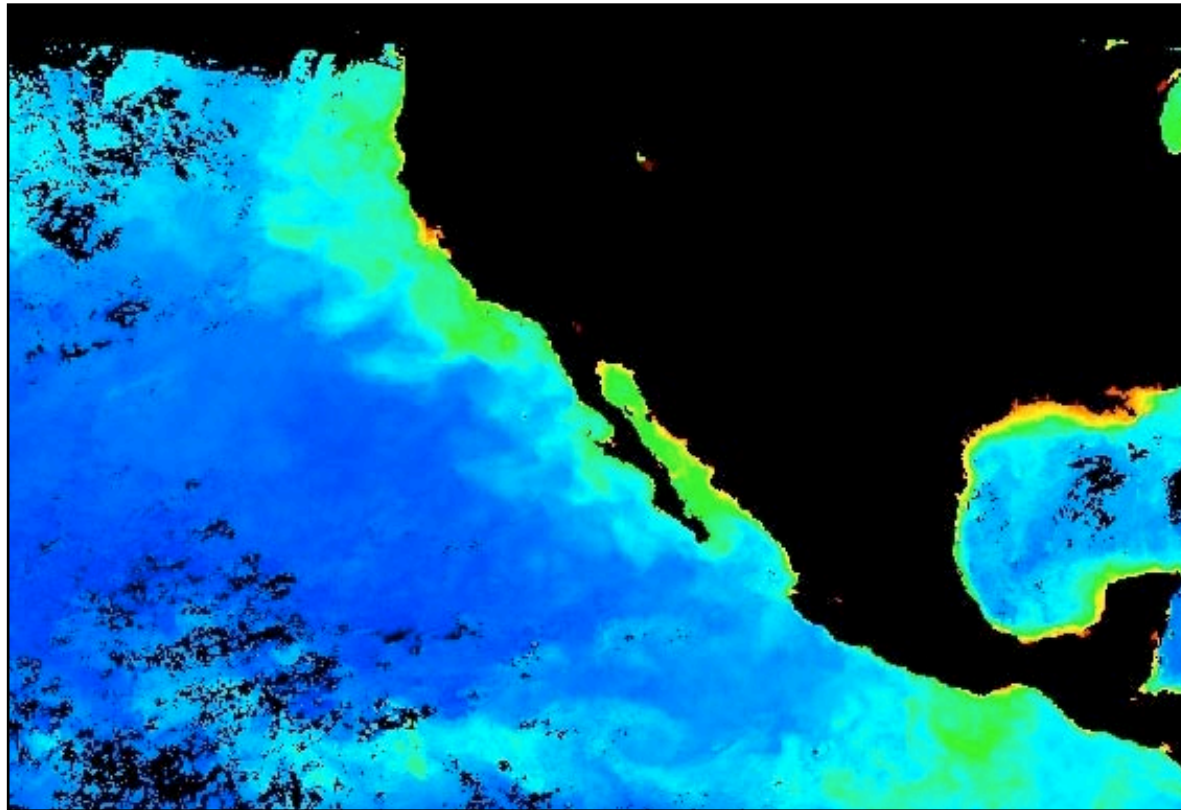




Real Science 2.0: Interacting with Scientific Imagery and Live Data



Jim Spadaccini
www.ideum.com
jims@ideum.com



Threads.

The technology. How is data gathered and incorporated?
What are the technical approaches for
developing interpretive tools?

Mediation and Interpretation. What additional materials
are provided? How do the interpretive tools function?

Usability & Design. How are data and associated
materials presented? What is the user experience like?

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mashup1



Today.

The Introductory Presentation. Working with scientific data-sets and why it is important to science centers.

Under the Hood. A look at websites/widgets & mashups that incorporate scientific data.

-break-

Top Science. Redesign an online exhibit that uses scientific data.



Why integrate scientific data into websites and exhibits?

- Due to their physical nature, most science exhibits cannot be directly converted into online experiences.
 - “Real things” are compelling. These exhibits use the same data that scientists use for research.
 - Creating online resources that mine data from real scientific endeavors sheds light on the scientific process.
- Physical science exhibits work well in showing scientific phenomena but not necessarily the scientific process.
 - These types of resources provide a link, both actual and metaphoric, to the scientific community.



Why Science Centers?

- Science centers have been rethinking their mission and more actively exploring the role that science plays in society (Bahls, 2004).
- Science centers and other educational organizations can present data across fields of research and can make scientific data and images understandable to the public.
 - The nature of the Web allowing direct and mediated access to scientific research and data provides opportunities for science centers not found elsewhere.
- Scientists can participate as advisors and partners on these projects is essential and both scientists and developers benefit from this interaction (Persson, 2000).



