GEON2 and OpenEarth Framework (OEF)

Bradley Wallet
School of Geology and Geophysics, University of Oklahoma
bwallet@ou.edu
Outline

- Background
- OEF Goals and Motivations
- OEF Philosophy
- OEF Visualization and Architecture
- Project Plans
GEON Portal and Cyberinfrastructure provide:

- Authenticated access to data and Web services
- Registration of data sets, tools, and services with metadata
- Search for data, tools, and services, using ontologies
- Scientific workflow environment and access to HPC
- Data and map integration capability
- Scientific data visualization and GIS mapping
GEON1 vs. GEON2

- GEON initially funded in 2002 to bring together 16 institutions develop an infrastructure for managing distributed collections of large, heterogeneous, multidisciplinary earth science datasets.

- GEON renewed this year – focus in v.2 of GEON is to expand infrastructure to include open source software for integrating, analyzing, and visualizing these data sets.
  - OpenEarth Framework
OpenEarth Framework Goals

Geologic Integration:

- *Data types* - topography, imagery, bore hole samples, velocity models from seismic tomography, gravity measurements, simulation results…

- *Data coordinate spaces and dimensionality* - 2D and 3D spatial representations and 4D that covers the range of geologic processes (EQ cycle to deep time).
Integration & Visualization of 3D/4D data

“For a given region (i.e. lat/long extent, plus depth), return a 3D structural model with accompanying physical parameters of density, seismic velocities, geochemistry, and geologic ages, using a cell size of 10km”

–Derived 3D volumetric model
  –Multiple isosurfaces with different transparencies
  –Slices through the volume
  –Variable gridding: data typically has lower resolution at greater depths

–2D surface data: Topography (“2.5D”) Satellite imagery, street maps, geologic maps, fault lines, and other derived features etc.

–Bore hole or well data and point observations.
OpenEarth Framework Goals

Structural Integration:

- *Data formats* – shapefiles, NetCDF, GeoTIFF, and other formal and defacto standards.

- *Data models* - 2D and 3D geometry to semantically richer models of features and relationships between those features.

- *Data delivery methods & Storage Schemes* - local files to database queries, web services (WMS, WFS) and services for new data types (large tomographic volumes, etc.).
OEF Philosophy

- OEF focused on integrating data spanning the geosciences.

- Open software architecture and corresponding software that can properly access, manipulate and visualize the integrated data.

- Open source to provide the necessary flexibility for academic research and to provide a flexible test bed for new data models and visualization ideas.
OEF Architecture

Data Interaction Services
--Deliver only the data needed, based on user request
--May issue multiple requests to the Data Modeling and Dataset Access services
--Use "stand-in" & cached data sets, as available

Data Modeling Services
--Support WFS, WMS, WCS. Extend GML to support volume data and GeoSciML to support different Earth Science domains and subdisciplines
--Provide services for volume data, e.g. a WVS (Web Volume Service)
--Obtain appropriate datasets from Dataset Access service, perform subsetting, "slice & dice" operations, and data gridding
--Implement a data caching system

Dataset Access Services
Provide access to datasets in a wide variety of formats, e.g. rdbmo, shapofilco, netCDF, XML, Excel, asci, geoTIFFs, etc
--Based on GEON1 platform

Remote Datasets

3rd Party Catalogs

GEON Catalog

Registered Datasets

Precomputed products
--standard products
--low resolution products
OEF Architecture

- **Data Layer:**
  - GEON Catalog (GEON register datasets)
  - 3rd Party Catalogs (Remote datasets)
OEF Architecture

- Data Access Services:
  - Manages and delivers stored data and metadata
  - Provides access to data in a variety of formats via various sources.
  - Hides storage and access details (location, authentication, protocols etc.)
Data Modeling Services:
- Provides on-demand and preprocessing operation on requested data.
- Operations to subset, extract and derive data for area of interest.
- Use recent access patterns to guide preprocessing to prepare data in anticipation of future need.
OEF Architecture

- Data Integration Services:
  - Designed to support rapid visualization of integrated datasets
  - operations to grid data, resample it at multiple resolutions and subdivide data to better support progressive changes to the display as the user pans and zooms
OEF Architecture

- Visualization Tools:
  - Run on the user's computer, dynamically query spatial and temporal data from the OEF services
  - Uses 3D graphics hardware for fast display
  - Open architecture supports multiple visualization tools authored throughout the community (e.g. GEON IDV)
  - New viz capabilities developed as necessary
Example Application - Waiting for example from Randy (?)...
Project Plans

- Currently testing visualization toolkits and various libraries.

- Beginning development with a sample of heterogeneous data for a region of interest (Parkfield).

- Using these data as a test case, we will develop software to enable visualization the integrated information as well as to interactively access and manipulate the underlying data.
Thank You

Contact:
bwallet@ou.edu

www.geongrid.org