

# ECHO System and Data Model Overview

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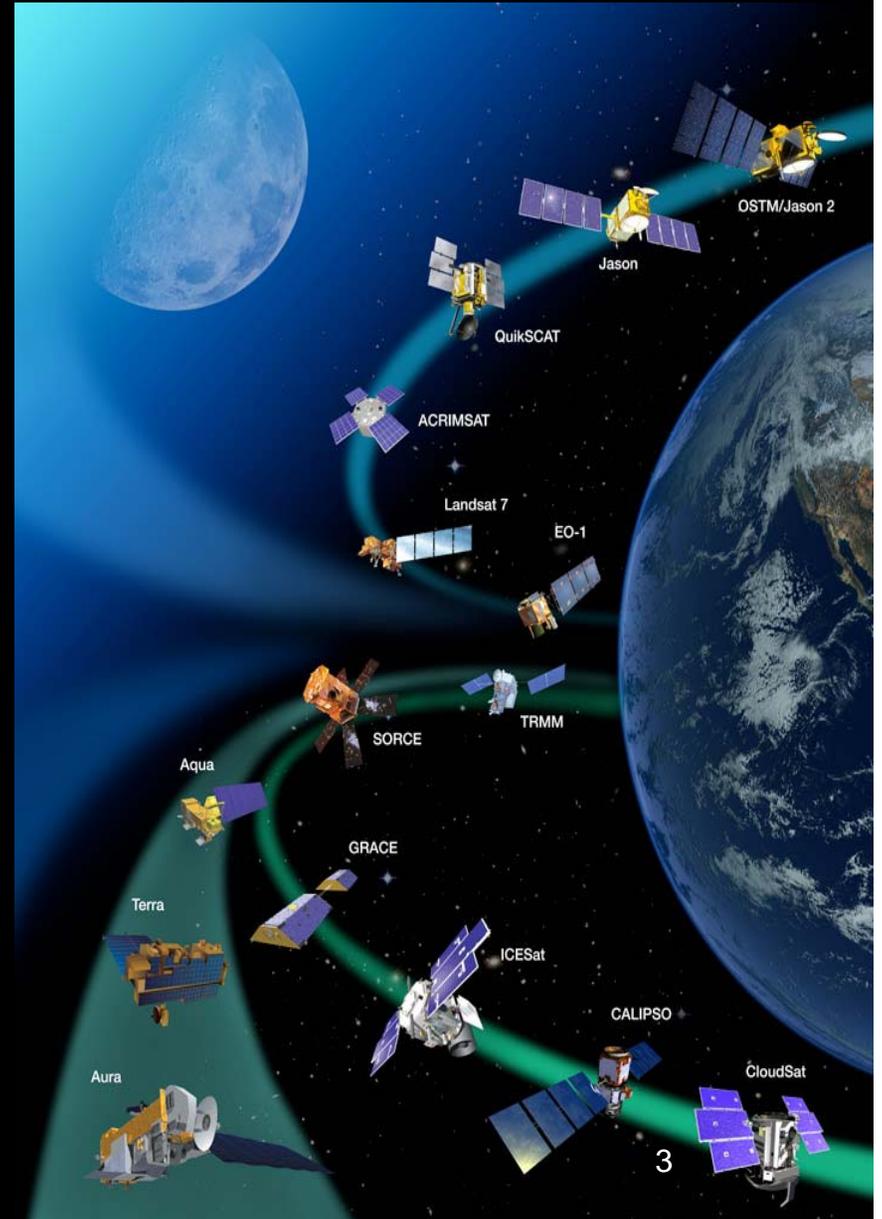


# Coordinating NASA's Earth Observing System

- NASA's Earth Observing System (EOS)
  - Mission is to collect Earth remote sensing data for global change research program
- NASA's Earth Observing System Data and Information System (EOSDIS)
  - A petabyte-scale archive of environmental data that supports global climate change research
  - Designed to receive, process, distribute and archive several terabytes of science data per day
  - Provides a distributed information framework supporting EOS investigators and other users
  - Open Data Policy – Data are openly available to all and free of charge except where governed by international agreements
  - By having open application layers to the EOSDIS framework, we allow many other value-added services access to NASA's vast Earth Science Collection
  - Interoperates with data archives of other agencies and countries

