

# Assessing Cloud-Based Solutions for Geospatial Data and Mapping

## Introduction

In today's world, data and document storage in the "cloud" can include just about anything – images, videos, contacts, calendars, presentations, etc. Geographic Information Systems are no different. GIS vendors are rapidly developing cloud-based solutions for private and public entities alike as a way to provide access to maps, web services, applications, and analytics.

The purpose of this document is to evaluate some of the more common cloud-based GIS solutions. This document will primarily focus on Esri's ArcGIS Online, although other vendor solutions are discussed.

## Benefits

Regardless of the industry there are strengths to using a cloud-based service. This may particularly be the case for GIS because of the potentially complex software tools and large datasets.

- *Hardware cost efficiencies* - This is perhaps the largest cost-savings. There is no need to procure the hardware infrastructure required to run the enterprise GIS. Also there are no maintenance costs.
- *Scalability* - The cloud infrastructure can be scaled to meet demand. This is a benefit if the consumption of the GIS maps, data, and web services fluctuate.
- *Ease of use* - Administering a cloud GIS is often very easy, giving the operator a simple-to-understand user experience/interface.
- *Disaster recovery and availability* - The cloud provider should meet certain up-time requirements and should have various physical locations for infrastructure in the event of a calamity.

## Limitations

While there are numerous benefits to using a cloud-based GIS, one should also be aware of the potential limits.

- *Lack of customization/enhancements* - The tools, applications, and functionality of the cloud-based GIS is by-and-large determined by the service provider. Think of it as "GIS for the masses."
- *Data formats* - The format of the data available through the cloud GIS is limited to what the provider delivers.
- *Privacy concerns* - Sensitive data or PII (Personally Identifiable Information) may prohibit the information from being stored off-premise (i.e. in the cloud).

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## GIS Cloud Solutions

Functionality, and therefore costs, differ depending on the GIS cloud provider. The narrative below highlights the tools, applications, and experiences of a few of the major cloud-based solutions.

### ArcGIS Online

#### Functionality:

ArcGIS Online is a cloud-based mapping platform designed by Esri. It includes functionality to accomplish tasks in the cloud. These functions can be grouped into “mapping”, “analysis”, and “applications.”

#### Mapping

The ArcGIS Online map gives the user the ability to add data from a number of sources. These include any web service discoverable from ArcGIS Online or an entity’s own on-premise ArcGIS Server implementation, in addition to data uploaded from a desktop. There is access to a number of Esri-sourced base maps. Users can add their own base map to the ArcGIS Online map, if desired.

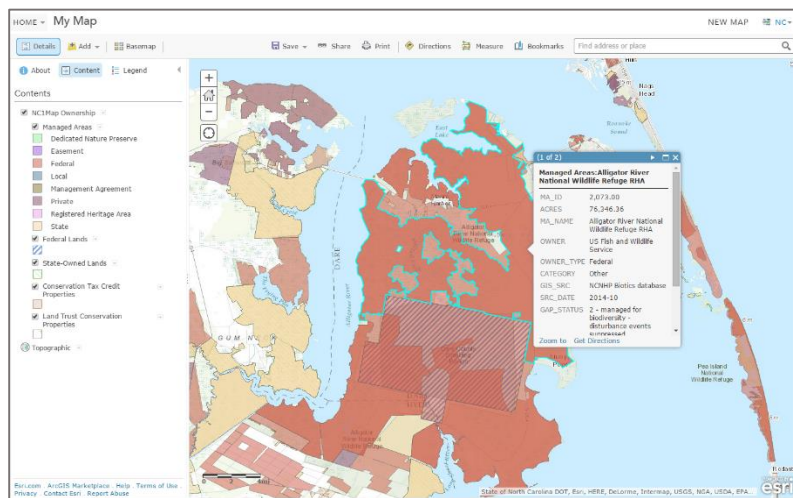


Figure 1 - ArcGIS Online map shown with basic mapping tools and popup.

of analysis tools that users have at their disposal (caveat: a paid subscription is needed to access these tools). A detailed summary of each tool can be accessed at: [doc.arcgis.com/en/arcgis-online/using-maps/perform-analysis.htm](http://doc.arcgis.com/en/arcgis-online/using-maps/perform-analysis.htm). The tools are grouped as:

Basic mapping functionality is presented when opening the map – zoom in/out, pan, travel directions, measure, bookmarks, and find an address or place, are included. Popups can be configured to display feature attributes (see Figure 1).

