Arkansas GIO GeoStor Platform

Current State Overview

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The original document provided by Zekiah Technologies, Inc. was modified by AGIO staff on August 2, 2011. Modifications included the removal of detailed cost provided.

This document represents a high-level overview of the current state of the GeoStor platform as of June 2011.

Contents

1.0 Background

1.1 AGIO
www.gis.arkansas.gov

The Arkansas Geographic Information Office (AGIO) acts as the functional arm of the Arkansas Geographic Information Systems Board (ACT 244 of 2009). Their major activities include providing administrative and technical support to the Board. They pursue activities that result in coordinated, cost-effective programs for spatial data development and distribution.

In fulfilling this role they coordinate with cities, counties, state, federal governments, and the private sector to reduce the duplication of effort. AGIO staff coordinate the completion and maintenance of shareable statewide framework data and applications of geographic information system technologies.

The AGIO's premier service is GeoStor, the official geospatial platform for the State of Arkansas. GeoStor is described in more detail throughout this document.

1.2 Cloud Migration Study
Zekiah Technologies was contracted by the Arkansas Geographic Information Office (AGIO) in April of 2011 to evaluate options for potentially migrating the GeoStor geospatial infrastructure to a cloud computing environment. "The cloud" has become subject to a wide variety of interpretations in the marketplace so the study was conducted within the context of the NIST draft definition available here: http://goo.gl/bTGTO.

This effort was broken into several parts:

1) Develop a detailed characterization of the current state of GeoStor (software, hardware, support, staffing and cost), its user base and the products and services it provides.
2) Derive the functional capabilities that are employed by GeoStor and would need to be supported in a new architecture.
3) Survey the geo community to determine availability of services.
4) Determine if current technology and cost are such that GeoStor could migrate to a cloud environment with the end-state costs being less than the annual expenditures for the current architecture.

2.0 User Communities

As a State entity, AGIO's user community is wide-ranging. Stakeholders include county and local governments within the State of Arkansas, other State agencies, the Federal Government, and the public. The "public" includes individual citizens, civic groups, non-government organizations, and private-sector companies.

This user community can be generally divided into three kinds of users, each with differing requirements for geospatial products and services from AGIO and the GeoStor infrastructure. These user categories are defined below.

2.1 Direct Users
Direct Users are defined as those users who regularly use components of the GeoStor infrastructure, whether through off-the-shelf tools or via custom applications. This community is made up of users from city, county, state and federal governments, educational institutions and the private sector.

2.2 Indirect Users
Indirect users are those that derive benefit from the GeoStor infrastructure without directly utilizing the applications or components of GeoStor. This community is best illustrated by county governments that provide geospatial data to AGIO for storage and dissemination thru GeoStor. This use eliminates the need for these governments to have significant GIS infrastructures of their own while providing a central location for direct users to access county-level data.

Another class of indirect users is those who receive products and services from AGIO such as ad-hoc maps and derived data products. In these cases, AGIO staff will internally make use of the GeoStor infrastructure to produce such products without the end-users interacting with GeoStor. Examples of such products may be legislative maps or Streamline sales tax data.

2.3 Public
This community is essentially made up of users that do not fall into either of the other categories. These users typically have very basic requirements, wishing to view a limited number of data sets, such as congressional districts or zoning, in a basic viewer with a behavior similar to that of Google Maps. These users will usually not interact with AGIO data sets outside of their web browser. Users who need more advanced access to data will be considered direct users.

