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If your application needs to quickly determine

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business and POI Search

API into its Google Enterprise Support Portal, so it

For Business

you to search for locations on the map based on

address database to your application, enabling

service level agreement.

by including 24-hour technical support and a

business. Google Maps APIs ensure peace of mind

Enterprise Support

profiles for any path, be it along a route or across

Elevation Profiles

areas, drop markers, and draw and edit shapes.

drawing tools that enable your users to select

on current traffic.

Google Maps APIs provides predictive travel time

a way to filter results by drive time, the Distance

for Business

Elevation Profiles

whitepaper

Google Maps

For Business

Dibyajyoti Pal
Executive Summary

For ages, maps have been integral to our daily lives. From our cave-painting days, we have been creating and using maps to define, explain, and navigate. Businesses, especially operation and transportation-intensive ones, are making great use of maps to leverage their operations, facilitating strategy, establish structured communication, and optimize resources better. Due to rising complexity, and to stay ahead of competitions, maps have been gaining notice lately across industries. The upcoming disruptions focus mainly on integration of Maps with IoT and Machine Learnings.

The transition to digital maps from print maps has observed lightning-fast development. The stepping stone for maps getting digitized was introduced in 1993 by Xerox. In 1995, MapGuide was introduced by Argus Technologies which was followed by MapQuest in 1996 who presented the first ever online Address Matching & Routing service. Almost after a decade, with the introduction of Google Maps, digitization of paper maps took a different dimension altogether. Thanks to Web Mapping or Web GIS (Geographical Information Systems), it’s been quite a progress from the restricted and costly use of hardware.

![The Evolution of Maps](image-url)
The Technology

Web mapping is the process of using maps delivered by GIS. A web map on the World Wide Web is both, served and consumed, thus making web mapping more than just web cartography. It is a service which lets consumers choose what the map will show. Web GIS emphasizes geodata processing aspects. It is more involved with design aspects such as data acquisition and server software architecture such as data storage and algorithms, than it does the end-user reports themselves.

Google’s Take

Google’s offering ranges from satellite imagery, street maps, 360° panoramic views of streets (Street View), real-time traffic conditions (Google Traffic), and route planning for traveling by foot, car, bicycle (in beta), or public transportation. As Google Maps is coded almost entirely in JavaScript and XML, some end users have reverse engineered the tool and produced client-side scripts and server-side hooks. It allowed a user or website to introduce expanded or customized features into the Google Maps interface.

Using the core engine and the map/satellite images hosted by Google, such tools can introduce custom location icons, location coordinates, metadata, and even custom-map image sources into the Google Maps interface. The script-insertion tool Greasemonkey provides a large number of client-side scripts to customize Google Maps data.

The Revolutionary Google Map API

After the success of reverse-engineered mashups such as ChicagoCrime.org and Housingmaps.com, Google launched the Google Maps API in June of 2005 to allow developers to integrate Google Maps into their websites. It is a free service, and currently does not contain ads, but Google states in its terms of use that they reserve the right to display ads in the future. By using Google Maps API, it is possible to embed the Google Maps site into an external website, onto which specific data can be overlaid. Although initially only a JavaScript API, the Maps API was expanded to include an API for Adobe Flash applications (but this has been deprecated), a service for retrieving static map images, and web services for performing geocoding, generating driving directions, and obtaining elevation profiles.
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default zoom setting—how often users pan
commonly use when looking at the map, thus
will fit in with other Analytics programs that
API into its Google Enterprise Support Portal, so it

Forward and Reverse Geocoding
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profiles for any path, be it along a route or across
The Google Maps APIs can deliver elevation
Elevation Profiles
The Google Maps APIs include ready-to-go
on current traffic.
Predictive Travel Time
a way to filter results by drive time, the Distance
building a location finder and want to offer users
(Street View), real-time traffic conditions (Google
street maps, 360° panoramic views of streets

Types of Google API

Places API
Places API helps in getting local data and improve customer experience using Autocomplete.
Autocomplete can significantly streamline and simplify address entry in your application, leading to higher conversion rates and a frictionless checkout for your customers.

Directions API
Directions API helps in giving your user the best route—walking, driving, cycling, or public transit.

Distance Matrix API
It calculates travel distance and time for multiple origins and destinations.

Roads API
Map GPS coordinates to the geometry of the road and determine speed limits.

Asset Tracking Applications
Asset Tracking Applications are customizable, mobile ready, and scalable.
Key Features of Google Maps APIs

> **Business and POI Search**
Google Maps APIs provide your application with full access to Google’s worldwide database of over 100 million business listings and Points of Interest. Whether you need to show your users nearby bars, coffee shops, airports, or grocery stores, you can provide a filtered list of places that are most relevant to your users.

> **45-Degree Imagery**
The Google Maps APIs include access to 45-degree imagery in over 120 cities worldwide, offering views of the cityscape from all four sides. This means that your users can explore your data with a unique perspective within a particular area.

> **Address Autocompletion**
Make address entry easy for your users. Any text field on your web page can be enhanced with the power of Google Maps Autocomplete, giving you fast, accurate, and easy address entry.

