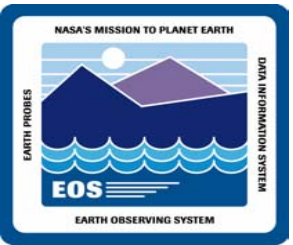
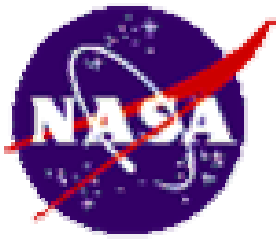
Extending ECHO

Keith Wichmann

wichmann@gst.com



Global Science & Technology, Inc.



ECHO's Purpose

- **ECHO is being built to provide a single portal on the internet where NASA's Earth Science metadata can be searched and orders can be forwarded to the appropriate data or service provider**
- **ECHO is an enabling system**
  - It uses APIs to give access to its services to clients
  - ECHO has no "native" search GUI – all ECHO clients have equivalent access to ECHO
  - Clients are free to address their community's needs without taking on the responsibility of acquiring metadata directly from providers
  - Providers can focus their resources on acquiring, archiving and delivering data and services rather than supporting searches
  - ECHO strives to be simple and focus on its direct goals

What is ECHO?

Portal Framework

- **Supports:**
  - XML based message invocation of functions
  - SOAP, RMI and Web Services views of functions
  - Catalog of Metadata under control of providers
  - Services represented that act on or produce data represented in Catalog
  - Built on BEA WebLogic and Oracle
- **Includes:**
  - Catalog Service
    - Capable of handling very large and complex data sets
  - Order Entry Service
    - Handles receiving a single order and sending it out to multiple providers
  - Data Management Service
    - Manages privileges for accessing catalog entries and controls the ability to order them
  - Subscription Service
    - Ability to send metadata updates directly to users

