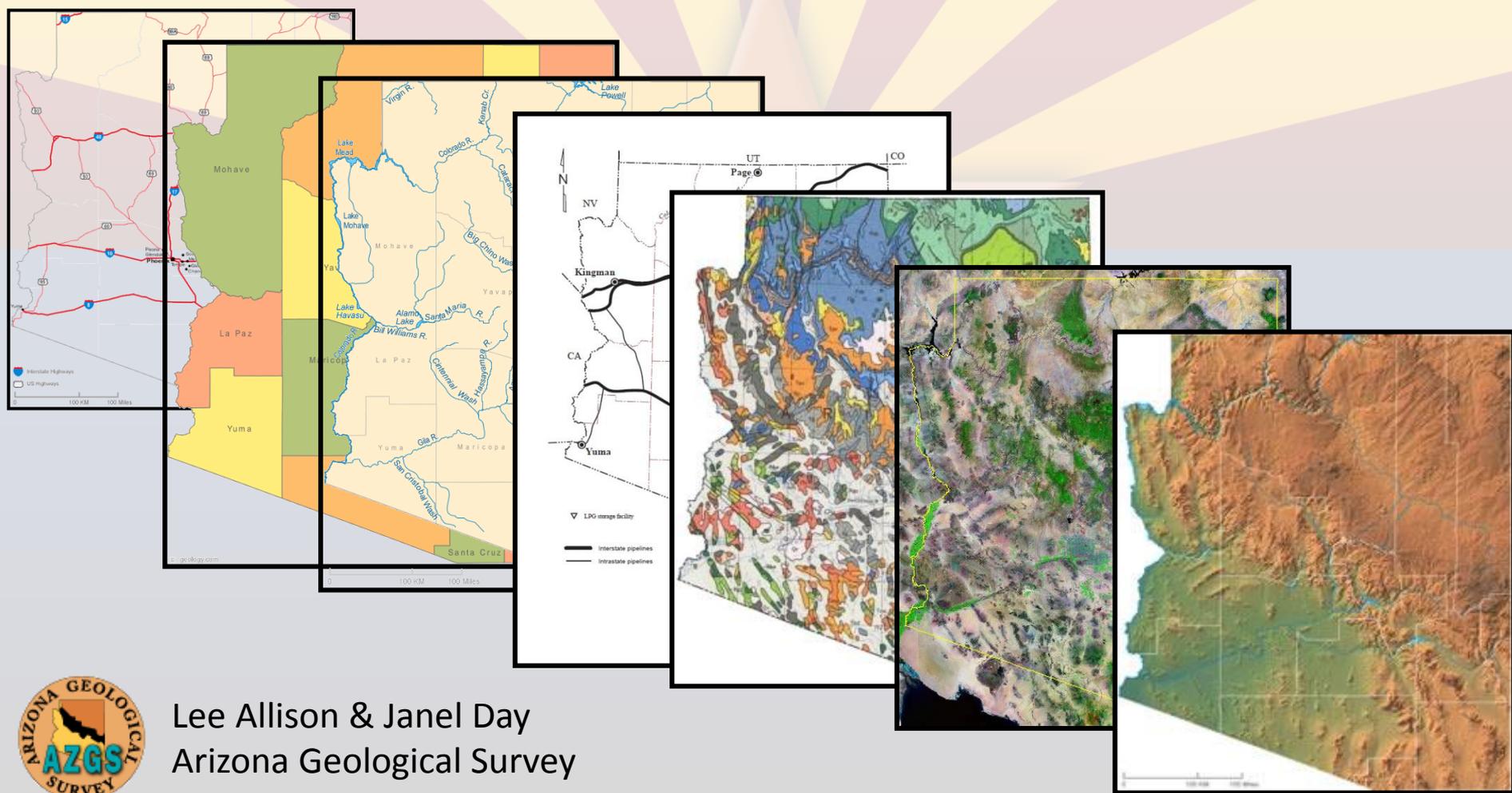


# A Coordinated and Centralized GIS Database Model for Arizona Land and Natural Resource Management



Lee Allison & Janel Day  
Arizona Geological Survey

# Overview

1. Natural Resources Review Council
2. Coordinated and centralized GIS database model
3. Arizona decision support system

# Natural Resources Review Council Review

- Established under Executive Order 2013-02, January 2013
  - to address Arizona's short-term and long-term land and natural resources management objectives
  - Comprised of 9 agencies and 5 Subcommittees

# Natural Resources Review Council (EO 2013-02)

## Executive Order 2013-02

### Establishing the Arizona Natural Resources Review Council

**WHEREAS**, the ability for state natural resource agencies to engage and impact federal land and resource management plans is paramount; and

**WHEREAS**, cross agency coordination is critical to a sound and timely response to actions on federal lands that will impact state resources and economies; and

**WHEREAS**, federal land and resource planning processes often do not consider the short and long-term needs of the State of Arizona and local governments; and

**WHEREAS**, political change at the federal level can impede the ability of state agencies to effectively engage the federal government and result in federal intrusion on state authorities; and

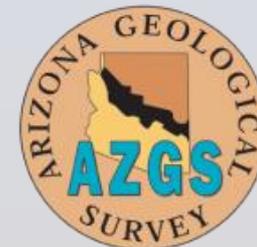
**WHEREAS**, federal land and resource management decisions are being driven by litigation processes that have resulted in diminished multiple-use and sustained-yield principles; and

**WHEREAS**, we must protect State interests related to wildlife, land, water and natural resources by actively engaging and countering federal encroachment on State authorities tasked with managing Arizona's natural resources.

# Council Goals

4. The Council shall prepare a comprehensive report and plan to the Governor for long-term land and natural resource management. The report shall include and address multiple use and sustained yield approaches, public access issues and sustainable economic development.
6. The Council shall identify and prioritize legal, legislative and incentive-based needs that protect and maintain state interests related to wildlife, land, water and other natural resources.
7. The Council shall provide recommendations to the Governor on a statewide approach to mitigation and conservation banking that includes State government, local governments and the private sector in order to meet long-term natural resource conservation objectives.

# NRRC member agencies



# NRRC Subcommittees

- GIS
- Clearinghouse
- Planning
- Mitigation
- Engagement and Partnering (June 2013)

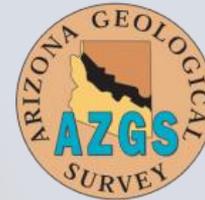
# Charge to GIS Subcommittee

“The Council [NRRC] shall develop a coordinated and centralized Geographic Information System database model that identifies current and future management priorities for designated land and natural resource areas.”