3.0 Services Supported by GeoStor
The services supported by GeoStor can be broken down into four categories:

1. Data Hosting and Infrastructure
2. Web Mapping and Application Hosting
3. Geospatial Data Distribution
4. Ad-hoc Mapping Services

With the exception of ad-hoc mapping services, all of these services make direct use of the infrastructure and assets of the GeoStor platform. Each of these services is detailed below. All of the resources available via these services are exposed through the overarching GeoStor search interface. Figure 1 depicts a high-level view of the GeoStor platform in relation to the services provided. It is important to note that GeoStor is relatively well-segmented by service, with the exception of the use of some raster data files by ArcGIS Server image services. This design was adopted to reduce dependencies across the platform and provide a greater level of stability.
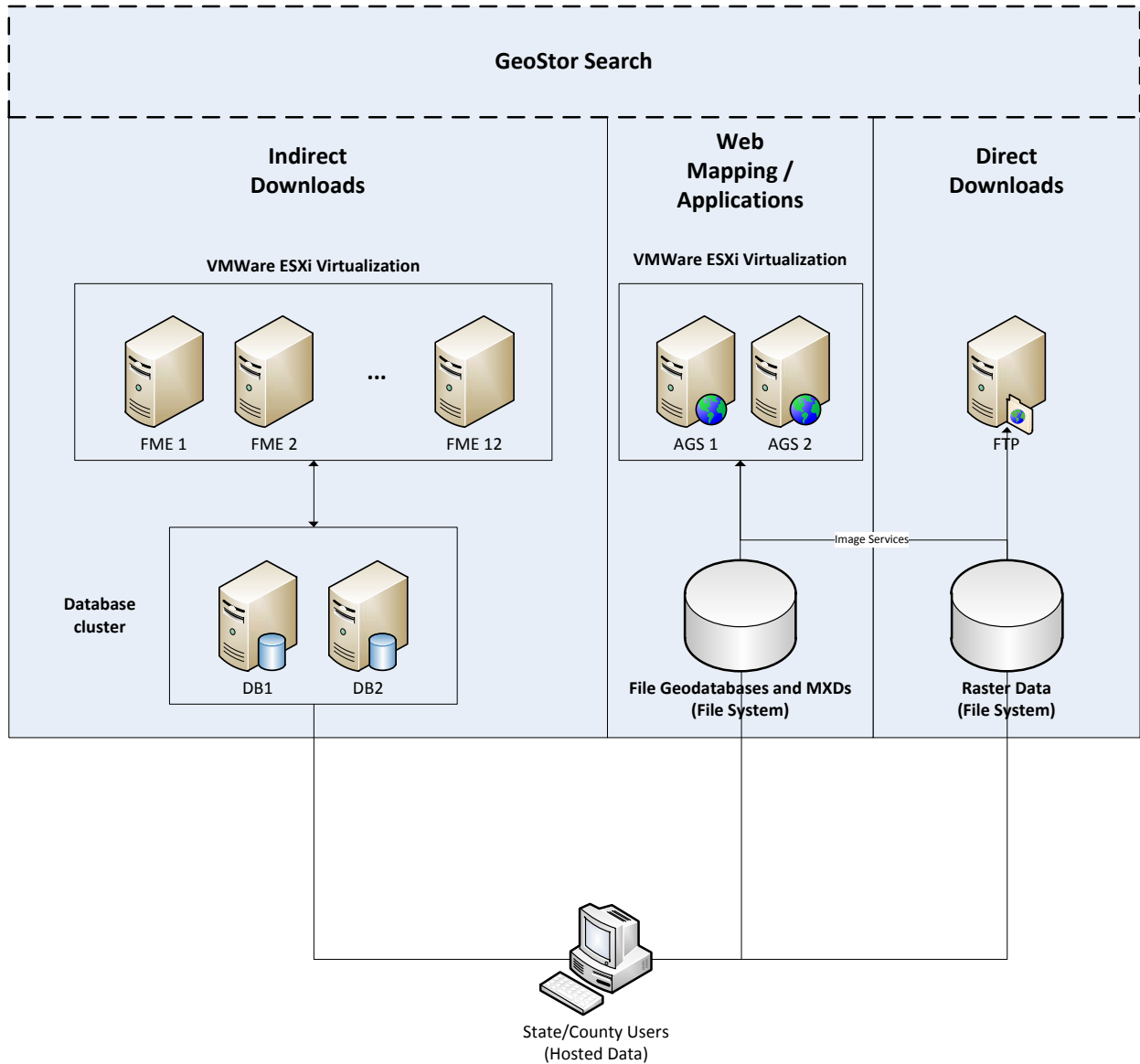
FIGURE 1: HIGH-LEVEL VIEW OF THE GEOSTOR PLATFORM