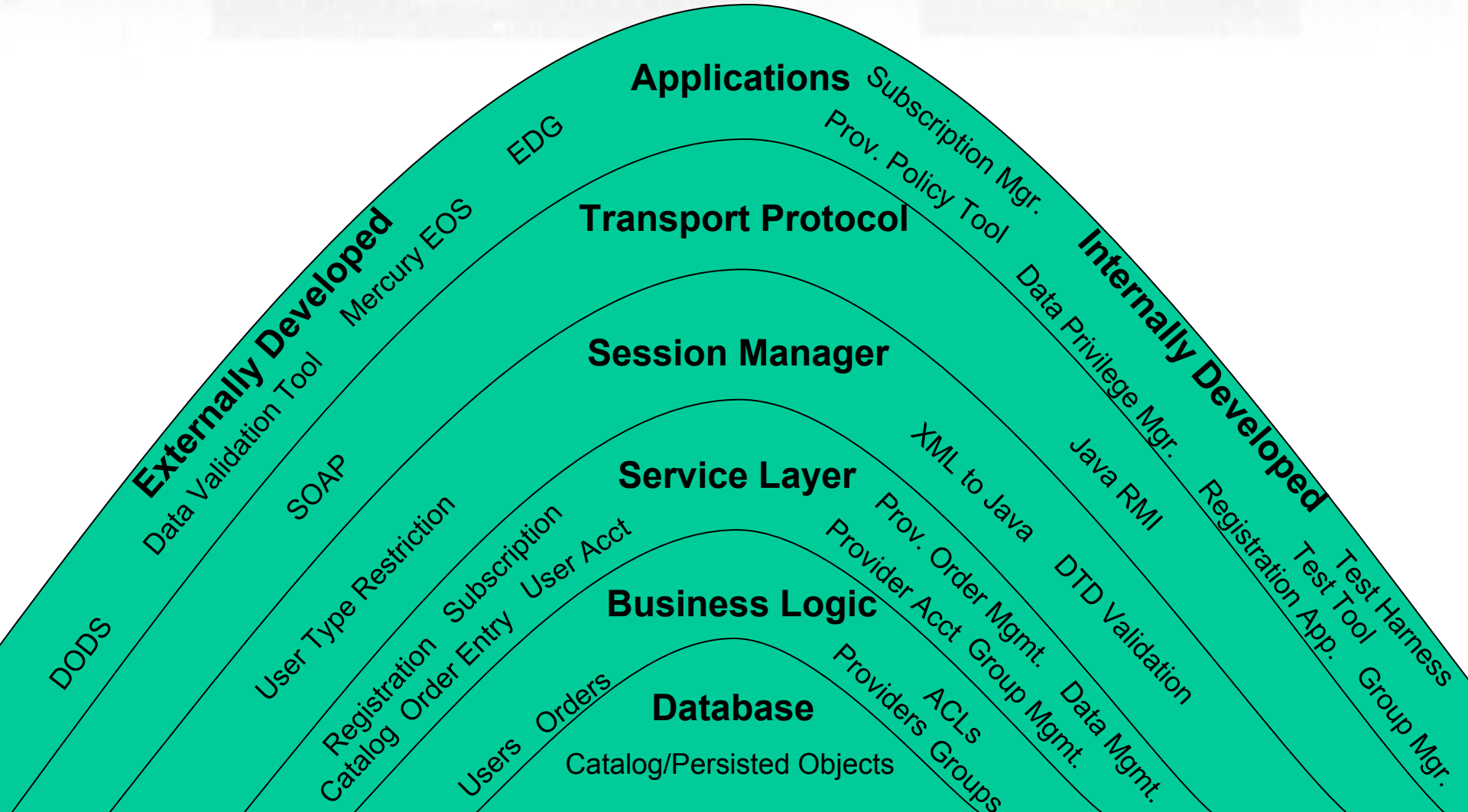
System Drivers

- **Ease of Participation**
- **API Driven**
- **Extensibility**
- **Provider Control**
- **Leverage Industry Advances**
- **Design for Change**
- **Cost to Field**
- **Cost to Maintain**
- **Cost to Operate**

ECHO- The EOS ClearingHOuse

- **Portal Framework**
- **EOS Science Metadata Model**
- **Data Providers**
  - Operational: ORNL, GSFC
  - In test: EDC, NSIDC, LaRC
  - On the horizon: SEDAC, Stennis, other V0 DAACs
- **Clients (Under development)**
  - EDG, Mercury-EOS, Data Validation Tool, DODS, Gizmo, Nepster, New Earth Observatory (NEO)

