Deploying a Cloud-Based & Open Source Enterprise GIS

Samantha Lustado and Rachel Skoza

Masters of Science in Geographic Information Science (MSGISci)

Department of Geography, California State University, Long Beach

Introduction

By taking advantage of open source software, we disseminated spatial data and provided visualization tools to create an interactive element for spatiotemporal natural phenomena within the Santa Monica Mountains National Recreation Area (SMMNRA) at very little financial cost. Free and open source software, also known as FOSS, is software that is freely licensed to use, copy, study, and change since the source code is openly shared. The purpose of utilizing FOSS for this project is not only to diversify geospatial skill sets, but to customize applications that are otherwise limited by cost and flexibility in a pure proprietary environment.

By using a hybrid approach of both proprietary and FOSS, we hoped to optimize the use of various GIS techniques that analyzed and disseminated relevant data. This project encompassed two goals and accompanying skillsets. Our first goal was to present spatial data and layers to analyze, and our second goal was to provide a platform on which this data can be interacted with and explored.

Data and Data Sources

The data used in this project were generated between 2000 and 2016, and were gathered from publicly available sources. The layers involved in the spatial analyses of SMMNRA included visitor park amenities, land cover type, vegetation indices, wildfire occurrences, and black bear habitat suitability areas. This project aimed to make these layers harmonize together in such a way that was not confusing to the user, and so that potential patterns may be interpreted.

Table 1. List of data and data sources used in the project

Dataset	Source
LiDAR DEM	LARIAC
LA County TIGER roads	http://egis3.lacounty.gov/dataportal/2011/04/25/2010-tiger-roads/
Ventura County TIGER roads	https://catalog.data.gov/dataset/tiger-line-shapefile-2013-county-ventura-county-ca-all-roads-county-based-shapefile
US Federal Lands - National Forests	ArcGIS Online
DEM	National Map Viewer
Landcover raster	CSULB Geography Department
CA Streams and Lakes	http://www.dfg.ca.gov/biogeodata/gis/clearinghouse.asp
MODIS Active Fire Points	https://earthdata.nasa.gov/earth-observation-data/near-real-time/firms/active-fire-data
SMMNRA Boundary	Santa Monica Mountains National Recreation GIS Staff
SMMNRA Public Trails	Santa Monica Mountains National Recreation GIS Staff
SMMNRA Trailheads	Santa Monica Mountains National Recreation GIS Staff
SMMNRA Points of Interest	Santa Monica Mountains National Recreation GIS Staff

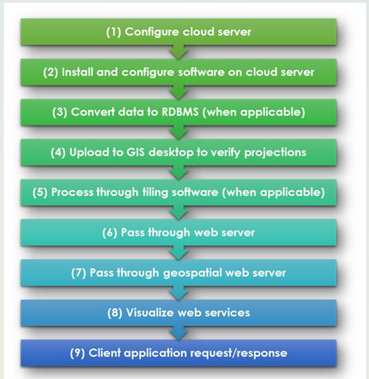
Table 2. List of data gathered from field collection devices

Dataset	Device
24 panoramic images	iPhone 5 - Google Street View Mobile App
806 static trail images	iPhone 5 - Mapillary Mobile App
Temescal Canyon Trail panoramic	Juno

Methodology

This section focused on an alternative way of sharing maps through a hybrid approach combining proprietary and open source methods. The components involved in this process were: (1) a cloud server (2) a relational database management system (RDBMS) (3) a web server (4) a geospatial server (5) desktop GIS software (6) an image tiling software (7) and a web mapping library API. Figure 1 shows the general steps on how to configure a cloud-based, open sourced GIS. Figure 2 depicts the intended system architecture. Due to timeline constraints, the model was adjusted to that shown in Figure 3.

Figure 1. Workflow of setting up an enterprise GIS starting with configuration of the cloud server to the deployment on a client application.



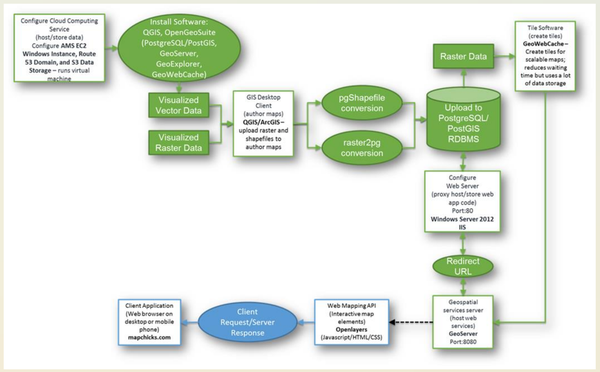


Figure 2. The original workflow model that included importing rasters into the RDBMS and using OpenLayers as the web mapping API.