3.1 Data Hosting and Infrastructure

AGIO acts as a central repository for geospatial data for other State agencies as well as counties that wish to avail themselves of this service. AGIO houses large volumes of raster and vector data for these users. This data is made available through GeoStor in lieu of each of these users establishing individual storage and dissemination infrastructures.

3.2 Web Mapping and Application Hosting

Web mapping and application hosting are similar but distinct services provided by GeoStor. Each is described in detail below. For the purposes of the this paper, "web mapping" represents any interactive maps or data streams being served from the central GeoStor data repository. "Application hosting"

represents interactive mapping applications that are being run on the GeoStor infrastructure on behalf of direct or indirect users. GeoStor currently uses Esri ArcGIS Server to support both of these functions

3.2.1 Web Mapping
Web mapping of data in the central GeoStor repository is accomplished in several ways

1. Interactive maps are served through the GeoStor Viewer. This application is a custom implementation of the Esri ArcGIS API for Javascript. The viewer provides basic map navigation, data inspection, search, address lookup, markup and printing capabilities.
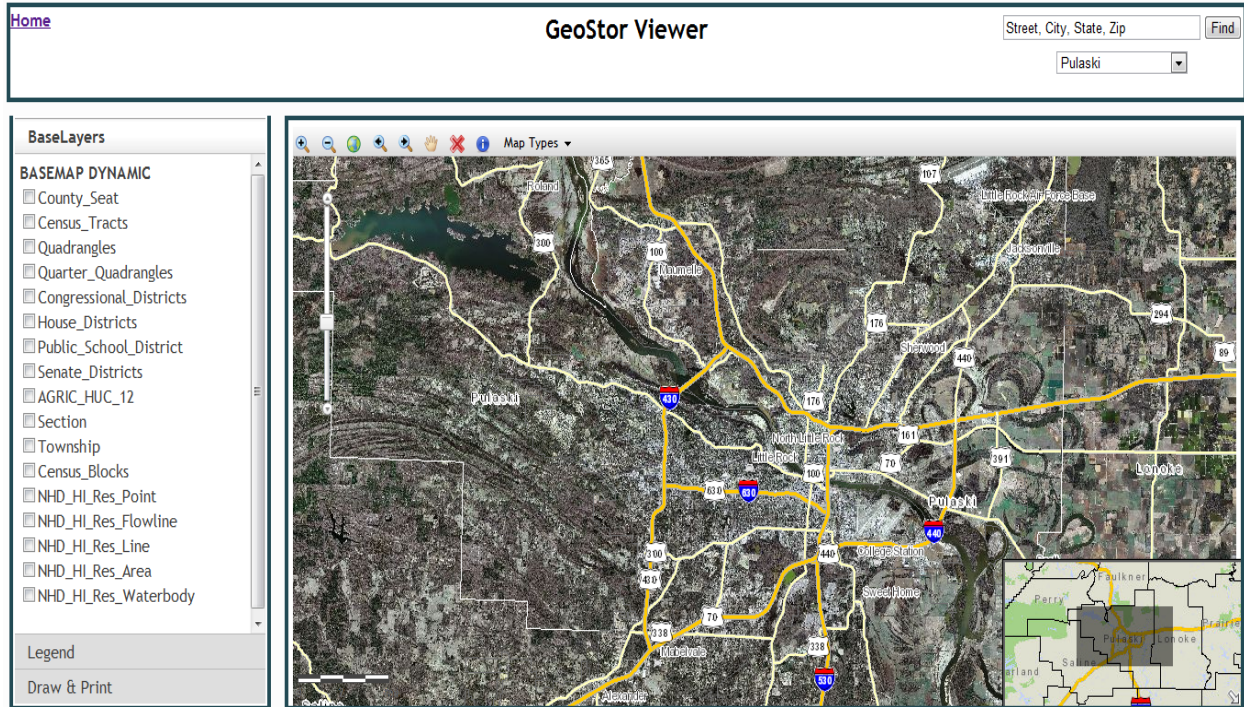

