White Paper
Embedding Location Intelligence into your Application
Contents

Overview............................................................................................................................................3
Location Intelligence what is it? ........................................................................................................4
    A brief history ......................................................................................................................................4
Your customers will benefit from Location Intelligence ...............................................................5
Why your customers want Location Intelligence ...........................................................................6
How to rapidly embed Location Intelligence into your application ...............................................7
    Step 1 Geocoding - creating geographic data types .................................................................7
    Step 2 Choosing the right level of detail ....................................................................................7
    Step 3 Choosing the right display option ...................................................................................8
    Geographic images – Rasta Maps ...............................................................................................8
    GIS data stored in any database ...............................................................................................8
    Google / Bing Maps ...................................................................................................................9
    Web Map Services ......................................................................................................................9
The Join Problem - Why layers are cool .......................................................................................10
Yellowfin’s Location Intelligence Solution ....................................................................................11
Summary ...........................................................................................................................................12

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Overview

Today’s knowledge workers deal with vast amounts of data in a variety of formats. As an application developer you provide a solution that helps your customers to manage their business. But what about the reporting that you provide to your customers? Does it include Location intelligence? Are you helping your customers to maximise the insight that your data can provide for their business?

A recent trend in reporting has been the rapid growth for demand in location based reporting. This has been driven in part by advances in technology which have led to the proliferation of geographical services, including online mapping solutions such as Google Maps and Microsoft® Virtual Earth. This technology was once the preserve of geographic information system (GIS) specialists but is now widely available to everyone.

These factors bring new expectations and opportunities for organizations. The ubiquity of geographical services, and the increasing sophistication with which users can consume data means that spatial information is just another component to be incorporated into a Business intelligence solution and used as a basis for making better decisions and providing higher value services.

Spatial data can be used in many ways, such as:

- How big is my market area?
- What is my share of the market area?
- Which market areas offer the greatest potential for growth?
- What is the spending potential for my product in this market?
- How many stores can this market support?

These examples represent only a few of the possibilities created by the integration of spatial data into software applications.

Yellowfin provides support for geographical data through the inclusion of location Intelligence capability, which you can use to query and present location-based information. The spatial support in Yellowfin can help users to make better decisions through analysis of location data in scenarios such as:

- Customer-base management and development
- Environmental-related data impact, analysis, and planning
- Financial and economic analysis in communities
- Government-based planning and development analysis
- Market segmentation and analysis
- Scientific research study design and analysis

This whitepaper provides a high-level introduction to the comprehensive spatial data support in Yellowfin, and describes its high-performance spatial capabilities and location-aware application extensibility that you could embed seamlessly into your application.
Location Intelligence what is it?

More than 70% of your customer organizational data has a location component - be it a customer address or a sales territory. This combined with the growing ability of businesses to quickly absorb large volumes of data, together with the increased availability of digital maps and spatially-enabled applications has created an unprecedented opportunity to incorporate geographic factors into decision making processes and analysis.

Location Intelligence is the capacity to organize and understand complex events through the use of geographic relationships inherent in all information. This is achieved by combining location-related data with other business data, organizations can gain critical insights, make better decisions and optimize important processes and applications. Location Intelligence offers organizations opportunities to streamline their business processes and customer relationships to improve performance and results.

Yellowfin’s Location Intelligence combines traditional Business Intelligence with the addition of a spatial element to let you easily visualize your spatial and business data simultaneously. As a BI platform with its fully integrated GIS capability, Yellowfin is unique. It lets you query the “where” as well as the “what” and “when”. This distinctive capability enables you to merge your spatial data with your corporate information. Table data and maps are interlinked and displayed as a single report.

The merging of spatial data into your business data will give your customers the analytic capability that they need to excel in their business.

A brief history

Location Intelligence is the provision of thematic maps that assist with the understanding of where events such as sales or incidents occur.

One of the earliest examples of the use of thematic mapping comes from London physician John Snow. Though disease had been mapped thematically, Snow’s cholera map in 1854 is the best known example of using thematic maps for analysis. Essentially, his technique and methodology anticipate principles of a geographic information system (GIS).

Starting with an accurate base map of a London neighborhood which included streets and pump locations, Snow mapped out the incidents of cholera death. The emerging pattern centered around one particular pump on Broad Street. At Snow’s request, the handle of the pump was removed, and new cholera cases ceased almost at once. Further investigation of the area revealed the Broad Street pump was near a sewer line.

