

Spatially Enabled Business Intelligence


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Many organisations have amassed huge quantities of data that they need to analyse in order to help them make objective operational decisions. These data are augmented by the plethora of externally published data that can be fed right to the desktop via connectivity to the Internet. In order to successfully synthesize these data, specialised data mining solutions and Business Intelligence (BI) applications have and continue to be deployed. The GIS vendor community have recognised this and have targeted this industry as one that can also use spatial analysis to augment existing BI solutions. This has led to many sophisticated and complicated integration efforts aimed at maximizing license revenues for the GIS vendors. Now with the advent of the Internet, Service Oriented Architectures (SOA) and the commercial availability of spatial data sets, should BI vendors be investigating independent component based solutions that can be more easily integrated into their customer's web-based BI solutions?

Spatial Enablement & Data

Why spatial enablement of BI analysis? One dimension typically omitted from traditional BI environments has been the location of where things are or where events occur – the ‘where’ factor. Enterprises typically capture business information such as customer addresses but not spatial data such as the actual geographic location of their customers. This is because, until recently, it has been difficult to do and justify getting the location attribute. This is possibly the main reason that a lot of spatial analysis has been confined to post code level which is collected as part of an address. However, the simple geographic location of any customer event(s) can, in some cases, can help better clarify the result of some complex analyses typically portrayed in BI reports. For example, its accepted that people's buying habits relate to many different demographics traits (such as average disposable income statistics) and access to demographic maps showing where these statistical groups are located are available in most developed countries – in our case, the Australian Bureau of Statistics (ABS). So understanding here either customers are located relative to these statistical demographic areas is arguably a very relevant correlation dimension when analysing customer spending habits and using that information in target marketing campaigns. Granted, this is a simple example but never the less it does highlight just how important the geographic location can be in any given analysis. So its no wonder BI customers would like to easily integrate spatial analysis functionality into their BI solutions. BI companies are paying attention to this requirement and are looking towards the GIS vendors to help them deliver partnered solutions.

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But once BI companies go down this road its clear that the spatial analysis is dependent on having access to geospatial data of some form and in many cases quite a variety of it. There is the base map data such as administrative boundaries (e.g. Suburbs, Post Codes, LGA boundaries, Political boundaries, etc), statistical boundaries (e.g. ABS Mesh Blocks, Census Collector Districts, etc), property data (e.g. Cadastral boundaries), topographic data (e.g. Roads, Rail, Rivers, Contours, Points of Interest, etc) and many other data depending on the application. However, any organisation seeking to spatially enable their BI solutions are most likely unaware of this requirement or it has presented as a ‘showstopper’. They really do not care about how to acquire or source these data - they just want the analysis to include the spatial dimension. So while they need spatial data they probably do not want to know anything about it.

These organisations need to consider subscribing to published geospatial data and services from a service provider who specialises in the acquisition, maintenance and publishing of it. There are many commercial companies that provide these services via a Service Oriented Architecture (SOA) using standards-based Web Services. BI solution providers looking to integrate spatial analysis into their customer solutions can continue to be locked in to the GIS vendor’s proprietary solutions – and in some cases data sets - or they can investigate connecting to commercially available geo-services via a SOA environment. So how does this work?

Service Oriented Architecture

SOA is all about the ‘separation of concerns’ which is an IT engineering development strategy that simply allows web-based service providers (e.g. spatial data publishers) and service requestors (e.g. BI application users) to focus on only what they each need and independently of each other. That is, the service provider concerns themselves with only that which is needed to provide the service with no concern as to the many and varied end users or systems using their service. Whereas the service requestor will concern themselves only with applications that use these services focusing on the geoanalysis supported by the provider. This can be transparently undertaken within a web enabled BI solution via web services.

The web service is one of the fundamental building blocks that supports a programmatic interface using open standards that executes a specific business process. The web service can be anywhere on the Web or in an internal network (Intranet). For example, in order to see any address data overlaid on a map its fundamentally important to be able to geocode that address (i.e. street address transformed into a geographic co-ordinate or location). Once geocoded the address is easily integrated into a spatial environment and can be subject to many geo-spatial analyses. Commercially available geocoding services are available today and can be used as either an interactive transaction or as a batch process to retrospectively convert a whole database of addresses. The user can also integrate the same web service into a web-based customer address entry process to both validate that the address given is correct or exists and to ‘geocode’ it and store the location with the other data in the database for later use.

By way of explanation I have developed a demonstrator using Google Maps (see Fig 1) as the spatial viewer to display data extracted from an XML file stored on the server. When the system loads, it automatically opens this server-side file of address records and uses the Google Maps Geocoding engine to convert each address at the time of loading ('on the fly') into a latitude and longitude coordinate or location (please note that if, at the time of entering the customer data, this geocoder web service was available the location could have been stored with the other customer data thus removing the need to geocode on the fly). Each location is then displayed as a marker on the map as a red dot. The address is listed in the left panel and these are 'hyperlinked' to the red dots. The application accesses a cascading Web Map Server via an OGC standard service requests to overlay ABS Collector Districts simulating the depiction of Disposable Income statistical data from a Spatial Data Infrastructure (SDI) node. In addition, the suburb boundaries are 'overlayed' from yet another distributed interoperable SDI service. Please feel free to use the demonstrator at http://www.cubewerx.com.au/bi_demo.html.