FIGURE 2: GEOSTOR VIEWER INTERFACE

2. Esri ArcGIS Server REST API – All GeoStor data services are exposed by default as resources using the Esri ArcGIS Server REST API. Any external client software that can communicate using the REST API can connect directly to any of the GeoStor resources. Available resource types include MapServer, GeocodeServer and ImageServer, depending on the resource being accessed.
3. Open Geospatial Consortitum (OGC) Web Mapping Services (WMS) –Many GeoStor data services, but not all, are exposed and OGC WMS services. Any external client software that can communicate via WMS can connect directly to GeoStor services.
4. OGC Web Feature Services (WFS) - Many GeoStor data services, but not all, are exposed and OGC WFS services. Any external client software that can communicate via WFS can connect directly to GeoStor services.
5. OGC Keyhole Markup Language (KML) - Many GeoStor data services, but not all, are exposed and OGC KML services. Any external client software that can communicate via KML can connect

directly to GeoStor services. These services are actually served using the compressed form of KML, known as KMZ.

3.2.2 Application Hosting

The GeoStor infrastructure is available to other State agencies and counties who have a requirement for web-based applications. The applications that are currently hosted by GeoStor are listed in the Application Inventory section of this document.

The majority of these applications are based on separate instances of the GeoStor Viewer, having the same look and feel. A small subset of these applications is based on custom implementations of the ArcGIS Javascript API or the ArcGIS API for Flex. All of the applications are built using technologies that leverage the ArcGIS Server REST API. These distinctions are enumerated in the Application Inventory.

A dedicated map service is created for each application and the data for each map service is stored in its own file geodatabase. The data that supports each application is separate and distinct from the main GeoStor data repository. Figure 1 depicts the process for creating and updating an application hosted on GeoStor.
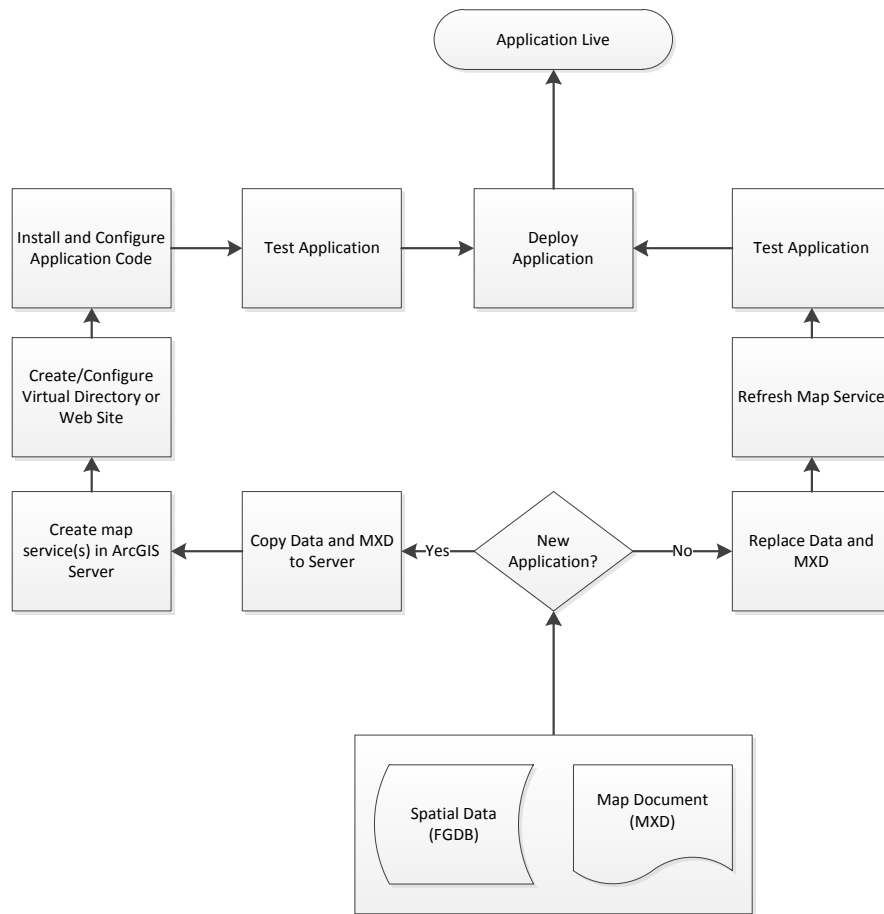