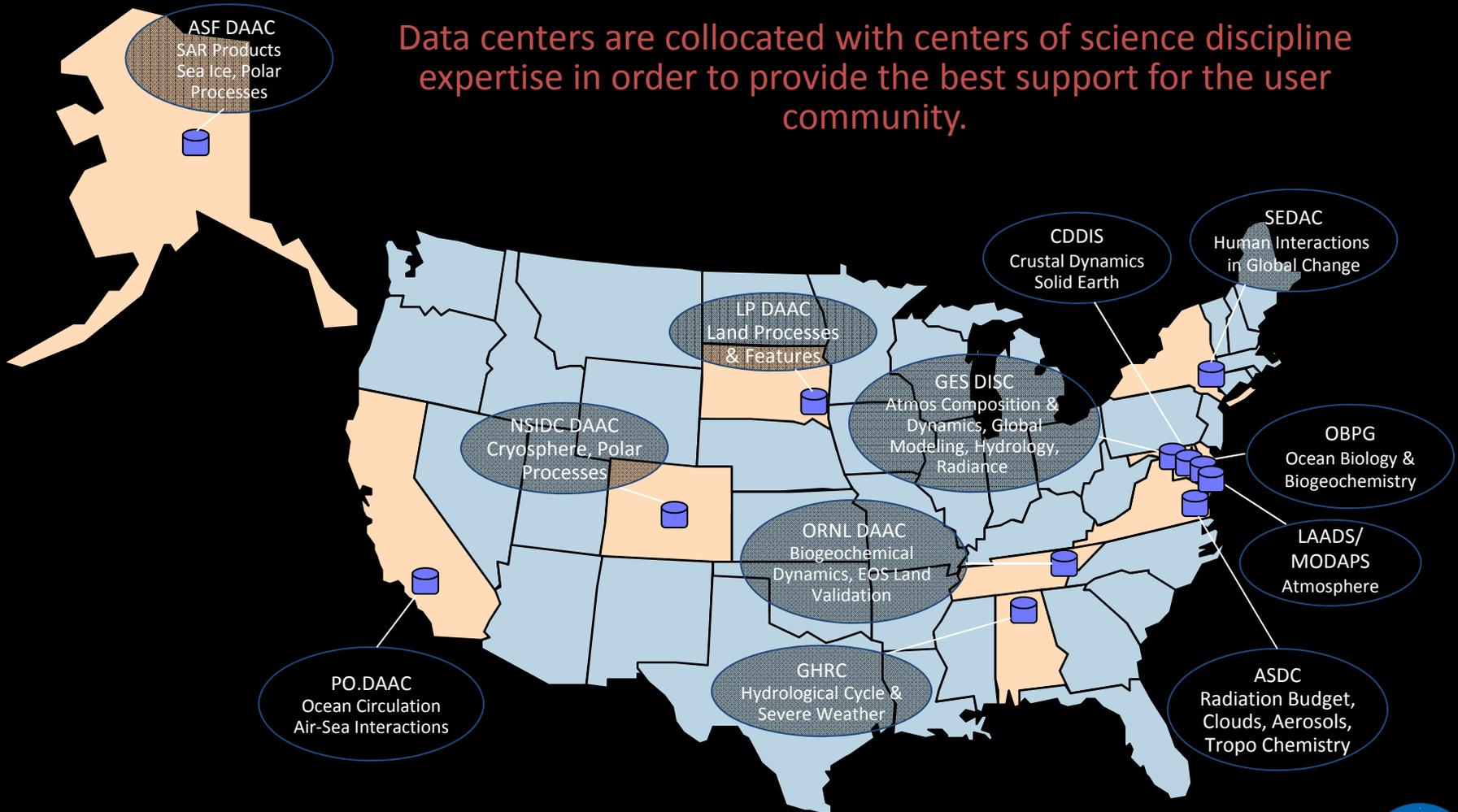
# Extensive Data Collection

- NASA's Earth Observing Satellites (EOS) monitor daily events and long term environmental changes
- EOSDIS data collection includes over 3,500 data types
- Land
  - Cover & Usage
  - Surface temperature
  - Soil moisture
  - Surface topography
- Atmosphere
  - Winds & Precipitation
  - Aerosols & Clouds
  - Temperature & Humidity
  - Solar radiation
- Ocean Dynamics
  - Surface temperature
  - Surface wind fields & Heat flux
  - Surface topography
  - Ocean color
- Cryosphere
  - Sea/Land Ice & Snow Cover
- Human Dimensions
  - Population & Land Use
  - Human & Environmental Health
  - Ecosystems



