



HEXAGON
GEOSPATIAL



EASILY UNLOCKING AND UTILIZING GEODATABASES

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Introduction

There are three types of Esri® Geodatabases.

Personal Geodatabase

Personal geodatabases are Microsoft Access based. They are intended for a single user working with small datasets and are limited in size to 2GB for the entire geodatabase.

File Geodatabase

Each geodatabase is held in a file folder, and each dataset is stored as a separate file on the disk. File geodatabases provide good performance and can scale to very large file sizes, up to one terabyte. They are extremely useful for data exchange.

ArcSDE Geodatabase

ArcSDE geodatabases manage spatial data within a relational database such as Oracle or SQL Server. ArcSDE geodatabases support a multiuser editing environment and can manage large datasets.

In addition to geodatabases, shapefiles are a time-tested method for data exchange. However, because today's projects are growing in size and complexity, technology is surpassing shapefiles' capabilities as a useful mechanism. The File Geodatabase (FGDB) format is becoming a better choice for data exchange, replacing shapefiles in modern data exchange workflows.

This paper discusses how the 2014 release of Hexagon Geospatial products, which include a new FGDB R/W dataserer, enables users to seamlessly work with Esri data in their workflows.

An Overview of GeoMedia® Technology

GeoMedia Desktop

GeoMedia is a powerful GIS management package that enables users to realize the maximum value of geospatial resources, integrating them to present clear, actionable information. It provides simultaneous access to geospatial data in almost any form, uniting them in a single map view for efficient processing, analysis, presentation, and sharing. GeoMedia's intuitive, dynamic analysis functionality enables concatenation of analysis processes so the results of one operation feed directly into the next process, as well as dynamic updating of results in response to data changes.

As an analysis tool, GeoMedia combines geographic data from different sources, in different formats, and with different map projections, all into a single view. With the addition of the new FGDB R/W dataserer in GeoMedia in the 2014 product release, GeoMedia users are now able to seamlessly incorporate FGDB datasets into their GeoMedia workflows.

