Geospatially enabled enterprise asset management

IBM

Contents

Executive summary

Geographic information systems (GIS) already play a major role across utilities, energy, government, transportation, telecommunications and many other asset-intensive industries by providing the capability to gather and summarize data about the diverse geographic locations and movements of strategic assets.

As GIS systems move from departmental, desktop-based solutions based on proprietary architectures to enterprise systems based on technology standards, organizations now have the opportunity to "spatially enable" a wide range of enterprise applications, including enterprise asset management solutions. Spatially enabled applications can support complex data analysis based on geographic location, such as representing data on maps in various spatial or geographic contexts, and determining proximity, adjacency and other location-based relationships among objects.

By combining GIS with enterprise asset management business processes in a modern, service-oriented architecture (SOA), a particularly powerful geospatial solution can be created—one that enables decision makers across the enterprise to make better-informed decisions, helping organizations increase productivity and efficiency while improving service to customers.

IBM Maximo® Spatial Asset Management was the first solution that unified the full functionality of industry-leading GIS and enterprise asset management (EAM) in a thoroughly modern architecture based on Java™, XML and Web services. With access to the full feature set of the industry-leading ESRI ArcGIS Server, its capabilities go far beyond the generation of static maps that typify traditional GIS/EAM integrations. For example, Maximo Spatial Asset Management supports queries like "Show me the locations of any units within one mile of this failed unit's location that have not yet been inspected this year," or "Show me the units most likely to be affected in the event of a flood in this area."

Organizations that own, operate or manage geographically dispersed assets can combine GIS with asset management processes to create a powerful geospatial solution.

Organizations that own, operate and/or manage geographically dispersed assets can accrue significant business benefits by further leveraging the tremendous value of their GIS-related investments in this way. Maximo Spatial Asset Management enables enterprise asset management users to view assets in a geospatial context, so they can more easily and dynamically visualize the spatial relationships among managed assets and the roads, buildings, pipelines, and other mapped features around them, empowering levels of awareness and insight that dry numbers alone cannot provide. Similarly, a wide range of asset-related data becomes available to GIS users to enrich their decision-making context as well. No duplication of data is required to support this unified view of asset and geospatial data.

This paper offers an overview of the key features and business benefits of the Maximo Spatial Asset Management solution, as well as a high-level description of its architecture.

Introduction

Geographic location is a fundamental reference point in the physical world. As enterprise business systems evolve to more accurately reflect real-world conditions, the capability to represent location has become increasingly critical.

GIS software creates, organizes, maintains, analyzes and visualizes information related to location. Among these core capabilities, mapping—i.e., the visualization of location-based data—is by far the most recognizable function that GIS systems perform. Other fundamental GIS capabilities that are highly valuable in the asset management context include proximity functions to more quickly determine adjacency, nearness, shortest distance, shortest path and other related functions.

The widespread popularity of Web-based 2-D and 3-D personal productivity tools for mapping and visualization, like Google Earth and Yahoo! Maps, has caused an explosion of interest in making visualization part of core business processes and workflows (Figure 1).
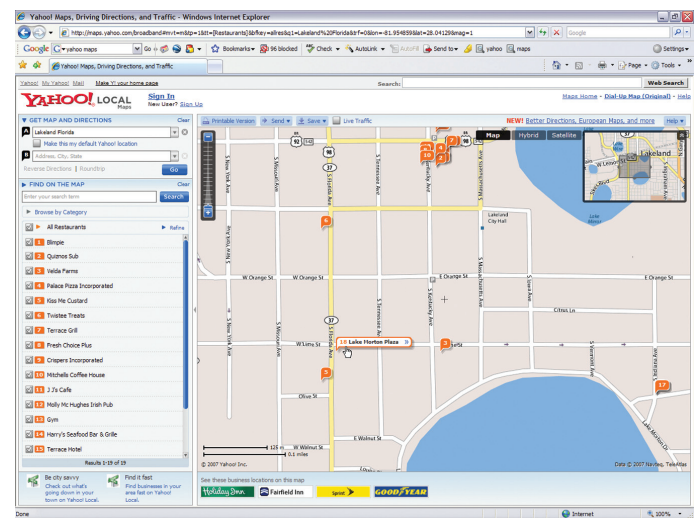

Figure 1: Web-based 2-D and 3-D personal productivity tools for mapping and visualization, like Google Earth and Yahoo! Maps, have gained widespread popularity.