Executive Order 2013-02

# Coordinated and centralized GIS database model, defined

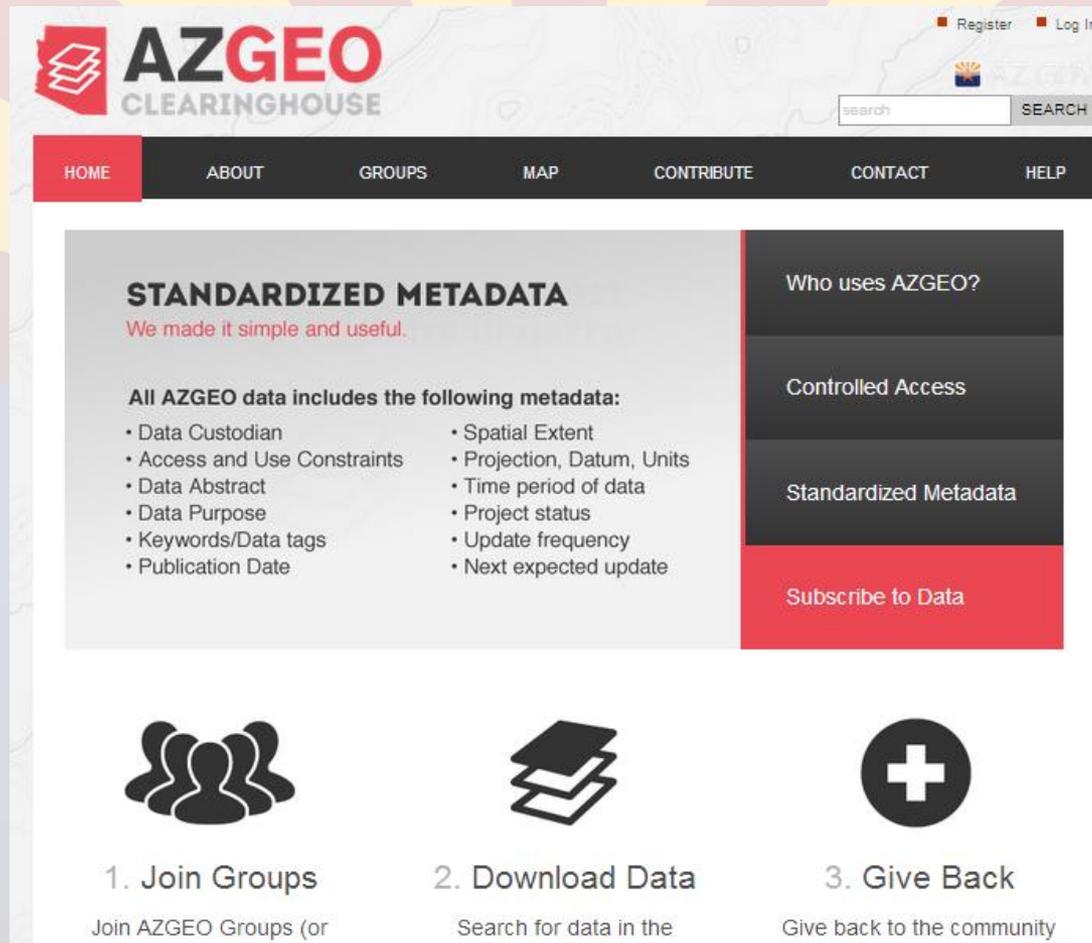
- A single, online location where natural resource management agencies can organize, access and use GIS data from multiple sources



# GIS Subcommittee Timeline: January - present

- Identified existing GIS resources
- Drafted GIS Subcommittee Report that will be submitted to the Natural Resources Review Council for review and approval, includes:
  - Summary of existing GIS resources
  - Recommendations for developing a coordinated and centralized GIS database model
  - Identifying opportunities for integrating GIS into a greater decision support system for Arizona's land and natural resource management needs

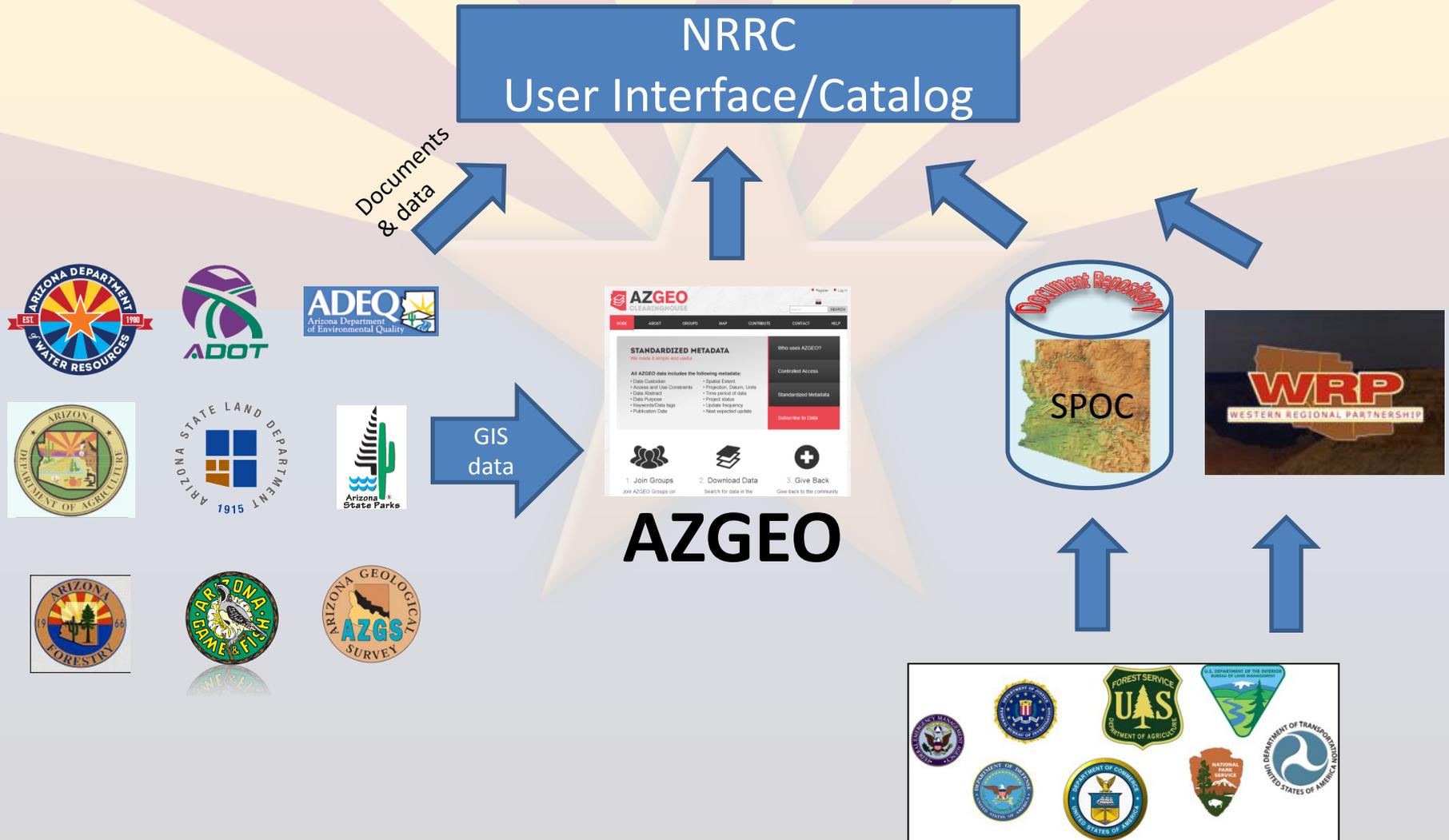
# AZGEO to serve as NRRC centralized database



