MAP MERGE

ESRI's innovative GIS technology virtually defines interoperability by bringing together data and information in a variety of ways.

In a world where storytelling pictographs predate written language by at least 25,000 years, it seems natural that images should have dazzled computer monitors long before lengthy text. In the domain of the binary code, however, words were much simpler to digitize than pictures.

For the past 35 years, ESRI has been in the business of reversing computing's counterintuitive beginnings by introducing increasingly sophisticated, yet easily understood GIS technology.

"This intuitive spatial, geographical representation that we call a map is a language that captures our imagination; that facilitates our imagination," said Jack Dangermond, president of ESRI.

Mission-Critical Mapping

Today, GIS information extends far beyond the traditional GIS community, becoming a fundamental piece of information infrastructure for many organizations.

In fact, ESRI GIS technology now supports more than one million desktop users. ESRI applications also run on more than 50,000 servers, meeting the needs of public-sector agencies responsible for public works, land records, engineering, environmental planning, public safety, facilities management, transportation and health, to name only a few.

And today, when interoperability is the watchword, ESRI's GIS technology embodies the very definition of the term, allowing disparate data sets to be combined to create a complete picture of a given situation.

GIS technology illustrates relationships, connections and patterns that are not obvious in any single data set, allowing public officials to make the best possible decisions based on all relevant facts.

"The minute you understand you can overlay information from one source onto a map from another source, you can truly understand the concept of interoperability between different data sources," said Dangermond. "That's when you understand that GIS is fundamentally about interoperability."

Investigating Interoperability

ESRI technology also embraces and facilitates the concept of interoperability on more complex levels.

"When speaking of GIS interoperability, we have to make the distinction between talking about one GIS interoperating with another; one GIS interoperating with other types of IT; or a third dimension which is

Jack Dangermond, president, ESRI

INTEROPERABLE DATA

The ArcGIS Data Interoperability extension, which became available in summer 2004, eliminates barriers for data sharing by providing state-of-the-art direct data access, transformation and export capabilities. This extension enables ArcGIS Desktop users to easily use and distribute data in many formats.

ArcGIS Data Interoperability enables agencies to directly read more than 65 spatial data formats including GML, XML, Autodesk DWG/DXF, MicroStation Design, MapInfo MID/MIF and TAB, Oracle and Oracle Spatial, and Intergraph GeoMedia warehouse.

The extension allows agencies to export to more than 50 spatial data formats, and model and diagram custom spatial data formats using a semantic data translation engine with 120 specialized transformers.

Agencies also can integrate with the geoprocessing framework and ModelBuilder to enable data format manipulation within GIS models.

GIS as an integrative technology that brings data from many different sources into a common environment," said Dangermond.

ESRI's ArcGIS product is an open systems platform that effectively serves the cause of interoperability on all three levels. The technology provides strong support for .NET and Java. It also supports all data base management systems and multiple operating systems, such as Linux, Microsoft Windows and Sun Solaris. Further, ESRI's ArcGIS Server and ArcGIS Engine implement standards-based GIS business logic in an enterprise server environment.

ESRI's open GIS system allows for the sharing of geographic data, integration among various GIS technologies and integration with other non-GIS applications.

"Using Web services, you can serve up a map and somebody else can read that map into their application as if it were a part of that application," explained Dangermond. "There is a definite movement toward server-based GIS, and that is allowing users to serve maps and spatial analysis into other applications."

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— *Jack Dangermond,* president, ESRI

Supplying Essential Standards

Because GIS technology has such far-reaching possibilities, ESRI works continually to ensure that its products support practical interoperability standards at both the data and software levels. Now ESRI software is the leading GIS platform for support of IT interoperability standards.

Additionally ESRI commits millions of dollars and an extraordinary number of man-hours to working with its user community to develop standards-based templates for layers and classes of GIS data sets, including stream networks, electrical networks, land records, census, forestry, soils and others.

"By creating standardized template data models, it becomes easy for our users to share their common knowledge," said Dangermond. "ESRI's GIS technology is capable of integrating services and data from multiple sources and in different formats."

Ultimately ESRI GIS technology gives users a deeper understanding of the world around them.

"GIS allows people to view information intuitively through maps, and visualization fuels imagination," said Dangermond. "It helps answer fundamental questions. 'What should we do with this land? How can we help this national forest? How should we plan?' GIS helps us better understand our world, evaluate our world, and it fires our imagination about our world. It's an incredibly powerful tool."

Case Study:

MAPPING SAFETY

ESRI provides the California Mountain Area Safety Taskforce with GIS technology that helps outwit Mother Nature, protect property and save lives.

Interoperability is not just a concept to the members of the California Mountain Area Safety Taskforce (MAST). Interoperability is the group's lifeblood — the essential force that allows it to protect lives and property from potential devastation.

MAST comprises representatives from widely disparate agencies including, the San Bernardino National Forest, Southern California Edison, California Department of Forestry and Fire Protection, San Bernardino County Fire Department, state and county offices of Emergency Services, Riverside County Sheriff's Department and the California Highway Patrol. In an unprecedented show of cooperation, these agencies banded together to protect the San Bernardino National Forest and ensure the safety of citizens who live in the area.

Preventive Preservation

GIS technology from ESRI is a fundamental resource for the innovative, multi-agency organization.

