

# Interoperability of Agent-based Generalization with Open, Geospatial Clients

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## Introduction

Laser-Scan and Intergraph are each well known for their generalization solutions and products within the mapping and cartography communities. Laser-Scan first entered the marketplace with their generalization solution based on the LAMPS2 product line. LAMPS2 was used and enhanced extensively during the AGENT project from 1997 to 2000 and is now being followed with Laser-Scan's own MAGNET program in which the latest product offering is Clarity. Intergraph's first product offering, Map Generalizer, was based on their Modular GIS Environment (MGE) product line. MGE Map Generalizer was introduced in 1992 and later followed with the Dynamo-based, DynaGen product, which is still being offered, and supported today.

National and regional mapping agencies, commercial map producers and university researchers around the world have come to know and appreciate the generalization solutions offered by both Laser-Scan and Intergraph. Each company continues to lead the industry with innovative ideas and solutions in the challenging and highly expert area of generalization.

Laser-Scan and Intergraph are working on an interoperable solution to progress the area of generalization. The companies will bring together their software modules to develop a generalization solution. The solution will be offered to every national, regional and commercial map producer, which needs to generate hardcopy or softcopy mapping products or digital databases at multiple scales from larger scale source data. Researchers will find the solution appealing due to the vast amounts of functionality available off-the-shelf and its flexible software development environment that promotes algorithm customization and development and provides real-time, what-if feedback.

This purpose of this paper is to announce the collaboration on generalization between Laser-Scan and Intergraph and to propose the system architecture for the solution.

## Solution Architecture

The Laser-Scan/Intergraph generalization solution as shown in figure 1, is based on the classic 3-tier architecture that promotes interoperability. The architecture separates the business logic from the data and presentation layers, which allows the distribution of services across multiple processing environments, and access from a variety of client applications.

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## Generalization 3-Tier

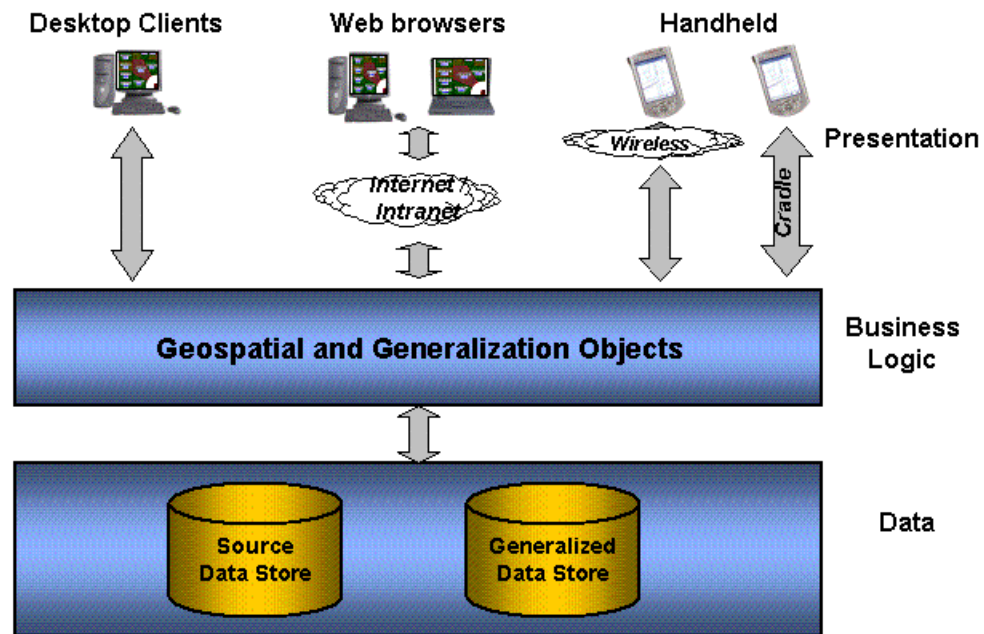


Figure 1

The Laser-Scan/Intergraph solution will use the best that both companies have to offer in the areas of generalization and geospatial capabilities. The data layers will be accessed using GeoMedia's data server technology, which can connect to a variety of different data sources. GeoMedia Professional and GeoMedia WebMap will be the client applications for viewing the source and generalized feature data. Clarity and its components of AGENT and GOTHIC will be the foundation for the generalization algorithms. Figure 2 details the physical components within the architecture.