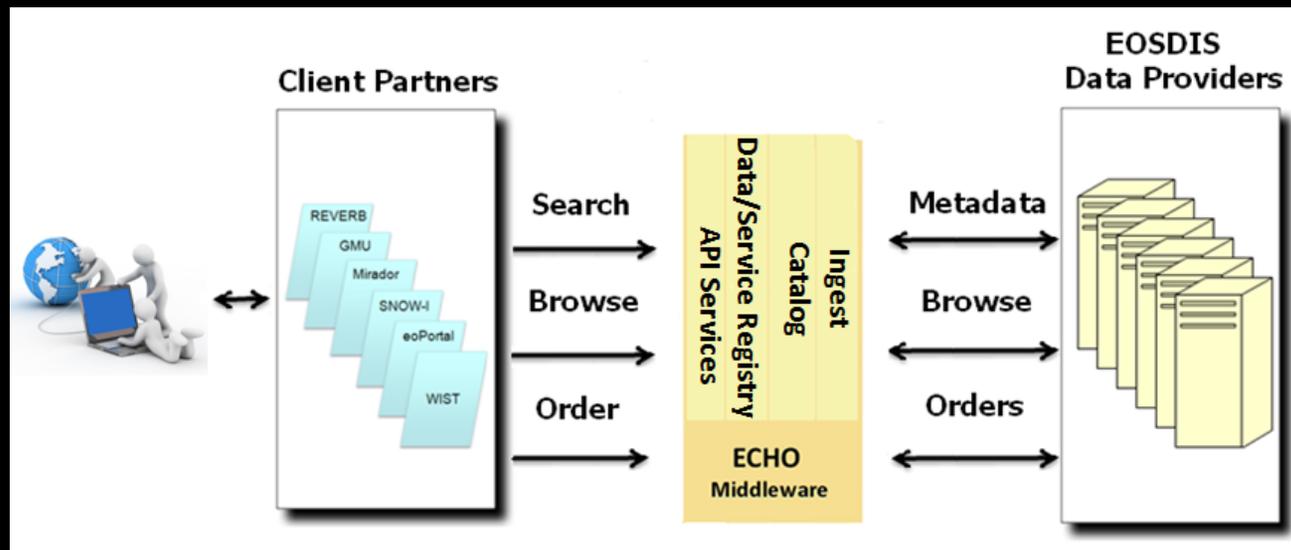
# Distributed Centers of Expertise

Data centers are collocated with centers of science discipline expertise in order to provide the best support for the user community.



# ECHO Architecture

- ECHO is NASA's middleware layer between Earth science data and users via a service-oriented architecture. Designed to improve the discovery and access of NASA data.



*Developed as a part of NASA's core data systems but fully adaptable to the needs/requirements of science communities.*

- Acts as an order broker between end users and EOSDIS Data Centers who provide metadata for their data holdings and other Earth science-related data holdings.
- User-defined specialized "clients" can be easily developed to give science data users of their community access to data and services using ECHO's open APIs.

# Next Generation Client - REVERB

The screenshot displays the REVERB web interface. At the top, it features the NASA logo and the text 'National Aeronautics and Space Administration'. Below this, the 'EOSDIS' logo is visible, along with 'NASA Earth Observing System Data and Information System'. The main header includes 'Reverb | ECHO' and 'The Next Generation Earth Science Discovery Tool'. The interface is divided into several sections: 'Search Options' on the left, 'Step 1: Select Search Criteria' in the center, and 'Step 2: Select Datasets' at the bottom. The 'Search Options' section includes 'Spatial', 'Temporal', 'Platforms & Instruments', 'Campaigns', 'Processing Levels', and 'Science Keywords'. The 'Step 1: Select Search Criteria' section features a 'Spatial Search' map with a bounding box and a 'Search Terms' input field. The 'Step 2: Select Datasets' section shows a list of datasets with checkboxes and buttons for selection. The 'Step 3: Discover Granules' section is partially visible at the bottom.

- Reverb is the primary web-based client for discovering and ordering cross-discipline data from all of ECHO's metadata holdings.
- Reverb allows users, including those without specific knowledge of the data, to search science data holdings, retrieve high-level descriptions of data sets and detailed descriptions of the data inventory, view browse images, and submit orders via ECHO to the appropriate data providers.
- Users are able to submit queries using spatial and temporal criteria and examine search results for relevancy using built-in tools.
- Exposes the ECHO service registry with relevant ECHO metadata