The screenshot shows the AZGEO Clearinghouse website. At the top left is the logo with the text "AZGEO CLEARINGHOUSE". To the right are links for "Register" and "Log In", and a search bar with the text "search" and a "SEARCH" button. Below the logo is a navigation menu with the following items: HOME, ABOUT, GROUPS, MAP, CONTRIBUTE, CONTACT, and HELP. The main content area is divided into two columns. The left column has a heading "STANDARDIZED METADATA" with the subtext "We made it simple and useful." Below this is a list of metadata items: "All AZGEO data includes the following metadata:" followed by two columns of bullet points: "Data Custodian", "Access and Use Constraints", "Data Abstract", "Data Purpose", "Keywords/Data tags", "Publication Date", "Spatial Extent", "Projection, Datum, Units", "Time period of data", "Project status", "Update frequency", and "Next expected update". The right column has a heading "Who uses AZGEO?" followed by "Controlled Access", "Standardized Metadata", and a red button labeled "Subscribe to Data". At the bottom, there are three icons: a group of people, a stack of papers, and a plus sign in a circle. Below each icon is a numbered step: "1. Join Groups" (with subtext "Join AZGEO Groups (or)"), "2. Download Data" (with subtext "Search for data in the"), and "3. Give Back" (with subtext "Give back to the community").

A single, online location where natural resource management agencies can organize, access and use GIS data from multiple sources

# AZGEO to be one component of an Integrated Decision Support System



# Integrated Decision Support System

- To meet the land and natural resource management needs of NRRC member agencies
- To be developed by the Clearinghouse Subcommittee

# Charge to Clearinghouse subcommittee

The system should provide for full data integration across the agencies and be scalable and transformable for other state agencies and able incorporate data from relevant federal agencies.

June 3, 2012

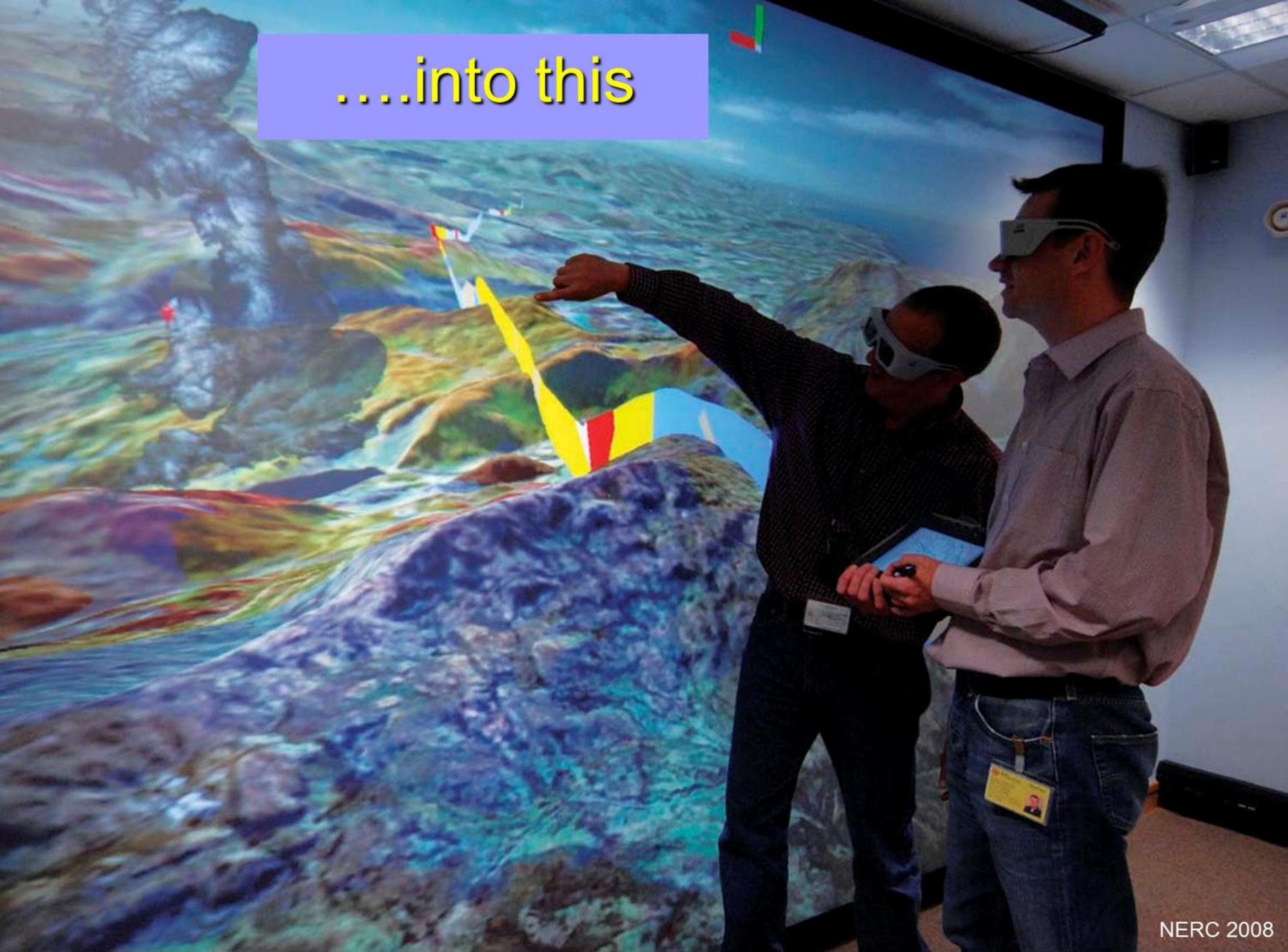
The system should provide the framework for the NRRC Clearinghouse.

June 25, 2013

Arizona is a world leader in turning this....



....into this



# How?

- A cross-agency, cross-platform approach that includes:
    - Data and document management system
    - Live data and map services
  - Add this...
    - A Single Point of Contact (SPOC)
    - User login roles
    - Notification system
    - GIS/AZGEO integration
    - Federal documents and data
- ...to complete the DSS

# Clearinghouse Subcommittee needs and requirements

- Dropbox for documents
- Links to URLs
- Notification triggers to agencies
- Work space for agencies
- Storage for agency responses
- Access levels to allow public accessibility to some materials
- User accounts with registration
- Version controls

# Clearinghouse Council Discussion

- Integrate documents from existing document management systems
  - ADWR – DocuShare (Xerox)
  - ADEQ – Sharepoint (Microsoft)
  - ADEQ – permit tracking system
  - AZGS – CKAN, Github, Sharepoint
  - ADOT – 3 systems plus many not in a system
- Allow each agency to maintain their internal systems
- Provide open source, free options for agencies without database management systems (DMS's)
- Automatic integration of federal documents into system
- Clearinghouse to be designated AZ Single Point of Contact (SPOC)
  - in accord with 1982 WH Executive Order 12372 (amended 12416)
- Allow each agency to have their own portal into clearinghouse

# Clearinghouse Architecture Components

- Catalog
- Data Services
- File repository
- Single Point of Contact (SPOC)
- Notification system
- Applications
- Federal documents and data

# Catalog

- Listing of all state information resources
- Access controls: public vs. state internal
- Search interfaces for people and machines
- Metadata in tiered formats
- Discover and access federal data

# Data Services

- Provide direct distribution of and access to
  - Web Map services
  - Structured data (spreadsheets, databases)

# File Repository

- Making documents web accessible
- Managed in an online document management system
  - Compatible with owner agency document management systems (i.e. DocuShare, Sharepoint)
- Metadata
- Access control

# Single Point of Contact (SPOC)

- In 1982, President Ronald Reagan signed Executive Order 12372, to “foster the intergovernmental partnership and strengthen federalism by relying on State and local processes for the coordination and review of proposed Federal financial assistance and direct Federal development.”
- EO 12372 requires federal agencies to provide notices to a Single Point of Contact if a State designates one.
- Arizona SPOC active until a decade ago
- New SPOC to be designated via NRRC, Clearinghouse Subcommittee
- 20 States currently have a SPOC

# Notification System

- Automated service to alert appropriate state authorities of new notifications
- Automated service to alert appropriate federal authorities of response
- Other?