While GIS technology has long been valued for its capability to display features (such as pipes, wires and buildings) and to help reduce costs by enhancing decision making, the value of traditional desktop-based GIS has often been limited to workgroup, project or departmental-level activities within the enterprise. GIS applications have largely been robust, vertically integrated, client/server systems that are optimized to support specific business workflows like utility asset management, land or natural resources management, linear asset management, and many similar applications.

However, the geospatial data and analytical capabilities that GIS technology makes possible are now beginning to be leveraged by an ever-wider range of business users, as GIS implementations evolve from proprietary architectures to networked, server-based solutions that leverage SOAs and Web controls.

GIS and enterprise asset management

Geospatial technology and data can extend the capabilities of asset and service management systems in a number of fundamental ways, including:

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Enhancing spatial context. Along with time, location is a fundamental reference point for countless human activities. In asset and service management systems, location data provides a useful context that makes other asset-related data more meaningful. For example, the capability to visualize the locations of recent asset failures on a map can provide the context needed to spot a trend that might well be missed by looking at a table of data.

Improving measurement capabilities. Geospatial data can help us understand the physical relationships among assets, such as the distance between them for routing purposes. This data also makes it possible to judge proximity, such as determining if something is "nearby" or "within" something else.

Extending modeling options. Analyzing and visualizing geospatial patterns can help identify trends and predict future events with greater accuracy. The ability to analyze unified GIS/asset management data sets enables you to ask questions such as: What unpaved roads washed out due to flooding more than twice in the past year? Is this the result of land use changes in those areas, resulting in increased runoff and, if so, might it make sense to pave those roads?

Deeper knowledge about asset locations. Many organizations with widely dispersed assets, such as municipal water utilities, electric and gas distribution utilities, and departments of transportation, find it useful to track the locations of assets over time. GIS provides a robust framework for managing these types of data to better support asset management activities, from documenting efforts to complying with federal mandates on gas pipelines, to the ability to more quickly locate open work orders pertaining to nearby assets when a crew finishes a job early.

Greatly improved visualization capabilities. Visually displaying location data on maps is the most familiar, and often the most valuable, use of geospatial technology. Applying this capability to strategic assets has a vast range of implications for improving business performance.

Geospatially enabled asset management systems better support customer service, work order management, emergency response, mobile dispatch and more.

Usage scenarios

Geospatially enabled asset management systems better support customer service, work order management, emergency (outage) response, mobile dispatch and more. A geospatially enabled asset management system permits users to know that an asset exists (as well as information about its condition, cost, maintenance history, etc.) and precisely where it is on a map and in relationship to other assets of various types.

In government public safety operations, for example, geospatially enabled asset management systems are the key IT components that support core business information needs, from a "common operating picture" of current assets and their condition to "situational awareness" dashboards that display how and where assets are deployed in real time.

There are numerous other applications, such as those described below, where the capability to dynamically combine GIS and asset management data is particularly powerful.

Work planning, scheduling and execution. Using a map interpolated from GIS and asset location data, planners are able to visualize current and potential work locations for decision-making purposes. They can, for instance, pinpoint the location of a single utility pole among thousands and automatically generate a work order to repair or replace it.

Locating assets for inspection, maintenance and repair. At large facilities, such as a military base, it can be challenging to locate assets for preventive and corrective maintenance activities. A geospatially enabled asset management system can create a map on which asset locations, including their Global Positioning System (GPS) coordinates, are color-coded to indicate condition, exposure, time since last maintenance, etc. Combining geospatial referents with desired asset attributes helps coordinate inspection and maintenance activities and serves as a basis for planning routes and optimizing resources.

Call center. Using a GIS-based map, call center agents can more rapidly pinpoint trouble locations by entering a key identifier (nearest intersection or cross street, customer address, etc.). The agent can then check whether other trouble has been reported nearby, whether a crew is assigned, and the status of the existing work order(s). The GIS can show the related infrastructure, thus providing a more comprehensive view of the situation. If needed, the agent can initiate a new work request.