#### Analysis

Analyzing data added to the map is performed by clicking on the menu button for that data set (see Figure 2). With quarterly ArcGIS Online updates, Esri is building a useful set

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- Summarize data
- Find locations
- Data enrichment
- Analyze patterns
- Use proximity
- Manage data

## Applications

Once a web map is authored and shared it can be used to create a web application. This application can reside within ArcGIS Online or on the user's own server. There are several configurable applications to choose from (Figure 3). These are pre-built web apps that can be customized extensively if it is downloaded and run from an on-premise server – the only limit is the extent of coding proficiency by the developer. Configurable apps that will reside in ArcGIS Online are only minimally customizable.

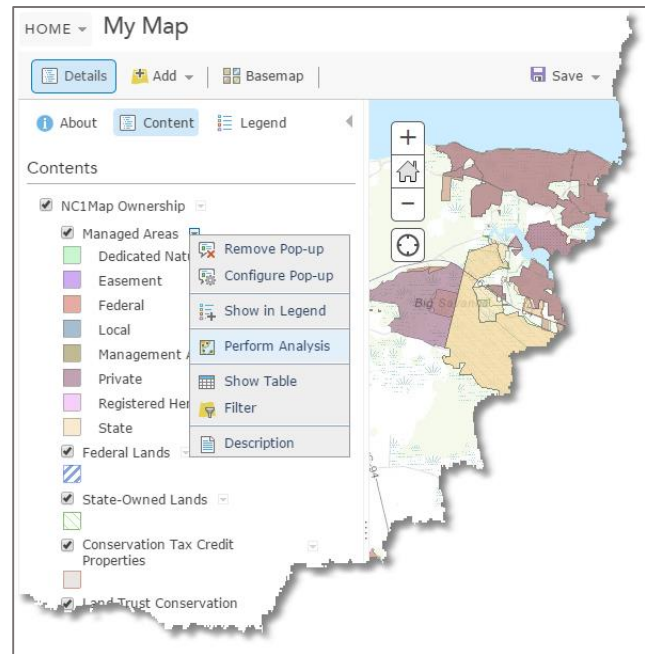


Figure 2 - Analysis tools are available by clicking next to the data set and selecting Perform Analysis.

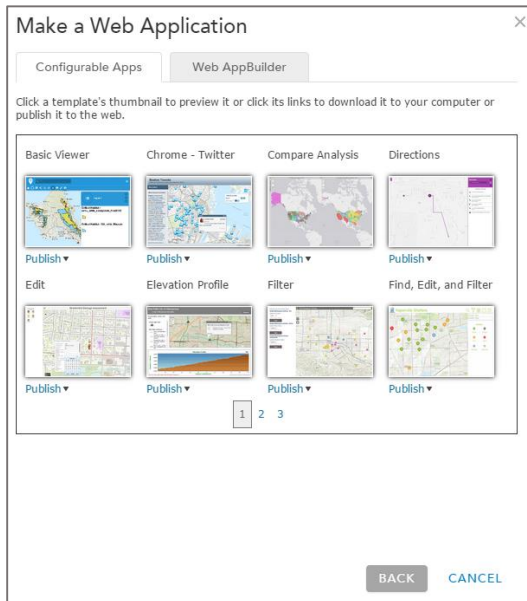


Figure 3 - The web application dialog box is displayed when clicking on the Share button at the top of the map and selecting Make A Web Application.

