Enhanced Collaborative Disaster Management Through Interoperable Data Visualization

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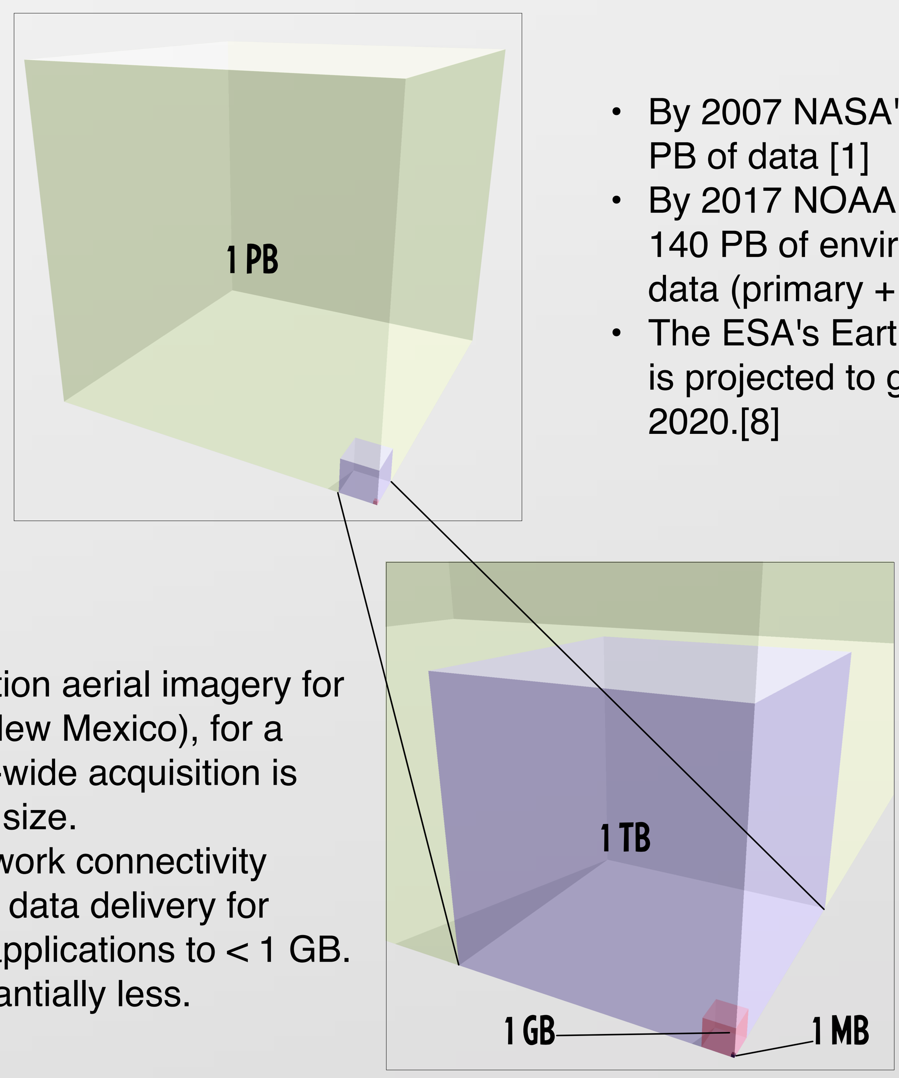
The Challenge

Disaster planning and response decision making increasingly relies upon targeted subsets of large (multi-TB) datasets, often totaling Petabytes in size.

Technical solutions that provide on-demand access to strategic subsets of key Earth observation and other data products can both improve planning and response to disasters.



- By 2007 NASA's EOSDIS held 3.7 PB of data [1]
- By 2017 NOAA plans on having over 140 PB of environmental observation data (primary + backups) [2]
- The ESA's Earth observation archive is projected to grow to 20 PB by 2020.[8]

- High-resolution aerial imagery for one state (New Mexico), for a single state-wide acquisition is over 2TB in size.
- Current network connectivity speeds limit data delivery for interactive applications to < 1 GB. Often substantially less.