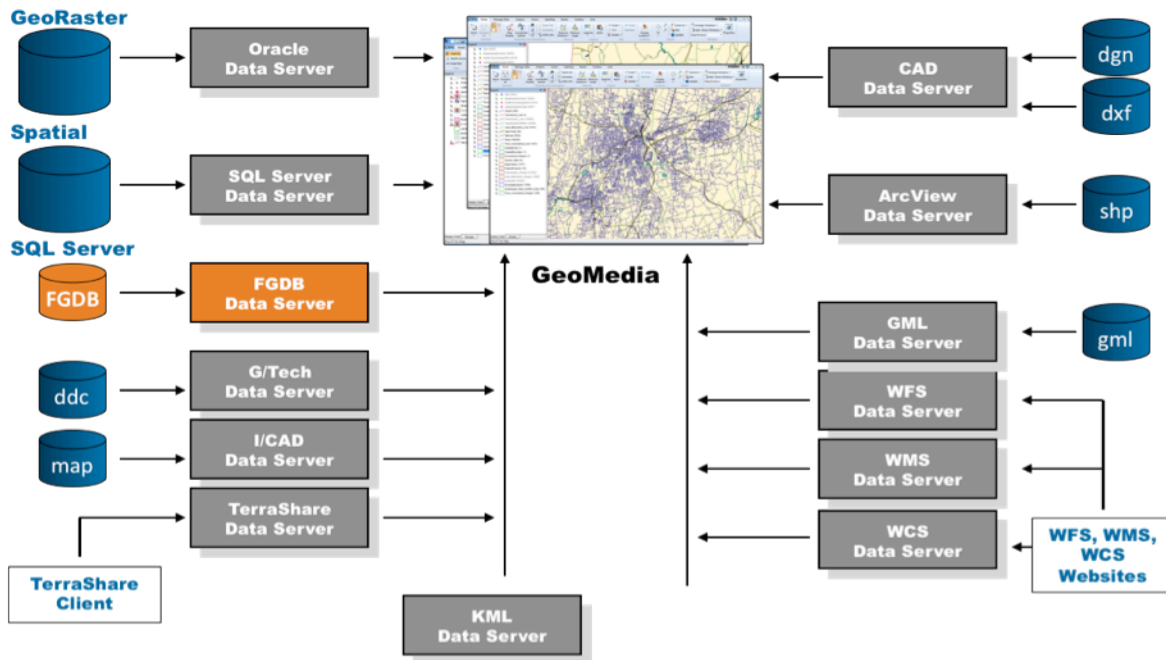
GeoMedia Smart Client

GeoMedia® Smart Client enables the entire organization to access and utilize rich geospatial data in their business processes. It delivers an enterprise geospatial platform engineered to support large numbers of users who need to operate full desktop products, but whose workflows need advanced geospatial functionality that cannot be supported by browser-based, web mapping tools. With GeoMedia Smart Client, a single deployment can be configured for an unlimited number of applications – making it the perfect GIS for a smarter organization. GeoMedia Smart Client provides:

- Focused Business Workflows – Rules definition and workflow configuration tools enable highly focused and efficient workflows without the need for expensive custom code.

GeoMedia Connectivity

New FGDB data server for File Geodatabase access in GeoMedia 2014



- Intuitive Interface – Simple interface configured for specific business workflows reduces training overhead while increasing productivity.
- Data Validation – Task-specific forms and workflows offer built-in data validation for quality assurance.
- Coordinated Data Access, Models, and Workflows – Better information sharing, coordination, and reuse prevents inefficiencies, errors, and risks that arise when departments work in data silos.

Connecting to Esri data sources

File Geodatabases (FGDB)

GeoMedia provides a rich environment for accessing a wide range of datasets to enable users to work seamlessly with data from multiple sources through dataserver technology. GeoMedia dataserver technology provides the necessary connectivity to the feature data warehouses that are needed in the execution of a project. With the 2014 release, GeoMedia incorporates an FGDB dataserver providing access to Esri FGDB files.

Architecture

The FGDB dataserver is similar to the other dataservers available in GeoMedia. It is implemented as a transactional dataserver, providing the ability to read and write existing feature sets conforming to the existing schema. Attribute fields and geometry can be edited through the GeoMedia FGDB dataserver.

Features

The GeoMedia FGDB dataserer has the following features:

- FGDB dataserer provides connectivity to File Geodatabase data
- Read access to FGDB files
- Transactional write¹
 - Attribute editing
 - Geometry editing
 - New geometry creation (with same attribution)
- Processing/display of Bezier curves and elliptical arcs²

Benefits

Benefits of FGDB connections:

- Seamless integration of FGDB datasets along with other data sources in GeoMedia.

Benefits of FGDB over shapefile for data exchange:

- Scalability
 - FGDB files are capable of storing very large datasets. FGDB datasets can be as large as 1 Terabyte. Shapefiles are limited to 2 Gigabytes. Utilizing FGDB format for data exchange enables users to handle larger projects without special planning and execution.
- Efficiency
 - FGDB files permit editing of multiple feature sets at the same time³ enabling a structured division of labor for expedient processing of large scale projects.
- Productivity
 - The use of FGDB files in place of shapefiles will result in efficiencies through a reduction of steps, resulting in faster turnaround for many workflows.

Multiuser Geodatabases

Multiuser Geodatabases are stored in relational databases such as Oracle or Microsoft SQL Server and rely on ArcSDE technology to support features not available in single-user (file or personal) geodatabases, such as versioning, replication and historical archiving. Multiuser geodatabases have a different set of system tables and a specific implementation for each supported DBMS.

There are three types of multiuser geodatabase (enterprise, workgroup and desktop), with variable storage capacity and number of possible concurrent users. Enterprise Geodatabases are the most robust of all the geodatabase types, and are intended for large-scale enterprise application scenarios. Workgroup and desktop geodatabases are implemented on Microsoft SQL Server Express, with preconfigured setup parameters. These

¹ Transactional write dataservers are not able to create new attribute fields (i.e. change schema).