Decision support. Enterprise decision makers can leverage GIS-based mapping capabilities in combination with asset management data to facilitate investment planning or other forms of analysis. For example, upon viewing a map showing the locations of all pipe repair work orders on water mains over a specified period, managers can better determine whether it makes economic sense to replace the water main. Both "outside plant" and "inside plant" analyses are enabled by a single system, simplifying high-level analysis and modeling efforts.

Benefits of geospatially enabled asset management

By leveraging extended asset management capabilities, government and commercial enterprises can derive fundamental, cross-functional benefits from geospatially enabling their asset and work management business processes. These potential benefits include:

Cost savings through greater efficiency. Streamlining work and scheduling activities, such as the logistics of maintaining assets, can help organizations save labor, time and materials.

Better informed decision making. Knowing more about where assets are located spatially and relative to one another naturally improves both tactical and strategic decision making, from better route selection to improved long-range planning of inspection, maintenance and repair activities.

Enhanced communication and collaboration. Maps and visualizations created using GIS data make it possible for individuals and teams to view and understand situations more quickly and completely. Maps provide an intuitive, visual framework for conceptualizing, understanding and determining activities. Ultimately, "the map becomes the report," illustrating key relationships and insights in an intuitive, visual manner that stakeholders can better relate to.

Creation of new business value. Through its support for new forms of data analysis and insight, geospatially enabling the asset management system can help drive new sources of business value and possibly even change how business is done. By creating a single source of information, all disciplines in the organization have access to the same information at the same time, eliminating the need to track data in multiple locations or synchronize asset attributes between the GIS and asset management systems.

Maximo Spatial Asset Management is a geospatially enabled asset management solution that makes the power of desktop GIS directly available to enterprise asset management users.

Maximo Spatial Asset Management

Maximo Spatial Asset Management is a geospatially enabled asset management solution that enables users to visualize all assets and work in a geospatial context to help optimize resources and decisions enterprise-wide.

While the integration of asset and work management with GIS is not a new idea, the technology approach taken by this solution, and the capabilities it delivers, represent a new level of innovation, usability and business value. Combining the ArcGIS Server from ESRI with the Maximo asset management solution using standards-based, service-oriented technology common to both architectures, Maximo Spatial Asset Management makes the power of desktop GIS directly available to enterprise asset management users. It offers a seamless user experience that incorporates map-based user interfaces, dynamic access to GIS data and interoperability with other GIS systems and data sets.

Maximo Spatial Asset Management use case

Maximo Spatial Asset Management can help organizations identify and plan work by enabling call center agents, supervisors and others to more easily locate assets geographically and

select assets for work. Further, executives can leverage insight into the geospatial relationships among assets for stronger decision support and more meaningful reporting.

Consider a scenario in which a customer calls to report water in the street in front of her home. Using Maximo Spatial Asset Management, the agent can quickly locate the problem based on an address search. Once the asset is identified, a new Service Request can be created in that location, as shown in Figure 2.

Figure 2: With Maximo Spatial Asset Management, agents can quickly locate the problem based on an address search and a new Service Request can be created in that location.

Viewing the infrastructure they can then ask appropriate questions to better identify the location of the problem. Rather than the hydrant on the corner, the problem is with the hydrant directly in front of their house. This will help direct the crew to the specific location of the problem accurately (Figure 3).
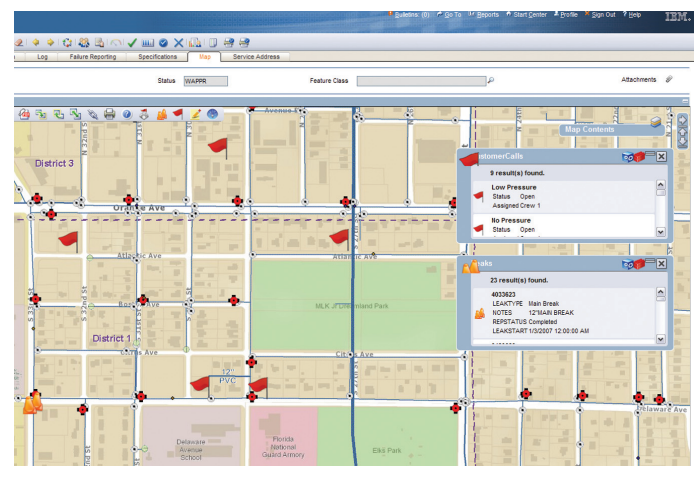

Figure 3: Viewing the infrastructure agents can determine the exact location of the hydrant.