FIGURE 3: PROCESS FOR HOSTING AN APPLICATION ON THE GEOSTOR INFRASTRUCTURE

3.3 Geospatial Data Distribution

One of the core missions of AGIO is spatial data distribution. GeoStor, as the primary spatial data platform for the State of Arkansas, was designed with efficient data distribution as an essential requirement. Geospatial Data Distribution takes two primary forms: Indirect Download and Download via FTP. Each of these methods is discussed below.

3.3.1 Indirect Download

Indirect download is also referred to as "clip, zip and ship." This capability allows users to specify parameters to customize a data download to their needs. These parameters include geographic area, data format, and spatial reference. Using these parameters, GeoStor will process the data and notify the user by e-mail that the requested data is ready. Because there can be a delay between the data request and the completion of data processing, this form of download is referred to as "indirect."

Figure 2 depicts a screen capture of the current GeoStor interface for indirect download. This capability is currently powered by Safe Software's FME Server running in a virtualized environment on the GeoStor infrastructure.

All of the vector data holdings, and a limited subset of raster data holdings, are available via indirect download.
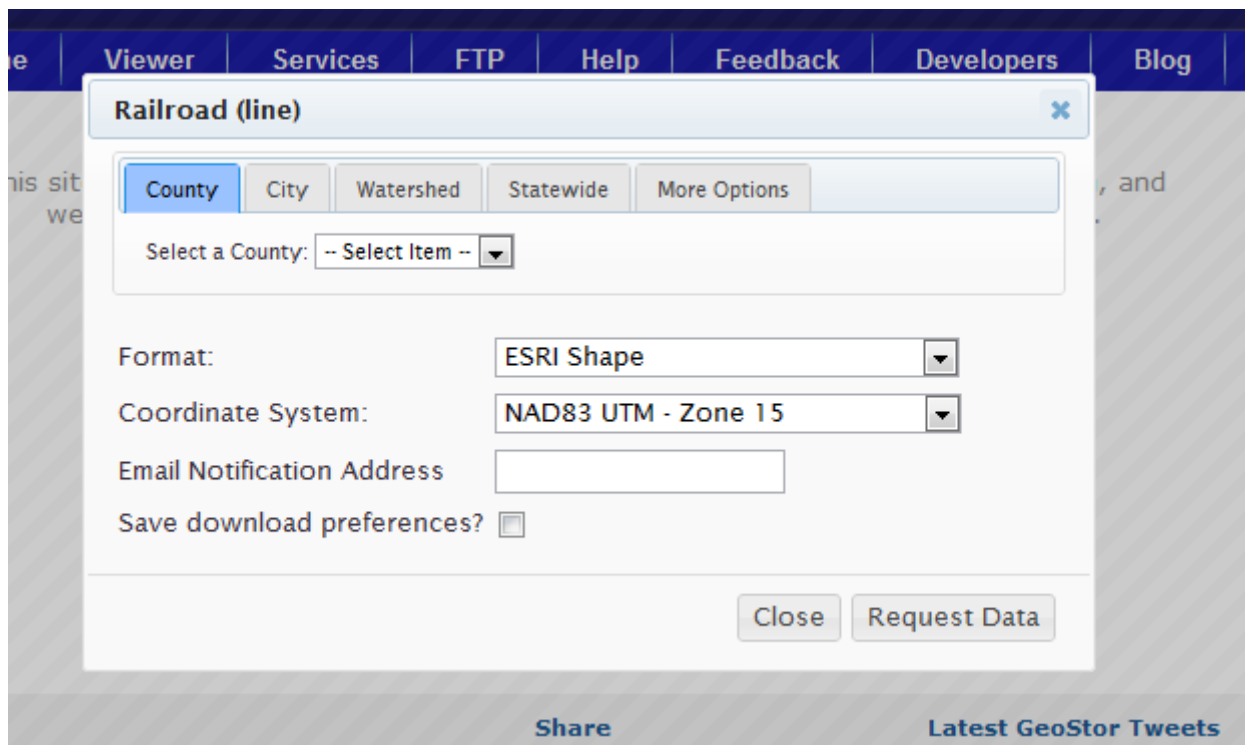

