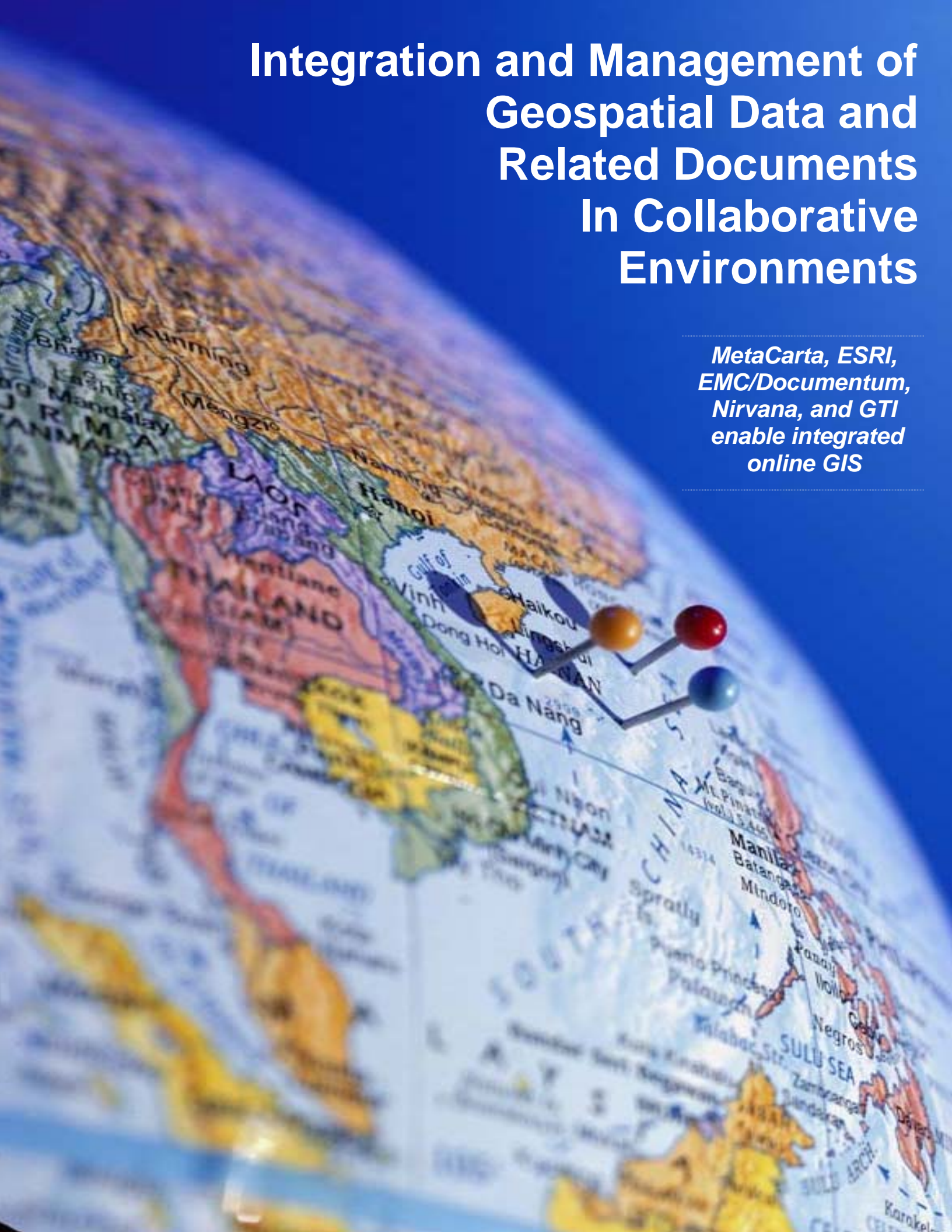
