

GABBs - Reusable Geospatial Data Analysis Building Blocks for Science Gateways

Carol Song, Ph.D. Purdue University

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Co-Authors & GABBs Team

































<u>Outline</u>

- Background
- GABBs components and integration with HUBzero
- GABBs-enabled science applications
- Dissemination



Motivation & Driving Use Cases



Collaboration around data



Software stack for spatial data

It is definitely not trivial to deal with geospatial data (processing, displaying, exchange/sharing, etc)



GABBS: Geospatial Data Building Blocks

Lower the **barrier**

Make it easy to **visualize** geospatial data

Make it easy to share geospatial/georeferenced data

Open source, **community** driven

Build a geospatially-enabled, integrated, self-service collaboration platform

Broaden participation Faster **dissemination** Enhance **learning**



Guiding Principles

Making it **easy** to manage, visualize and share geospatial data and applications

- self service
- enable end-to-end workflow
- tools that domain scientists and high school students can use
- easy to share "live" dataset (interactive, visual)
- accessible and available
- science driven, co-development
- Reusable software modules/building blocks for other gateways



High-level View



User Community





Specific Goals

- Integrated data management environment with built-in geospatial data support (*iData/Project*)
- Toolkits for rapid application development, no GIS programming expertise required (*Rappture, pyMapLib*)
- Data visualization builders and tools that require no programming (*GeoBuilder, MultiSpec, mobile app*)
- Production system open to research and education use, 24x7
- Packaging for easy installation



GABBs Architecture



GABBS Data Considerations

- Support standard protocols (WMS, WFS, WMTS, ...)
- Geospatial viewing (quick and comprehensive)
- Automated metadata extraction
- Geospatial search
- Easy data publication
- Bridge the separate tool space and web server space to enable dynamic work flows
- Seamless workflow for users -> integrate with HUBzero's Project implementation



End-to-end work flow

Create Project, add members, start collaborating!

New Project		Employing Satellite Data to Predict Crop Yields
Describe your project Add team member(s) Start using your project!		Connections » → iRODS
Pick project title and name	🖭 Updates	O Upload ▲ + fill Ø ■ Name + ■ ● ■ ● ■ ● ■ ● ■ ● ■ ● ■ ● ■ ● ■ ● <
Title REQUIRED	1 Info	📄 🔄 Administrative Documents
	🖈 Team 🦻	C Parica Files
Full name for your project, such as "Quantum Dot Lab"	Files 4	📄 🔚 Geospatial Data
Alias Name (for the project URL) REQUIRED	🔒 Default Storage	Project Reports
	🔒 iRODS	
Short name for your project to build the project URL. Please use a combination of lowercase letters and numbers. No spaces, special characters of	🍖 To Do	initegoc A
quantumdotlab	🖋 Notes	📄 📔 filedata
	Publications 1	Itime-series-data.csv
Save all and continue	Databases 1	

Manage files, edit metadata as needed, view to verify

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🛦. Team 🔡	a Datas e	Geographic Coverage		· Hide ·
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iRODS To Do	D Darvest afre	southlimit	: -89.999997	
Notes		eastlimit	: 180.000005	
Publications	¢	westlimit	: -180.000005	
Databases	¢	latmin	: -89.999997	
		latmax	: 90.000005	
		Ionmin	: -180.000005	
		lonmax	: 180.000005	



End-to-end work flow

Open with tool, and start interacting and exploring data



Start new publication, select data sets and publish with DOI!







Publications » In dataset "Chile Maize Yield Data for 2002"

Data Service API

- Access to all project file operations
 - Create, delete, rename
 - Metadata management
- Useful for third-party applications
 - Authorization via OAuth maintains access control
 - Applications for building data repositories (crowd sourcing, etc)
- Useful for augmenting metadata not automatically captured
 - Typically used in hub tools



Example: GrABBs Mobile Application

- Enable users to connect to GABBs iData using devices
 - iPhone and Android versions
 - Browse, upload, download, annotate, map display, rename, delete
 - Data sources: Camera, photos, videos, record audio
 - Automatically extract geospatial information







Geospatial Data Visualization

Rappture Toolkit



- . Geospatial Output Widget
- . Render server support
- . 2D / 3D support
- Rappture applications and supported languages

 Tol/Tk
- Tcl/Tk

PyMapLib



Python Based

- . Generic Framework
- 2D Data support
- Compatible with C++ & Java user interfaces



Rappture & Render Servers



Rappture & Render Servers



Visualization



Visualization





1H

Visualization



5 Step Widget Integration

- 1. Setup the MapViewer
- 2. Describe the Layers
- 3. Configure Attribute Placard
- 4. Configure the Camera
- 5. Render Results





PyMapLib

- Generic framework for geospatial data visualization
- Requires little expertise in GIS programming
- Handles common data types, including:
 - Raster, ESRI shapefile, Delimited text
- Uses PyQGIS as the basic geospatial data rendering engine
- Configurable map tools for the map viewer widget
 - Pan, zoom, select, map tips, layer management, map overview, map value inspection and plotting, map style
- Default map viewer widget
 - Import as a QT widget and extend as needed in Python code
 - Embed as-is in Java or C++ tools
- Not HUBzero specific, can be used in any standalone python program
- Available in github: <u>https://github.com/waneric/PyMapLib</u>





PyMapLib sample code

Add an Open Street Map as the base layer

self.map = gabbs.maps.Map("WorldMap")
self.map.setMapCenter(-86, 39)
self.map.setMapZoom(7)
self.map.setMapScale(3, 9)
self.mapContainer.addLayer(self.map)

Add map tools to the map viewer as toolbar buttons

```
self.mapContainer = gabbs.maps.MapContainer()
self.mapContainer.setLayerControl(True)
self.mapContainer.setPanControl(True, size = "CUSTOM", options = "ZOOMIN,
ZOOMOUT")
self.mapContainer.setSelectControl(True, size = "CUSTOM", options = "SINGLE,
RECTANGLE, POLYGON")
self.mapContainer.setPlugin("drawing")
```



GeoBuilder





²⁷ https://mygeohub.org/tools/geobuilder

Scientific Applications



What's on the hub?







	Release Delivery					
		MyGeoHub.org	Virtual Machine	Amazon Machine Image (AMI)		Packages
	iData			Multi-Instance	Single Instance	rom
Feature	Rappture					rpm / tar
	MultiSpec					rpm
	PyMapLib					rpm
	GeoBuilder					rpm
	Render Server					tar



		Release Delivery				
		MyGeoHub.org	Virtual Machine	Amazon Machi	ne Image (AMI)	Packages
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 Video illustrating the use of an AWS CloudFormation template to deploy a GABBsenabled HUBzero instance in Amazon Web Services (AWS)

https://mygeohub.org/resources/1291



In Summary

Open source, Self serve Platform for collaboration around geospatial data





Thank you!

Questions?

Contact: <u>carolxsong@purdue.edu</u> Project: <u>http://mygeohub.org/groups/gabbs</u> Production site: <u>http://MyGeoHub.org</u>



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