Timeline

Table 3. Timeline of project management

PHASE	DATES	OBJECTIVE
1	June 5 - June 11	Completed Introduction; Researched methods
2	June 26 - July 2	Researched and decided on data dissemination architecture and spatial analyses
3	July 3 - July 9	Installed and configured data dissemination components
4	July 10 - July 16	Integrate visualizations and analyses to interactive web map
5	July 17 - August 6	Completed Methodology, Results, and Discussions
6	August 7 - August 13	Completed Abstract/Intro/Conclusion and presentation. MSciGIS Complete!

Results

An enterprise GIS was successfully configured so that data were accessible through the web using the configuration in Figure 3. Project deliverables were meant to be disseminated via the project website http://www.mapchicks.com. Due to time constraints the project is currently hosted on http://smmnra.weebly.com, (Figure 4). The interactive map of the open-source system environment is shown in Figure 5.

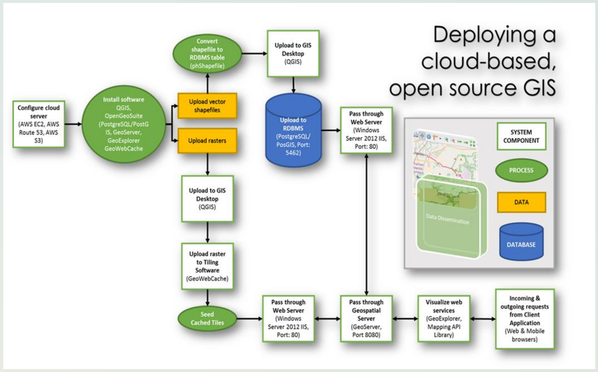


Figure 3. Modified workflow of system architecture where rasters are not imported into the RDBMS and OpenLayers was not used as the web mapping API.

Figure 4. Homepage of the website (http://smmnra.weebly.com) that hosts all of the project deliverables.

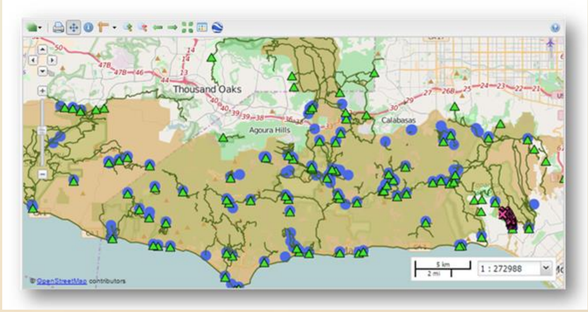


Figure 5. 2D map of PostGIS tables that was disseminated through AWS, IIS, and GeoServer.

Discussion

Many geovisualizations and spatial analyses of SMMNRA were created using GIS software. The purpose of developing a data dissemination architecture was to share these GIS products through a public platform so they are easily accessible to stakeholders.

A general hurdle while developing an open source enterprise GIS was configuring it on a Windows server. When technical difficulties were encountered, many resources that were available through the online community were specific to Linux servers. This made research and troubleshooting more difficult and time-consuming. Using a Windows based configuration was chosen because of previous experience with the Windows operating system and lack of experience with Linux. It was deduced that configuring an AWS Windows Instance with PostgresSQL/PostGIS, IIS, and GeoServer was a unique and uncommon configuration.

This project's data dissemination architecture is practical for organizations that are unable to afford proprietary GIS environments. After attending the NPS Special Interest Group (SIG) at the Esri UC 2016, the panel revealed that the biggest challenge is affording the resources to develop mature GIS deployments. Deploying a cloud-based, open source GIS would require investment in research, development, and training, but it is a very comprehensive skill set that could help an organization to access enterprise GIS. Use of the deployable architecture proposed in this project has the potential to provide the benefits of an enterprise system even if funding is an issue.

Conclusion

There are many ways to deploy an enterprise GIS. This project's architecture proved successful in using a hybrid approach that combines proprietary and open source software. Once all system components were configured correctly, geospatial data were published so that a user can access the data through an interactive web map.

Had the opportunity presented itself to implement a different methodology, the Linux platform would have been used instead of Windows. Linux would integrate easier with the other open source software because of the seamless interoperability and the availability of technical assistance resources.

Because of the extensive amount of time and some funds invested into this project, there are plans to continue developing www.mapchicks.com by incorporating HTML, CSS, and JavaScript.

Submitted in partial fulfillment of the requirements of the Masters of Science in Geographic Information Science on August 13, 2016.

Please refer to *Geovisualizations and Spatial Analyses of a National Recreation Area* poster for more information on how the data described in this poster were disseminated.

For additional information please contact:
Samantha Lustado slustado@gmail.com
Rachel Skoza rachelskoza@gmail.com
Website: http://smmnra.weebly.com