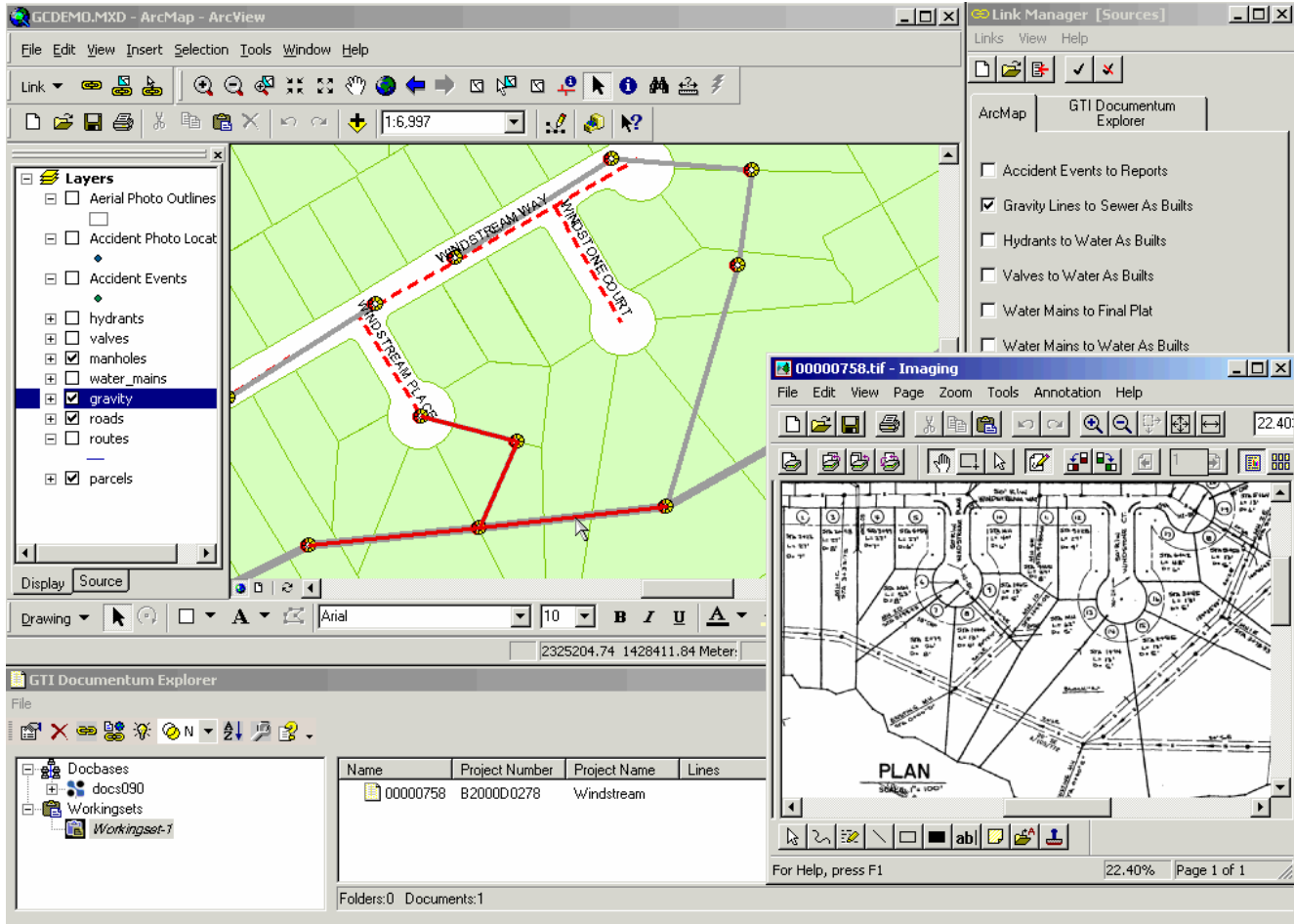