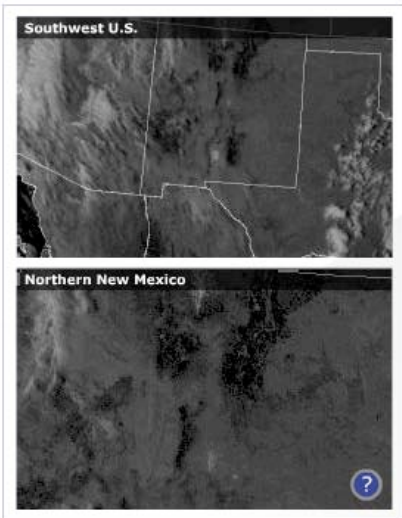
Why Science Centers? Traditional Methods for connecting to public audiences:

1. Transmission of scientific information. Providing public access to raw data of the results of scientific inquiry. For example, Mars Pathfinder images or a map of the human genome.
2. Improving skills such as creativity, curiosity, collaboration, et-cetera: Creating experiences that engage the public. For example, interactive exhibits or other museum programs.
3. Modeling the scientific process: Providing opportunities for the public to explore how and where science happens and who conducts it. For example, lab-based activities, connections to research centers, or access to scientists.



What's Out There?

Images & data from a wide variety of scientific disciplines...

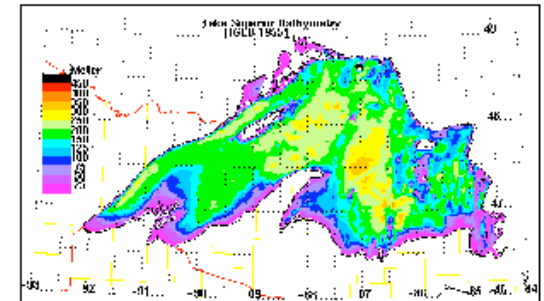
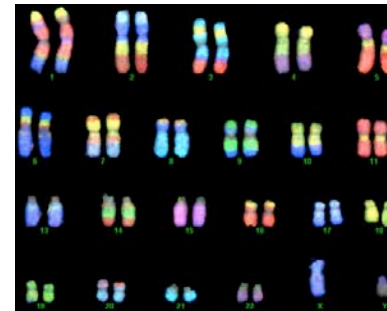
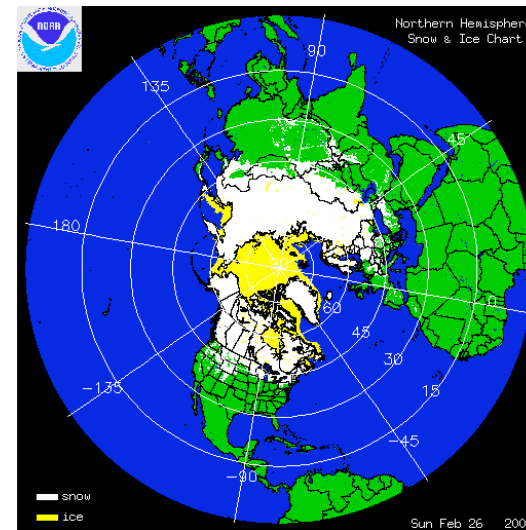
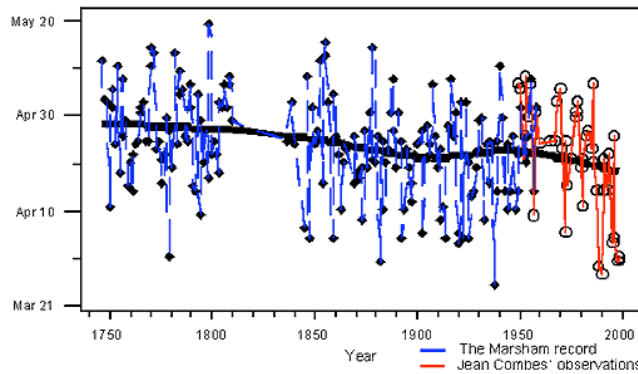
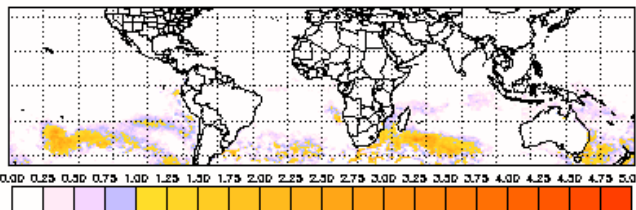


Current Weather Conditions in Corrales, NM

(Mon, 27 Feb 2006 14:56:00 -0700 MST)