# Applications

- Work space for agencies
- Collaboration space
- Allow agencies to maintain portals to system and their apps

# Federal Documents and Data

- Integrate into NRRC DSS:
  - WRP data and services
  - Other federal data catalogs and services

# File Repository



### Create Document-like Information Object

This content type is the catch-all for document metadata and/or attached resources.

Title: \*

Keywords:

Enter one(1) term at a time. A comma will be included in the term and will NOT separate terms.

Add popular tags: [Earth Fissures](#) + [Geologic Hazards](#) + [Pinal County](#) + [Maricopa County](#) + [Arizona](#) + [USGIN](#) + [Luke](#) + [Heaton](#) + [Wintersburg](#) + [Chandler Heights](#) + [Harquahala](#) + [Greene Wash](#) + [Signal Buttes](#) + [Web application](#) + [Dragoon Road](#) + [Friendly Corners](#) + [Picacho](#) + [Pete's Corner](#)

#### Basic Information

#### File Attachments

#### Web Resource Links

#### Geographic Extent

#### Temporal Extent

#### Unique Resource Identification

#### Previous Citation

#### Unique Metadata ID

#### Revision information

The following information must be provided:

Collection: \*

Select the collection(s) this DLIO belongs to.

Document Type: \*

The available metadata types are:

- Book - published or unpublished
- Journal Article
- Report - formal or informal
- Presentation - posters, Power Point, etc.
- Map - cartographic representation of spatial data
- Dataset - any measured and/or classified data
- Software - custom-created applications
- Web Resource - Web applications or other web-based resources