The agent can easily view on the map other assets in the area (Figure 4). Notes and other redline information can be added to the map to provide additional details to the crew responding to the problem. The map with notes is then attached to the service request. An automated workflow then routes the unresolved service request to the appropriate reviewer.
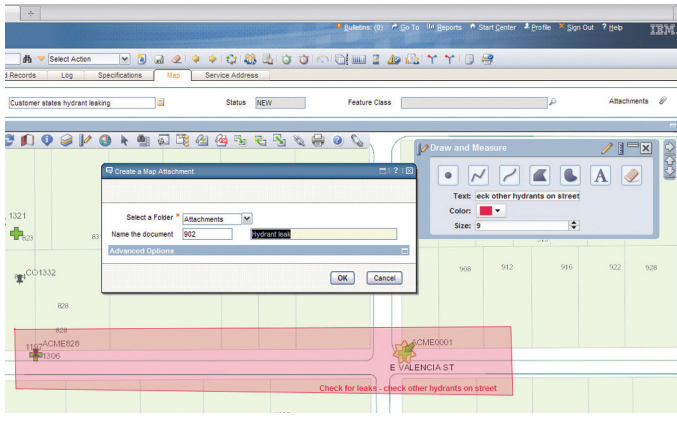
Figure 4: Agents can easily view on the map other assets in the area to assist the crew responding.

Upon review of the service request, it is determined that a work order will be required to resolve the issue; one is created easily from the service request. Next, the supervisor checks for other open Work Orders in the area, thus maximizing the value of the truck roll.

The geospatial context also allows an engineer to visually identify "hot spots" of repair activity and to leverage other asset-related data to make decisions on how best to restore service (Figure 5). These same capabilities can also be used to pinpoint the locations where the most work on the system has been required, in order to recommend upgrades to management on that basis.

Key features of Maximo Spatial Asset Management

Going far beyond simply publishing static images of asset locations, embedding ArcGIS Server Java controls directly into the Maximo software provides access to the full power of GIS for spatial analysis, tracing, location-based services, etc., from within the Maximo application. This uniquely rich and powerful functional integration reflects the investments both ESRI and IBM have made in component architectures.

Any Maximo entity can be spatially enabled: Assets, Service Requests, Locations, and Work Orders are currently enabled. This allows work orders and service requests to be created directly on maps. Results sets from Maximo software queries can be viewed on maps, or selected from maps to form results sets in the Maximo application.
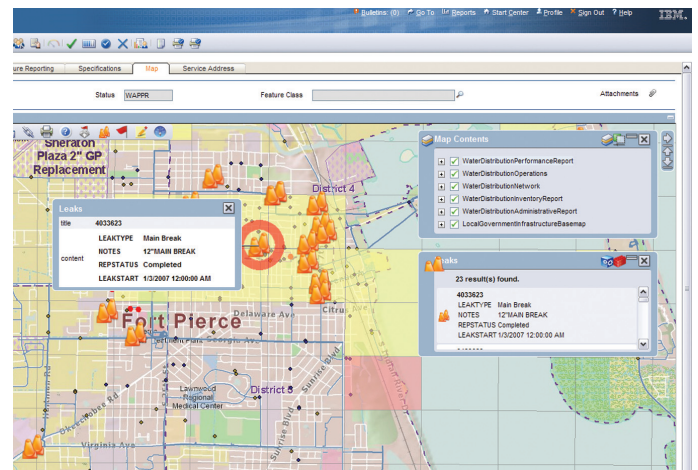

Figure 5: The geospatial context also allows an engineer to visually identify "hot spots" of repair activity and to leverage other asset-related data to make decisions on how best to restore service.