Subsequently maps used to help explain complex phenomenon have been used with increasing regularity. By the early 20th century map theory had led to the development of maps which were separated into layers, and computer hardware development spurred by nuclear weapon research would lead to general-purpose computer "mapping" applications by the early 1960s.

By the early 1980s commercial vendors of GIS software such as ESRI made GIS applications available to highly trained users within organizations. However, it was through the rapid growth of
internet based GIS applications, such as Google Maps launches in 2005, that truly exposed the power of location based decision making to a much broader business audience.

**Your customers will benefit from Location Intelligence**

Location Intelligence provides your customers with the ability to visualize your spatial or geographic data on maps, floorplans etc. This style of visualisation differs from standard table or grid reports and charts in that it associates your data with a particular location and allows you to easily see patterns which are otherwise hidden within a dataset.

1. **Used where traditional tables/grid, graphs and other analysis tools fall short**

   Tables/grids and charts only tell a part of the story. Map visualizations are the only way to quickly relate BI data with locations that are meaningful to your business and to detect geographic trends such as customer clusters or outliers.

2. **Shows where data is NOT located in addition to where it is located**

   Geographic visualizations are complete. This means that when looking at a map we see it in its entirety. For example when looking at a map of the US we see the entire USA laid out before us. So when overlaying your data onto a map not only do you see where you are on the map but where you are **not** located. This provides you with instant insight into the potential markets that you may be missing out on.

3. **Set you maps in motion to see changes over time**

   In addition to location, time is also a critical determinant of data analysis. With Yellowfin’s map animation you can ‘re-play’ your data and to see the changes overtime animated. This provides your customers with an understanding of how trends are changing and hot spots are moving geographically.
Why your customers want Location Intelligence

Your customers can leverage Location Intelligence to benefit all aspects of the enterprise. The three primary benefits of providing Location Intelligence to your customers are:

1. **Better Business decisions**
   
   Your customers can make use of Location Intelligence to provide insight into optimal business strategy operations and intelligence. Typically, providing map visualizations helps your end users to quickly identify way of improving their business outcomes by focussing on the geographic nature of their data.

2. **Improved customer-facing portals and activities**
   
   This form of Location Intelligence can provide CRM features such as customer service and self-service. Real estate is an area that has embraced location intelligence and has begun to explore the possibilities for sales, marketing, customer service and self-service. This represents a possible growth in the number of users that have access to your application and its data.

3. **Consumer applications**
   
   Mash-ups are perfect examples of businesses focused on providing services to consumers. Applications that build loyalty among customers and influence purchasing behaviors. For example, retailers can execute store-specific promotions with more accuracy, and profile and target their markets, resulting in the identification of higher value customers. Or retailers may use location intelligence to augment loyalty program services via internet channels, as in neighbourhood smart store offerings.
How to rapidly embed Location Intelligence into your application

Step 1 Geocoding - creating geographic data types

The key to getting Location Intelligence delivered quickly is the ability to reference your data to a location. This is done through a process called geocoding. Essentially geospatial data consists of the where an event or item took place or exists. This data could be represented by something as abstract as a country or a state to as detailed as a full address including: address, city, state, postal code, and country. The more data available, the better the accuracy of location plotting that can be achieved. The entire process of going from raw data to being able to plot that information on a map consists of a step called geocoding.

Geocoding is taking your street address information or other types of geographic data like an internet IP Address and getting a latitude and longitude from that. With a latitude and longitude you can produce aggregated heat maps or bubble plots. This geospatial data will also give you the ability to filter that data in amazing ways as well; imagine being able to filter for all related data within x-number of miles from that, or points that only exist within a boundary.

Initially you may not have geographic data types available for your data. However Geocoding provides you with the process to turn basic address information into meaningful geographic data points by relating a physical address such as 360 Elizabeth street, Melbourne, Victoria, Australia into a latitude and longitude (-37.810838,144.961849)

So taking this example further we could choose the level of geocoding that is relevant for your customer set. The options from the example above would be to:

Link this address to:
Country = Australia
State = Victoria
City = Melbourne
Postcode = 3000
Lat Long = -37.810838,144.961849

Depending on the level of detail needed by your customers you can choose to geo-code to a level that is right for you. For example Lat, Long may be too detailed if all you are interested in are the countries which are your biggest export markets. But Lat, Long may be relevant if you want to know the density of your customers in a specific geographic area say within a zip or post code.