² Bezier curves and elliptical arcs can be edited but will be stroked when saved back to the database.

³ Qualifying conditions apply.

are respectively intended for the small- to medium-sized departmental application scenarios, and to small teams or a single user who requires the functionality of a multiuser geodatabase.

A direct connection to a geodatabase is one that is made using the database management system's (DBMS) connection methods and direct-connect drivers in the client application. The connection is made directly from the client to the DBMS without the use of an ArcSDE service. When the direct connection to the geodatabase is used, most of the processes that would have taken place on the server are now going to take place on the client machines. Direct connections are also known as two-tiered connections and are currently the default and recommended connection mode by Esri.

Hexagon Geospatial products like GeoMedia, GeoMedia SmartClient or GeoMedia WebMap can connect to multiuser Geodatabases created and managed using the direct connection mode. To connect to the spatial and attributive data stored in multiuser Geodatabases, standard data server connections to the underlying geospatial database (Oracle or Microsoft SQL Server) can be used.

In case spatial data is stored in Esri specific binary formats, they should be primarily converted to the standard spatial storage types of the underlying database (Geometry/Geography in SQL Server, SDO_Geometry in Oracle), using ArcSDE administrative tools. Complex geospatial data rules, relationships, behaviors and models such as networks and topologies, stored in Geodatabase system tables are not supported.

Case Studies

The following case studies provide examples of how Hexagon Geospatial's dataserver technology enables organizations to seamlessly incorporate Esri data sources into their GIS workflows.

Workflow 1 – Public Safety: Computer-Aided Dispatch Basemap Update

Overview

To ensure quick and effective incident response, Public Safety organizations must have current and accurate maps available for use by dispatchers. Existing maps must be regularly updated to ensure that new roads, new or renamed streets, new buildings, and any other relevant changes are included in those updates and the resulting revised maps are made available onscreen to dispatchers through their Computer-Aided Dispatch System.

The workflow discussed here focuses on the map update cycle for a Computer-Aided Dispatch System, and the steps involved to complete the map update. A comparison is made between the workflow as it is done using shapefiles as the data exchange format and how that workflow will improve by moving to FGDB format for the data exchange.

Workflow

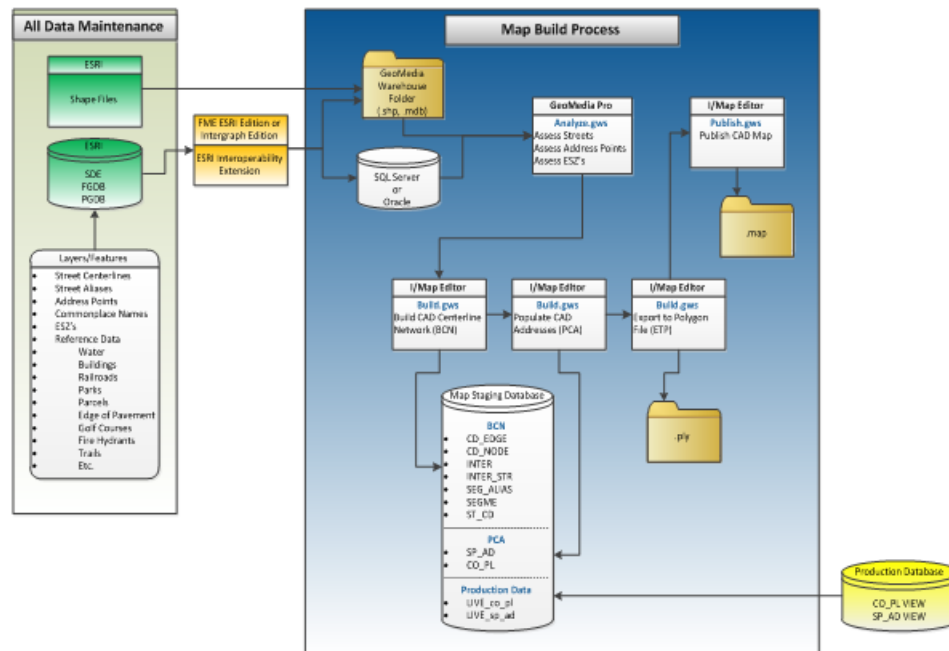
Shapefile-based Workflow

Workflow Steps:

- Esri ArcGIS with FGDB Source dataset
- Shapefile Conversion
- GeoMedia Professional
- I/Map Editor (an extension to GeoMedia)

- I/CAD: Intergraph Computer-Aided Dispatch system (not shown)

Common Map Building Workflow - Shapefile



1. The required source data is made available as an FGDB dataset.
2. The FGDB files are converted to shapefiles from the source data. They become the working dataset for the update project team.
3. The shapefiles files are accessed by GeoMedia and converted to a working database.
4. An analysis is performed on the data to detect and correct errors in geometry.
5. Analysis is done on the attribution to ensure that it conforms to standards.
6. As errors are found in steps 4 and 5, they are logged and communicated back to the GIS department where the corrections are made.
7. A new FGDB dataset is generated.
8. The FGDB files are converted to shapefiles. They become the updated dataset for the update project team.
9. The analysis continues on the data to ensure there are no further errors in geometry.
10. Analysis continues on the attribution to ensure that there are no further errors.
11. I/Map Editor uses the shapefile data to create a new I/CAD map staging database with street centerline and address point data.

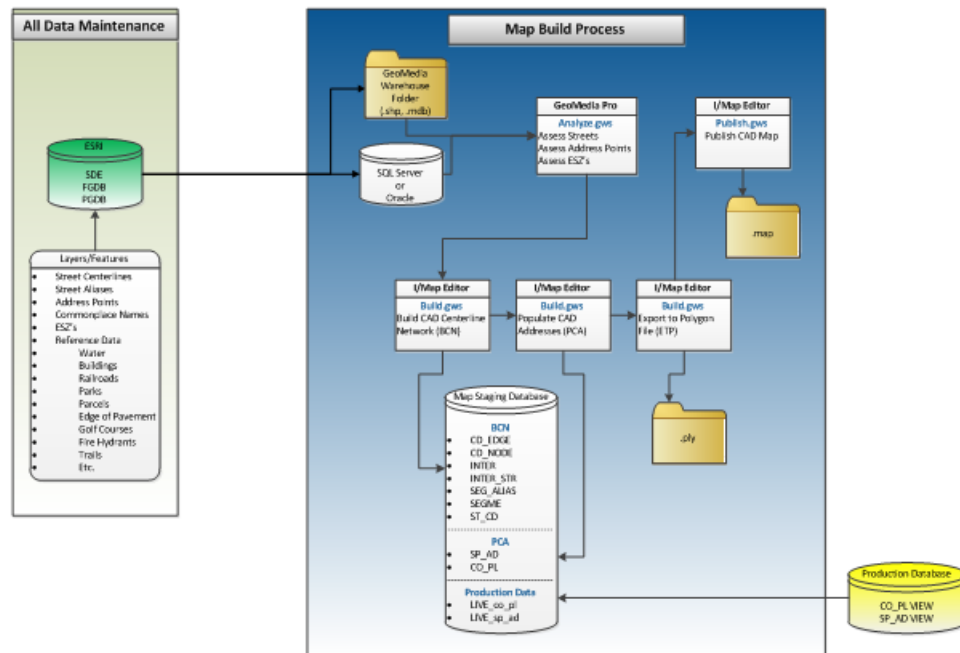
12. Emergency Service Zone checks are done by I/Map Editor.
13. Once all preparation steps are completed, I/Map Editor creates a new .map file for the I/CAD system.
14. The new map file is run through test cycles to ensure quality.
15. When testing is completed, the I/CAD System base map is replaced with the new, updated base map.