Prototype using  
Drupal content  
management system

Registration produces  
required minimum  
metadata

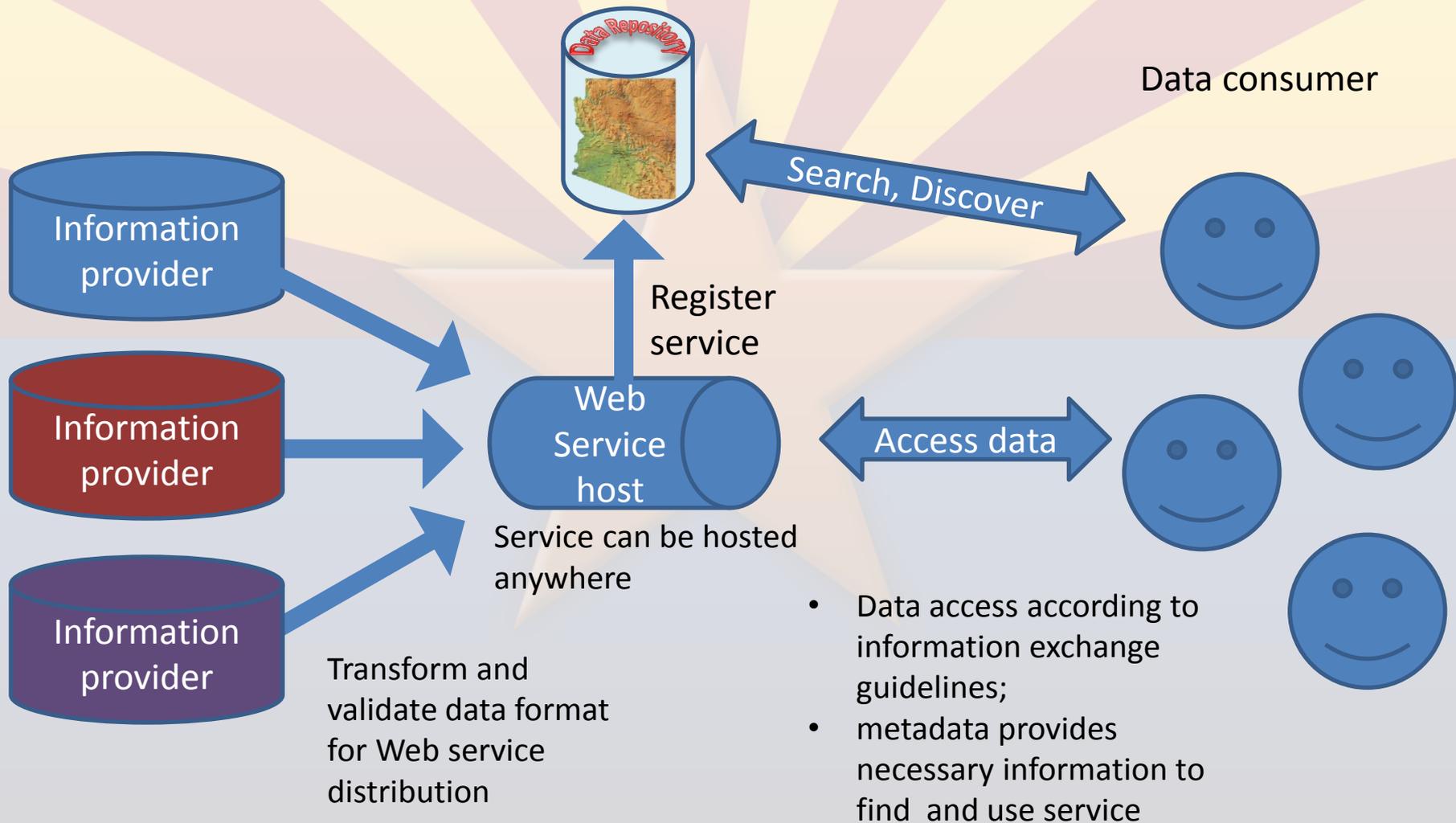
Tabs for various  
aspects of metadata

# Discover, access, view use

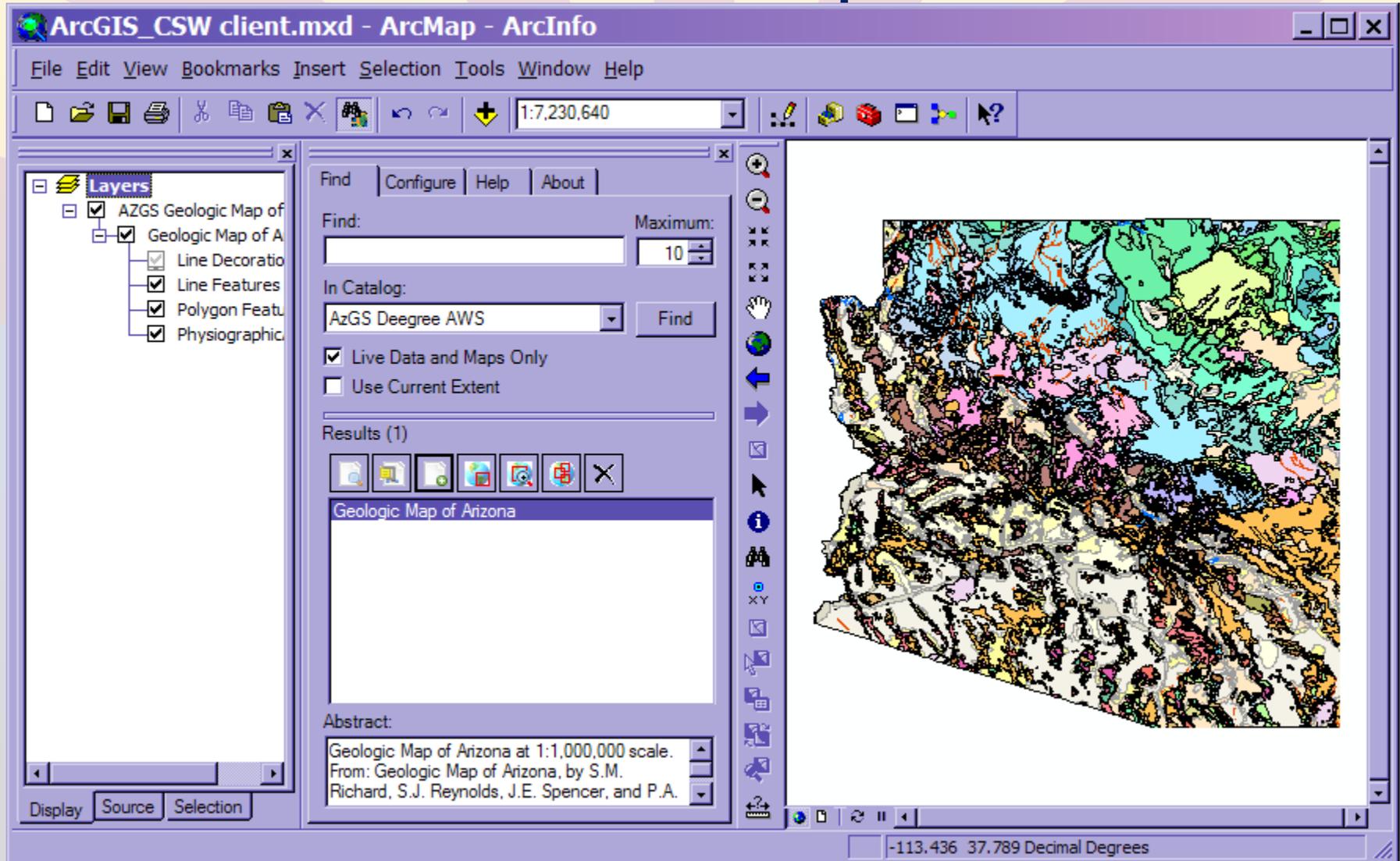
The image shows two overlapping web browser windows. The top-left window is the USGIN Document Repository, featuring a navigation menu with 'Home', 'Search', 'Browse Collections', 'This Repository', 'Dashboard', and 'My account'. Below the menu is a form titled 'Create Document-like Information Object' with fields for 'Title:', 'Keywords:', and 'Add popular tags:'. The bottom-right window is geodata.gov, displaying a 'Popular Maps' section with five map thumbnails. The browser's address bar shows the URL: http://gos2.geodata.gov/vips/portal/gos/kcxml/04\_Sj9SPykssy0xPLMnMz0vMAfjzeO94w0dg831o3350xOTK\_VD83L1w3ITKzJ2M6tSU\_Qj9KPMgEqMnf. The system tray at the bottom right indicates the time is 8:27 PM.

**distributed data**  
**distributed catalogs**  
**distributed apps**

# Data services: operation



# Find and display data services in ArcMap



# View

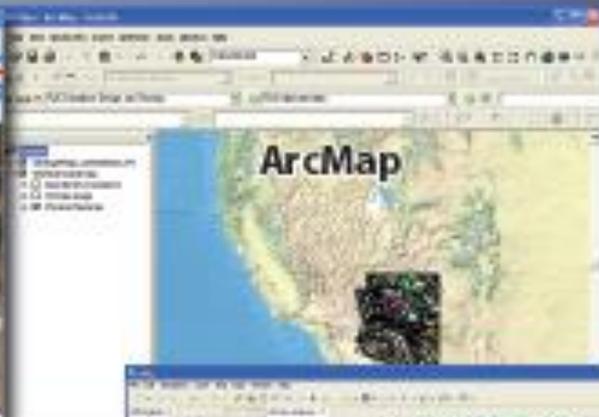
Spatial data as a WMS  
Feature Data as a WFS



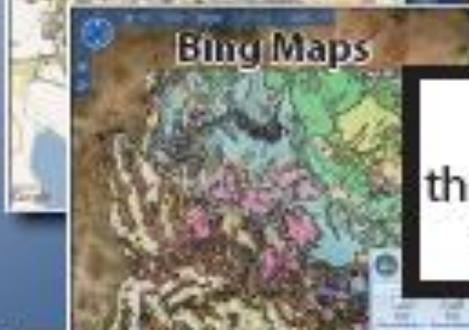
Google Maps



OneGeology



ArcMap

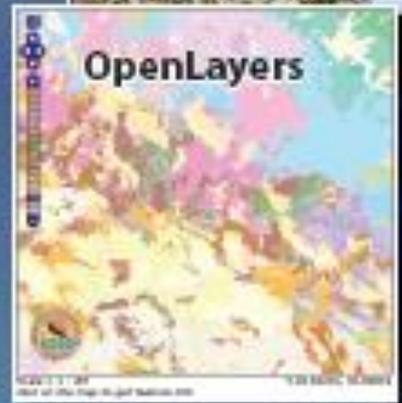


Bing Maps

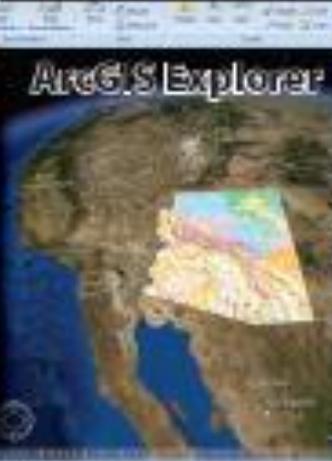
**Choose**  
the application you'd like to use to  
view WFS and WMS datasets



uDig



OpenLayers



ArcGIS Explorer



Google Earth



Gaia

# Web services and apps

**Make your data available to a wide variety of applications:** Make it easy for developers to create custom applications, or mash-up your data with any other data sources.