Transfer Size	640K DSL (640k bps)	T3/DS3 (45 Mbps)	OC3 (156 Mbps)
1 MB	0:00:13	0:00:00	0:00:00
1 GB	3:43:41	0:03:12	0:00:55
1 TB	3817:44:55	54:37:02	15:44:35
1 PB	3909374:40:35	55928:06:25	16121:07:57

Table 1. Estimated data transfer times (HH:MM:SS) for a variety of connection speeds and transfer sizes. Sub-minute transfer times highlighted in green. (from http://www.ibeast.com/content/tools/band-calc.asp)

Abstract

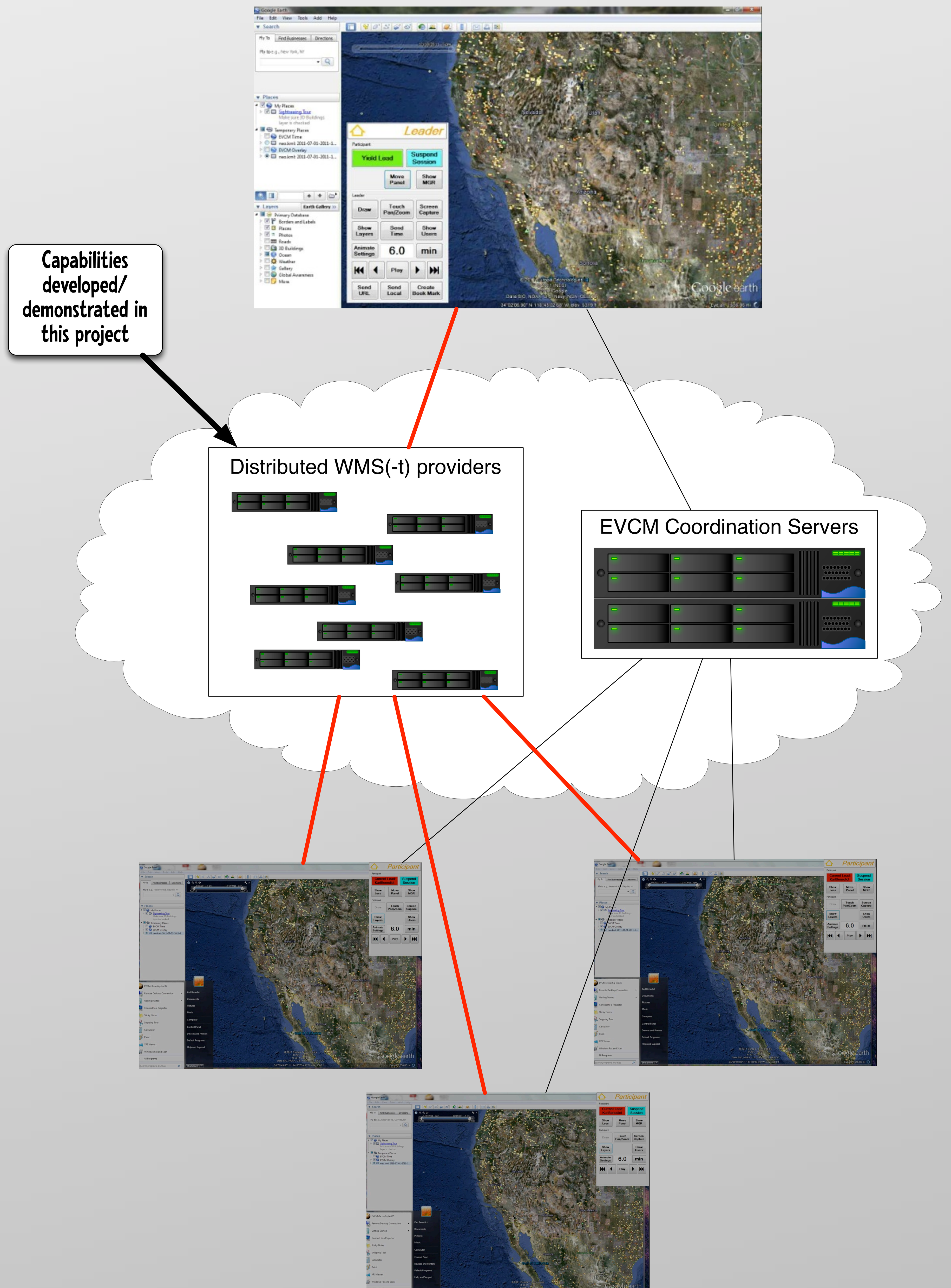
Rapid access to shared data and information is the key to successful planning and response to disasters. Many of the complex geoinformation (GIS) systems used today exist as standalone islands that were not designed to be interoperable. Thus, many of today's advanced systems do not currently work together from an overall mission or joint perspective. Additionally, despite all the advances in satellite and environmental data acquisition, processing and distribution, the "last mile", getting the data to the end user, is still the hardest part.

