Environmental Protection Agency Delivers Rapid Damage Assessments

Customer Profile

U.S. Environmental Protection Agency, Region 5 Superfund Division/FIELDS
Chicago, IL
www.epa.gov

Industry:
Government

Employees:
>=10000

Oracle Products & Services

- Oracle Database 10*g*
- Oracle Spatial

Key Benefits

- Speeds decision-making by automating fact-finding and eliminating data duplication
- Improves data quality and manageability by storing all pertinent data in a single repository
- Scales to a searchable, secure, multiterabyte repository containing various formats of geography-based data
- Integrates layers of data from various sources to render a complete picture of contamination
- Enables tracking of changes over time
- Allows use of any third-party GIS software
- More cost-effective than traditional GIS client-server technology

"Oracle Database 10g with Oracle Spatial delivers geographically-based data in an intuitive way that helps our analysts make sound decisions quickly during emergencies." -- Larry Callant, Research Associate, Region 5 Superfund Division/FIELDS, U.S. Environmental Protection Agency

If the nation experiences a toxic chemical spill or other health-threatening pollution, the U.S. Environmental Protection Agency (EPA) swings into action, dispatching analysts to size up the contamination. The EPA's rapid assessments help local authorities take appropriate action to protect life and property. In such emergencies, there is no time to spare to search through file drawers or stacks of CDs to locate the maps that describe affected rivers, schools, residences, and hospitals.

Thanks to an application developed by the EPA's Region 5 Superfund Division, EPA analysts have the data they need at their fingertips. The application could not have been developed without the image storage, management, and query capabilities of Oracle Database 10*g*, Oracle Spatial (an option available for the Enterprise Edition of the database), and the GeoRaster feature of Oracle Spatial. Oracle Spatial enables the EPA to integrate and rapidly search terabytes of diverse types of digital data such as photographs, maps, and Geiger counter readings.

Fast Emergency Assessments

To illustrate how the EPA's solution works, imagine that a truck spills a noxious chemical on a highway and an EPA analyst is dispatched to the scene with a laptop and global positioning system device (GPS). Using a GPS, the location is uploaded into the application and the analyst's laptop screen displays an aerial photo of the area. Additional layers of other data are added to the picture as needed to show physical markers such as roads, bodies of water, housing, hospitals, airports, and any schools to evacuate. Information such as river flow rates and wind velocity can be added to help predict the contamination spread, making an accurate visual representation of the data available to the EPA within minutes after the analyst arrives at the scene.

This is light years ahead of the EPA's previous emergency response methods, which relied on telephone calls and manual searches of maps and data stored on CDs and flat files. "We required a central repository of data and the ability to deliver it to anyone who needs it," said Larry Callant, research associate for Region 5 Superfund Division/FIELDS of the U.S. Environmental Protection Agency. "Using Oracle Database 10*g* with the features of Oracle Spatial, we can simply use a GPS reading or specify a road or a single point in a county as a reference, and visually present the surrounding area in a format we select. Managing the data is easier because we no longer have to store multiple copies of an image on different computers, so the data is consistent and accurate."

Instant Picture of Contamination

The EPA gets its environmental assessment data from a combination of external devices such as radiation, air quality,

particulate, and bathymetry meters; U.S. Census Bureau maps of roads and streams; U.S. Geological Survey data that describe structures such as airport locations, hospital locations, and schools; and aerial photos from state and other federal agencies.

Once the data is collected and loaded into the database in Oracle Database 10*g*, it is immediately accessible. Oracle Spatial 10*g* contains a GeoRaster feature that enables EPA to store raster data such as aerial photos in a native Oracle data type that can be indexed and searched.

Map locations, which can be tagged with depths, altitudes, or attributes such as date stamps, are all accessible in ASCII format. Two-dimensional map locations, three-dimensional locations tagged with depths or altitudes, and four-dimensional locations tagged with attributes such as date stamps are all accessible in ASCII format. The data can be layered and presented in the context of the information sought. For example, aerial maps can be integrated with Geiger counter readings to show the distribution and spread of radioactivity. "Users love that they can plug in a meter and see real-time information coming in on the computer screen," Callant said. "They can collect data by walking around rather than having to record the data and enter it into the database when returning to the office. It relieves the extra burden of having to think about how to collect and enter data during a crisis."

The EPA developed the client application on Windows 2000 for viewing and querying map data. "We were pleased that Oracle supports Windows so we didn't have to invest in a new skill set," Callant said. Spatial data is stored and managed in a central repository on the back end in Oracle Database with Oracle Spatial. The application reads data from Oracle Spatial and converts it to a format required by a viewer that the EPA designed. Data is queried by latitude and longitude, city and state, or with a user-defined polygon. The EPA's Oracle Database 10*g* runs on a Dell 73 gigabyte server, and is accessible from laptops using Oracle Database 10*g* Personal Edition.

Why Oracle?

The EPA was won over by Oracle Spatial's capability to store vector data such as roads, pipelines, and political and geographic feature boundaries as well as its efficient handling of geographically referenced raster data such as airborne imagery--something only possible with the GeoRaster feature of Oracle Database 10*g*.

"What we like about Oracle is that it's a flexible database that lets you store things spatially," Callant said. "There are no limitations on the use of raster data. Oracle Database 10*g* with Oracle Spatial lets you decide how you want to extract the data. You can put it in any format you want and use whatever tool you want to read it. Also, it's economical. Our application does not require complex geographic information systems (GIS) features, so Oracle Spatial fulfills our needs--we don't have to purchase unnecessary GIS software licenses."

Implementation Process

Callant's team developed its emergency response application using Java and Oracle application-programming interface. The first step in loading the database was to create 27 tables for the vector data. Callant said the team is building 237 tables to hold 3 terabytes of digital aerial photos. When all the data is collected for Region 5, an area that encompasses Minnesota, Wisconsin, Illinois, Indiana, Michigan, and Ohio, the database will easily scale to 7 terabytes. It may also grow well beyond that because the EPA is looking into expanding the use of the application nationwide in partnership with other agencies, including the Department of Energy, the Department of Homeland Security, and numerous local and state

governments.

Advice from Region 5 Superfund Division/FIELDS, U.S. Environmental Protection Agency

"With Oracle Spatial, it's just a matter of using SQL queries to extract data," Callant said. "There are few additional things to learn about Spatial, but you can pick up what you need simply by talking to people who have worked with it or through manuals."

The Environmental Protection Agency heads U.S. environmental science, research, education, and assessment efforts and enforces environmental regulations enacted by Congress. Its mission is to protect human health and the environment.