# GeoMedia – Clarity Architecture

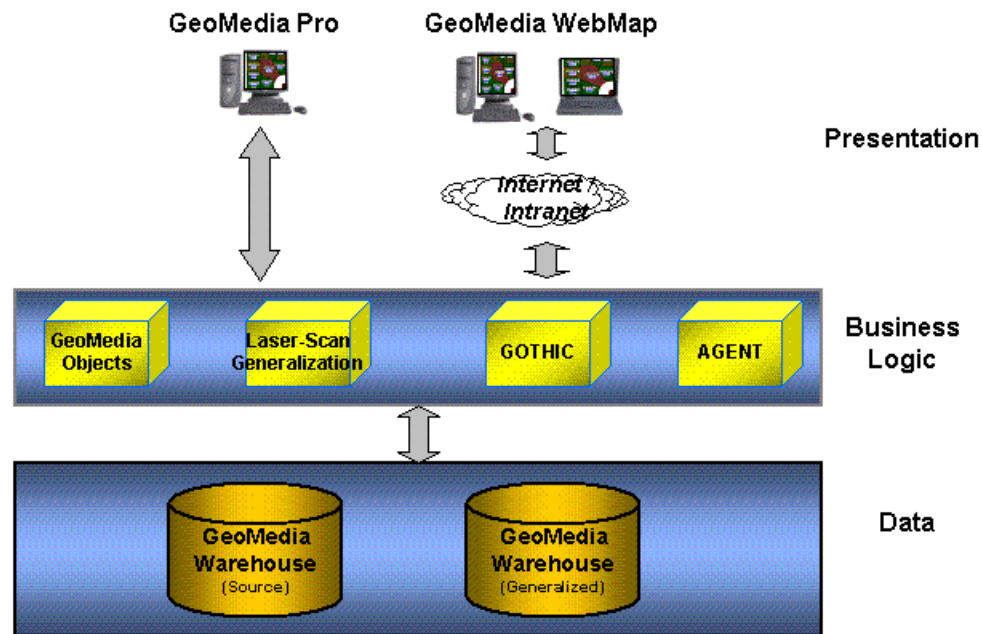


Figure 2

## Laser-Scan Architecture Components

Gothic is a complete suite of technologies based on the Gothic geo-processing server and comes with a development environment. Gothic offers fully customizable, object-based data modules and behaviours, the ability to dynamically generate, maintain and analyze topological relationships as the data model is modified, self-validating dataset to ensure data integrity at all times and the ability to handle large and complex datasets.

Clarity is a Gothic-based spatial data processing environment for generalization. It comes with off-the-shelf generalization algorithms and, because it is built with Java, users can create and customize generalization flowlines easily.

The AGENT system uses agents, which are objects that control themselves in order to improve each of their cartographic appearances. Each agent can be described by a set of rules or characteristics, known as constraints. These constraints are used when an agent is set to evaluate itself. If the constraints are not met, they propose algorithms or plans to apply to the agent. The agent system is optimized for contextual analysis, i.e. agents analyze all features in their environment not just individual objects. Groups of agents can collaborate to optimize the overall appearance of larger groups of features. Together these capabilities allow an adaptive output-driven approach to generalisation that can routinely handle spatial data with a high degree of complexity. The entire process is known as the agent lifecycle, and is fundamental to the core of the AGENT system within Clarity.

AGENT (Automatic GEneralisation New Technology) was a European Commission funded project (ESPRIT 24939), set up to develop new techniques for generalisation. Laser-Scan joined the multi-national consortium as the software supplier. Other members included Institut Géographique National (IGN) in Paris and the universities of Zurich, Edinburgh, and Grenoble.