FGDB-based Workflow

Workflow Steps:

- Esri ArcGIS with FGDB Source dataset
- GeoMedia Professional
- I/Map Editor
- Intergraph Computer-Aided Dispatch system (not shown)

Common Map Building Workflow – FGDB



1. The required source data FGDB files are delivered by the GIS department to the Public Safety organization. They become the working dataset for the update project team.
2. FGDB files are accessed by GeoMedia through a Read/Write connection.
3. An analysis is performed on the data to detect and correct errors in geometry.
4. Analysis is done on the attribution to ensure that it conforms to standards.

5. As errors are found in steps 3 and 4, they can be corrected on the working FGDB dataset and work continues.
6. I/Map Editor uses the FGDB data to create a new I/CAD map staging database with street centerline and address point data.
7. Emergency Service Zone checks are done by I/Map Editor.
8. Once all the preparation steps are completed, I/Map Editor creates a new .map file for the I/CAD system.
9. The new map file is run through test cycles to ensure quality.
10. When testing is completed, the I/CAD System base map is replaced with the new base map.

Benefits

- File Geodatabase is a more efficient format for data exchange between the GIS department and the Public Safety organization.
- Productivity gain over previous projects resulting from the direct use of FGDB files in place of Shapefiles. The Shapefile to FGDB conversion step is eliminated.
- Work could be divided up and assigned to multiple users for larger projects, leveraging the multi-user capabilities of FGDB datasets.
- The seamless incorporation of FGDB files into the I/CAD Basemap workflow along with the FGDB R/W capability of GeoMedia provides immediate updates to the project database during an update cycle, dramatically reducing the error correction time. Previous updates had to be cycled through the GIS department and turnaround time could be days.
- Bezier curves and elliptical arcs are supported as stroked geometry in the FGDB dataserver. These geometries were previously not processed in Shapefile format by GeoMedia, creating another workflow inefficiency as offline methods had to be deployed to address the requirement to provide stroked data to the I/CAD system.
- The FGDB workflow demonstrated is capable of scaling allowing large datasets, well beyond the 2GB limit of Shapefiles.

Additional Products Included in this Workflow Discussion

Intergraph Computer-Aided Dispatch

Intergraph's geospatially powered Computer-Aided Dispatch software ensures dispatchers have the right tools to field calls, enter and update incident details, and manage critical resources. It combines an interactive, real-time map display with call-handling, dispatch, records management, commercial intelligence data, and mobile technologies to bring you life-saving information when you need it.

I/Calltaker and I/Dispatcher form the core of the solution. I/Calltaker answers calls, verifies locations, enters precise incident data, and forwards calls to control-room dispatchers. Automatic feeds from alarm systems and ANI/ALI controllers, combined with the display of geographical location, address, and other information, allow call-takers to rapidly identify where an incident is happening. The software further provides structured questions that guide call-takers through specific situations to help them quickly assess and prioritize calls. I/Dispatcher adds resource management to I/Calltaker, so dispatchers can dispatch units and resources, and monitor incident status. Using the integrated map display, I/Dispatcher recommends resources based on incident and vehicle location, drive time, unit type, officer skills and availability, and other factors. Mobile technologies bring feature

rich dispatch and query capabilities from laptops, tablets, and smartphones. All these features instill confidence that organizations have the right information on hand to help save lives.

I/Map Editor

Intergraph's I/Map Editor brings advanced mapping features to Intergraph's map build and editing environment, automating and streamlining map creation and maintenance. It provides a unified toolset to create CAD maps and import data from industry standard geographic information systems (GIS) formats. With I/Map Editor, you can build and edit road networks, maintain address points, create polygons for emergency service zones, and maintain graphic features. Built on Intergraph's widely used GeoMedia® Professional geospatially powered mapping software, I/Map Editor streamlines workflows to create and maintain the CAD network and map files, so you have access to critical updates. Leveraging all the power of the GeoMedia platform, it lets you use GIS data from third-party systems as the source of map graphics for Intergraph Computer-Aided Dispatch.