<http://reverb.echo.nasa.gov/reverb>



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# METADATA CONCEPTS



# Some Definitions

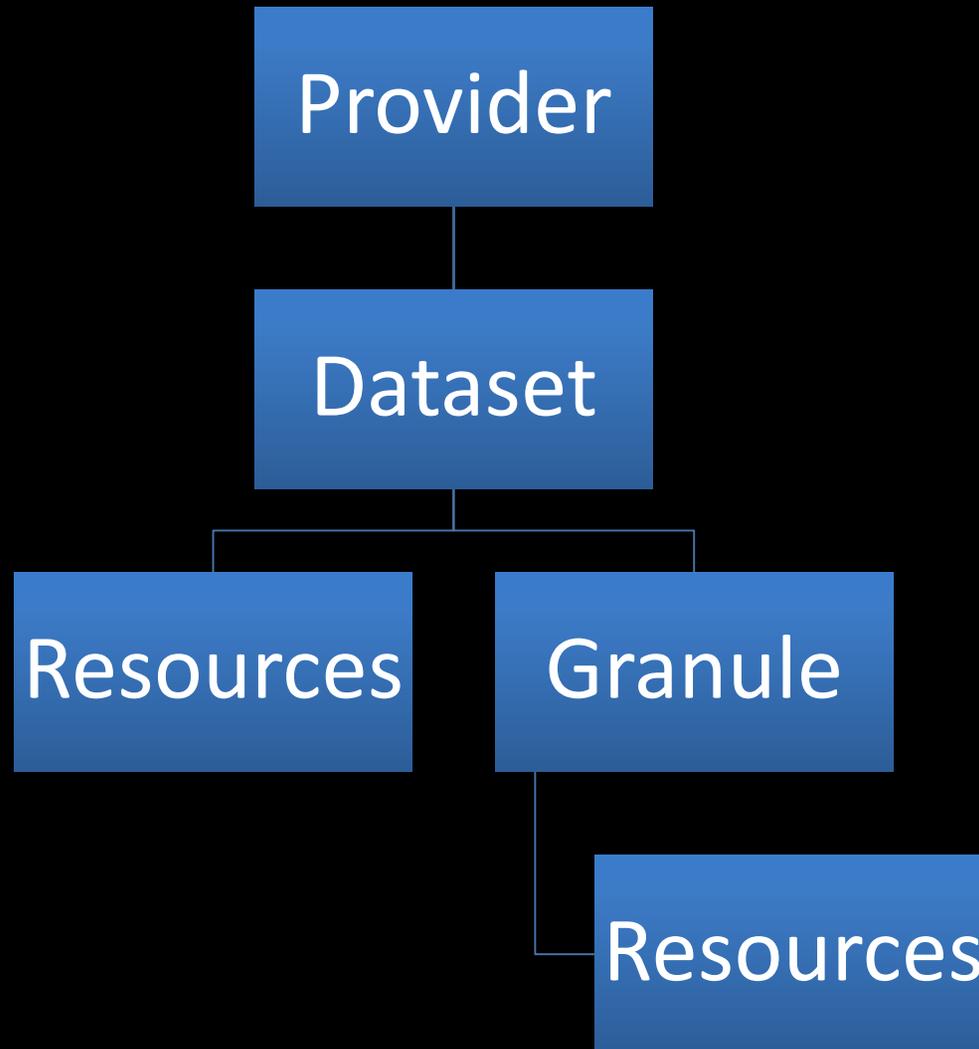
Providers – DAACs and other Data Hosts

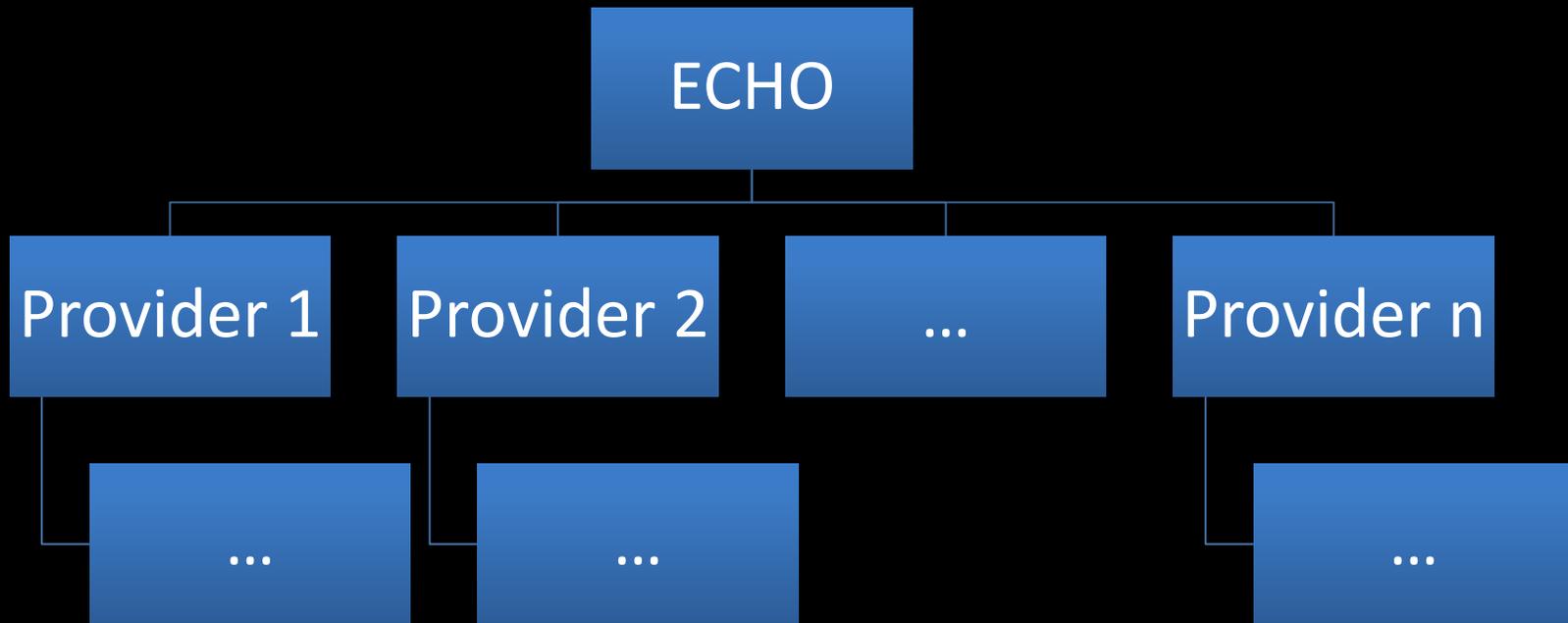
Collections– groups of related granules or ISO datasets; defines common attributes about the granules.