- Maximo Spatial Asset Management provides a valid geospatial context for all asset and location types: Linear (roads, rails, pipelines, power lines, waterways); Area/Polygon (buildings, roofs, forests, service areas, campuses, offices); and Points (poles, hydrants, meters, signs, transformers, houses).
- Maximo Spatial Asset Management supports geocoding—the capability to convert street addresses and similar location data into latitude/longitude (GPS) coordinates, and vice versa. This capability is the foundation for capturing asset location data in the field using GPS.
- Maximo Spatial Asset Management could support tracing networks—the capability to spatially relate the components of a pipeline system or network, taking into account the direction of "flow" of the gas, water, electricity, etc. This capability is the foundation for determining which customers will be affected by maintenance activities and other service interruptions.
- Maximo Spatial Asset Management could support enhanced routing or route planning capabilities by providing core GIS routing capabilities in combination with rich asset management data such as maintenance and other historical data.
- Maximo Spatial Asset Management gives asset management users the ability to more conveniently edit certain GIS-based data elements from within the familiar Maximo software interface.
- When working with GIS data in the Maximo application, all Maximo Administration Controls are supported (Security, Organizations, Sites, Stored Queries, Preferences, etc.). There is no need to set up special security for Maximo Spatial Asset Management; for instance, a maintenance worker can see the GPS coordinates of a customer but will not be able to access the customer's account data.

- GIS data entered in the Maximo application can be edited by the standard ESRI desktop applications.
- Because of its SOA-based architecture and ArcGIS components, Maximo Spatial Asset Management can leverage data from virtually any external GIS data source. Examples include GPS Automatic Vehicle Location (AVL) feeds to track resources, assets, and tools, and data from services such as Federal Emergency Management Agency (FEMA) for flood plain data, census data, and data in other Web services compatible formats.

The Maximo Spatial Asset Management solution is a dynamic framework for unified, enterprise-scale, geospatially enabled enterprise asset management. This means that when ESRI creates new features for its ArcGIS product family, Maximo Spatial Asset Management users can enjoy seamless, immediate access to these features.

Maximo Spatial Asset Management leverages the full feature set of the industry-leading ESRI ArcGIS Server.

Architecture overview

The Maximo asset management solution, developed by the Maximo business unit within the IBM Tivoli® software brand, is the industry's leading enterprise asset management solution. ArcGIS Server is the state of the art in GIS from ESRI.

To combine the power and business value of these two industry-leading solutions, Maximo Spatial Asset Management takes advantage of the component architecture in ArcGIS Server software. ESRI ArcObjects and IBM Maximo Business Objects, both Java-based, are utilized in combination with

map and navigation controls to provide spatial capabilities within the Maximo software user interface. Both applications are browser-based and use commercial application servers to provide scalability, performance, and failover capability. Figure 6 illustrates the Maximo Spatial Asset Management architecture.
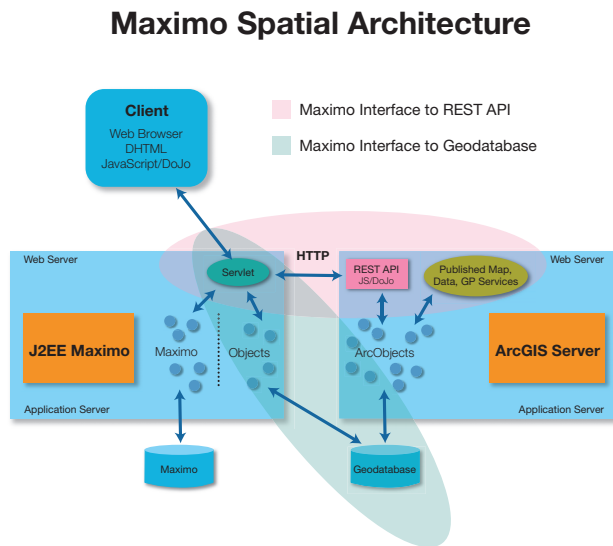
Maximo Spatial Architecture

Figure 6: Maximo Spatial Asset Management architecture

Maximo Spatial Asset Management supports complex queries across database instances without the need for data duplication or synchronization.