Workflow 2 - Transportation: Web-based Workflow

Overview

Many state Departments of Transportation (DOT) have long-standing implementations of their roadway information management systems that began as a client/server application, and relied heavily on restricted access to a few qualified individuals, to gain access to road network GIS information. Today, many of these systems have been extended or evolved into a web-based mapping solution. The web-based solution serves a much wider audience, beyond a few specialists, with the ability to include internal DOT employees, federal, state, and local government agencies, as well as DOT contractors. Publicly available online services are also available; however these are not the focus of this document.

The tenet of any web-based solution is to allow users to quickly formulate queries on roadway information, with results displayed in both map and report formats. They typically include query building, viewing, mapping, and report generation functions for all those who have access.

At the heart of such web-based systems is a GeoMedia® WebMap server implementation customized to meet the requirements for serving the subscribed user base.

GeoMedia WebMap 2014 incorporates the capability to read FGDB data. With the size and complexity of data continually increasing, many organizations are producing datasets in this format. The new FGDB capabilities in GeoMedia WebMap 2014 help to easily utilize this data.

Workflow

Workflow Steps:

- Source Geospatial database
- GeoMedia
- GeoMedia WebMap
- Customized application built on GeoMedia WebMap
- Incorporate new FGDB source data

1. The typical user is a DOT power user performing an analysis on the state's roadway network in support of business functions.
2. The users perform analyses through a series of queries on the system.
3. Visual observation may be all that is necessary, in which case, the process ends.
4. In many cases however, the results of the analysis need to be exported and delivered outside the DOT organization to another state department or to a third party contractor. In this case, the results are exported as shapefiles.
5. Often the analysis results in a very large data set. In this case the data is exported as shapefiles, as long as the file size is within limitations. The situation is handled as a special case off-line using a dedicated workstation (i.e. running GeoMedia).
6. New data, or data updates, may become available that will greatly improve overall analyses being performed. More often this data is available in FGDB format as a first option.

Benefits

1. The value of geographic information is increased by publishing on line, providing employees, and business partners fast and easy access to geospatial data and analysis tools.
2. File Geodatabases are an emerging data exchange format and their availability is trending upward. The ability to read FGDB data directly enables organizations to incorporate this emerging format into their on line systems and take advantage of any updated data that can benefit their user base.
3. Accessing and analyzing geospatial data anywhere, anytime, enables users to consider up-to-date information quickly, improving overall productivity while assisting in well-informed decision making.

Products Included in this Workflow Discussion

GeoMedia WebMap

GeoMedia WebMap supports a broad range of users needing to visualize and examine geographic data online. From easily creating web services and interactive web mapping applications, to providing sophisticated, Web-based visualization and analysis of an enterprise's valuable geographic information, GeoMedia WebMap enables users to build powerful geospatial web applications that securely share an organization's geospatial data.

GeoMedia WebMap enables direct development of interactive web maps using the configuration and application creation tools provided in GeoMedia itself. You can configure the layout of your web interface, as well as user-defined queries and other components, and provide direct, real-time access to your geospatial data. Users can simultaneously access multiple geospatial formats and view, query, and analyze geospatial data with no pre-publishing or translation required.

Workflow 3 – Municipal Planning & Management: Smart Workflows

Overview

Most public organizations at a regional and municipal level, have the need to share information between different departments, to integrate activities such as urban planning or utilities asset inspection and maintenance.

Web based geospatial solutions are a common cost-effective approach to disseminate data across such organizations. Many of the municipal planning and management business workflows require editing capabilities in online and offline mode, which are more challenging for typical web-based geospatial solutions.

For such systems, the core product is GeoMedia SmartClient, a web solution that integrates the common capabilities of a standard Web GIS solution, with the editing tools typically only available in desktop software packages. It also offers the possibility to easily configure business specific and highly-productive, map-based workflows.

