Goals of the presentation

• View of the future
• ECHO Overview
• Approach to Registries
• Interoperability
• Current status & activities
Supporting a comprehensive, and coordinated environment

- For science, education, governments, industry
- For system development and contribution
- Organic resource utilization
  - Resource capacity is established throughout the partner community
  - Partners offer what they wish
- Enabling Science that is...
  - Comprehensive
  - Coordinated
  - Sustained
New paradigm

- Service-oriented enterprise
- Net-centric computing
  - Power to the participants – producers and consumers
  - Enable with infrastructure of service middleware
- GEOSS momentum
Cyberinfrastructure - Underlying Fabric

- Infrastructure
- Services
- Directory
- Security
- Collaboration
- System Management
- Storage
- Discovery
...

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ECHO Vision

- **Goals**
  - Support a Marketplace ...
  - Enabling ...

- **Approach**
  - Interoperable Registries
  - Not "the" solution/system
    - But integrated into a dynamic enterprise
    - Building systems, interoperating with systems
  - Net-centric
    - Power to the partners
**ECHO Is...**

- **Interoperability middleware solution** -
  - Open, XML-based APIs
  - Supporting net-centric architectures and solutions
  - Set of interoperable registries for both data (metadata) and services
  - Provides user accounts and common infrastructure for the registries
  - Operational since November 2002
  - Available as open source

### Data Registry
- Representing data resources through metadata
  - Publish Capability
    - Supports collection, granules, and browse
  - Discovery Capability
    - Collection/Dataset, Granule/Inventory, Granule/Inventory standard data model
  - Access Capability
    - Online Access, Legacy Order Mechanisms, Access Control

### Service Registry
- Service offerings leveraging Web Service Standards
  - Publish Capability
    - Advertisements, Service Interfaces, Service Implementations, Service GUIs
  - Discovery Capability
    - UDDI Standard Based, Data Registry View, What services are appropriate for this
  - Future
    - Service Brokering, Access Controls
Power in the hands of the community

• **Data and Service Partners**
  - Use ECHO’s Partner Interface tools to manage how their resources are represented in the registries
  - 2-level access control in Data Registry (metadata visibility, ordering)
  - In defining each dataset, partners can establish which spatial search mechanism (Cartesian, geodetic, orbital) is best suited for searching that dataset
  - Special data modules supported as needed. (i.e. Orbital search module)
  - Extending the standard data model through product specific metadata

• **Client Partners**
  - Provide discipline specific, application specific or individual preferred views of the contents of the clearinghouse
  - Use ECHOs APIs to access the clearinghouse to convey a seamless, efficient view of data holdings

• **Service Partners**
  - Advertise their service offerings
    - General Advertisements, Service Interfaces (API specifications), Service Instances (web services) or GUIs
  - Classification of services through taxonomies
  - Service offerings describe in WSDL
  - Access to services through SOAP
Registries in the Enterprise

enterprise network solutions
• point solutions
• open system solutions
• closed system solutions
ECHO Service Registry

- **Supporting SOA**
  - Publish
  - Find
  - Bind

- **Using Web Service Strategy**
  - Service Description
    - WSDL (Interface & Implementation)
    - Parameter language (ECHO/ISO 19115 subset)
  - Service Binding
    - SOAP
    - WxS Issues
  - Registry
    - UDDI
Fundamental Use Cases

- Publishing
- Discovering
- Understanding
- Accessing
Publish
Resource Partners "advertise" their offerings to publicly available registries

Data Registry

• Public Interface: "IngestService"
  - Register, Ingest services
• Standards
  - Data Dictionary ISO 11179 based
  - Data Model based on EOS
  - ISO 19115 Compliant
  - GCMD mapping
  - FGDC mapping
• Technology - Oracle database

Service Registry

• Public Interface:
  "ExtendedServicesManagement"
  - Register service
• Standards
  - Service Description - WSDL
  - Registry - UDDI
  - OGC Service Taxonomy (ISO 19119)
• Technology - Systinet WASP UDDI Server

Issues

Data Model inconsistency
• Ingest adapters for data model translation and validation
Data Fidelity
• Update and delete interfaces available
• Time delays between registry and source

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Discovery
Consumers participate in the marketplace by looking for resources of interest

**Data Registry**
- Public Interface: “CatalogService”
  - Query
- Inventory and Dataset level
- Standards
  - Z30.50 based queries and results management
- Technology – XML-based API
  - Oracle augmented with additional spatial query engine

**Service Registry**
- Public Interface:
  - UDDI: Inquiry
  - Registry (domain)
- Standards
  - UDDI
- Technology – Systinet WASP UDDI Server

**Issues**
Interoperability
- Data represented in a consistent data model
- Service – Data interoperability through Taxonomies
- Common Data Language for data definition and parameter specification

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**Brokering Service**

- Public Interface: "BrokerService"
  - Validate, Submit
- Optimize data access pattern, bind to service on behalf of consumer, manage status and results delivery
- Standards
  - TCP/IP based data access and delivery
- Technology – XML-based API

**Issues**

Interoperability – Matching services to data
- Common Data Language for data definition and parameter specification
- Validation operation (optional)
- Co-location
  - Moving data, not services (so far)
  - Temporary resources provided for facilitating data movement

Resource Efficiency
- Validation operation (optional)
- Security
  - Registered Users only
  - Moving data, not services
Basic Brokering Pattern

*Multiple paths for data movement in support of brokering or orchestrating services*