This poster presents the products of a collaboration between StormCenter Inc. and the Earth Data Analysis Center that was funded through the ESIP Federation's Funding Friday program in which general purpose time-enabled WMS services are packaged in KML for delivery specifically through the Envirocast® Vision™ Collaboration Module (EVCM) developed by StormCenter Inc., and also more generally through any client application that has implemented support for KML's temporal elements and WMS access model.

This project has resulted in
- Increased integration of Earth Science data products into disaster planning and management through expansion of the data and products that may be integrated into the EVCM
- Increased system performance in the collaboration environment through the packaging of large data sets (potentially multi-PB in size) into KML with embedded WMS
  - delivering targeted map images instead of entire data sets
- Demonstrated the utility of integrating KML-wrapped WMS into the existing system
  - increasing the potential utility of published WMS services coming out of the Earth Science community (e.g. NASA NEO, NOAA NGDC)

An Answer

The use of server-side processing (such as that provided through the OGC Web Map Service standard) to deliver time-space specific map images based upon large collections of data can provide scalable capabilities for providing access to multi-PB data collections. KML with embedded data were already in use within the EVCM. This project demonstrated the feasibility and developed an initial capability for efficient transformation of WMS-t services into corresponding KML representations.



Completed Capabilities

- ☑ Develop OGC WMS 1.1.1 capabilities XML - KML converter for time-enabled WMS service
- ☑ Implement support for WMS single Time, Time list, Time Interval, and multiple Time Interval representations [3 (Annex B, C),4 (Annex C, D)]
- ☑ Implement support for ISO 8601 Time Duration [5] representation for Years (PnY), Months (PnM), and Days (PnD)
- ☑ Implement date subsetting from source capabilities XML

Enhancements

- ☐ Implement support for WMS 1.3.0
- ☐ Implement support for WMS 1.3.0 ISO 8601 Time Duration representation for Weeks (PnW), and Time (Hours, Minutes, Seconds)
- ☐ Implement layer subsetting from source capabilities XML
- ☐ Exclude empty layers after subset operation
- ☐ Include non-temporal layers in generated KML
- ☐ Publish REST service for remote KML generation from current capabilities XML URL.
- ☐ Sync time controller across Leader and Participant systems
- ☐ Implement a caching proxy for increased speed for delivery to large collaboration teams.

What You Can Do to Help ...

- ☑ Develop time-enabled WMS for your data collections that implement the full temporal representation model defined in the OGC WMS standards [3, 4]
- ☑ Advertise those services through WMS capabilities XML documents that provide a complete and correct representation of the available time dimension(s).
- ☑ Configure your WMS servers to use the current recommendations for HTTP caching [6], including delivery of "Expires", "Cache-Control", and "Last-Modified" headers as needed, and explicitly defining HTTPS content as "public" to encourage caching that otherwise is not performed on content delivered via HTTPS [7].

Acknowledgements

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Federation of Earth Science Information Partners
Fostering connections to make data matter

The demonstrated WMS services are hosted by NASA's NEO Project.

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