To Geocode you need to store the geo-coded data into your database in a usable format. These need to be stored as a single field. So if your address is a single line you will have to split it into its component parts of country and state, similar to the example above.

Step 2 Choosing the right level of detail

As discussed above the level of detail in your mapping that you need should be driven by the reporting requirements. So once you have geocoded your data you need to think about the detail of the maps going to be presented. Taking the country export as an example, the detail needed for that type of report is very low. At most you need a simple country outline within a world map. This
example is ideal for heat maps. You do not need to try and show street level detail since at the country level the user is only concerned about the relativity of one country to another.

Step 3 Choosing the right display option

There are a few distinct ways that you can choose to render maps for your customers. The level of detail you need is important because it will drive the selection of the most appropriate way to deliver your maps to your customers. The following map options are just some of the ways that you deliver Location Intelligence to your customers.

Geographic images – Rasta Maps

Rasta maps are the fastest way to get deliver location intelligence. In some cases you may not have access to detailed maps and your mapping requirements are relatively simple. For instance you want to show sales volume be state or sales region. In this scenario you can quickly and easily implement geographic images, or rasta images, to deliver your location intelligence needs. These images have the benefit that with almost no geo-coding you can create meaningful maps for your users.

The Rasta map works by creating an image or a location – the world, a country or even a floor plan of a building and color coding the areas of the image. (In the example below each country of the world has been given a unique shade of green). These colors are then associated with values in the database. In this example country. So when running a report Yellowfin can dynamically swap the image color for the heat map shade based on the data value for that country. See below.

GIS data stored in any database

Once you have geo-coded your spatial data address etc these can be stored in any database as text fields in any database or if your database supports spatial data types such as Oracle, MySQL and SQL Server then stored as a spatial data type. By storing spatial data in relational tables, the database makes it possible to combine spatial data with any other kind of business data; this removes the need to maintain a separate, dedicated spatial data store and enables high performance queries that do not need to combine data from multiple external sources.
One of the major benefits of Yellowfin is that you do not need to have a spatially supported database to store and report spatial data types. Yellowfin can convert these on the fly for you during the render process.

Spatial formats vary based on the way in which you want to render your maps and data. Different geographical features are expressed by different types of geometry, such as:

1. **Points**
   
   Points (often expressed as latitude and longitude) are used for geographical features that can best be expressed by a single point reference; in other words, simple location. For example, the locations of customers, stores or points of interest. Points convey the least amount of information and no measurements are possible with point features.

2. **Lines**
   
   One-dimensional lines are used for linear features such as roads and railroads. Line features can measure distance.

3. **Polygons**
   
   Two-dimensional polygons are used for geographical features that cover a particular area such as sales territory, drive time from stores, customer density, or land uses. Polygons convey the most amount of information and can be used to measure perimeter and area.

<table>
<thead>
<tr>
<th>Customer Sales by Address</th>
<th>Basic Map Layer</th>
<th>Territory Sales Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Map Image]</td>
<td>![Map Image]</td>
<td>![Map Image]</td>
</tr>
</tbody>
</table>

Each of these geometries is linked to a row in a database that describes their attributes. For example, a database that describes a sales territory may contain average household income, population by segment, and sales history. This information can be used to make a map to describe a particular attribute of the dataset. For example, sales territory could be coloured depending on level of sales. Different geometries can also be compared. For example, the GIS could be used to identify all customers (point geometry) that are within 100 kilometres of a sales territory (polygon geometry) that has a high level of sales.

**Google / Bing Maps**

Google and Bing Maps are basic web mapping service applications, free (for non-commercial use), that powers many map-based services, and maps embedded on third-party websites via the API. The consideration you need to make is that these services are not free for enterprise use and your customers will need to make commercial decisions based on the associated costs.

With this option you will need to have access to latitude and longitude data. So your data will have to be highly geocoded to enable points to be placed on a map.

**Web Map Services**

A Web Map Service (WMS) is a standard protocol for serving georeferenced map images over the Internet that are generated by a map server using data from a GIS database. This standard allows you to access any spatial data stored by externally hosted GIS data providers. This is an extremely
good way to deliver detailed maps to your customers as there are many service providers available for different countries and at different pricepoints.