Another method to create a web application is called the Web AppBuilder for ArcGIS. This allows for a choice of a pre-defined set of map widgets that can be configured within the application. Different themes can be chosen to customize even further. Applications created with either the configurable apps or the Web AppBuilder can be shared with anyone and can also be embedded within a web page. If the application is hosted on ArcGIS Online there is no previous experience needed in coding web applications. The Web AppBuilder dialog is accessed from the same Make a Web Application window seen in Figure 3.

## Costs:

The ArcGIS Online subscription plan prices can be found at: <http://www.arcgis.com/features/plans/pricing.html>.

The costs are based on the number of users. Each escalating subscription plan includes in increased amount of service credits. The service credits are used for things

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like data storage and analytics in the cloud. For more information on service credits see: <http://www.arcgis.com/features/plans/credits.html>.

Esri also offers ArcGIS for Server on Amazon Web Services (AWS). This is different from ArcGIS Online in that it is the full ArcGIS for Server software running in the cloud. There is an in-depth white paper to estimate the cost involved with using ArcGIS for Server on AWS. Please refer to: (<http://www.esri.com/library/whitepapers/pdfs/estimating-cost-gis-cloud.pdf>).

## OpenGeo Suite on AWS

### Functionality:

The OpenGeo Suite is a GIS platform used to build and manage maps, data, and applications. It uses open source geospatial software and different open source products for each functional GIS tier.

Functional Tier	GIS Product
Web Interface	GeoExt and OpenLayers
Application Server	GeoWebCache and GeoServer
Database	PostGIS
Desktop	QGIS

These software applications are free, however the OpenGeo Suite is the packaged product accessible from Boundless (<http://boundlessgeo.com>). Boundless offers this suite in the cloud through AWS (<http://boundlessgeo.com/solutions/opengeo-suite/opengeo-suite-amazon-web-services>).

The suite runs on Windows, Linux, and Mac OS. It supports many Open Geospatial Consortium (OGC) standards:

- Web Feature Service (WFS)
- Web Map Service (WMS)
- Web Coverage Service (WCS)
- Web Processing Service (WPS)
- Styled Layer Descriptor (SLD)
- Geography Markup Language (GML)
- Keyhole Markup Language (KML)
- SQL Simple Features
- Filter Encoding

A subset of the supported database, vector, and raster formats is below, including some that are proprietary:

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- Oracle Spatial
- PostgreSQL / PostGIS
- Esri ArcSDE
- IBM DB2
- Microsoft SQL Server
- Esri Shapefile
- MapInfo MIF/MID
- TIFF, GeoTIFF, BigTIFF, ECW, JPEG2000, MrSID, GTOPO30

The OpenGeo Suite can export to many popular data formats, such as KML, GML, Shapefile, GeoRSS, GeoJSON, CSV, Excel, PDF, SVG, JPEG, GIF, and PNG.

## Costs:

OpenGeo Suite on AWS is offered by the hour

([https://aws.amazon.com/marketplace/pp/B00ED5D1TA/ref=ptnr\\_web\\_suite\\_hourly](https://aws.amazon.com/marketplace/pp/B00ED5D1TA/ref=ptnr_web_suite_hourly)) or month

([https://aws.amazon.com/marketplace/pp/B00ED5EGP8/ref=ptnr\\_web\\_suite\\_monthly](https://aws.amazon.com/marketplace/pp/B00ED5EGP8/ref=ptnr_web_suite_monthly)).

## Other Cloud-Based Solutions

- GIS Cloud - <http://www.giscloud.com>
- CartoDB - <http://cartodb.com/gis-online-software>
- AcuGIS – <https://www.acugis.com/index.html>
- GeoSolutions - <http://www.geo-solutions.it/blog/geoserver-in-da-cloud>

## References

- GIS in the Cloud: An Introduction (Series) - <http://gis-centric.net/2012/01/16/gis-in-the-cloud-an-introduction>