Wind North at NaN MPH
Visibility 10 mile(s)
Sky Conditions A Few Clouds

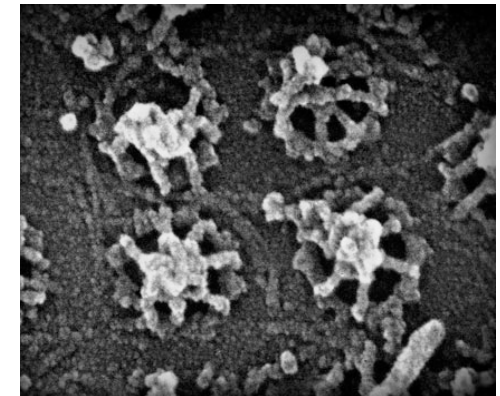
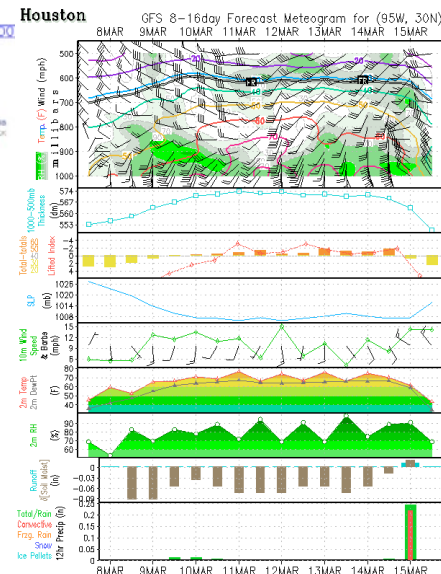
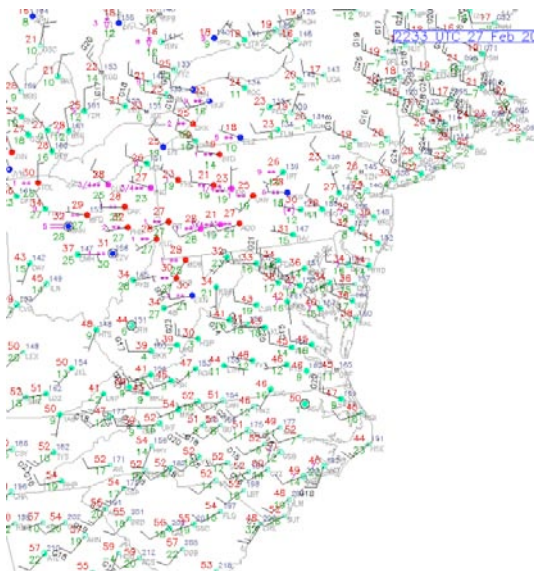
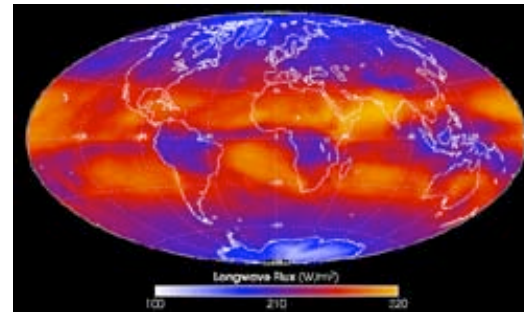
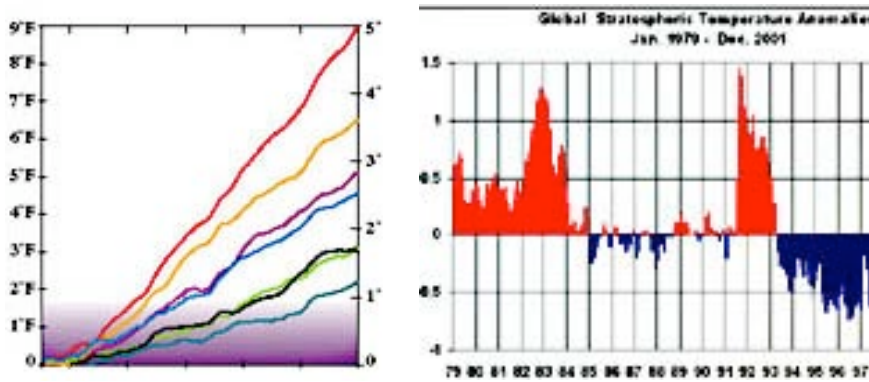
NOAA/NESDIS Current HotSpots, 2/25/2006





What's Out There?

Images & data in many forms and formats...