Integration and Management of Geospatial Data and Related Documents In Collaborative Environments

MetaCarta, ESRI, EMC/Documentum, Nirvana, and GTI enable integrated online GIS





Message

This document is intended for those involved in the capture, management and use of GIS map data and related documents in complex environments. The proposed solution offers easy access to content referenced to specific geographic locations integrated for display with maps, and enables more comprehensive, enterprise-wide or even cross-enterprise implementations.

EMC has initiated a collaborative integration of GIS capabilities among the leading providers of software function related to geospatial information. These companies have teamed to provide a wide range of capabilities specific to virtually any client requirement, in virtually any existing or desired configuration. This coordinated offering includes the combined function from five leading software companies, and addresses the integration of non-

structured content documents with maps in multi-location, heterogeneous working environments.

Solution Elements

EMC/ Documentum, ESRI, GTI, MetaCarta and Nirvana have teamed to provide a market-specific solution for the integration of non-structured documents with maps to simplify work effort, enable collaboration, increase operational efficiency and provide a greatly expanded ability to locate and use pertinent information for geographically-referenced documents. The participating software companies and the products provided by each – the solution elements - are described briefly below:

ESRI is the world's largest provider of GIS software and services and offers a framework for implementing GIS technology in any organization with a seamless link from personal GIS on the desktop to enterprise-wide GIS client/server and data management systems.

Documentum software from EMC Corporation includes enterprise content management solutions that enable organizations to unite teams, content, and associated business processes. With a single platform, Documentum enterprise content management software enables people to collaboratively create, manage, deliver, and archive the content that drives business operations, from documents and discussions to e-mail, Web pages, records, and rich media.

MetaCarta, a provider of geographic intelligence solutions, provides users with map-driven geographic search, geographic referencing, and data visualization capabilities. MetaCarta products make data and unstructured content "location-aware", making that information geographically relevant. These innovative solutions make it possible for customers to discover, visualize, and act on important location-based information.

GTI delivers a broad range of technical services including GIS application design and programming, document management implementation, systems integration, project management, system optimization, staff augmentation, and a full range of supporting services. Enterprises manage data in

three fundamental forms – tabular databases, maps, and documents. GTI's integration products bridge from each of these basic data types to the others, providing users integrated access to the information they need regardless of its form.

PlaceLynx™ for ESRI GIS integrates ESRI GIS products with document management and database management systems.

EMC is the world leader in products, services, and solutions for information storage and its management. EMC helps enterprises of all sizes manage their growing volumes of information - from creation to disposal - according to its changing value to the business through Information Lifecycle Management (ILM) strategies. EMC information infrastructure solutions are at the heart of this mission, helping organizations manage, use, protect, and share their information assets more efficiently and cost effectively. EMC's world class solutions integrate network storage technologies, storage systems, software, and services.

Nirvana SRB enables a unified view of logically-related data spread across heterogeneous environments, enabling discovery, presentation, and management of diverse data collections within a global namespace. Developed in a joint effort with the San Diego Supercomputing Center since 1995, SRB has formed the foundation for over 150 of the world's most advanced and demanding collaborative projects among networked institutions. The key contribution of SRB in this integrated solution is to quickly and easily enable a unified logical view of all data within an environment designed for this purpose of geospatial and document data access.



The Integration Challenge

From small map producers to large government agencies, GIS organizations struggle with the rapid growth and increasing complexity of large-scale GIS implementations. Both structured GIS data and unstructured documents with geospatial references are often distributed among several offices and different data repositories, as well as on a variety of storage devices and systems, and in an array of data types.

The users of GIS data struggle to find the required images, maps, relational data, and associated documents among several distributed and incompatible data repositories.

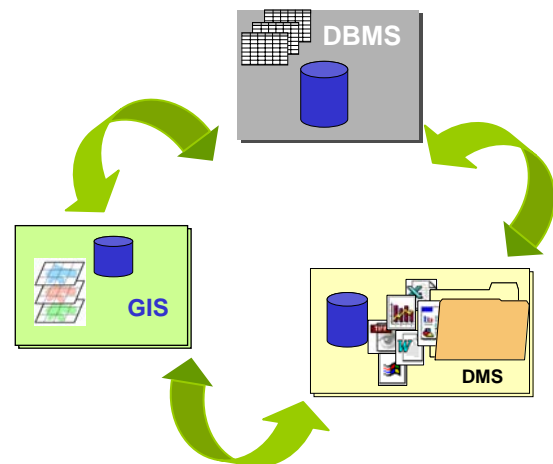
The administrators of GIS data do not have a good understanding of all the data needed for effective collaboration and often lack standard automated procedures for managing the life cycle of such data. Typically the newly created data, or data associated with a current project, is accessed more frequently than older data. Yet it is very important to keep older data online as it might be required for historical analysis or reprocessing.