# Search by keyword or map area

The screenshot displays the USGS National Map Viewer interface. The browser address bar shows the URL `viewer.nationalmap.gov/viewer/`. The USGS logo and 'The National Map Viewer' text are visible in the top left. A search bar contains the text 'Search'. The interface includes a toolbar with various map tools and a 'Download Data' button. The map shows the southwestern United States, including Nevada, California, and New Mexico, with major cities like Reno, Carson City, Las Vegas, and Albuquerque labeled. The map is overlaid with several data layers: a dense cluster of pink squares in the central region, blue circles in the northern region, and red triangles in the southern region. A green circle with the number '10' is also visible. The left sidebar shows search results for 'Identify Layers', listing 10 items. The first two items are 'aasggeothermal/AZWellLogs > WellLog' and the remaining eight are 'aasggeothermal/AZAqueousChemistry1\_10 > WaterQuality'. Each result includes a 'Zoom To' and 'More' link.

viewer.nationalmap.gov/viewer/

USGS The National Map Viewer

Search

Download Data

Active Tool: Identify

Overlays Selection Cart

Standard Advanced Annotation

Results Identify Layers

Showing 1 - 10 out of 208 from last results.

- A [aasggeothermal/AZWellLogs](#)  
aasggeothermal/AZWellLogs > WellLog  
Zoom To More
- B [aasggeothermal/AZWellLogs](#)  
aasggeothermal/AZWellLogs > WellLog  
Zoom To More
- C [aasggeothermal/AZWellLogs](#)  
aasggeothermal/AZWellLogs > WellLog  
Zoom To More
- D [aasggeothermal/AZWellLogs](#)  
aasggeothermal/AZWellLogs > WellLog  
Zoom To More
- E [aasggeothermal/AZAqueousChemistry1\\_10](#)  
aasggeothermal/AZAqueousChemistry1\_10 > WaterQuality  
Zoom To More
- F [aasggeothermal/AZAqueousChemistry1\\_10](#)  
aasggeothermal/AZAqueousChemistry1\_10 > WaterQuality  
Zoom To More
- G [aasggeothermal/AZAqueousChemistry1\\_10](#)  
aasggeothermal/AZAqueousChemistry1\_10 > WaterQuality  
Zoom To More
- H [aasggeothermal/AZAqueousChemistry1\\_10](#)  
aasggeothermal/AZAqueousChemistry1\_10 > WaterQuality  
Zoom To More
- I [aasggeothermal/AZAqueousChemistry1\\_10](#)  
aasggeothermal/AZAqueousChemistry1\_10 > WaterQuality  
Zoom To More

Topo Imagery Topo Imagery Hydro-NHD Hill Shade Blank

NEVADA COLORADO NEW MEXICO

UFAH Grand Junction

Grand Canyon National Park

Las Vegas

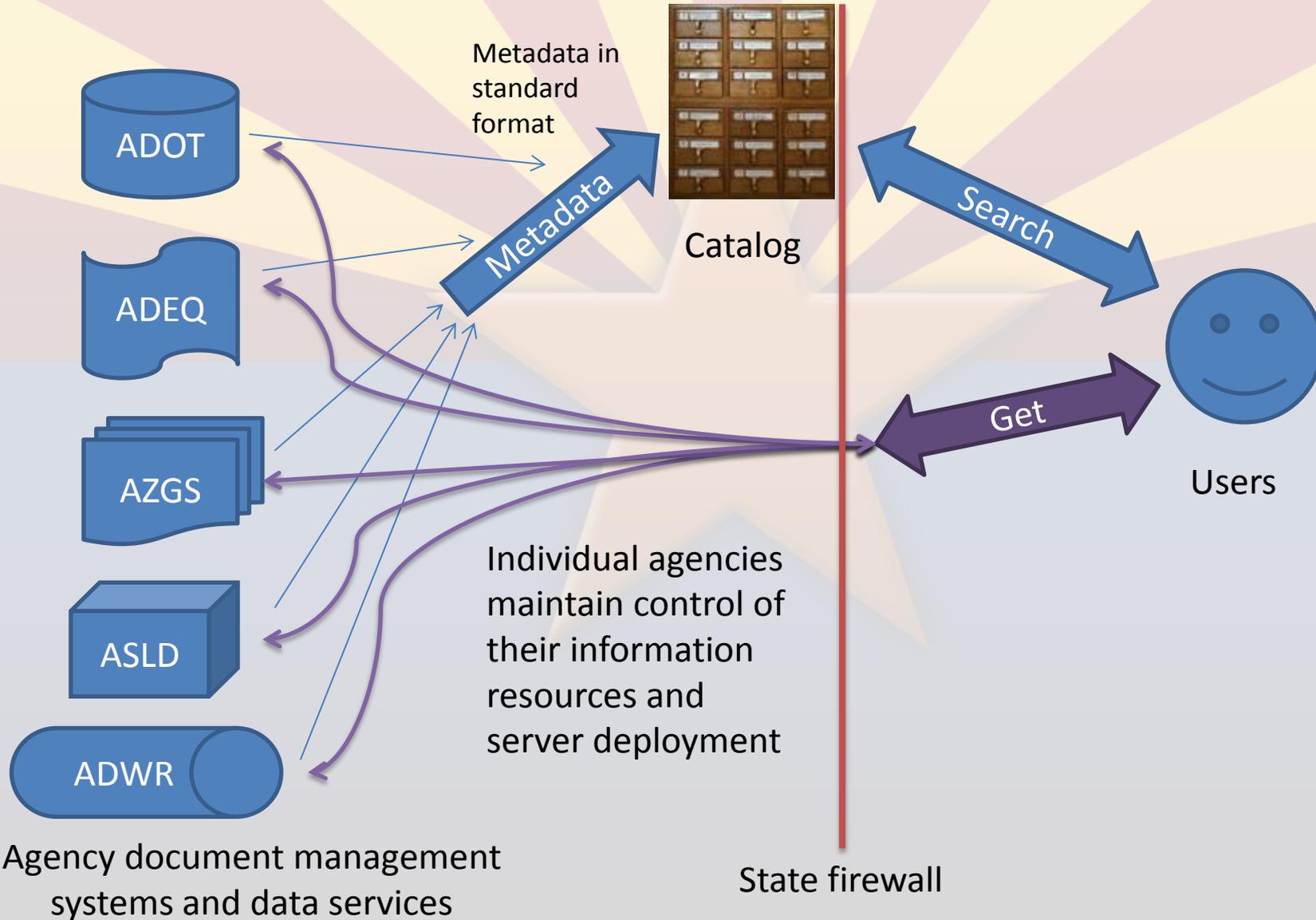
Albuquerque

Yuma

Mexico

Documents  
and data

# Clearinghouse



# Western Regional Partnership

The screenshot displays the Western Regional Partnership website. At the top, there is a navigation bar with links for Home, About Us, Contact Us, and Site Map, along with a search box containing the text 'Enter Search Term' and a 'Search' button. The main header features the WRP logo and the text 'WESTERN REGIONAL PARTNERSHIP' over a background image of a desert canyon. On the left side, there is a 'Partner Log In' section with input fields for 'Enter Username' and 'Enter Password', a 'Log In' button, and links for 'Request an Account' and 'Forgot Username/Password?'. Below this is a vertical navigation menu with the following items: News & Reports, Events, Resources, Mailing List, Committees, Steering Committee, Principals, GIS & Maps, Regional Projects (highlighted in red), and DoD Information. The main content area is titled 'Regional Project Database' and contains a text box explaining that users can submit project information, which will be searchable by location and keywords. Below this text is a 'Partners: Please log in to view more options.' message and a search box for projects with a 'Search' button. The bottom of the page features a row of four images: solar panels, a person with a surveying instrument, wind turbines, and a deer in a field.