## Intergraph Architecture Components

GeoMedia® provides true data integration. It enables you to bring data from disparate databases into a single GIS environment for viewing, analysis, and presentation. No translation of data is required. Problems with redundant and out-of-date data are avoided, because the data is always accessed from the source. GeoMedia's data server technology supports open standards, providing direct access to all major geospatial/CAD data formats and to industry-standard relational databases. GeoMedia provides a full suite of powerful analysis tools, including attribute and spatial query, buffer zones, spatial overlays, and thematics. The data server technology allows a user to apply analysis across multiple geospatial formats. GeoMedia can perform what-if by stringing together multiple operations in an analysis pipeline. Changing any of the data along the pipeline automatically updates the results. Finally, GeoMedia's layout composition tools give you the flexibility to design maps to meet unique needs. Using easy-to-use, standard tools, you can create aesthetically pleasing maps with quick turnaround time when necessary, or focus on high-quality cartographic output.

Like GeoMedia, GeoMedia WebMap, Intergraph's Web-based map visualization and analysis tool, provides real-time links to geospatial data warehouses. It maximizes the value of geographic information by publishing it on the Web. GeoMedia WebMap includes location-based Web services that enable integrated systems to take advantage of geospatial analysis, routing, and geocoding. GeoMedia WebMap also offers visual authoring functionality.

DynaGen automates the generation of map products at varying scales from a single high-resolution database, providing cost savings in long-term data maintenance. It offers a large number of operators and algorithms for generalization of feature geometry for the purpose of either the reduction of data or for cartographic presentation. Dynamic displays enable the user to see the results of the generalization before committing the changes and generalization parameters may be saved for reuse later and organized for batch processing. Because it is based on Dynamo, DynaGen validates all generalization against user-specified checks to ensure that changes do not violate topological and real world feature-to-feature relationships. Lastly, DynaGen even calculates and updates attribute information for modified or newly created generalized features.

## Solution Development Approach

Laser-Scan and Intergraph plan to develop a feasibility prototype of the solution. Figure 3 depicts the prototype architecture and high-level dataflows.

# GeoMedia – Clarity Prototype

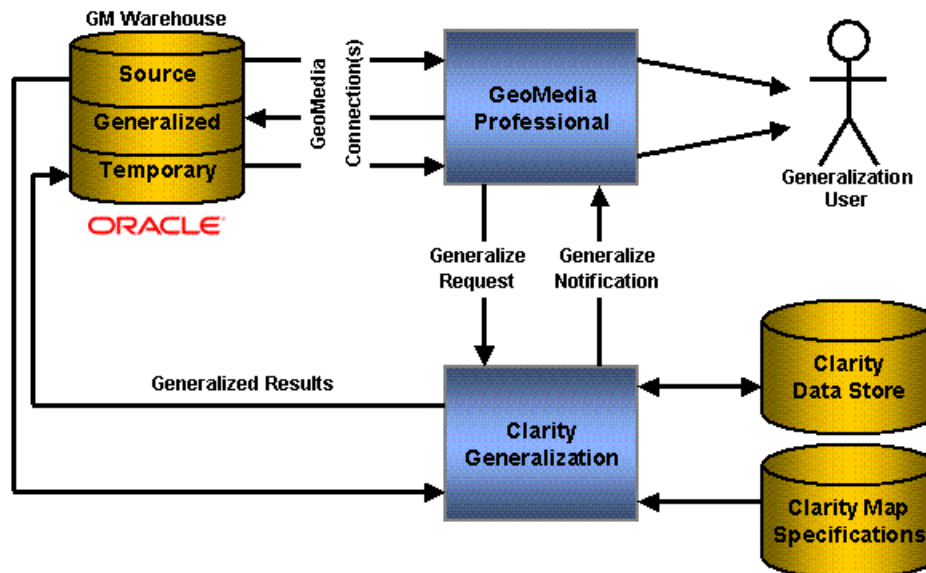


Figure 3

An Oracle warehouse is used as a repository for both source and generalized data. A temporary datastore is used to hold generalized data until the generalization results are reviewed and approved. At that point, the temporary data is committed to the generalized data, similar to a transaction-processing environment. Clarity will be used as a server application using data stores and configuration data as required. GeoMedia Professional will be the client application for user to interact with the source and generalized data.

## Conclusions

Laser-Scan and Intergraph are working to bring together the best generalization technology and best geospatial technology available today in the marketplace. With a collaborative approach and using interoperability principles of open standards-based data exchange, significant advances can be made in the field of generalization.

## References

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