Solution Overview

This offering is a complete, purpose-built solution for the effective management of mixed (text and map) data in a complex, collaborative working environment. The solution utilizes storage from EMC ideally suited to the application environment, while also accommodating legacy storage products and supporting a wide range of common current and future storage alternatives and ILM schemes. Content management capabilities are provided by recognized leader Documentum. GTI provides the connector that links ESRI software with EMC/Documentum. MetaCarta's Geographical Text Search (GTS) is in turn integrated with ESRI software. The Storage Resource Broker (SRB) from Nirvana serves as the infrastructure and enables the federation of locations, data, and storage types into collaborative working groups. The objective of this integration of capabilities - and the market offering resulting - is to provide advanced solutions from the best proven components available, resulting in unprecedented capabilities that are applicable to a broad spectrum of users and organizations in the GIS market:

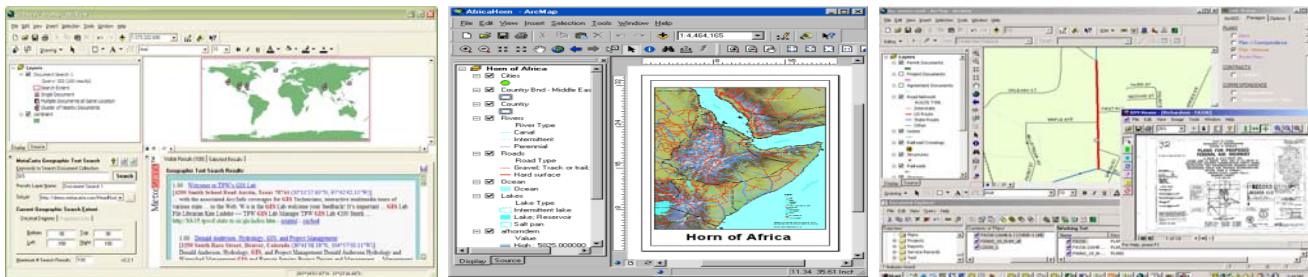
- Real estate developers in distributed locations find deeds and encumbrances related to a set of parcels by indicating an area of interest on a map display at a business or on the web.
- Citizens use browser-based maps to retrieve documents describing zoning and special use permits and restrictions for their properties.
- Police and Fire personnel responding to 911 calls use GIS to locate the calls and determine the fastest route, then, while en route, examine floor plans and photographs of the building.
- Surveyors use map displays to indicate project locations and are immediately presented with existing corner records, records of survey, notes, and other related documents.
- Crime analysts query the document management system for reports that match certain criteria, and then create map displays to analyze spatial distribution.
- An engineering department uses workflow to manage its design processes and stores CAD drawings in the document management system. Others in remote locations can retrieve and display the drawings together with GIS data in a map display.

The solution serves both GIS data user and administrator. From a user's perspective, there is no change in workflow or in interfaces unless necessary to improve productivity. Users more readily adopt a solution presented within a familiar environment, so applications and user interfaces are all based on familiar ESRI software such as ArcView, ArcInfo, ArcSDE, and ArcIMS.



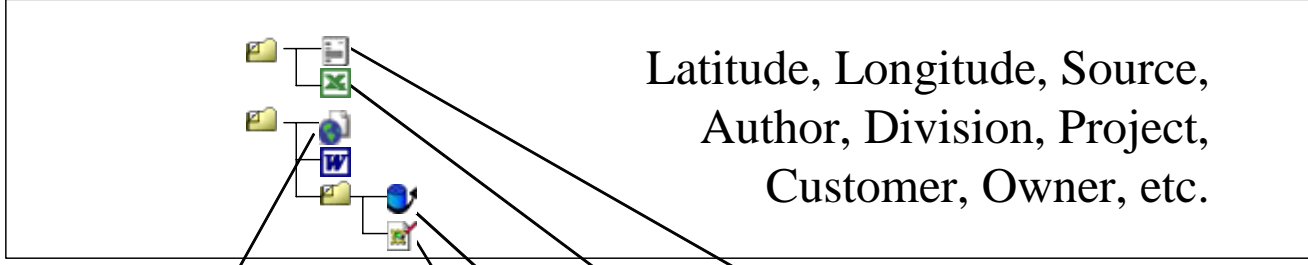
This solution, in a two-pronged approach, directly integrates with ESRI applications such as ArcView or ArcMap, but also provides all GIS applications a transparent interface to globally distributed GIS data as well as unstructured documents with geospatial references.

The direct integrations into ESRI applications feature Documentum connectors and a MetaCarta Geographical Text Search (GTS) integration into ArcMap.