- Control
- Data

Brokering Service optimizes data movement from path based on:
- Data partner access options
- Service Partner access and delivery options
- Consumer requests

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Orchestration

Customers orchestrate the active integration of multiple resources in a sequence

Orchestration Service

- Public Interface: “Orchestrate”
  - Validate, Submit
- Ensure service invocation sequence is valid
- Translucent and Aggregate/Opaque capabilities
- Standards
  - OCG efforts (OWS 2.0) ISO 19119
- Technology – XML-based API

Issues

Interoperability –

- Data represented in a consistent data model
- Service – data interoperability through taxonomies
- Common data language for data definition and service parameter specification
Service model
Interoperability

- **Between registries**
  - Service Registry through Taxonomies
  - Data Registry through Catalog Service
    - <details>

- **External Interoperability**
  - Adaptors
    - Protocol interoperability with Partners for order and ingest
    - Data model interoperability through Ingest Adapters and data set registration
    - Can establish "Views" of results

- **API's enable external other interoperability through adaptors**
  - Ostensibly, ECHO clients
Classification

- Taxonomies (so far)
  - Data Set
    Data Partner → Dataset → Version
  - Data Format
    Similar to mime-type
  - Service Type
    OCG/OSE model
    Looking for others

- Other Classification schemes possible

- Potential for user defined taxonomies
  - Dynamically defined and leveraged
  - Profile entities
  - Semantic web integration
Service Semantic understanding

- **Ensure that services can work together**
  - Enabling binding is easy for a registry
  - Flexibility always has its price
    - Understanding relevance of context and parameters in an open, dynamic and loosely coupled network enterprise is the challenge
  - Developing a Common Data Language for parameter specification

- **Service Metadata**
  - Common way of describing
    - Partner
    - Service Type
    - Interface
    - Source
    - Capability
    - Understanding
    - Applicability
UDDI v3

- Upcoming Technology evolution

- Key Features
  - Multi-registry environments
    - Allows for federation of service registries
  - Publisher specified keys
    - Beyond UUIDs
    - Flexible and powerful namespace management
  - Security enhancements
    - Adds digital signing to core data types
Rules of Engagement for Service Partners

- Register

- Provide Reference Web Page

- Active Services
  - Provide WSDL
  - SOAP binding point

- Optionally:
  - Categorize resource

- Brokered
  - Declare Input access support
  - Declare Output support
### Current Data Partner Status

#### 5 Operational:

<table>
<thead>
<tr>
<th>Data Center Name</th>
<th>Location</th>
<th>Collections</th>
<th>Granules</th>
<th>Browse</th>
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<tr>
<td>Oak Ridge National Laboratory (ORNL)</td>
<td>Department of Energy, ORNL, Oak Ridge, Tennessee</td>
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<td>Land Processes EOS Core System (ECS) DAAC</td>
<td>USGS Eros Data Center, Sioux Falls, SD</td>
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<td>Socioeconomic Data and Applications Center (SEDAC)</td>
<td>Columbia University, New York, NY</td>
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<td>University of Alaska, Fairbanks, AK</td>
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#### 3 Development/Test:

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<th>Data Center Name</th>
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<th>Collections</th>
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<th>Browse</th>
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**Total data items in ECHO = 34,671,705**
## Current Client Partner Status

### 2 Operational:

<table>
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<tr>
<th>Client</th>
<th>Description</th>
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</thead>
<tbody>
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<td>Mercury EOS</td>
<td>Oak Ridge National Laboratory (ORNL) DAAC, Department of Energy, ORNL, Oak Ridge, Tennessee</td>
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<tr>
<td>Power User Interface (script based)</td>
<td>Earth Science Data and Information System (ESDIS) Project, NASA/GSFC, Greenbelt, MD</td>
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</table>

### 9 Development/Test:

<table>
<thead>
<tr>
<th>Client</th>
<th>Description</th>
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<tbody>
<tr>
<td>ASF ECHO Client</td>
<td>University of Alaska, Fairbanks, AK</td>
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<td>Data Validation User Interface (DVUI)</td>
<td>ESDIS Project, NASA/GSFC, Greenbelt, MD</td>
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<td>MODIS Website</td>
<td>MODIS Project, NASA/GSFC, Greenbelt MD</td>
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<td>SNOWI-E</td>
<td>NSIDC, University of Colorado, Boulder, CO</td>
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<td>WISRD</td>
<td>NSIDC, University of Colorado, Boulder, CO</td>
</tr>
<tr>
<td>WIST (Warehouse Inventory Search Tool)</td>
<td>ESDIS Project, NASA/GSFC, Greenbelt, MD</td>
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<tr>
<td>New Earth Observer (NEO)</td>
<td>Earth Science Directorate, NASA/GSFC, Greenbelt MD</td>
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<tr>
<td>Simple MODIS ECHO Client (SIMECC)</td>
<td>MODIS Rapidfire Project, NASA/GSFC, Greenbelt MD</td>
</tr>
<tr>
<td>Invasive Species</td>
<td>NASA and USGS</td>
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Current Activities

- Brokering Services
- Service Orchestration – exploration within the ESIP community
ESIP Participation

- **Strategic Direction**
  - Promote Services that can participate in SOA systems
  - Descriptions in WSDL
  - SOAP access/interface

- **Establish a testbed of a service registry**
  - Using ECHO
  - Semi-public

- **Explore techniques and technologies of orchestration**