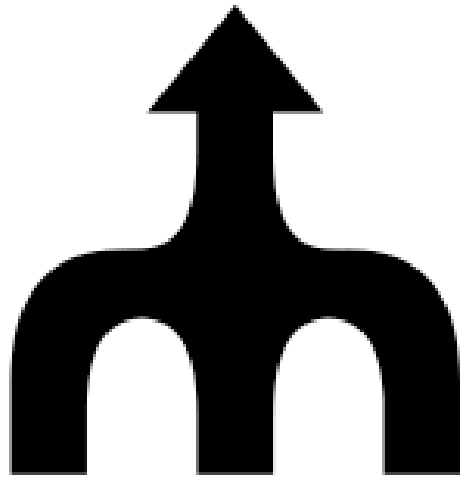


The nature of scientific datasets

Data Frequency. Near real-time, short term, long term...

Data Availability. “Pre-Internet,” proprietary areas of research, no APIs (application program interface)...

Data Form & Format. Visual format, visual “complexity,”
file formats...



A mashup is a website or application that combines content from more than one source into an integrated experience.

"We know we don't have a corner on creativity. There are creative people all around the world, hundreds of millions of them, and they are going to think of things to do with our basic platform that we didn't think of. So the mashup stuff is a wonderful way of allowing people to find new ways of applying the basic infrastructures we're propagating."

Vint Cerf



One of the central concepts in **Complex Systems** is **Emergence**. It is this automagical process through which elements of a system give rise to a higher order system. Emergence is how physics becomes chemistry and chemistry becomes biology. It is how web 1.0 evolved into web 2.0, and how that, in turn, will become the next web.

While the exact mechanics of emergence is complicated and far from being completely understood, scientists know that a new system emerges as a combination of its elements and their interactions. In other words, complex systems are really networks - where elements interact with each other and give rise to a new system.

Perhaps today we are witnessing one of the most vivid examples of emergence - the remixing of the world wide web. The parts of the new web have crystallized - blogs, photos, video, audio, maps, RSS, social network profiles and even plain old HTML pages have formed an impressive network, that now can be mined and remixed.

Mashups are really nothing new, the web has been a programmable oyster for at least a few years now.



Emergence is the development of complex organized systems. Like intelligence in the field of AI, or agents in distributed artificial intelligence, emergence is a central concept in complex systems yet very controversial.

"Perhaps the most elaborate recent definition of emergence was provided by Jeffrey Goldstein in the inaugural issue of *Emergence*. (Goldstein 1999) To Goldstein, emergence refers to "the arising of novel and coherent structures, patterns and properties during the process of self-organization in complex systems."

The common characteristics are: (1) radical novelty (features not previously observed in systems); (2) coherence or correlation (meaning integrated wholes that maintain themselves over some period of time); (3) A global or macro "level" (i.e. there is some property of "wholeness"); (4) it is the product of a dynamical process (it evolves); and (5) it is "ostensive" - it can be perceived.



Design Considerations

The aesthetic qualities of scientific data. All data-sets are *not* created equal.

Design of Support Materials & Interpretive Tools (usability)
Placement of data-sets and tools, layering...

Design limitations Screen “real estate,” download (and connect) times, form and formats, complexity of data-sets...

Graphic design & resource identity Enhancing, or at least not distracting from, the aesthetic quality and usability of the piece.



Connections & Distribution



HTML & JavaScript (AJAX) embedding, deep linking, connecting to server-side technologies...



Macromedia (Adobe) Flash embedding, deep linking, connecting to server-side technologies, XML & RSS consumption...



Widgets (Yahoo! & Mac Dashboard) Deep linking, RSS & XML consumption, connecting to server-side technologies..



Server-side technologies PHP, CF, ASP, CGI, SQL, Ruby on Rails, generating RSS, generating XML...

All of these types of connections may be able to connect to “services” through open APIs (i.e. mashups)



Interpretation & Presentation

Support Materials for mediating and explaining data-sets (and the scientific process). Can include: annotation and other text-based explanations, animations, video interviews (with Scientists or others), glossaries, comments & tagging (other Web 2.0 enhancements), and more.

Interpretive Tools for interacting with, and better understanding data. Pan & zoom, contextual annotation, overlays, comparisons, onion-skinning, time-display, drawing tools, and more.

The screenshot displays a web browser window with several tabs: 'hydrosphere', 'cryosphere', 'biosphere', and 'global effects'. The active page is titled 'Hydrosphere: Qu...' and contains text about climate change and El Niño. A 'glossary terms' overlay is visible, listing terms like aerosols, carbon cycle, coral bleaching, deforestation, greening hypothesis, and phenology. Below the browser, a satellite image viewer is shown, displaying a large-scale view of Earth's atmosphere with a zoom control and a 'SIZE OF EARTH' indicator.



Final thoughts in this Introduction.

“Mining” scientific data is the right metaphor.

The scientific community itself needs to help make available more open APIs that allow developers to connect to data.

We need to go beyond mirroring scientific data-sets.