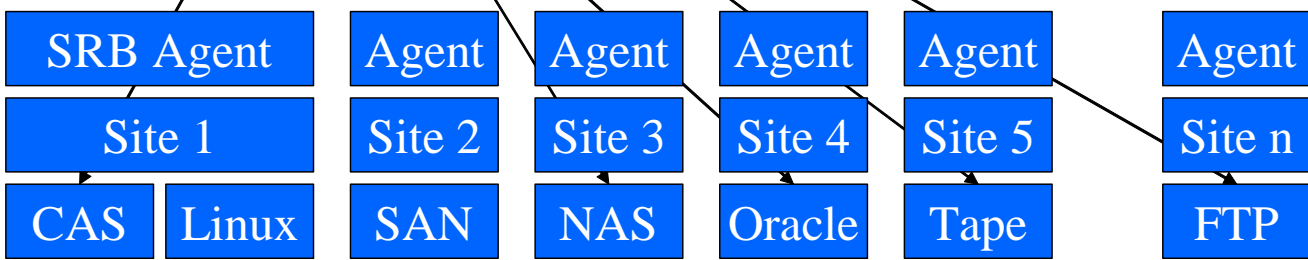


MetaCarta Appliance ESRI ArcSDE Documentum

Logical Collections of images, maps, documents, and metadata



SRB Metadata Catalog

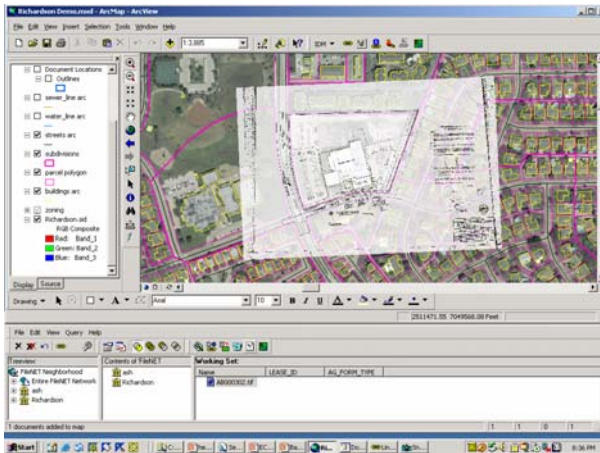


The Documentum connection is provided by a Link Server that resolves relationships between relational databases, GIS data, and the documents in Documentum containing geospatial references. In this way a number of links can be constructed between databases, maps, and unstructured documents: relational links, address links, DynSeg links, and coordinate links. Combining a document management system (DMS) with geographic information system (GIS) creates “spatially enabled documents” – documents that retain their

traditional characteristics but gain location and spatial relationships as new attributes. Users can retrieve documents by pointing at a map display or can generate a map display that provides a spatial context for documents of interest. The integration gives document management users new ways to find documents by harnessing powerful GIS query functions. Similarly, it enables GIS users to incorporate information stored in the document management system in their geographic queries. The GIS serves as an index to spatially enabled

documents allowing users to find the information they need in new, more intuitive ways.

Defining relationships between the schemas of the GIS, tabular databases, and document repositories underlies the integration. Map features and documents are connected through document properties that correspond to feature attributes in the GIS. Similarly, tables may be linked with documents and maps. This *schema level integration* means that it is not required to explicitly link one entity to another.

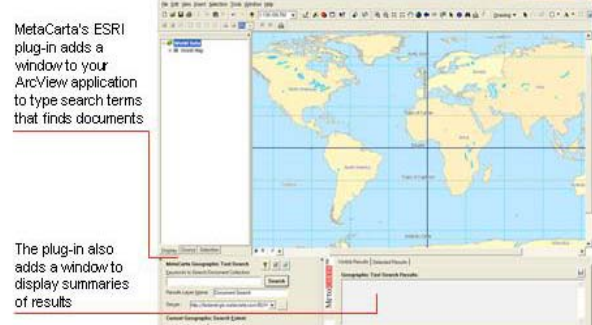


Instead, we document relationships between information sources that are implicit in the database design of each system. We call these defined relationships “links”. Links can begin and end with same type of information - tables can be linked with tables, documents with documents, and map features with map features. Or links can span from one type of information to another. A query can begin with a map, a table, or a document and ripple through all relevant information sources.

MetaCarta’s integration with ESRI ArcMap allows ArcMap users to search for unstructured content using MetaCarta’s Geographic Text Search with the ArcMap interface. This overlay of information combines ESRI GIS with search results from MetaCarta.