Content management system in development

# Initial WRP Principle Organizations

## Federal Agencies

- Air Force
- Army
- Army Corps of Engineers
- Bureau of Land Management
- Bureau of Indian Affairs
- Bureau of Reclamation
- Customs and Border Protection
- Federal Aviation Administration
- Federal Emergency Management Agency
- Federal Highway Administration
- Marine Corps
- National Park Service
- Natural Resources Conservation Service
- Navy
- Office of the Secretary of Defense
- U.S. Environmental Protection Agency
- U.S. Fish & Wildlife Service
- U.S. Forest Service
- U.S. Coast Guard
- U.S. Geological Survey

## States

- State of Arizona
- State of California
- State of New Mexico
- State of Nevada
- State of Utah



# Federal data streams: WRP

~10,000 GIS layers, land use, land management



## WRP Web Mapping Application (WMA)

The Western Regional Partnership (WRP) developed the Web Mapping Application to assist partner planning efforts in the region. The application displays spatially referenced data using a common platform and publically available data. To take full advantage of the mapping tool, WRP partners need only an internet connection, web browser, and WRPinfo.org user account. The mapping application references GIS data contained in the WRP regional GIS database, which includes datasets from WRP state, federal and non-governmental partners.



### WMA FEATURES

#### Data Layer Search, Grouping, and Location Filter



*Find the layers you are looking for via keyword search or browse data layers by source agency or thematic grouping. Data may also be filtered by location, i.e. Mojave ecoregion.*

#### Download Data



*State and Federal Partners may download GIS data in ESRI shapefile format directly through the application.*

#### Choose from Multiple Basemap Options

MOU in place for GIS integration

# WRP Viewer

**WRP Web Mapping Application - Mozilla Firefox**

File Edit View History Bookmarks Tools Help

https://wrpinfo.org/wrmap/Default.aspx

Most Visited Twitter / AZStateGeo ... Twitter / Geoblogfeed http://twitter.com/sta... Twitter / RonsGeoPicks

**WRP Web Mapping Application**

**WRP WESTERN REGIONAL PARTNERSHIP WEB MAPPING APPLICATION**

Home Feedback Logout

SEARCH

GROUP BY SOURCE CATEGORY NONE

SHOW METADATA DOWNLOAD

- Argonne National Laboratory
- Bureau of Land Management
- California Energy Commission
- Department of Defense
  - Military Installations
  - Military Ranges
  - Military Training Route Centerline
  - Military Training Route Corridor
  - Special Use Airspace
  - Alert Areas
  - Military Operations Areas
  - Restricted Areas
  - Warning Areas
- Environmental Systems Research Institute
- Global Energy Decisions
- National Renewable Energy Laboratory
- The Nature Conservancy
- U.S. Census Bureau
- U.S. Fish and Wildlife Service
- United States Department of Agriculture

SELECTED LAYERS CLEAR

LAYERS TO DOWNLOAD

Done

100 mi 200 km

Longitude: -114.934 Latitude: 35.775

start Microsoft PowerPoint ... WRP Web Mapping A... 7:57 PM

# Notification operations

- Post notification:
  - Web form
    - Accessible to authorized state and federal agency contact points
  - Notification publish/Subscribe
    - Management agency posts notifications in a standardized format to a publishing end point
    - Clearinghouse harvests notifications
- ‘Scrape’ existing sites (e.g. WRP Regional Project Database)

The screenshot shows the 'Arizona Single Point of Contact Notifications Clearinghouse' web interface. The page title is 'Arizona Single Point of Contact Notifications Clearinghouse' with links for 'Contact', 'My Account', and 'Logout'. The main heading is 'Create new notification' with 'Save' and 'Validate' buttons. A checkbox for 'Published / Visible to the public' is present. The form fields include: 'Title' (text input), 'Description' (text area), 'Publication Date' (dropdown menu), 'Resource ID' (text input), 'Keywords' (text input), and 'Geographic Extent' (a table with four rows: North Bound, South Bound, East Bound, and West Bound, each with a '0' value). The left sidebar contains sections for 'Manage Collections', 'Manage File Attachments', 'Resource Location' (with a map of Arizona), and 'Site Information'.

# Clearinghouse: Notifications

Federal Agencies



Notifications can originate from any authorized agency- Federal, State, or Local

Notification of action

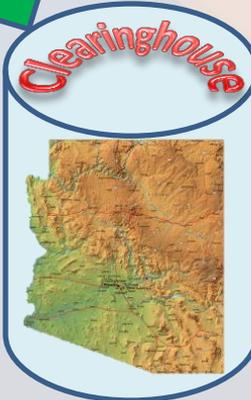
Notification of action

Subscription

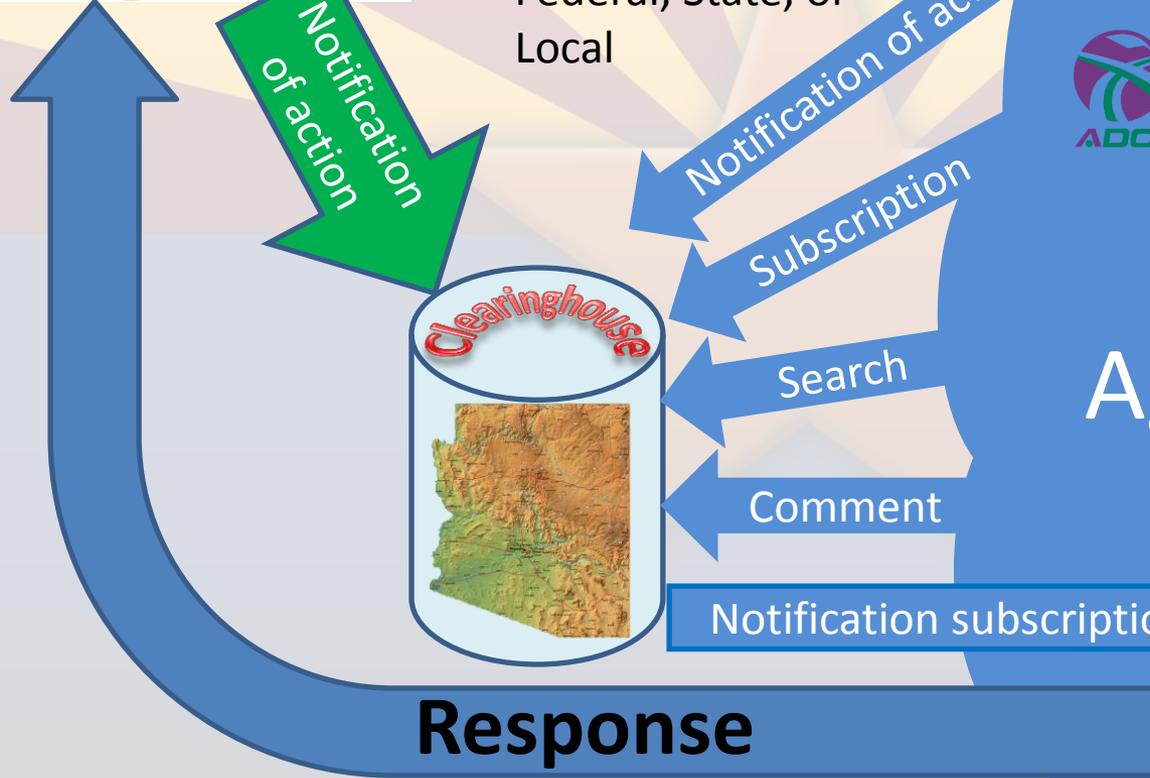
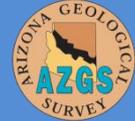
Search

