GE Energy

Smallworld 4 Product Suite

Spatial Intelligence:

Making better business decisions using spatial analysis

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Abstract

Many enterprises began their relationship with spatial data by embarking on an often lengthy process of turning their paper-based documents into spatially enabled network data. This was a significant commitment for many companies and it yielded real business benefits: easier and faster access to information, more up-to-date data and reduced costs to name but a few. However, many enterprises soon began to wonder if this new wealth of spatial information now at their fingertips could be exploited even further. Many departments in an organisation had for a long time used conventional attribute data to perform complex analyses of their networks, but with the addition of a spatial data, the possibility of gaining a much deeper insight into their network became a reality with the advent of new, powerful spatial analysis tools such as Smallworld Spatial Intelligence* from GE Energy.

Spatial data is not attribute data

It is sometimes tempting to think of spatial data as simply an extended form of attribute data: after all, a location is just a pair of x and y numbers that are similar to other attributes belonging to an asset. This assertion often leads to a failure to fully appreciate the full potential of spatial data. Simply knowing the location of an asset is useful in its own right but this is only part of the true benefit: the real advantage comes from knowing how that asset relates spatially and topologically to other assets in the network. Just as integers support specific functions such as addition, subtraction and so on, spatial data has a unique set of functions such as inside, touching, and connected that allow spatial analysis tools to reveal important relationships between assets that might not be obvious by simply probing reams of attribute data or studying abstract graphs.

Another important difference of spatial data compared to attribute data is that not only does it offer the possibility of new types of analysis but it also offers new ways to present the results of these analyses: business leaders can make convincing presentations that dramatically illustrate important information or trends such as concentrations of untapped customers, operating areas with unusually high customer complaints and so on. This ability to present the results of a spatial analysis pictorially in a meaningful way is a significant benefit to enterprises accustomed to seeing data as just numbers.

The sum is greater than its parts

The home for spatial data is typically a GIS and for a good reason: these systems have been designed and optimised to host and process this kind of data. However, it is a fact of life in today's enterprises that useful and important data is held in a wide variety of disparate systems: billing information might be in one system, maintenance information in another, work force management records in a third. Other sources of useful data can be more mundane and include spreadsheets, desktop databases and even tab delimited files. Sometimes the data is not even owned by the enterprise but is purchased from third parties who, for example, might specialise in providing targeted demographic data.

Each category of data is important in its own right and each helps to support an important business process. However, more often than not, combining this data can often result in something that is more useful than the sum of it parts. For example, a customer database might have information about the amount each cable television subscriber spends per month. In the GIS the same customer has a location. If both tables could be linked, it would allow a marketing executive to see where the most profitable customers are. By aggregating this revenue information up to an operating district and colour coding it appropriately, it suddenly becomes much more obvious where to target growth of a new premium movie service. This is an insight that would have not been obvious to someone examining the raw data in the customer database.

Data on demand

The ability to build relationships between typically unrelated data stored in disparate systems is a powerful mechanism. However, it is important to mention that the motivation for building such relationships is often an ad hoc one that is a consequence of a dynamic business environment. This means that much of the benefit of bringing disparate data together can only be realised by an ad hoc approach to data integration. Simply exporting data from one format to another is too cumbersome, leads to integrity problems and often results in out-of-date data being analysed, which in turn results in bad business decisions. The key point is not just to support data from a wide range of sources but, importantly, to do so in way that is flexible and convenient to the user.

Another important point is that most enterprises value the data in their organisation more highly than the software systems that access it. Not surprisingly, therefore, there is much reluctance by database administrators to expose an enterprise's data to a raft of analysis tools, each of which might end up changing values here or there.

Lastly, many enterprises have numerous regulatory reporting obligations. This often means being able to produce reports on data at a particular point in time and archiving the results. Frequently regulatory authorities will wish to inspect the raw data used to generate these reports. This raises problems if the analysis tool only works with live, up to date data.

Focusing on the user and not the functionality

The usefulness of a comprehensive spatial analysis tool will be diminished if it is overly complex to use. Some applications focus heavily on functionality resulting in an unwieldy product that might be confusing to use.

Some advanced spatial analyses will have greater complexity, just as calculus is more difficult than long division. The key idea here is to support complex tasks by building them out of smaller, more manageable and easier to understand building blocks. This building block approach presents a shallow learning curve to new users but also allows more experienced users to exploit the full potential of the analysis tool.

An intelligent approach to spatial analysis

Introductions are not required

A commitment to focusing on the user has been a cornerstone of the Smallworld platform and this, combined with an extensive experience of spatial analysis technology, has resulted in a project based, elegant, easy to use spatial analysis tool that sits well with other desktop applications such as Microsoft Office. An intuitive user interface with drag and drop functionality, wizards and a Microsoft look and feel allow a wide range of users to exploit a comprehensive set of powerful spatial analysis functions without the need for a thorough understanding of underlying complexity of the data, its relationships or indeed of its origin.

