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Enterprise Application for Location Intelligence using Open Layers, Google and Bing API's

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Abstract

Today Geospatial Technology has been growing quickly over time however decade before Geospatial technology occupied simple geospatial database building such as Points, lines and Polygons layers related to different themes for resolving any kind of geospatial problems via desktop applications. The current technology trend has taken up huge demand towards building complex geo data model and it can be accessed through customized enterprise GIS.

In this context we will be presenting the enterprise location based solution on how the customers can access their highest level of positional accuracy geospatial data for managing assets, and enhancing business analytics such as Parcel centroid that is defined by actual latitude/longitude, parcel boundary, Assessor's Parcel Number (APN) or Tax ID Number, Property Address and their property flood risk zone. This data can be delivered in the ESRI shapefile format and has the flexibility to be accessed through any platform which they prefer.

This paper intends to deal with the main mechanism of J2ee, Oracle Spatial, Open layers, AJAX, Geoserver and Google & Bing API's responsibilities of each component and finally demonstrates how the Web mapping application deliver the data to the customers. These data from (GIS) databases are published with the GeoServer, which is fully compliant to WMS, WFS and WCS specifications. The data is exposed / overlaid on Google Maps and Bing Maps, for more clarity and can be accessed by the clients through a web browser. Through the GeoServer, we have been able to effectively provide the geospatial data via OGC standards to end users. The WMS capabilities for the general purpose viewing or display of the data and the WFS capabilities can be used for

identifying the features, downloading the GIS data in GML, JSON, excel or ESRI ShapeFile format.

1.0 Introduction

In recent years many large companies and organizations have switched from independent, stand-alone GIS systems to more integrated approaches that share resources and applications. In this context Enterprise GIS is to address the needs of departments collectively instead on individually. The development of one comprehensive infrastructure minimizes potential conflicts and misunderstandings and can result in significant cost savings and performance improvements.

In this paper describes how a ***First American Spatial Solutions*** will helpful to typical local government or public agency to understand a relationship between a property's physical location and surrounding geographic features through Geospatial enabled Enterprise Application for Insurance, Utility and Energy industries.

2.0 Scope and outline

- To integrate Geospatial Information System (GIS) databases into leading mapping and visualization applications to provide businesses the geographic insights needed to make intelligent decisions

- Analyzing the spatial information associated with the genocides location, and the spatial layers, you can gain new insight into the location and its surroundings

- Proximity analysis of different risk zones (fire, flood, earthquake, and so on) is this location in or near

- To allow utility companies to determine spatial locations and ownership, create accurate forecasts and budgets, and provide a foundation for their own spatial databases

3.0 System Architecture

While designing any Enterprise-GIS system or solution with the help of customer requirement, the salient factors those is important to be included are well-designed component, GUI, data downloading time, system performance and the cost of the solution. The system must be portable and expandable to accommodate the future changes in hardware, software and networking Keeping in view these factors, the designing of the system has been done using Open source GIS along with commercial GIS products.

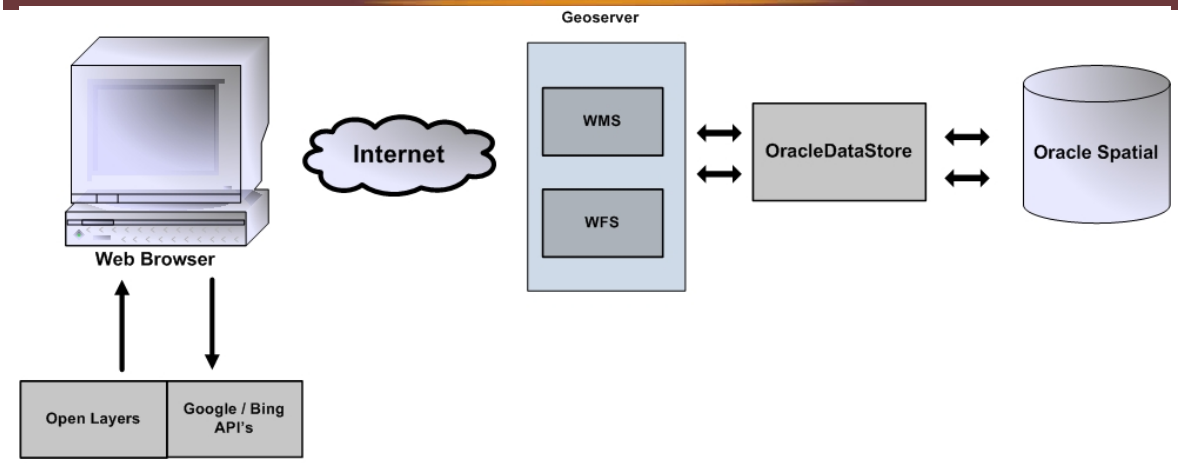


Fig - I

Geoserver provides a databases are published which is fully compliant to WMS, WFS and WCS specifications. It uses server-side technologies for data integration with Oracle Spatial and is capable of serving to multiple clients' request in a minimum response time. It is specifically built to serve GIS on the Internet.