Granules – individual spatial or temporal data elements (ISO datasets)

Resources – Anything referenced by granules or collections. Format specific. For example, browse metadata is a resource



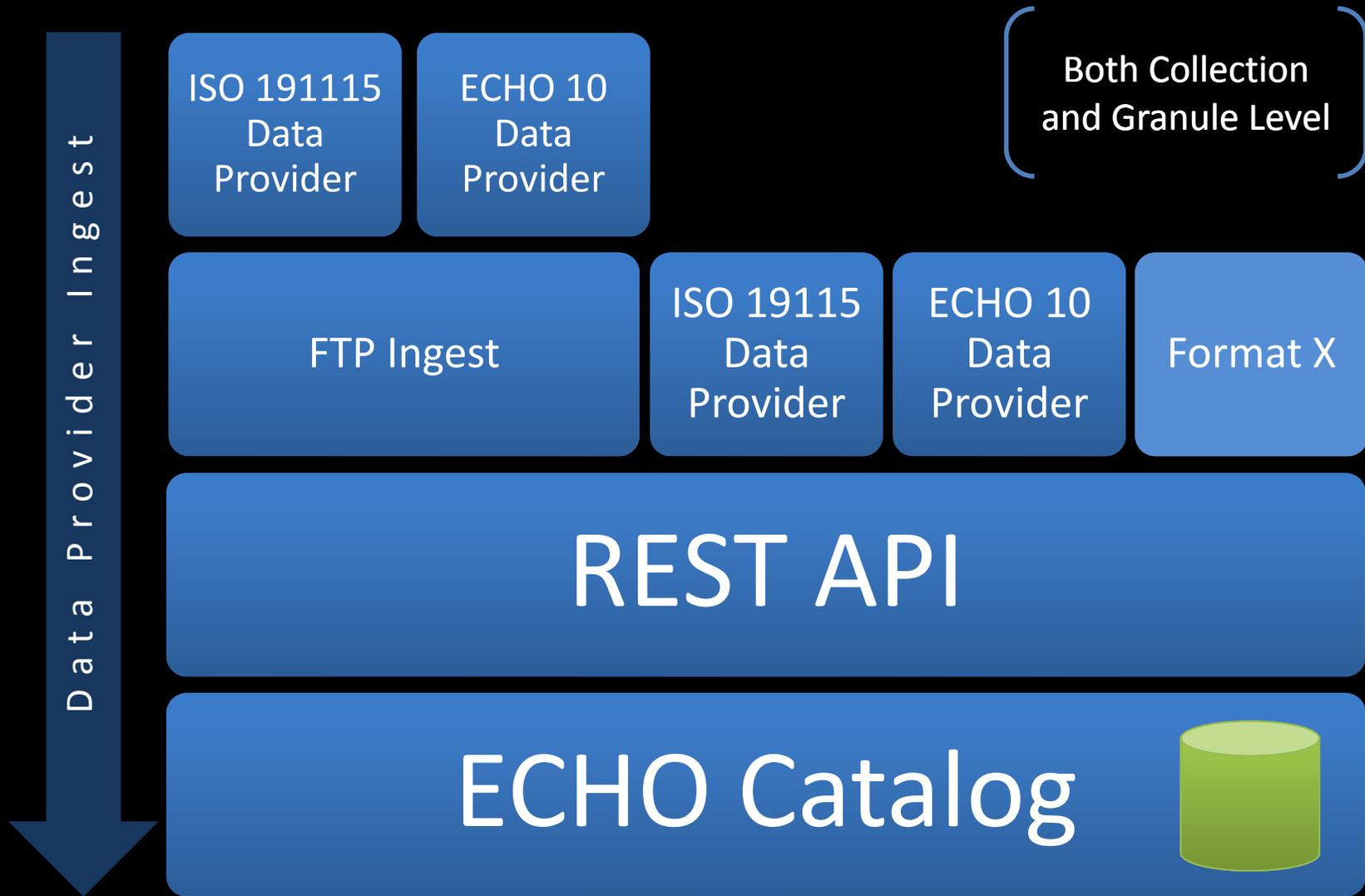




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# DATA FLOW





Client Data Retrieval ↑

Reverb

Mirador  
Giovanni  
...



ESIP  
OpenSearch

Direct  
Clients

**REST API**

- Searching
- Ordering
- Multi-format Retrieval
  - ECHO10
  - JSON
  - ISO 19115