An on the fly approach to data

Smallworld Spatial Intelligence provides out-of-the-box support for a wide range of spatial and attribute data sources from corporate systems based on Oracle technology to desktop applications such as Microsoft® Excel or Microsoft Access. Smallworld Spatial Intelligence can also exploit data formats supported by Smallworld Spatial Object Manager* technology including Oracle® Spatial, legacy formats and other data sources accessible via ODBC and ADO.

Data from external sources can be added to a project on the fly when needed or configured to be permanently accessible via an existing installation of Smallworld Core Spatial Technology* depending on the frequency of access and needs of the user. Whatever its origin, the data appears to the user as if it were native Smallworld system data allowing the user to work with it using a

consistent set of spatial analysis tools. Powerful relationships between disparate data sources can be easily created using wizard dialogs and other graphical tools facilitating the integration of data without the need for the skills or authority of a specialised database administrator.

Finally, the data used in a project never affects the original data source, thus protecting its integrity. Data is always accessed in read-only mode and users can choose either to use live data or take a snapshot (that is stored within the project) which can be used for historic and comparative analysis.

Powerful tools, simple concepts

Many spatial analysis functions are based on very advanced mathematics. However, Smallworld Spatial Intelligence shields the user from this underlying complexity by exposing its functionality though a small set of simple concepts:

- **Tables.** These represent the raw data that a user adds to a project. They might be native Smallworld software tables or external tables but to the user they are treated in the same consistent way. For example, they can be browsed, saved or printed using the same tools.
- **Queries.** Queries take tables as their input and provide a powerful way for the user to add additional value to the data. This might involve creating a relationship with another table or adding calculations to perform spatial aggregations. Once the basic structure has been defined, a query can be filtered to exclude records that fail to meet a defined test. When a query is saved a new table is created holding the results of the query.
- **Analyses.** Analyses consist of rich set of powerful spatial functions. The list is comprehensive but some examples include buffering, polygon analysis (intersection, union and so on), network tracing and clustering. Again, the result of an analysis is a new table.
- **Layers.** Layers present the content of a single table (with spatial data) geographically to the user. Layers are stacked upon each other and may be reordered for emphasis. Each layer can be configured by the user to have its own style that is independent of the original data source allowing key aspects of the data, such as trends and concentrations, to be conveyed to users without expertise of the underlying data. Layers may be turned off or on to reduce clutter and filtered to remove records that are not of interest. Users may annotate layers with simple sketches to draw attention to particular features.
- **Reports.** Smallworld Spatial Intelligence ships with a simple ad hoc reporting tool for quick reports as well as tight integration with the market leading reporting suite Crystal Reports®, enabling a series of reports to be distributed in a range of ways from PDF files to HTML pages. This allows the contents of a table to be easily fed into an existing report template designed to meet, for example, regulatory obligations.
- **Layouts.** Layouts allow the user to generate impressive print outs containing the results of a spatial analysis. Each layout can consist of a number of maps, each of which can be configured to display an important aspect of the analysis. Legends and other embellishments such as scale bars can also be included.

Queries, analyses and layers can yield new tables which, in turn, can be used as the basis of new queries and analyses. This simple concept allows complex spatial analyses to be built up out of smaller, more understandable steps.

A project will typically include several tables, queries, analyses, reports and layouts. When a project is saved, all these resources are also saved allowing users to re-open the project at a later date and to start working on it immediately. Projects are single, self-contained files that can be shared and distributed within an organisation (as long as any external data referenced is still accessible) or distributed via the internet to a wider community.

Extensible and customisable

In addition to its standard set of powerful spatial analysis tools, Smallworld Spatial Intelligence also provides an extensible and customisable architecture that enterprises can exploit to meet their own specific needs:

- A customisable user interface allows menus, toolbars and so on to be rearranged. Menu and toolbar entries can be removed or new ones added to expose supplementary functionality. This allows the user interface to be focused on a particular type of user simplifying workflows by, for example, removing functionality that is not required.
- Microsoft Visual Basic® for Applications (VBA) is embedded to allow repetitive tasks to be automated using this popular scripting technology. VBA also supports simple user interfaces allowing custom dialogs to be added to Smallworld Spatial Intelligence and accessed via a customised menu.
- For more advanced applications an add-in mechanism is provided that allows additional functionality to be added using modules written in Microsoft Visual Basic or Microsoft C++.
- Much of the underlying power of Smallworld Spatial Intelligence is exposed through a COM based API. This allows third party applications, VBA scripts and add-ins to access and drive much of the core functionality provided.

This set of customisation options provides a wide range of approaches to customising Smallworld Spatial Intelligence from simple modifications to the standard user interface to the integration of commercially sensitive site location algorithms.

Conclusion

Many enterprises now have vast quantities of spatial data readily available to them in electronic form. Spatial data has many unique characteristics that distinguish it from plain attribute data and this presents enterprises with the opportunity to have a much greater understanding of their businesses. Conventional analysis tools that were originally designed to work with plain attribute data simply do not offer the capabilities to fully exploit the true value of this spatial data.

Smallworld Spatial Intelligence has been designed to analyse spatial data and unlock its full potential, giving enterprises a much greater understanding of their most important network assets, which in turn leads to better business decisions.

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