Comment

Notification subscription



State Agencies



# Notification subscription

## 1. User sets up subscription:

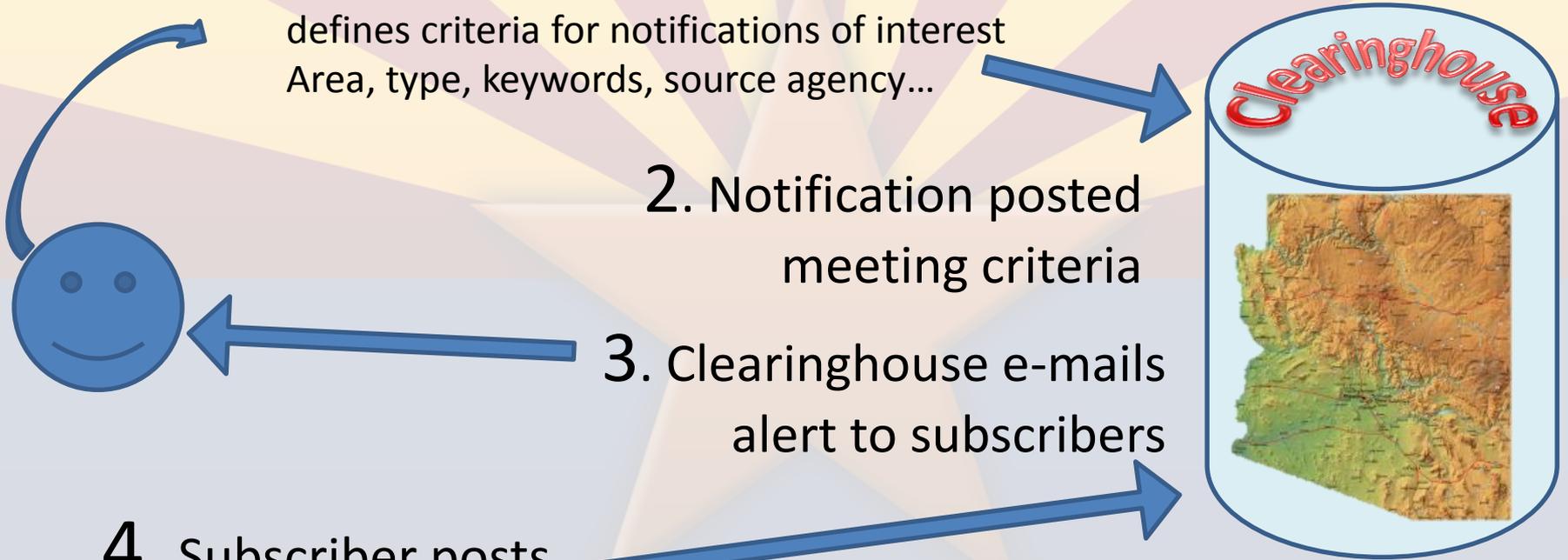
defines criteria for notifications of interest  
Area, type, keywords, source agency...

## 2. Notification posted meeting criteria

## 3. Clearinghouse e-mails alert to subscribers

## 4. Subscriber posts comments in response, takes any other necessary actions

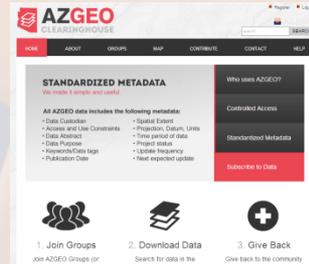
## 5. State SPOC summarizes comments and responds to notification



# System Design

NRRC  
User Interface/Catalog

Documents  
& data



AZGEO



# Next steps

- Demo demonstrating integration of modules:
  - AZGEO
  - Data and documents catalog – work with at least two agencies
  - federal documents and materials (harvested from AZ SPOC and WRP Regional Project Database)

# If demo is successful

- Implement AZ SPOC by engaging Federal partners (e.g., via WRP, Open Data Project, etc) to supply AZ SPOC with digital notifications and documents
- Investigate the use of free text-analytic software to determine keywords and georeferencing information from these documents automatically as an alternative to federal keywording and georeferencing
- Provide free, open source software solutions to agencies that don't already have document or data management software in place

# Longer term. . .

- Deploy enhanced User Interface, with functionality for geographic (e.g., bounding box) and faceted search of the AZ SPOC and agency resources available to NRRC
- Promote the integration of data and documents from different sources and different software through standard OGC data services
- Accommodate agency-specific analyses of AZ SPOC materials
  - Accommodate and encourage software applications developed by anyone
- Training and help to state agencies on digital standards, exposing data in compatible formats, and creating Web services to share data and documents
- Continued refinement of scope and development needs based on federal level objectives and goals

# The Bigger Picture: White House Open Data Initiatives

1. Increasing Access to the Results of Federally Funded Scientific Research (Memo, February 2013)
  - Office of Science and Technology Policy (OSTP) Director John Holdren has directed Federal agencies with more than \$100M in R&D expenditures to develop plans to make the published results of federally funded research freely available to the public within one year of publication and requiring researchers to better account for and manage the digital data resulting from federally funded scientific research
2. Making Open and Machine Readable the New Default for Government Information (Executive Order, May 9, 2013)
  - calls for government information to be managed as an asset throughout its life cycle to “promote interoperability and openness, and.... to ensure that data are released to the public in ways that make the data easy to find, accessible, and usable”

# Increasing Access to the Results of Federally Funded Scientific Research

- Collect or create information in a way that supports downstream information processing and dissemination activities
  - Use machine-readable and open formats
  - Use data standards
  - Ensure information stewardship through the use of open licenses
  - Use common core and extensible metadata
- Build information systems to support interoperability and information accessibility
- Create and maintain an enterprise data inventory
- Create and maintain a public data listing

February 2013

# Open data initiative

Making information resources accessible, discoverable, and usable by the public can help fuel entrepreneurship, innovation, and scientific discovery....

“...requires agencies to collect or create information in a way that supports downstream information processing and dissemination activities. This includes using machine-readable and open formats, data standards, and common core and extensible metadata for all new information creation and collection efforts”

“...building or modernizing information systems in a way that maximizes interoperability and information accessibility...”

“The system design must be scalable, flexible, and facilitate extraction of data in multiple formats and for a range of uses as internal and external needs change, including potential uses not accounted for in the original design.”

May 9, 2013