These types of resources can help fulfill the mission of science centers.

Scientific data-sets represent great, untapped potential for online and museum floor exhibits.

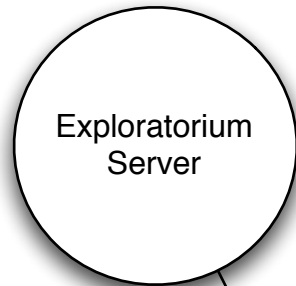


Under the Hood. A look at websites/widgets & mashups that incorporate scientific data.



Solar Max/Auroras

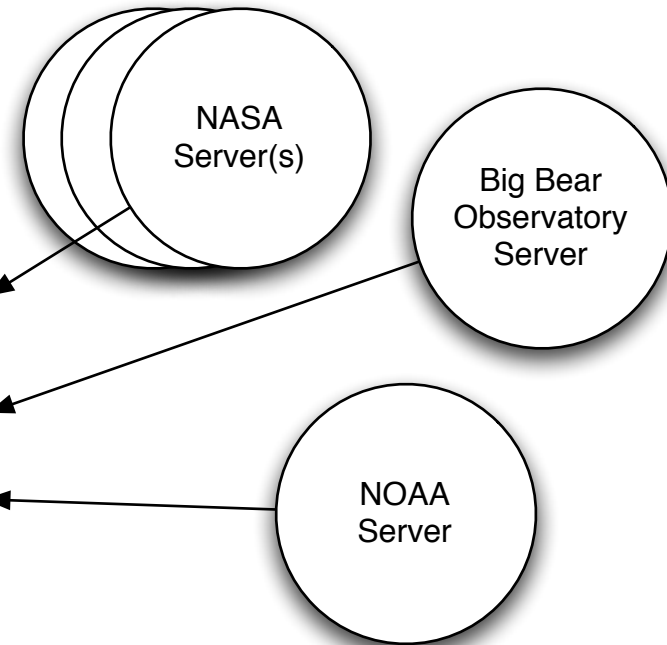
Data model: Deep Linking
Presentation model: Portal



HTML pages.

The screenshot shows the 'Solar Max/Auroras' website. At the top, there are tabs for 'SOLAR MAX' and 'AURORAS'. Below the tabs is the site title 'ソーラー マックス SOLAR MAX' and the tagline 'Your Guide to the Year of the Active Sun'. A 'Main Guide' link is visible. The main content area is divided into several sections: 'News about Solar Max in 2000', 'Current Solar Images' (with sub-sections for White Light, Soft X-Ray Images, and Coronagraph), 'Extreme Ultraviolet Images', 'Solar Max FAQ', 'Upcoming Sun-Earth Events', 'Glossary of Solar Terms', 'Classroom Activities', and 'Other Solar Max sites'. Each section contains links to various resources and images.

"Remote" servers
Near-realtime data
HTTP protocol



Support Materials: For mediating & explaining data-sets:

- text explanations
- common questions
- glossary terms
- related sites

interpretive Tools:

- indirect comparison



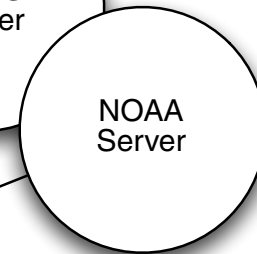
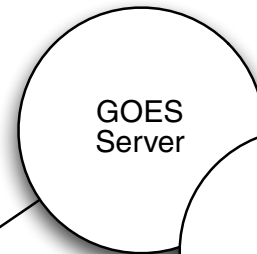
Global Climate Change

Data model: Deep Linking
Presentation model: Portal



HTML pages,
short term and long term data

"Remote" servers
Near-realtime data
HTTP protocol



Resources: For mediating & explaining data-sets:

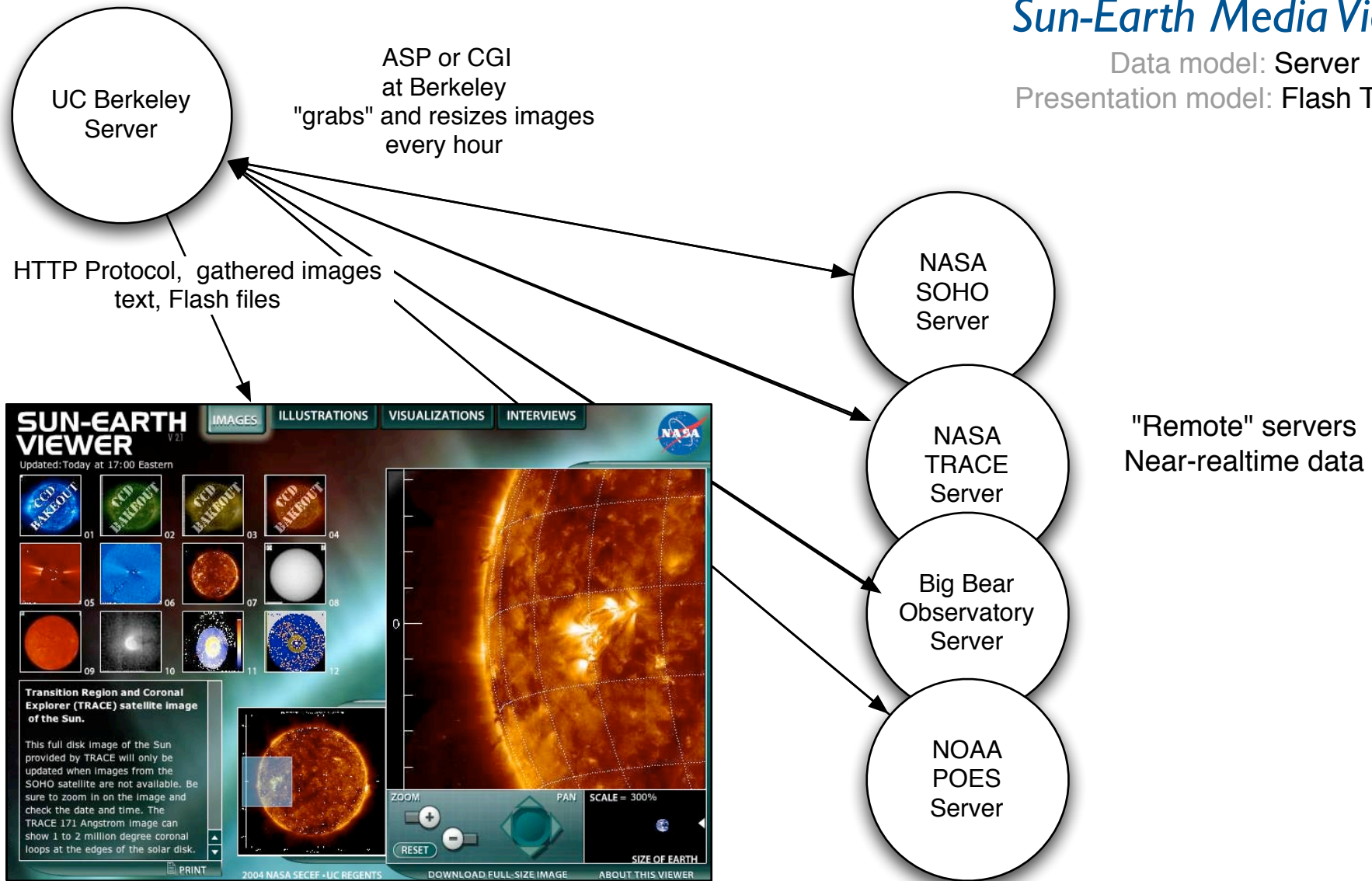
- text explanations
- common questions
- glossary terms
- related sites

Direct interpretive Tools: color keys (provided with data-sets)



Sun-Earth Media Viewer

Data model: Server
Presentation model: Flash Tool Kit



Support Materials: For mediating & explaining data-sets:

- text explanations
- Illustrations
- Visualizations
- Scientist Interviews

Interpretive Tools:

- pan & zoom
- scale tool
- indirect comparison



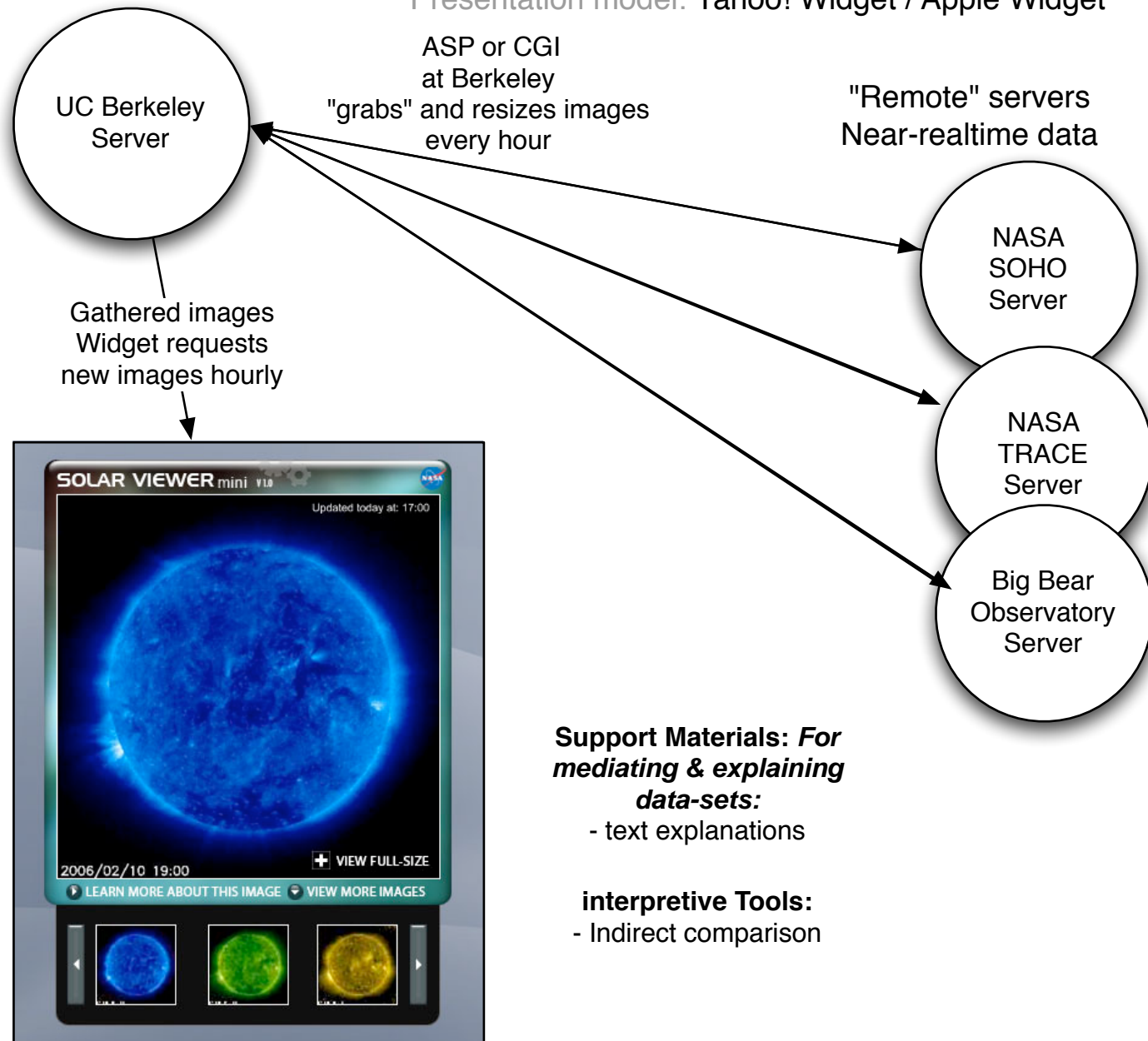
Flash is used to present the data and the support and interpretive tools



Solar Viewer

Data model: Server

Presentation model: Yahoo! Widget / Apple Widget

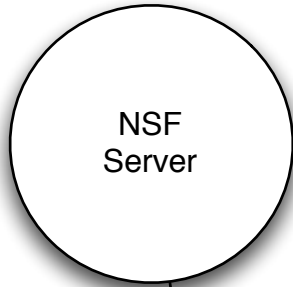


Support Materials: For mediating & explaining data-sets:

- text explanations

interpretive Tools:

- Indirect comparison



NSF
Server

New images and text are
entered into
a database
PHP is used to
generate a RSS Feed

RSS Feed XML RSS 1.0 Standard
RSS requests every hour
<http://www.nsf.gov/news/mmg/rss/ideummmg.xml>

National Science Foundation · Latest Image

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Qaidam Basin, the largest terrestrial basin on the Tibetan Plateau where a team of ...

Qaidam Basin, the largest terrestrial basin on the Tibetan Plateau where a team of researchers funded by grants from the National Science Foundation (INT 02-04923 and EAR 04-44073) studied fossils, sediments and

>> More about this image

Learn more about this image

Support Materials: *For mediating & explaining data-sets:*

- text explanations

Interpretive Tools:

- none

NSF Latest Image

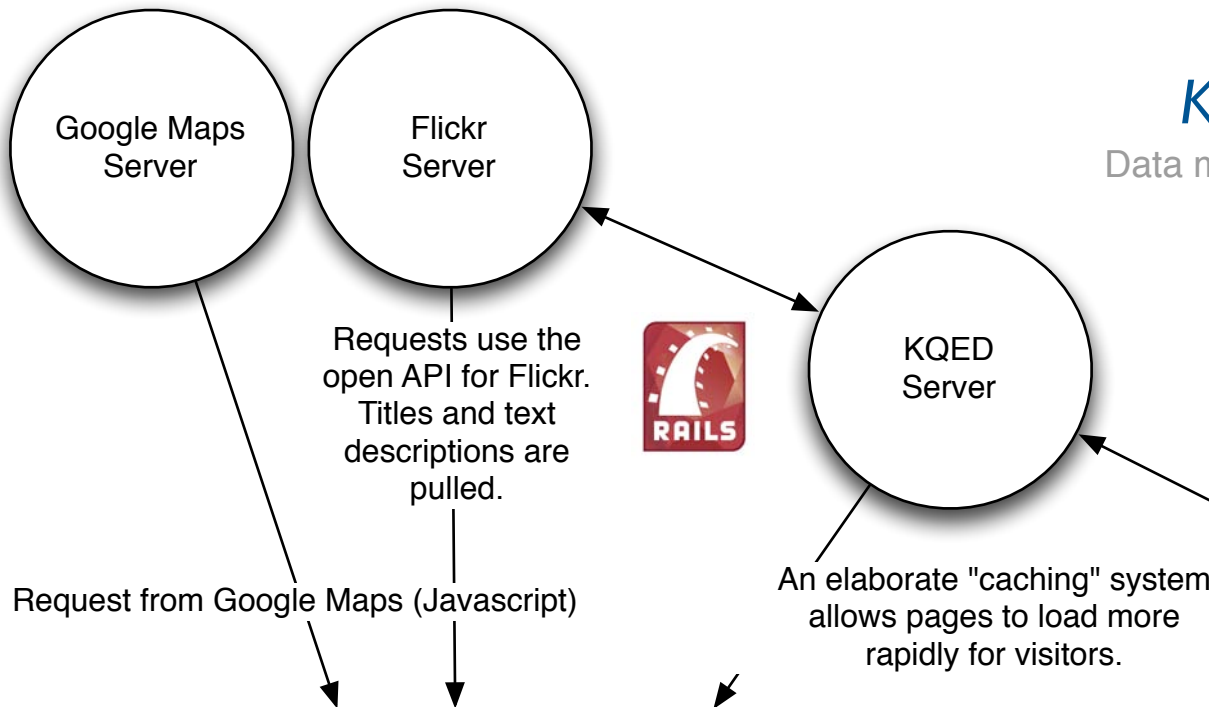
Data model: RSS Feed

Presentation model: Yahoo! Widget

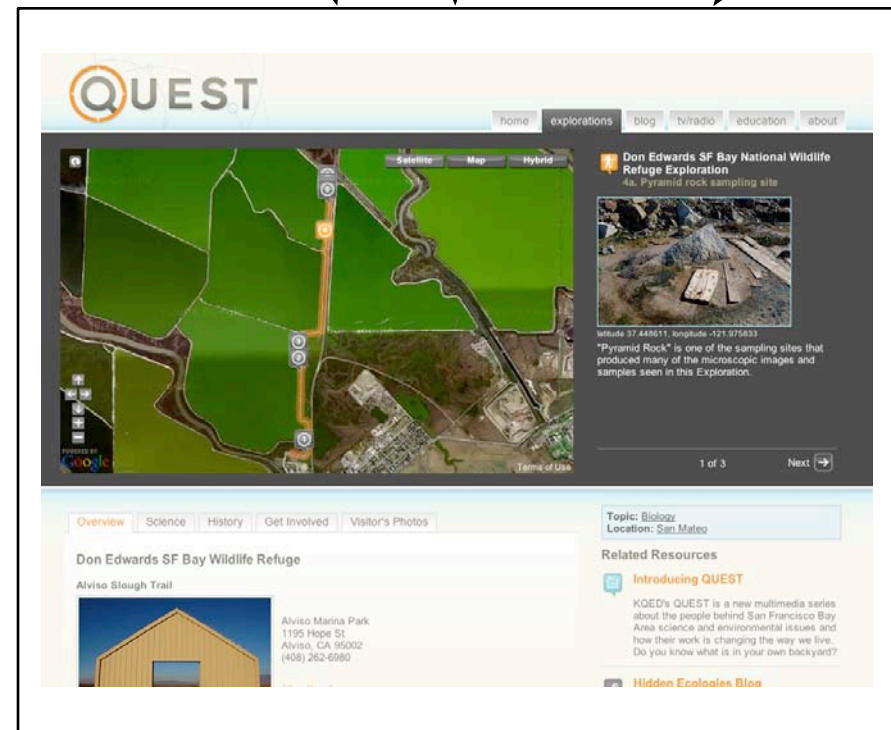


KQED Quest Explorations

Data model: Google API, Flickr API, Geocoded
 Presentation model: Web mashup



A secure admin page allows KQED Staff to update an exploration and upload a GPX file and assign a Flickr Photoset or Group.



Support Materials: For mediating & explaining data-sets:

- text explanations (maps and ground-based photos)

Interpretive Tools:

- Maps, and Ground-based Photos (Flickr notes and comments)