"When it became evident that much of the forest was dying due to bark beetle infestation and drought, it was inevitable that something had to be done," explained Russ Johnson, public safety industry manager for ESRI. "The problem crossed jurisdictions. No one agency could tackle the problem itself. They needed a strategic approach. We knew ESRI could provide that, so we reached out to help."

And that help came just in time.

In 2003, ESRI President Jack Dangermond met with MAST officials and suggested GIS technology as a way to gain a comprehensive view of problems facing the forest and facilitate planning short- and long-term crisis intervention.

MAST representatives understood immediately the power of GIS technology to bring together each agency's information. By forming a common GIS-based database, MAST officials could plan for potential disaster and detail the level of forest destruction being caused by insects and drought.

ESRI helped establish the MAST Geographic Information Lab, hosted by ESRI's Center for Innovative Geospatial Technology. MAST used a wide variety of ESRI GIS technologies, including ArcSDE for enterprisewide data analysis and innovative ArcGlobe technology that provided the group with 3-D mapping abilities.

"In terms of visualization, GIS is an extremely powerful tool," said Sean Redar, resource information specialist for the San Bernardino National Forest. "Our MAST GIS database turned out to be a great benefit at a time when we really needed it."

Critical Response

That time came in late October 2003, when a fast-moving blaze roared through the forest, quickly turning more than 750,000 acres into smoldering ash and consuming dozens of residential and commercial properties along its fiery path.

Despite the devastation wreaked by the inferno, MAST members say the damage could have been much worse without the unprecedented insight provided by the GIS database and various GIS mapping tools, including ArcPad for mobile GIS and field mapping applications.

Sean Redar, resource information specialist, San Bernardino National Forest

Prior to the fire, MAST team members had created a multilayered depiction of the San Bernardino National Forest and surrounding areas. The maps included topological information such as slope gradient, vegetation characteristics, soil types, population information, access and evacuation routes, and even water locations.

During the fire, GIS lab resources provided real-time integrated mapping support to firefighting command centers and firefighters that facilitated quick evacuations, helped predict fire movement, coordinated water usage, directed emergency vehicles and even produced real-time maps of the fire and emergency equipment that could be printed or viewed on wireless handheld devices.

"We had so much information we were able to use in an integrated fashion," said Redar. "The technology truly brought all of these different agencies together. We were able to better distribute resources in a coordinated effort. It was a great example of where we are going with this technology."

Case Study:

WHAT'S MINE IS YOURS

Utah's Automated Geographic Reference Center and State Geographic Information Database share layers of GIS data with all state and local agencies — free of charge.

Efforts to share geospatial data in Utah stretch back to 1981, when the state created its Automated Geographic Reference Center (AGRC).

Utah launched the AGRC to coordinate GIS policy and standards, and to provide GIS technical services to state and local agencies. One of the AGRC's primary goals was to develop a central geographic database that would allow state and local agencies to easily exchange digital information.

In 1991, the AGRC unveiled the State Geographic Information Database (SGID), a massive information resource which shares GIS data with all state and local agencies in Utah. The central storehouse of GIS data makes it easy for agencies to combine and analyze data from multiple sources, which is fundamental to sophisticated planning and other public decision-making.

"The SGID, which is based on ESRI's ArcSDE architecture, provides GIS users the ability to integrate more than 200 themes of data into their unique analysis and product needs," said AGRC Manager Dennis Goreham. The database includes GIS data layers describing land use, demographic, environmental, infrastructure, historical, and political features throughout the state.

Interoperability Today

AGRC GIS Specialist Matt Peters said the AGRC shares information with many state agencies — including the Department of Natural Resources, the Governor's Office of Planning and Budget, and the Department of Health — as well as local governments throughout Utah.

"ESRI products such as ArcSDE and ArcIMS allow us to share information," Peters said. "ArcSDE can be deployed as an enterprise data clearinghouse for geospatial information, and ArcIMS allows us to provide complex map services that other agencies can use to overlay their own information to do analysis and create a graphical output."

In May 2004, Utah Gov. Olene Walker broadened GIS data sharing even further by signing an agreement to coordinate geospatial data acquisition and access with 12 federal agencies, Goreham said. "Through ESRI Internet technology, the AGRC provides access to the SGID to everyone."

Goreham added that the AGRC also works closely with national programs including the National Map, Geospatial One-Stop and ESRI's Geography Network to register and provide access to local data through other portals.

The interoperable design of ESRI technology allows the AGRC to meet the needs of a broad range of federal, state and local agencies, Goreham said. "Standardizing on ESRI products nearly two decades ago has enhanced our ability to work together and provide better products and services to the citizens of Utah."

The ESRI Experience

The AGRC has worked with ESRI since it inception in 1981, and the organization still interacts with an ESRI representative about once a week, Peters said.

"They have introduced new products to us and helped us get established in the new technologies," he said, adding that the AGRC uses ESRI's ArcGIS family of products and numerous extensions, including ArcIMS and ArcSDE.

Technology improvements over the past several years have made it easier to share valuable GIS data with new classes of users. "Both in ease of delivering data to requestors and in handling large data sets, the technology has increased our efficiency," Goreham said.

Those improvements, combined with stronger national standards, help the AGRC continue to deliver vital GIS data wherever it's required.

"As national standards emerge through processes, including the Federal Geographic Data Committee and Geospatial One-Stop, Utah typically adopts those," Goreham said. "Often as in the case of the Utah Transportation Data Model, we have developed our own standard. It is absolutely necessary to create and adhere to standards. To make data more functional for a variety of government needs, standards will help ensure accuracy and credibility."

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