With Hexagon Geospatial technology, spatial data stored in a central repository, including multiuser geodatabases, can be shared between different applications and systems, improving collaboration and communication between departments. GeoMedia SmartClient workflows can be used to manage and update the organization's data repository. With task-specific forms and pre-built data validation tools, Smart Client assures data quality and high levels of productivity.

Workflow

Workflow Steps:

- Common Source Geospatial database
 - Incorporate new Geodatabase source data
 - GeoMedia
 - GeoMedia SmartClient project with dynamic workflows
1. Users from different departments typically need to view spatial data from all thematic domains, but should only be allowed to change features related to their field of expertise.
 2. By storing geospatial data using native database spatial types and managing its integrity in a common central repository, many disparate applications and software packages can access and manipulate the geospatial data. Using standard Oracle and SQL Server data servers, GeoMedia and GeoMedia SmartClient can connect to multiuser geodatabases that have been created by using the ArcSDE direct connection option.
 3. The configuration of the contents, legends and styles to be used on the Web-Solution is done in GeoMedia.
 4. Feature Classes and tools that should be available for each user group, according to their roles and responsibilities, are defined in SmartClient's web-based Administration Console.
 5. Through the configuration and deployment of workflows across the organization, each user will have access to task-specific forms, providing all the necessary information to carry on their job, collecting, updating or validating data in a guided way, without compromising accuracy or productivity.
 6. As soon as the information is submitted, the central data repository is automatically updated, and data becomes available to all users and systems across the organization.

Benefits

1. **Increase the value of geospatial data** - The value of geographic information is increased by providing all users fast and easy online access to geospatial data and by providing advanced editing and analysis capabilities, normally not available on the web solutions, but without the complexity inherent to desktop solutions, which are intended for the advanced and technical GIS professional.
2. **Incorporate disparate data sources** – Data server technology allows direct connections to geospatial databases enabling organizations to incorporate the information they already have (including multiuser

geodatabases) into their online systems, and allowing the dissemination of any updated data to other systems sharing the same repository.

- 3. Easily deploy tailored map-based workflows in a single platform** - GeoMedia Smart Client provides a single deployment platform that can be configured for an unlimited number of applications without the need for developing and maintaining extensive and expensive custom code – making it the perfect GIS for a smarter organization.
- 4. Facilitate decision-making** - Accessing and analyzing geospatial data anywhere, anytime, enables users to consider up-to-date information quickly, improving overall productivity while assisting in well-informed decision making.
- 5. Work offline** - This solution also provides the possibility to work in offline mode, e.g. to perform field inspections, and upload the data edits after reconnecting to the network and restarting GeoMedia Smart Client.

Summary

The case studies in this document highlight how File and Multiuser Geodatabases can be accessed, utilized, and seamlessly incorporated for scalability, efficiency, and productivity in Intergraph cross-product workflows.

In addition to the Geodatabase access capabilities for GeoMedia, GeoMedia WebMap and GeoMedia Smart Client described in this document, ERDAS IMAGINE[®], also supports access to Geodatabases.

GeoMedia WebMap 2014 leverages FGDB datasever technology for read only access to FGDB datasets for incorporation into web-based workflows.

GeoMedia Smart Client 2014 can read FGDB datasets and read and write multiuser geodatabases with smart workflows.

ERDAS IMAGINE access to FGDB data is through the installation of a Geodatabase Support module. When installed, ERDAS IMAGINE users can connect and bring FGDB data into ERDAS IMAGINE. ERDAS IMAGINE also has built in support for ArcSDE Geodatabases.

About Hexagon Geospatial

Hexagon Geospatial helps you make sense of the dynamically changing world. Known globally as a maker of leading-edge technology, we enable our customers to easily transform their data into actionable information, shortening the lifecycle from the moment of change to action. Hexagon Geospatial provides the software products and platforms to a large variety of customers through direct sales, channel partners, and Hexagon businesses, including the underlying geospatial technology to drive Intergraph® Security, Government & Infrastructure (SG&I) industry solutions. Hexagon Geospatial is a division of Intergraph® Corporation. For more information, visit www.hexagongeospatial.com.

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