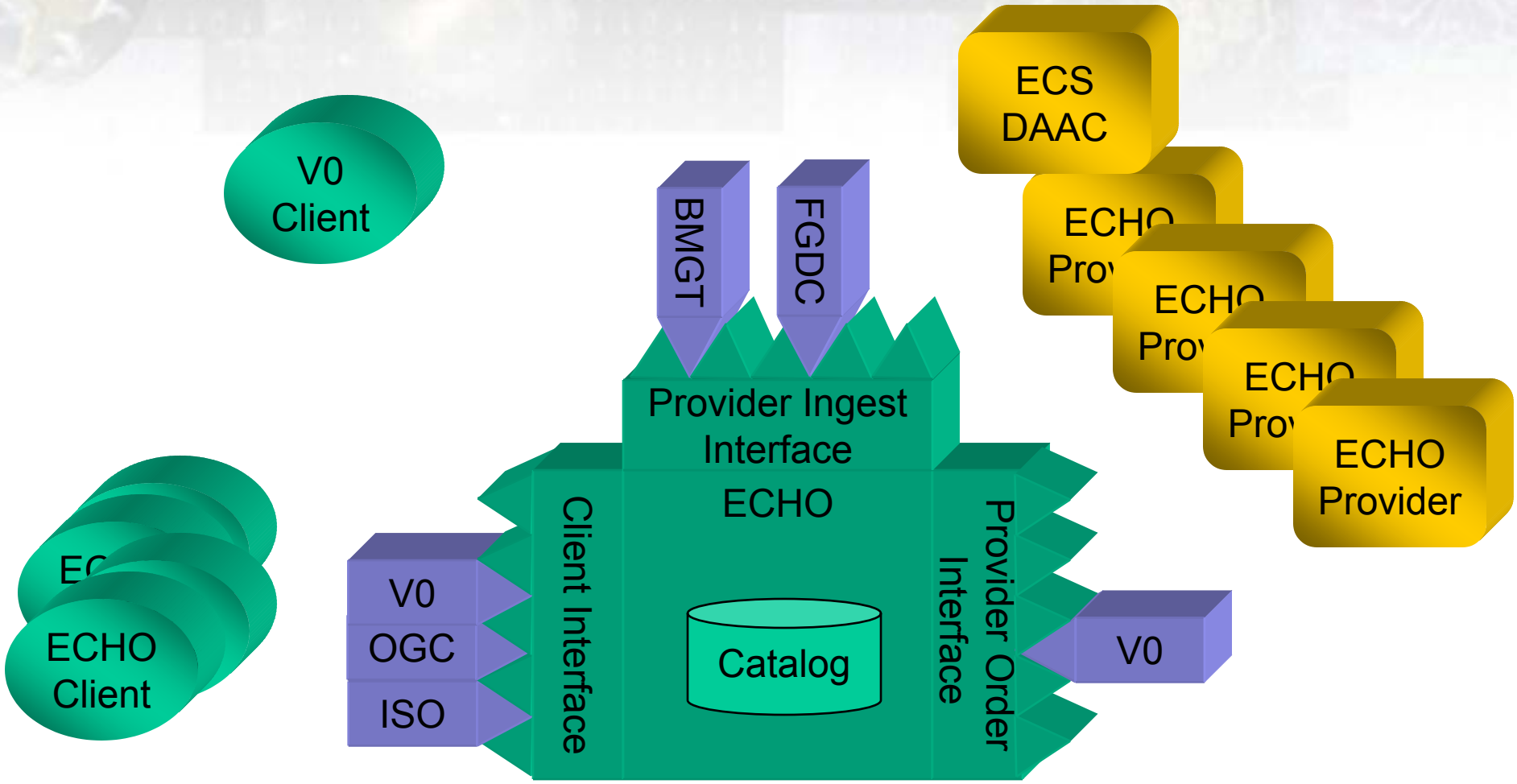
ECHO's Layered API Architecture



ECHO Extension Points

- **Clients**
- **Data Providers**
  - Product Specific Attributes
- **Service Providers**
  - Search (Metadata Utility) Service
  - Data Service
  - Utility Service
- **Ingest Proxies**
- **Order Proxies**
- **Adaptors**

ECHO Extension Points



Services and ECHO

- **ECHO identifies 3 classes of services based on what actions they perform**
  - Data Services: Produce Earth Science data
    - Subsetting, Reprojection, Science Algorithms, Conversions
    - Invoked by client directly, or by ECHO on behalf of user
  - Metadata Utility Services: Augment ECHO's basic search functions
    - Thesaurus, Gazetteer, Coincidence Search, Query Preview
    - Invoked by client directly
  - Administrative Services: Augment internal ECHO functions allowing ECHO to tie into the Enterprise more effectively
    - Billing and Accounting, LDAP
    - Invoked by ECHO as part of its regular operation