3.1 OpenLayers

OpenLayers is a pure JavaScript library for displaying map data in most modern web browsers, with no server-side dependencies. OpenLayers implements a JavaScript API for building rich web-based geographic applications, similar to the Google Maps and MSN Bing APIs, with one important difference – Open Layers is free Software, developed for and by the Open Source software community.

3.2 Displaying Maps with OpenLayers

Google Maps gives you a quick and easy way to add maps to your Web site, but when you're using Google's API, your ability to display other data is limited. If you have your own data you want to display, or data from sources other than Google, OpenLayers, an open source JavaScript library, can give you more options.

3.3 Web Map Services

Web Map Service (WMS) provides a simple HTTP interface for requesting geo-registered map images from one or more distributed geospatial databases. A WMS request defines the geographic layer(s) and area of interest to be processed. The response to the request is one or more geo-registered map images (returned as JPEG, PNG, etc) that can be displayed in a browser application. The interface also supports the ability to specify whether the returned images should be transparent so that layers from multiple servers can be combined or not. WMS specifies a three different request types, GetCapabilities, GetMap and GetFeatureInfo.

3.4 GetCapabilities

Returns parameters about the WMS and the available layers. This includes names of data layers exposed, geographic extents of the layers, styling available for the layers, and output formats supported for the layers. GetCapabilities requires no parameters other than "request" and is typically used by a developer to discover what data is available and how it may be consumed in a web application.

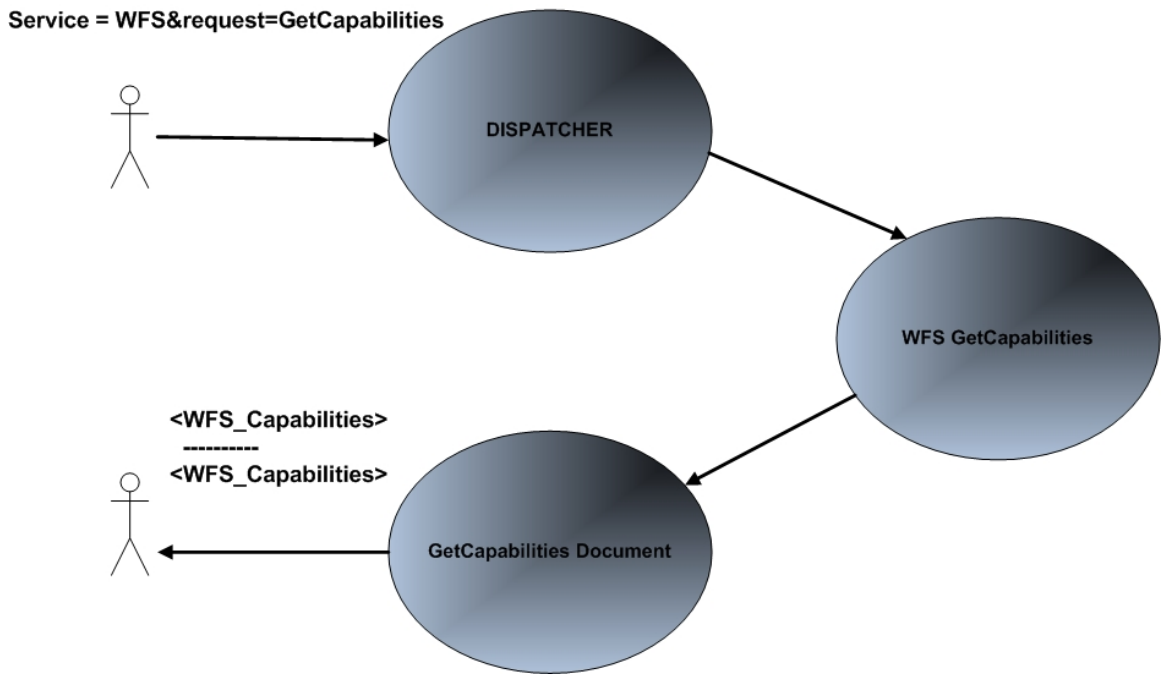


Fig – II

3.5 GetMap

GetMap allows the client to specify distinct layers, the spatial reference system, the geographic area, and other parameters describing the returned map format.