Eliminating data duplication

Currently, many systems require you to copy or synchronize GIS data to work with it in other applications, introducing significant IT complexity and cost. Maximo Spatial Asset Management offers full flexibility in how organizations set up their GIS and asset management database instances. Complex queries across database instances are supported without the need for data duplication or synchronization.

When a relationship exists between a feature class in the GIS environment and an asset in the Maximo application, the two can be linked and viewed together within the Maximo Map tab. GIS maps and data are not duplicated; instead, the most current data is dynamically accessed on request.

ESRI ArcGIS Server also includes powerful data interoperability extensions that allow Maximo Spatial Asset Management to interoperate with a number of competitive GIS systems. In addition, ArcGIS Server can "read" some 70 data types and interoperate with the great majority of them.

The ESRI-IBM alliance

For more than 20 years, IBM and ESRI have offered integrated, enterprise-scale spatial information management and geospatial analytic solutions for large government and commercial organizations. Over 10 years ago, the two firms established an ongoing Strategic Alliance partnership that combines the strengths of both companies: IBM's worldwide leadership in information technology, SOA, server hardware and business consulting services; and ESRI's 40 years of leadership in GIS software solutions, function, industry domain expertise and services skills.

Our Strategic Alliance partnership ensures a commitment to our customers and partners in a number of critical ways:

- Provides innovative, comprehensive business solutions like Maximo Spatial to our joint customers comprised of both off-the-shelf software products and spatial services.
- Defines a collaborative business environment comprised of deep, development-level technical exchange, customer support, and geospatial and SOA services engagement.
- IBM's Spatial Services consultants can help implement and integrate Maximo, Maximo Spatial and ESRI ArcGIS Server to enable greater visibility and facilitate better decision making.
- Maintains close corporate communications to move quickly to address the business challenges of joint customers where geospatial data and/or functionality are important.
- Leverages the strengths of ESRI's geospatial toolset and services capabilities and IBM's strengths in enterprise asset management software, IT middleware, services, and hardware to forge innovative, competitive, leading business solutions.
- Develops recognized leadership as a closely coordinated, technology and business team in the geospatial enterprise applications marketplace.

Together, IBM and ESRI provide unmatched GIS-enabled asset management solutions and services that may be leveraged by leading organizations to realize new business value, enhance business workflows, and lower costs.

About Maximo software from IBM

IBM Maximo software was recently named the #1 market share and technology leader by ARC Advisory Group in its 2009 EAM/CMMS Solutions Worldwide Outlook—Market Analysis and Forecast Through 2013.[1] IBM Maximo software is used by many of the world's top companies to efficiently manage how they buy, maintain and retire assets—such as production equipment, facilities, transportation and IT hardware and software—in a wide variety of industries including utilities, manufacturing, energy, pharmaceutical, and telecommunications. IBM Maximo software builds upon IBM's strategy to leverage business consulting, IT services and software to develop repeatable tools that help clients optimize and transform their businesses.

About Tivoli software from IBM

Tivoli software provides a set of offerings and capabilities in support of IBM Service Management, a scalable, modular approach used to deliver more efficient and effective services to your business. Helping meet the needs of any size business, Tivoli software enables you to deliver service excellence in support of your business objectives through integration and automation of processes, workflows and tasks. The security-rich, open standards-based Tivoli service management platform is complemented by proactive operational management solutions that provide end-to-end visibility and control. It is also backed by world-class IBM Services, IBM Support and an active ecosystem of IBM Business Partners. Tivoli customers and business partners can also leverage each other's best practices by participating in independently run IBM Tivoli User Groups around the world. To learn more, visit www.tivoli-ug.org

For more information

To learn more about IBM Maximo Spatial Asset Management, please contact your IBM representative or IBM Business Partner, or visit:

ibm.com/maximospatial
ibm.com/tivoli/maximo

Additionally, IBM Global Financing can tailor financing solutions to your specific IT needs. For more information on great rates, flexible payment plans and loans, and asset buyback and disposal, visit: **ibm.com**/financing

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[1] According to ARC Advisory Group's 2009 EAM/CMMS Solutions Worldwide Outlook (Market Analysis and Forecast Through 2013).

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