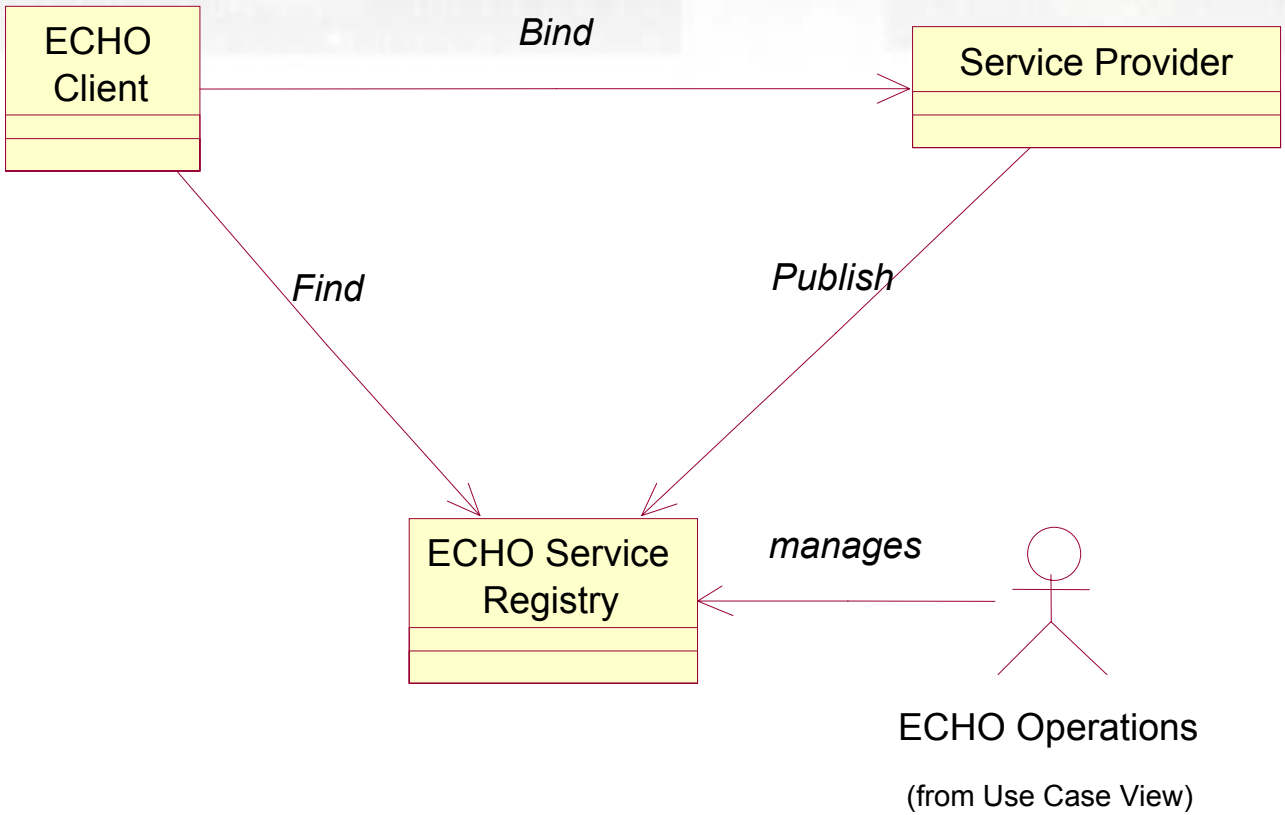
Data Services

- **Dynamically registered and represented in ECHO, and potentially in ECHO clients**
- **Four interaction types**
  - Advertised: ECHO supports finding the service and provides a URL to it
  - Context-based: ECHO supports finding the service and creating an invocation URI which the client will invoke
  - Brokered: ECHO supports finding the service and brokers the clients request for its invocation in the same way it brokers requests for data
  - Order options: ECHO supports specifying a service to be invoked by a data provider when it processes the order
- **Two views of services in ECHO**
  - Service view: Client can search for services based on service descriptions
  - Data view: Client can identify services that can act on selected data represented in ECHO, or produce data like it

Metadata Utility Services

- **ECHO can add new services to its registry of services**
  - Advertised
    - Client developer finds out about new Search Services from ECHO
    - Client developer uses Search Service API to augment query it is formulating for submission to ECHO
    - Dynamically registered and represented in ECHO, but client requires augmentation

Service Architecture Pattern – Advertised



Advertised Approach For Search Services

- **Pros**
  - Service receives direct exposure to Earth Science client community
  - Clients can manage availability of services
  - ECHO not reliant on service being available to perform a search
  - New services can be added without change to ECHO
- **Cons**
  - Multiple interfaces for client to interact with
  - Each search service must be understood by client developer

Search Service Example 1 - Thesaurus

- **ECHO maintains a set of keywords and collections that cross disciplines in Earth Science**
- **A user from a particular discipline is familiar with a certain vocabulary that is not directly represented in ECHO**
- **A thesaurus can be used to map from the vocabulary of the community to that of ECHO, and vice versa**
- **Advertised**
  - The client sends the set of keywords to the Thesaurus, which returns the ECHO keywords that are equivalent and productive, then submits the query to ECHO with the appropriate keywords

Search Service Example 2 - Gazetteer

- **ECHO supports spatial queries based on polygons, circles, bounding boxes, etc.**
- **Many clients would benefit from allowing a user to search on "Maryland," "Russia" or "Kashmir"**
- **ECHO has no mandate to take on the responsibility of monitoring political and coastal boundaries and keeping an appropriate set of polygons for each name**
- **A client (or ECHO) could take advantage of a Gazetteer whose charter is the responsibility to convert a search based on a textual description of a spatial area into a spatial polygon**
  - Note that a similar technique could be applied for moving objects such as hurricanes where a combination of spatial and temporal information is provided

Goals for Search Services in ECHO

- ECHO should enable the infusion of work performed elsewhere into the Earth Science Enterprise
- ECHO should provide a framework in which a Search Service that has particular user interaction needs can achieve that interaction such that clients can incorporate it in a standard way

Broader Applicability

- The software that is ECHO can be applied to other data models
- It provides an easily extensible base upon which other functionality can be built

Conclusions

- **ECHO became operational in November 2002**
  - We are currently working on getting data into the system and getting the first clients available
- **ECHO is providing a service to the Enterprise that could prove crucial**
- **The ECHO team continues to encourage other groups to leverage ECHO's extensibility and develop useful systems**
  - Technology advances
  - Customized to communities