Fig - III

Upon receiving the GetM p request, a WMS site will either satisfy the request or send an error message in accordance with the exception instructions contained in the GetMap request.

3.6 GetFeatureInfo

Return info about feature(s) at a query (mouse click) location. GetFeatureInfo is a WMS standard call that allows one to retrieve information about features and coverage's displayed in a map also provides feature information by identifying a point on a map based on its pixel location. The GetFeatureInfo request embeds many of the parameters required in the GetMap request along with parameters specific to querying layers.

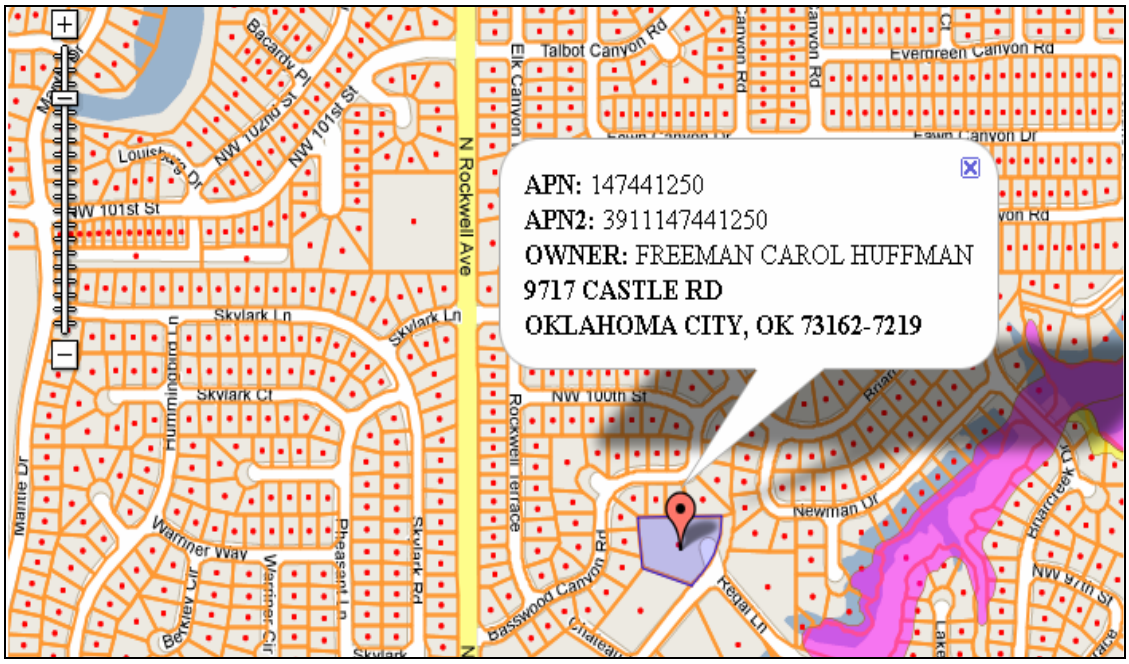
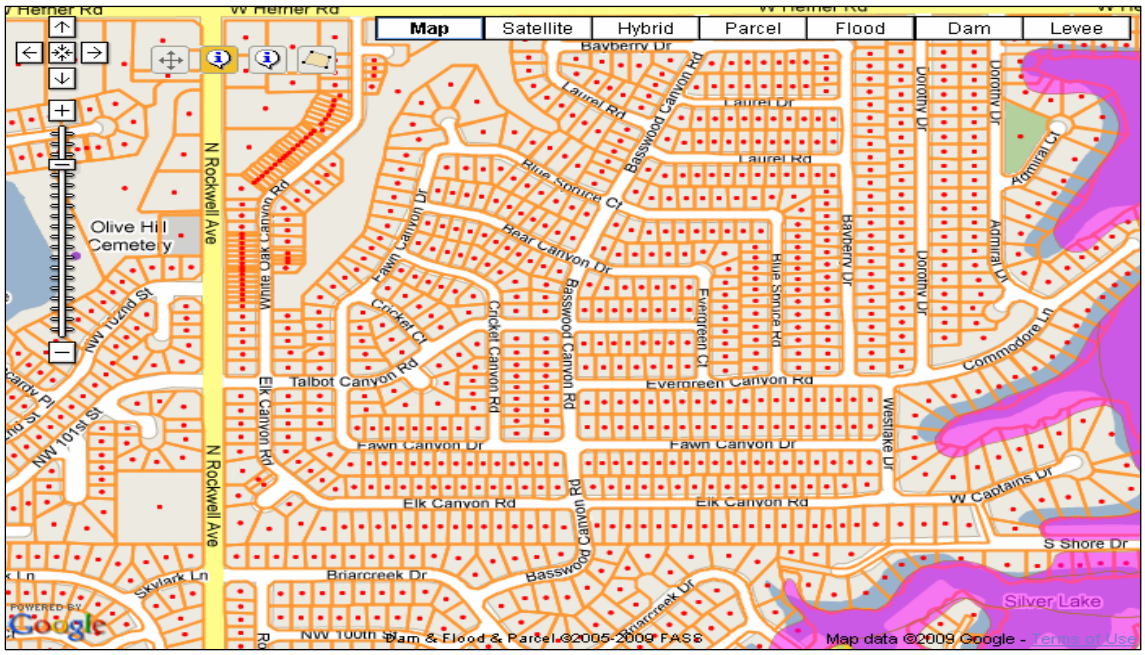