**ECHO Catalog**

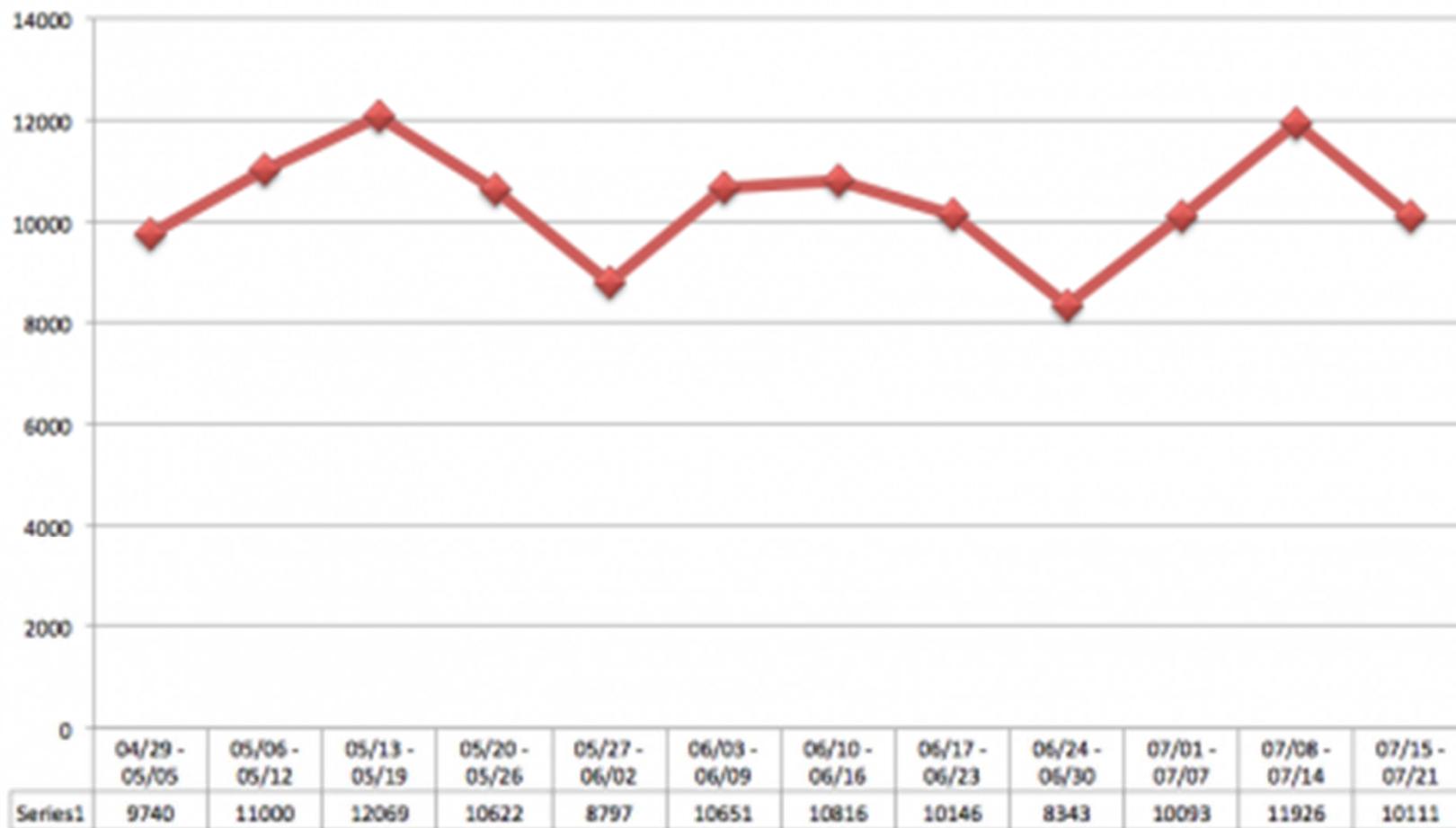


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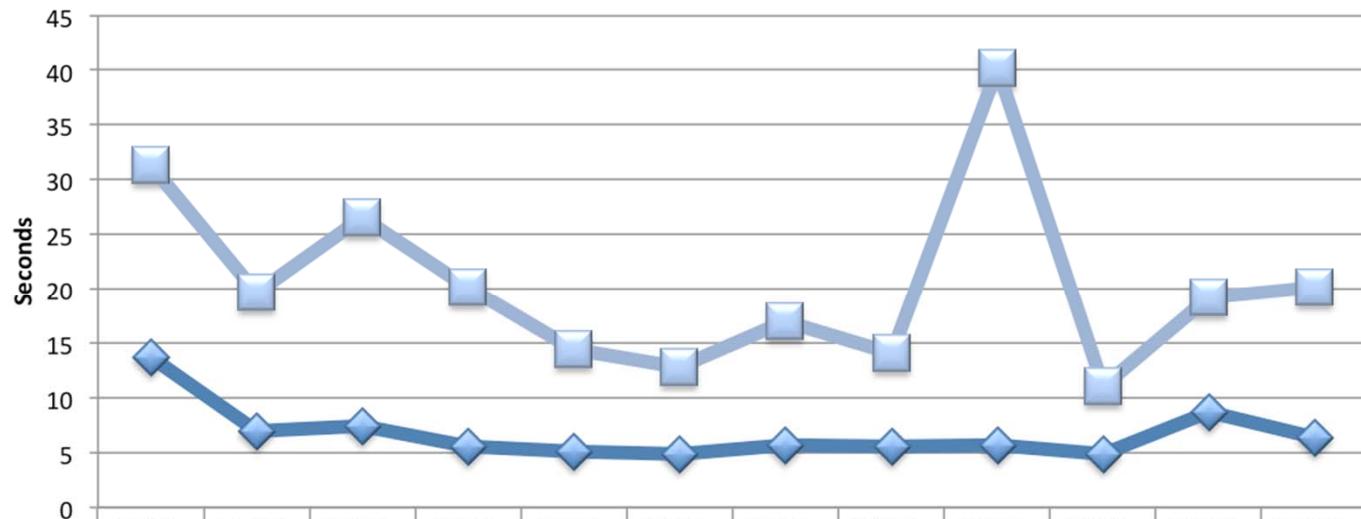
# USAGE METRICS