FIGURE 4: GEOSTOR INDIRECT DOWNLOAD INTERFACE

As depicted in Figure 2, users can provide various parameters to customize downloads via the indirect download capability. These parameters include geographic area (county, city, watershed, quadrangle, township, statewide), output format and output coordinate system.
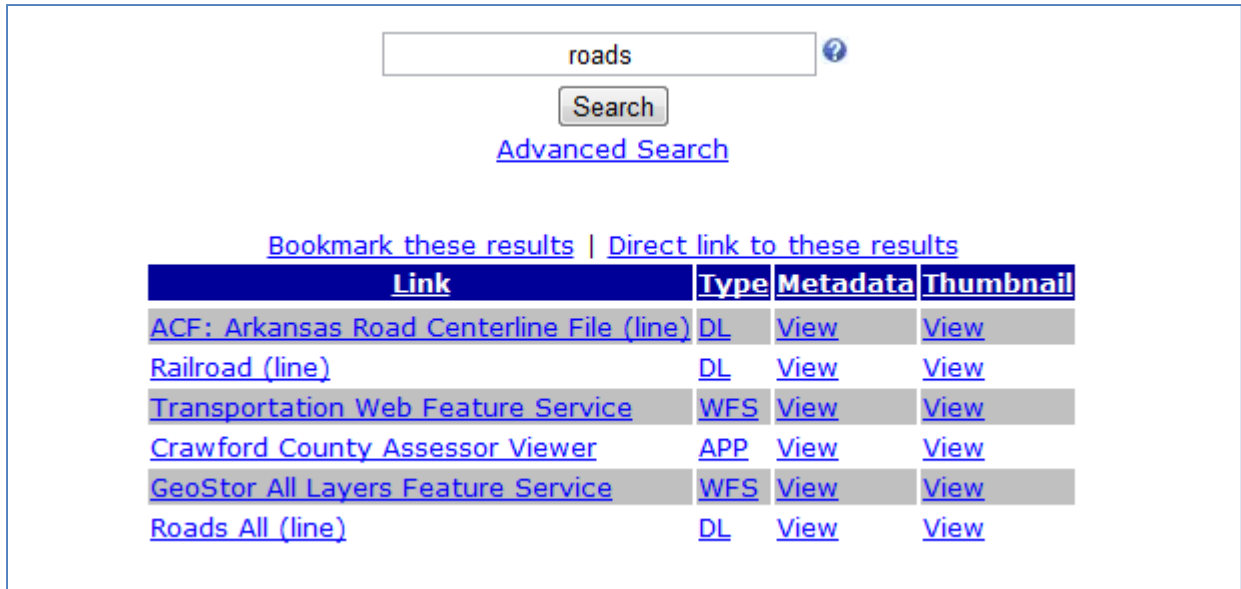
FIGURE 5: GEOSTOR SEARCH INTERFACE WITH SEARCH RESULTS

Data sets that are available for indirect download are accessed through the GeoStor search capability depicted in Figure 5. Any data set with a type of "DL" is downloadable via indirect download.