Fig – IV

For example, if a parcel map is drawn but the user not only wants to see the boundaries, but also wants to know who owns a certain parcel on their screen, a click (or hover) handler is written which creates a GetFeatureInfo request which is then relayed to the WMS server and the server responds with XML/HTML/text representing the attributes of this parcel.

4 WMS with Google Map

Google Maps API is a viable web mapping API providing conventional road maps as well as high resolution satellite imagery and Point Of Interest. The API is implemented as a single piece of Javascript which is consumed directly from Google at runtime. The



Google Maps API provides easy customization through a robust set of Javascript classes. Most notable is the ability to bring in tiles from another source to overlay on the Google Map which is provided by the GTileLayer class.

Fig – V

It is very easy to utilize this GTileLayer class and a little pre-written Javascript to consume WMS to overlay with other spatial data's. Once you have your own API key, you can use WMS in your own application.

5 WMS with Bing Map

Bing is a web mapping API and web service providing road maps as well as high resolution imagery. Bing provides not only the underlying map imagery via a web service, but also a web mapping API known as the Map Control for allowing web developers to create fully featured web mapping applications with only basic geographic knowledge. The official Microsoft Bing website is your best resource for learning about Microsoft Bing Web Service and the Map Control.

All that is necessary for a web application to embed a Bing map is inclusion of the JavaScript which provides the Map Control classes, an HTML div to use for the map, and

a small amount of JavaScript to initialize the map. Bing Map Control is based on a set of pre-rendered tiles of map images at a pre-defined set of scales.