## Reverb Granule Queries

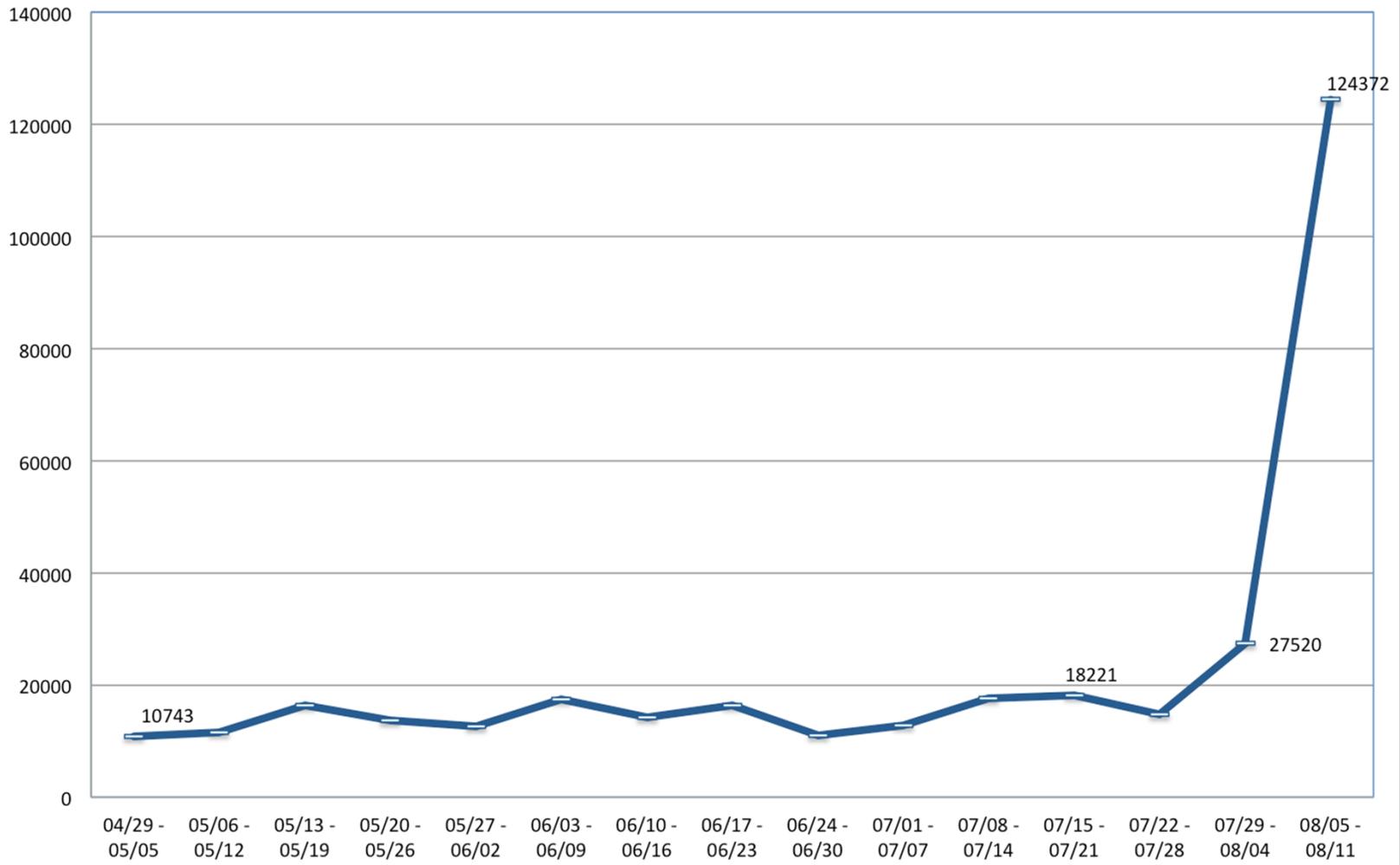


## Average Query Performance

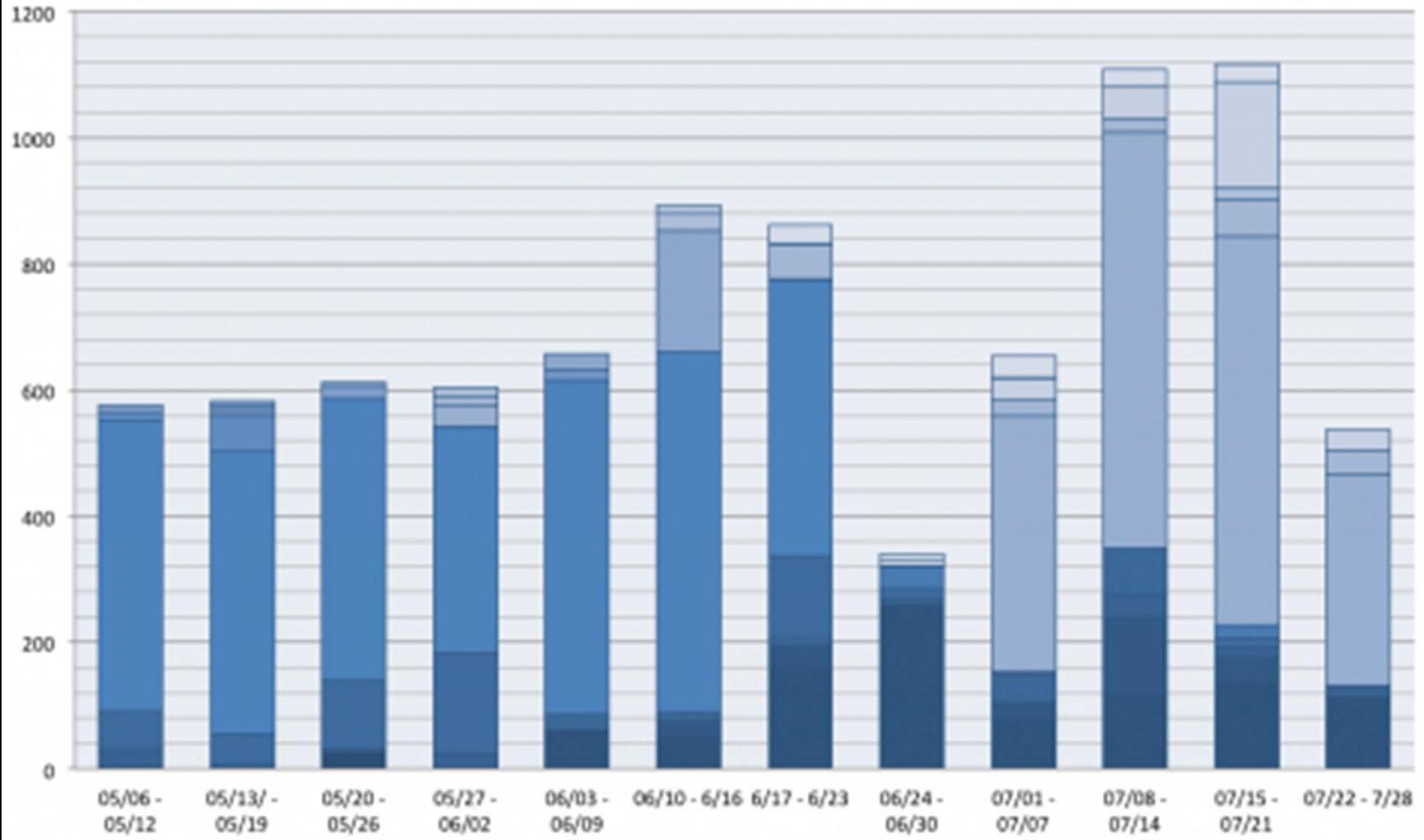


◆ Avg Exec Time	13.78	6.93	7.47	5.53	5.06	4.92	5.69	5.61	5.74	4.88	8.75	6.45
■ Exec Time Std. Dev.	31.33	19.63	26.49	20.15	14.41	12.83	16.94	14.09	40.19	11.02	19.24	20.11

### Total ECHO Queries by Week, All Clients



## ECHO OpenSearch Queries By Week



- **Data Metrics Weekly Activity Metrics**
  - >99.9% Uptime
  - 2TB Data Index covering PBs of data
- **Current Public Holdings:**
  - Collections: 2798
  - Granules: 105 million
  - Growing by ~100k granules/week
- **Other Fun Facts**
  - 60K+ registered users, utilizing EOSDIS URS
  - 12 Active Data Partners
  - 34 million ECHO hosted Browse Images