The Join Problem - Why layers are cool

One of the most valuable functions of Location intelligence is its ability to overcome the “join problem”. This is when data has various levels of granularity and using a traditional SQL environment it is not possible to correlate these together into a meaningful report easily because the data is incompatible. Granularity is when one aspect of your data is captured at the customer level for example demographics, but other data is captured at the store level for example revenue. If you wanted to compare revenue to demographic this would be hard to do in a standard table report but with Map Layers this becomes easy.

In most GIS software data is organized in themes as data layers, such as customer distribution, store drive time etc. This approach allows data to be input as separate themes and overlaid based on analysis requirements.

The really powerful aspect of layers is that the human brain, which is wired to find patterns, joins the incompatible data together rather than a complex query, and it is so intuitive that anyone can understand the data being presented to them.

In any Location Intelligence project a variety of data layers will be required. These must be identified before the project is started and a priority given to the input or digitizing of the spatial data layers. This is mandatory, as often one data layer contains features that are coincident with another, e.g. lakes can be used to define polygons within the forest inventory data layer. Data layers are commonly defined based on the needs of the user and the availability of data. They should be completely user definable.
Yellowfin’s Location Intelligence Solution

As you can see from this paper there are many ways in which to deliver Location Intelligence to your customers. The challenge of multiple geographic and business data sources is to have a platform that seamlessly ties all of these together. The real power of Location Intelligence is the integration of business and spatial data.

The highest level of integration for technology is always at the functional level. It is here where we see an effort to make transparent the use of underlying technology for the user. Yellowfin is one example of leading technology that achieves this level of integration; simplifying the integration of geographical data and traditional data sources for your Business and Location Intelligence needs. The solution easily applies traditional data, geographic data, and advanced visualization into a cohesive BI platform.

This combination is where leading products like Yellowfin excel. Establishing a common analytic platform that reaches across disparate data and technologies, bringing them together is a single, cohesive, synchronized data discovery solution for all user communities.

The benefit to you is that you can easily embed Yellowfin into your application to seamlessly deliver the benefits of Location Intelligence to your customers.

Presentation Quality Maps

Save time and money creating maps with up-to-date data quickly. Yellowfin can effortlessly display your data in a wide variety of mapping formats. From basic google maps, GIS data sets to Web Map Services (WMS), Yellowfin provides you with highly layered maps containing deep analytical insight. Via WMS Yellowfin lets you rapidly integrate or create mashups using your customers existing GIS tools such as ESRI or MapInfo.
Detect Geographic Trends

Better entity placement, customer and competitor analysis. Yellowfin’s out of the box Location Intelligence means that you can start to leverage the power of location instantly without the need for 3rd party plugins. What proportion of my customers live within 15 miles of a store, what is the geographic spread of my customers and how has this changed over time. Your ability to view table and map data simultaneously gives you a deeper understanding of geographic trends.

Take advantage of Data Layering & Statistical Data

The ability to overlay demographic or statistical data onto your maps provides you with an additional layer of analysis that can add to your interpretation of the data. Data such as Per capita income, census data, retail statistics, telco statistics can easily be layered onto a map. Often with this type of data the additional data set is incompatible with your initial data set. For example you have sales income by sales territory and customer details by address. How do you merge or join the two together? Typically this is difficult using traditional database techniques but with Yellowfin you can create multilayers maps. These layers let the human eye doing the joining for you – creating that ‘aha’ moment.

Summary

Our ability to exploit the massive amounts of complex, disparate data will never be resolved by the traditional technology we introduce or the common techniques we attempt to implement. Pie charts and other typical graphics, for example, fall short of supporting better decision making. A pie chart is simply not sufficient to interrogate a large OLAP cube or provide the necessary insight from the data pushed into our dashboards.

Innovative visualization technology is necessary to effectively synthesize detailed data into information and present this content in an understandable manner to users. However, for leading business intelligence (BI) environments, this visualization must be based on spatial (geographic) data. Effective BI, therefore, is dependent on its capacity to include spatial data and deliver Location Intelligence.

Integrating spatial data with visualization technology delivers accurate, high-impact information content. Solutions like Yellowfin deliver this integration, transforming data into human understanding and actionable insight.

Find out more

Contact Yellowfin at www.yellowfin.bi and ask for our proven roadmap to assist you to successfully integrate Yellowfin’s Location Intelligence into your application.