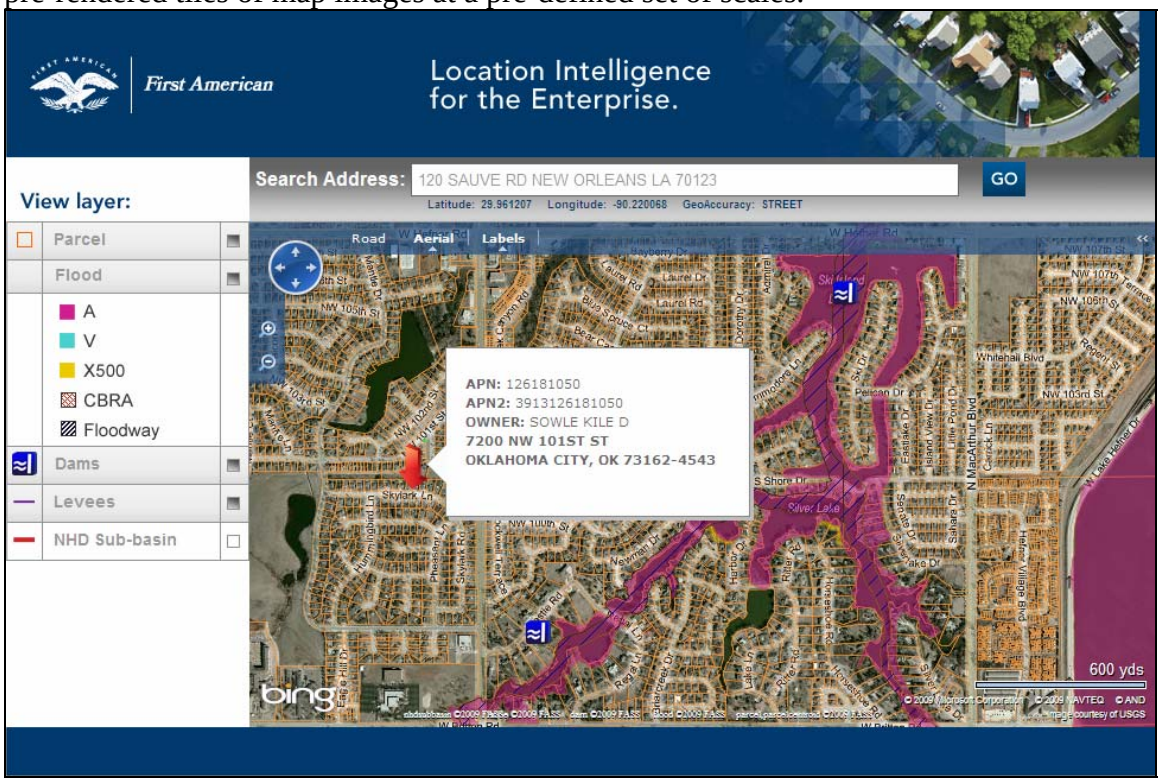


Fig - VI

The way these tiles are defined and the scales at which they are available is best described by the MSDN. Despite its simplicity Bing provides easy extension through a robust set of JavaScript classes.

6 Application Development and Methodology

To allow access to WMS, the Google and Bing map tile requests has to be converted into WMS request to create the tiles. An HTTP handler is set up to intercept the tile requests and fulfill them with the information from WMS, essentially a kind of proxy server.

Google Maps API interfaces are implemented within JavaScript through assignment of the prototype property to an instance of the inherited object. Overlays are objects on the map that are tied to latitude/longitude coordinates, so they move when we drag or zoom the map.

To display Custom map tiles, we can use the two options:

- Implement your own tile overlay on existing map types using GTileLayerOverlay

- Implement your own custom map type using GMapType

Each case requires us to implement three abstract methods from the GTileOverlay interface:

- getTileUrl() returns to the map a URL containing the tile image, given a passed GPoint and zoom level.

- isPng() returns to the map a Boolean indicating whether the image is a PNG file(which can be displayed transparently). If true, the image is assumed to be a PNG.

- getOpacity() returns a value between 0.0 and 1.0 indicating the level of opacity to display this image.

The Google Maps API constructs a GTileLayer passing a GTileLayerOptions argument as an object literal. The GTileLayerOptions argument contains a tileUrlTemplate property that maps tile requests to URLs based on tile coordinates.

Similar to Google map API, The Bing Map Control API is built on a foundation of tiles. Each tile represents a particular view of a rectangular piece of information. To specify a custom tile source, create a new VETileSourceSpecification object containing the tile source information. The VETileSourceSpecification has several important properties, like TileSource, Bounds, ZIndex, MinZoom, MaxZoom, Opacity, etc.

The tile source contains a URL that points to the servers that are going to host the tiles.

In both Google map and Bing Map, the GetFeatureInfo provides feature information by identifying a point on a map based on its pixel location. The GetFeatureInfo request embeds many of the parameters required in the GetMap request along with parameters specific to querying layers. GetFeatureInfo can generate output in various formats like GML2, plain text and HTML. OpenLayers and the Map API's use the output to highlight the feature or the parcel that is to be identified.

7 Results and Conclusion

This application enables users to access the highest level of positional accuracy for location-based solutions, all kind of utilities, managing assets, and enhancing business analytics for insurance industries. Our data set has high-precision geocoding and spatial analytics engines, which utilizes multiple data sources including, U.S. parcel boundary, and delivers accurate locations for properties across the United States.

For analyzing geographic relationships near or surrounding a geocoded location, such as how far an insured policy is from the coastline or determining the correct tax jurisdiction for a property, offers multiple spatial operations to compute location and distance information.

Analyzing the spatial information associated with the geocoded location, and the spatial layers, you can gain new insight into the location and its surroundings for example which risk zones (fire, flood, earthquake, and so on) is this location in or near? How far is this location from my nearest store or closest competitor? What sales and use taxes are required for this location?

8 Acknowledgements

This document acknowledges Bruce Thelen First American Spatial Solutions valuable support and inputs provided during the application development.

9.0 References

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