  - 11 Operational Clients
  - Several Clients in Test & Evaluation



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# ENGAGEMENT AND FUTURE WORK



# Embracing Change

We understand that ECHO's data formats won't work for everyone.

That's OK.

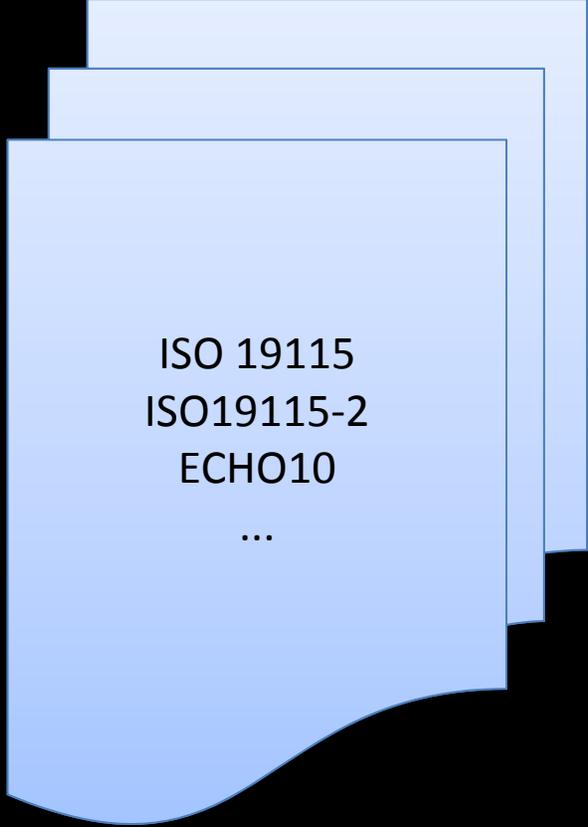
- Format Translators
- Format Indexers
- Retaining Pristine Format
- Validation/Verification Flexibility



Credit: FreeDigitalPhotos.net

## Current Limitations (Future Opportunities)

- ISO 19115 is based on a snapshot
- Future Mission Planning: SMAP
- Validation is going to be a challenge, looking forward for collaboration and guidance
- Services Integration



ISO 19115  
ISO19115-2  
ECHO10  
...

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**QUESTIONS?**