PlaceLynx™ utilizes known relationships between the schemas of different information systems to interconnect map features, all types of files, and database records within an enterprise. The relationships are based on the designs of the systems in question.

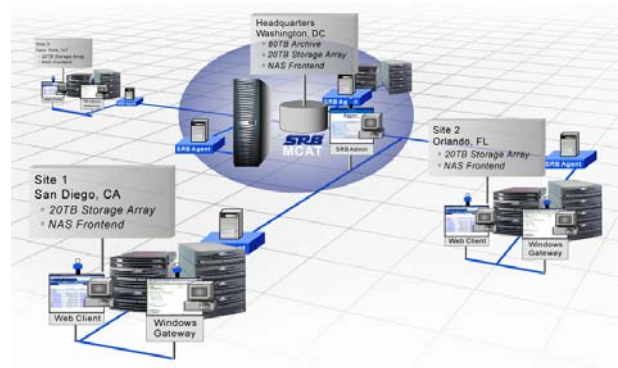
MetaCarta uses sophisticated natural language processing algorithms to analyze the content of



text documents and to compare that content with a gazetteer of place names.

In effect, MetaCarta discovers document-place relationships that are not necessarily inherent in the design of either the GIS or the document management system. After MetaCarta discovers these relationships, PlaceLynx™ can use them.

Nirvana Storage Resource Broker (SRB) federates the entire working environment by providing a global view of all GIS data and documents related to the ESRI, Documentum, and MetaCarta applications.



SRB also provides the means for enterprise-wide information life cycle management based on administrator-defined policies. SRB is also used to rapidly integrate new data repositories into the global view and to make the data and documents in those repositories readily accessible to the user-facing GIS applications.

In this environment data, documents, and maps can be quickly discovered using metadata queries through SRB or Documentum, geospatially referenced full-text search through the MetaCarta plug-in, or links displayed in layers on a map using the GTI ESRI-Documentum connector.

Summary and Conclusion

For organizations struggling with the rapid growth and increasing complexity of large-scale GIS implementations, a team of leading GIS software providers led by EMC have designed a purpose-built solution capable of integrating non-structured documents with maps, in heterogeneous and geographically-distributed locations, making enterprise-level or even cross-enterprise collaboration around GIS data a realistic short term objective.

To learn more (or to get started) contact Doug Burnside of EMC (burnside_douglas@emc.com or 303-660-0131) or any of the participants shown below for more information about this coordinated approach using proven solution elements.

Information and Contacts

Nirvana and SRB

More information about SRB is available at the Nirvana website, www.nirvanastorage.com, including white papers specific to ILM and departmental geospatial applications (“Geospatial Data and SRB: Online GIS Integration in ESRI Environments with SRB MapServer and Centera”) and an overview of complex, cross-agency designs for HPC implementations (“Collaborative SRB Data Federations: A Unified View for Heterogeneous High-Performance Computing”). Contact us directly with inquiries about SRB: Constantin Scheder, Chief Architect, 3550 General Atomics Ct, San Diego, CA, 92121-1122, T: 858-455-2500, F: 858-455-2529, email srb@nirvanastorage.com.

MetaCarta and Geographic Text Search

MetaCarta is headquartered in Cambridge, Massachusetts with offices in Vienna, Virginia and Houston, Texas. For general information, visit www.metacarta.com, and for information regarding MetaCarta’s integration with Nirvana, ESRI, and EMC, contact Claudine Bianchi, Vice President, Marketing, 350 Massachusetts Avenue, Cambridge, MA 02139, T: 617-661-6382; email: cbianchi@metacarta.com.

ESRI

More information about ESRI software products and services, go to www.esri.com. ESRI is headquartered in Redlands, CA, at 380 New York St. 92373-8100. T: 909-793-2853, F: 909-793-5953.

EMC

Headquartered in Hopkinton Massachusetts 01748-9103, Telephone 508-435-1000 or 866-464-7381. For more information regarding EMC products and services inquire at www.emc.com, or contact [Kress Frances@emc.com](mailto:Kress_Frances@emc.com).

Documentum

For more information about Documentum software and its role in this solution, contact Mark Thorp, Director Business Development, T: 925-600-5688, e-mail thorp_mark@emc.com, and for more general information on Documentum see www.emc.com/documentum, or call 800-607-9546 (outside U.S. +1-925-600-6754).

GTI

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