This demonstrates how you can use a Google Maps application ('mashup') to provide a simple level of additional spatial analysis. Data is extracted from a BI system via a complex query that simply lists a collection of addresses in an XML file - in this case only over the suburb of Cherrybrook NSW. The client application then overlays these addresses on an interactive Google Map and also provides online access to a wealth of demographic data stored within an interoperable SDI. The demographic data is rendered as a semi transparent overlay (Demographic Drape) that enables visual correlation between these areas and the plotted customer addresses.

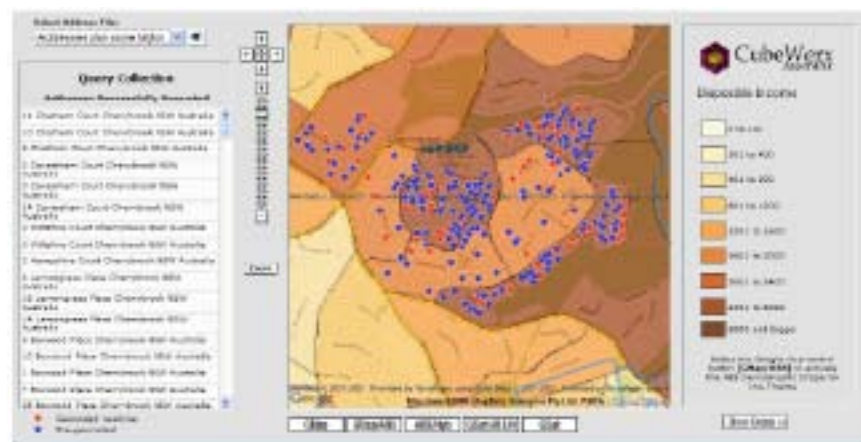


Fig 1

Example of a list of customers superimposed on top of a simulated Disposable Income Demographic Drape.

This simulated query could have been undertaken by 'Acme Retail Pty Ltd' who wanted to analyse their customer's spending habits based on information stored in their BI system. A query to list all those customers who, say, spent more than a certain threshold per week in their store was generated in an XML format and then made available for this spatial analysis. The locations of these customers really suggested little, other than there were some random groupings, until the user activated the ABS data layer to see if there was any correlation of actual spending against Disposable Income statistical areas. Armed with this information

the Acme Retail company could look at targeting specific products through the local outlet or even market product promotions through mail drop programs targeted at demographically identified customers.

Whilst this is a very simple analysis its clear that the criteria used for the search is unlimited and with access to the many thousands of Demographic Drapes that will be possible on an SDI - or from a commercial provider - this type of BI analysis is both convenient, technically easy to implement and potentially extremely powerful.

Portal Applications

With the availability of commercial geo-services (web services), BI software integrators now have new options when it comes to integrating spatial analysis into their solutions. BI solutions providers, being part of the an IT sector, are probably deploying their solutions via Portals built with commercially available Portal development frameworks such as IBM's WebSphere, BEA WebLogic and even open source products like JBOSS and GridSphere. These platforms are a perfect integration environment in that these web services - once packaged as Portlets (functional software components that are written as web services) can be used and re-used within a Portal application framework - can be accessed and can communicate with one another via the industry standard Application Program Interface (API) called JRS168 from within an overall Portal application. Over 20 major suppliers of Portal development frameworks support this standard ensuring that Portlets developed based on this standard will be interoperable, re-usable and even remotely discoverable. Vendors of geo-spatial Portlets are beginning to appear in the market which means that BI solution providers will be able to easily integrate these into their Portal solutions.

To provide such solutions requires that the BI solution provider and/or end customer negotiate with a service provider(s) to have access to such web services and that can be interfaced via the JSR 168 Portlet standard. In addition, any such Portlets will need to have access to the geospatial data - which should be subject to Service Level Agreements (SLA) to guarantee access. This is by far a different model to selling a GIS product that will require end user training, developer training and probably contains far more geo-processing features than are required for any given BI application. In such a model the BI solutions provider can select precisely the functionality they need for their customer keeping the solution as simple as possible; even the mapping data services can be hired from suppliers like Google.

Conclusion

This is an emerging concept and increasingly there will be new geospatial web services packaged for integration into these Portal applications via Portlets. Someday it may even be possible to discover such geo-services via registries further opening up the whole geo-spatial domain. The BI solution providers should keep a watchful, strategic eye on developments in this area as it will benefit both them and their customers and bring geospatial analysis and data integration to a far broader community.

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