

## GIS: Providing the Geographic Perspective

*By Jack Dangermond, President of ESRI*

*A significant change is currently taking place in the manner in which we view our world and how we subsequently manage it. Our environment, which was largely directed by natural processes in the past, is becoming increasingly influenced by human activities.*

*Formerly the role of geography has been one of recording, documenting, and describing the world and all that's in it. It was primarily focused on measuring and classifying places, as well as modeling geographic processes of change.*

With advances in computing capabilities, the study of geography has been evolving toward more quantitative approaches in geographical analysis that incorporate advanced measurement and digital processing techniques. At the same time, we see the emergence of widespread use of GIS to organize, manage, and provide access to a virtual digital world of geographic information. GIS technology is making it possible to better apply the structure of geographic knowledge to problems throughout the world and will increasingly be important as a framework for global advancement.

I believe that GIS will continue to evolve as a strategic platform for the development of applications that assist in the understanding and management of both natural and constructed processes. Taken as a whole, GIS is improving our understanding of these processes at both the micro and macro levels. GIS helps increase efficiency, reduce costs, and promotes better and quicker decision-making. Because it is presented in the context of a visual language, GIS stimulates communication, collaboration, and coordination.

GIS-related applications have been developed for numerous industries. Almost every government and business sector including national security, conservation, emergency response, real estate site selection, land use planning, and the management of natural resources has benefited. We are also seeing GIS as a critical component in education, both as a course of study and as a teaching aid. The cumulative effect of this technological initiative includes greater efficiency, better decision-making, and clearer communication.

As the use of GIS continues to expand, we are seeing growing interest in developing GIS as a societal infrastructure for providing widespread access to geographically related knowledge. This vision is possible because of the rapid evolution of GIS technology on the Internet with geographic information servers and interoperability standards.

It has been suggested that fast computing, the ability to store large amounts of geographic information, and accelerated communication networks together with GIS software advances, will ultimate-

ly lead to a kind of technologically-based global nervous system. It will not only provide access to our collective geographic knowledge, making it accessible for applications ranging from the support of greater citizen awareness to detailed scientific analysis, but the system will also monitor the physical dynamics of the planet itself. This vision is being supported by the rapid progress in underlying technology and the increasing need for better geographic information to support nearly all natural and constructed activities.

Increasingly, server-based GIS and Web services will complement the work that GIS professionals are now doing, such as providing maps, developing spatial analysis models, and supporting complex geospatial workflows. This new Web-based environment will support the dissemination of geospatial knowledge over Web services networks and dramatically leverage the capabilities of GIS professionals and the investments that have been made by traditional GIS users. Ultimately, GIS server technology will support the realization of a global spatial data infrastructure by allowing the development

of a system-of-systems based on a network of distributed nodes of geospatial knowledge. This new architecture will support and link distributed and multiparticipant GIS networks for regions, states, and nations throughout the world.

Currently, GIS is being implemented on the Internet with simple Web mapping technologies. Recent advances such as the Google Earth 3D visualization environment are simply extending map-viewing capabilities in this traditional manner. However, as the GIS server architecture takes hold, we will see the leveraging of the Web 2.0 environment for integration and the linking of a whole multitude of distributed services, as well as the development of a whole new generation of embedded applications that will make use of these services. This new architecture will support both existing and new workflows that will lead to improvements in how information is integrated and used to support multi-agency/multi-organization collaboration.

I like to call this new environment the GeoWeb; a large, widespread, distributed collaboration of geospatial knowledge services that can be dynamically inter-related and orchestrated for applications support. I believe this will lead to a whole new generation of applications that support greater cooperation and collaboration. Recent catastro-

phic events such as Hurricane Katrina could have enormously benefited from this type of system-of-systems architecture.

Service-oriented architecture (SOA) with geo-services was initially envisioned by the earth science and remote sensing communities and this concept has even more applicability for GIS implementation. However, to realize its full potential, certain procedures and protocols will have to be implemented, which include the standardization of data models, creation of interoperability procedures such as ETL and related technology, implementation of GIS portals, willingness among both public and private entities to collaborate and share information, implementation of collaborative agreements, and the further development of the underlying fundamental technology. This next generation of geo-services will enable a new synergistic relationship between groups and agencies with data and services going back and forth between them.

Interoperability is a key aspect of the expanded use of spatial information. Interoperability standards will ensure open access to geospatial content, the ability to integrate multiple geo-services, and the ability to better integrate geo-services with the rest of the IT infrastructure, such as ERP, CRM, and so on.

This new generation of GIS technology will mean a gre-

at step forward in our ability to work together and better manage our world. I am personally very excited about what is about to happen. While political leadership and knowledgeable GIS professionals are essential to make this vision a reality, emerging technology, such as full GIS servers will be the key to creating the system-of-systems capabilities. Future services will include image processing, maps and visualizations, globe services, geocoding and gazetteer services, real time tracking services, terrain services, and metadata catalog services, which will collectively provide the technical key for portal integration and will ultimately promote broad intellectual discovery.

Geographically referenced knowledge is critically important in our world and we are now beginning to fully comprehend its inherent power and the value that the analytical capabilities of GIS provides in nearly everything that we do. GIS has the potential to afford our international community clear, quantitative information that can be used to better understand and address the problems inherent in the global changes we are beginning to see today. In short, GIS can help us make better, more environmentally sustainable decisions, which will allow us to act as more efficient and more responsible stewards of our planet.

#### **Om forfatteren**

Jack Dangermond, Direktør og ejer af ESRI, Redlands Californien, USA