

Applied Generalization & MRDB for Mapping Agencies using Open, Geospatial Clients

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Abstract

Intergraph was a pioneer of generalization research in the 1980's supplying the first off-the-shelf, commercial generalization product, MGE Map Generalizer, in 1992. Since that time, it has supplied generalization tools and algorithms in other commercial applications. In 2007 and 2008, Intergraph's Security, Government and Infrastructure (SG&I) division launched two new GeoMedia-based products, GeoMedia Fusion and GeoMedia Map Publisher. GeoMedia is Intergraph's enterprise-wide, desktop geospatial product for data management, analysis, collaboration, and dissemination of geospatial data. It is based on open standards, including the OGC standards WMS, WFS, WFS-T, WCS, and ISO standards such as the metadata catalogue ISO-19115. GeoMedia Fusion is Intergraph's solution for integrating disparate data sources into a single enterprise database, using functionality such as conflation, data validation and schema remodelling. GeoMedia Map Publisher is Intergraph's offering for building and maintaining cartographic databases, related to source data or digital landscape models (DLMs), for the purpose of generating cartographic products, both hardcopy and digital. All of these products support regional, national and military mapping organizations. In addition, Intergraph has announced plans to support the Europe's Spatial Data Infrastructure (SDI) initiative, INSPIRE, using thin and smart clients.

The purpose of this presentation is to highlight Intergraph's plans for implementing generalization in three areas: 1) model generalization for GeoMedia Fusion, 2) cartographic generalization for GeoMedia Map Publisher and 3) web services using service oriented architecture (SOA) to support Europe's INSPIRE initiatives.

Implementation

Intergraph has a long history of developing generalization functionality dating back to 1986. Recently, Intergraph has attempted to partner with other companies to augment its legacy generalization functionality with new research and functionality made available in the 1990's through 2005. For various reasons, the partnerships have failed to produce a generalization solution based on GeoMedia technology.

Intergraph recently concluded it would implement generalization capabilities, without a 3rd party partner, across three of its applications, GeoMedia Desktop, GeoMedia Fusion and GeoMedia Map Publisher. In addition, using service oriented architecture (SOA), the generalization functionality will be available in GeoMedia Web-based products to support INSPIRE initiatives and directives.

The implementation will begin by redeveloping the algorithms from Intergraph's DynaGen product using GeoMedia's expression system and pipe technology. Expressions are based on functions which operate on feature geometry and attributes, one feature record at a time. Expressions consist of logic, allowing users to customize GeoMedia functionality. Custom functions, developed by users, can be added to the list of functions, made available out-of-the-box with GeoMedia. GeoMedia currently delivers over 150 functions. GeoMedia already delivers algorithms for collapsing areas to points as functions. Additional algorithms, specifically those for simplification and smoothing will also be developed as functions and delivered in the core GeoMedia desktop product. Any algorithm, based on a single geometry is a candidate for a new function in GeoMedia. Of course, given the research on generalization available, it is no longer appropriate to refer to processing of a single feature's geometry as generalization. Generalization needs to be performed given some contextual information.

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The next layer of generalization work will be for the purposes of model generalization within the GeoMedia Fusion product. GeoMedia Fusion is Intergraph's product for building digital landscape models. Fusion accesses various formats of data through GeoMedia's data server technology. Fusion has developed functionality to perform extensive feature geometry and attribute validation, schema remodelling and conflation in order to build appropriate DLM's. Generalization functionality will be added to Fusion for customers that require DLM's at multiple scales or when their source data is at a scale larger than the preferred DLM. GeoMedia's pipe technology allows GeoMedia Fusion to concatenate generalization algorithms, along with any other geoprocessing functionality, such as schema remodelling, conflation, and including any analytical geoprocessing available in the GeoMedia desktop product, into pipelines. For instance, a pipeline could consist of performing analysis across all data sources to select features given spatial relationships, conflating two area features from different data sources, smoothing and simplifying the resulting area, collapsing the area to a point, and then mapping the attributes of the area (or point) onto the DLM schema. All pipelines could be stored for later use or provided to other users for reuse. Graphical interfaces will be available in GeoMedia Fusion so users can provide algorithm parameters and test the results prior to availability to other users.

Pipeline technology can only provide limited results when it comes to cartographic generalization. Iterative and optimization algorithms provide a much better platform for increasing the levels of automation. GeoMedia Map Publisher is Intergraph's product for creating cartographic databases and series map production. Map Publisher has a rule-based approach for detecting style conflicts and spatial relationships which can be used to perform such operations as displacement, suppression of styles along feature segments, orientation of point styles or replacement of styles. Map Publisher uses a cartographic database to store the results of these automated processes. Additionally, any interactive editing of geometry or attributes can be stored in the cartographic database, creating a digital cartographic model (DCM). All cartographic editing, whether it is automated or interactive, is related back to the DLM. Map Publisher allows the user to distinguish cartographic source from cartographic edits within a single map view.

The implementation of generalization as GeoMedia functions and pipes will need to be reapplied for GeoMedia Map Publishing within an iterative environment in order to achieve acceptable cartographic generalization results. Intergraph has had some past experience with object-oriented, iterative and optimization techniques in past map production systems. Some Intergraph partners also use these techniques to achieve high level of automation and productivity in similar applications.

All development for Intergraph's desktop applications must be reusable in a thin, smart, or web browser environment as well. Generalization functionality will be built as services using service oriented architecture (SOA) and open interfaces such as WPS from the OGC. The primary beneficiary of this effort will be the European Union community working on INSPIRE initiatives and directives. Intergraph has one project already underway, called GIS4EU. The GIS4EU project aims at providing base cartography datasets (administration units, hydrography, transportation networks and elevation themes) for Europe, and to ensure its cross-scale, cross-language and cross-border interoperability and accessibility according to International Standards and INSPIRE requirements. The principal objective of GIS4EU project is to enable the access to consistent and homogeneous reference data provided by cartographic authorities from different countries and levels (national, regional and local) without building one central database and service. The proposed approach is based on development of common data model, the rules and guidelines for harmonization, aggregation, and exposition of geographic data. These guidelines and procedures will be defined with respect to existing International Standards, European legal acts and INSPIRE Implementing Rules. INSPIRE Generic Conceptual Model (INSPIRE DS-D2.5) identifies several aspects or components of data and services harmonization. Of particular significance in reference to generalization is the component of multiple representations. In short, this component will describe best practices how data can be aggregated across time/space and different resolutions ("generalization" of data).

Summary

Intergraph has a long history with generalization research and development. In recent years attempts to implement generalization solutions using partnerships have not been successful, leading to decisions to

once again design and development generalization functionality directly into the GeoMedia products. Three desktop products, GeoMedia, GeoMedia Fusion and GeoMedia Map Publisher will provide the delivery methods for generalization. GeoMedia architecture will provide the basis of the development; GeoMedia Fusion will offer functionality for implementing model generalization, with GeoMedia Map Publisher offering cartographic generalization possibilities. All generalization functionality will be developed using service oriented architecture and open interfaces such as WPS from OGC, for reuse in web environments, to support INSPIRE directive and initiatives. As Intergraph progresses in these efforts additional details on architecture and experiences for developing generalization solutions for model and cartographic generalization will be made available.

References

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