Supported download formats are:

Vector	Raster
Esri Shapefile	GeoTIFF
Vector Markup Language (VML)	ERDAS RAW
Scalable Vector Graphic (SVG)	ERDAS IMG
Microstation Design V8	GIF
AutoCAD DXF/DWG	JPEG
AutoCAD DWF	JPEG 2000
MapInfo TAB	Esri BIL
GIF Image	Esri ASCII GRID
GeoPDF	
Esri Personal Geodatabase	
Esri File Geodatabase	
Keyhole Markup Language (KML)	

3.3.2 Direct Download

GeoStor exposes the majority of its raster data holdings and a small set of key vector data sets via direct download. Direct downloads are enabled through the use of a File Transfer Protocol (FTP) server. This method does not support the search and customization capabilities of indirect download but does provide instant access to geospatial data.

Raster data sets that are available via FTP include USGS Quadrangle and other data sets that are not deemed too large to be downloaded in their entirety. Raster data sets are downloaded in their entirety, in their native formats and coordinate systems. Subsequent preparation and processing is the responsibility of the user.

Vector data sets that are available via FTP are only those that have been identified as critical by State emergency response agencies. These data sets are made available via FTP in Esri Shapefile format. Direct download of these data sets is made available as an alternate method in the event that the GeoStor indirect download capability is offline.

3.4 Ad-Hoc Mapping Services

Periodically, AGIO is tasked to perform spatial analysis and/or produce cartographic products in support of other State agencies, the Arkansas Congressional delegation, Executive or Legislative Branch of state government . These tasks are not specifically a core function of GeoStor but AGIO may leverage components of the GeoStor infrastructure, especially spatial data, to support them.

4.0 Application Inventory

The following applications are currently hosted by AGIO on the GeoStor platform:

Application Name	Client Technology
GeoStor Viewer	ESRI Javascript API
Arkansas House of Representatives Viewer	ESRI Javascript API
City of Hope Viewer	GeoStor Viewer
City of Jonesboro Viewer	GeoStor Viewer
Saline County Assessor Viewer	GeoStor Viewer
State Methamphetamine Statistics Map	GeoStor Viewer
State Network Status Map	Google Maps API
Streamlined Sales and Use Tax Online Lookup	None
ADEQ EnviroView	GeoStor Viewer
Arkansas Game and Fish Commission Viewer	ESRI Flex API
Arkansas Oil and Gas Commission Viewer	GeoStor Viewer
Arkansas Online Plat Retrieval System	GeoStor Viewer
Crawford County Assessor Viewer	None

5.0 Data Statistics

5.1 Vector

GeoStor currently houses 305 vector data sets. These data sets are stored in the Oracle RDBMS and managed using the ArcSDE middleware component of Esri ArcGIS Server.

Total size of these vector data sets is approximately 525 gigabytes.

5.2 Raster

Geostor houses most of its raster data in a file system, with a small number (approximately 60) of data sets housed in ArcSDE. Raster data sets include imagery, aerial photography, digital elevation models, land use/land cover, LIDAR and USGS Digital Ortho Quarter Quadrangle raster graphics.

The total size of these raster data sets is approximately 7.16 terabytes

6.0 Annual GeoStor Expenditures

Item	Current
Software	**$ 64,102.40**
Hardware	
Servers/Storage (5 year spread)	$ 50,000.00
Consumables/Replacements	$ 25,000.00
Hardware Subtotal	**$ 75,000.00**
Support	**$ 10,000.00**
Hosting	**$ 36,000.00**
Labor	
AGIO staff	$ 75,000.00
Labor subtotal	**$ 75,000.00**
GeoStor Total Annual Expenditures	*$ 260,102.40*

The total estimated annual expenditure related to GeoStor is $260,102.40. This total includes all software licenses, hardware (spread over a 5 year period), vendor support, hosting fees and staff labor.