> **Analytics**
Get deeper insight into how your website visitors interact with your maps through Analytics for Google Maps. It is designed to give businesses some basic analytics over how visitors to their websites interact with their customized maps. Google says the API is similar to existing Google Analytics programs that help companies determine how users utilize their company websites. Google has integrated the new Maps API into its Google Enterprise Support Portal, so it will fit in with other Analytics programs that businesses currently run.

Among other things, the Maps API gives users insights into what zoom level users most commonly use when looking at the map, thus giving companies the ability to make it their default zoom setting—how often users pan around on the map to find what they’re looking for, thus giving companies the opportunity to re-center their maps to meet customer needs—and know how shifting the display angles on a company’s default map increases or decreases user activity.

> **Directions**
The Google Maps APIs deliver the full power of Google’s routing engine to your applications. You can generate routes for up to 23 locations—be it driving, walking, or cycling. Up to three alternate routes are offered, and users can drag routes on the map to make changes. Routes can avoid toll roads or highways, and travel time can be reduced by calculating the optimal order to visit each location.

> **Distance Matrices**
If your application needs to quickly determine travel time and distance between many pairs of locations, you can use the Distance Matrix service.
of the Google Maps APIs. For example, if you’re building a location finder and want to offer users a way to filter results by drive time, the Distance Matrix service is a quick and easy way to evaluate which nearby locations to include.

> **Predictive Travel Time**
Google Maps APIs provides predictive travel time based on historical time-of-the-day and day-of-the-week data.

> **Routing in Traffic**
Google Maps APIs give you the best routes based on current traffic.

> **Drawing Tools**
The Google Maps APIs include ready-to-go drawing tools that enable your users to select areas, drop markers, and draw and edit shapes.

> **Elevation Profiles**
The Google Maps APIs can deliver elevation profiles for any path, be it along a route or across a continent. It even returns depths underwater!

> **Enterprise Support**
Your mapping application can be crucial to your business. Google Maps APIs ensure peace of mind by including 24-hour technical support and a service level agreement.

> **Forward and Reverse Geocoding**
The Google Maps APIs deliver Google's global address database to your application, enabling you to search for locations on the map based on an address, or find the address for a given location, anywhere in the world.

> **Global Satellite Imagery**
The global catalog of high resolution aerial imagery offered by Google Earth is also available in the Google Maps APIs. You can switch any map to satellite view using the optional labels. The highest level of detail at a given location can be automatically determined, allowing you to show your users the best image possible.

> **Rapid Updates from MapMaker**
If you spot an error on the map, you can fix it using Google MapMaker and see the change reflected in your Google Maps APIs application within minutes.

> **Real Time Traffic**
Major streets can be color coded to reflect the current volume of traffic in real time.

> **Rock Solid Reliability**
The Google Maps APIs offer proven reliability, with 100% uptime measured in a recent independent evaluation of API availability.

> **Static Maps**
The Static Maps API can generate an image of a map with support for pins, lines, shapes, and styling.

> **Street View**
The Google Maps APIs allow you to embed Street View panoramas into your application. You can
control the direction the panorama faces, respond to changes in the view triggered by your users, and add interactive elements such as markers, popup windows, or even your own panoramic images.

> **Styled Maps**
The Google Maps look and feel is familiar and trusted around the world, but if you need something a little different, the Google Maps APIs let you tailor the style of the map to your needs. You can simplify the map to draw more attention to your data, or restyle the map to fit the rest of your application.

> **Support for Different Devices**
The Google Maps APIs ensure that your maps will work on major web browsers and mobile devices. High-resolution screens are detected and the map is automatically adjusted to ensure that it remains perfectly crisp and clear.

## A Look into IoT

Google's version of IoT standards, open source frameworks, and cloud services are compelling, but puts it in a highly competitive market. However, Google's long-term R&D investments in machine learning, cloud, and geo-location technologies uniquely differentiate its vision.

**Machine learning to teach IoT networks to behave intelligently**

If This Then That (ITTT) rule engines have been applied to controlling and integrating IoT devices. A good example of IITTT might be a thermostat instructed to send a push notification to a user if the house temperature drops below 50 degrees during the day when no one is home.

ITTT works well for many applications, but its recipes are constrained by the complexity of creating rules for larger and larger systems. Google's open source machine-learning project Tensorflow gives developers the tools they need to build large, intelligent IoT networks of sensors to do things like ease traffic flow through a city, for example.

**Using Bluetooth LE beacons and cloud for geolocation**

For more than a decade, Google has invested in outdoor geolocation research to build APIs that developers can use to build geographic position into apps for navigation and geofencing that leverage GPS, Wi-Fi, and cell towers to locate people and things.

Google's Eddystone’s open source Bluetooth Low Energy beacon brings geolocation indoors, increasing the resolution from meters to centimeters, either as longitude and latitude, or a relative scale within the confines of a building.
Google has about 20 Eddystone beacon manufacturing partners as of now.

Eddystone uses broadcast-only radios, operating at a range of frequencies that send small packets of data called frames configured with unique IDs, URLs, and application-specific data. Google provides a cloud-based registry of information of every Eddystone beacon that app developers can use to store the meaning of each beacon. The plan is to make the cloud registry capable of scaling to manage the experiences of tens of billions of unique devices with Google's large-scale systems and the IoT domain of its Nest team.

The frame payload and radio frequency can be provisioned, but the devices are broadcast only to eliminate privacy and security concerns. The beacon's identifying payload can be resolved by iOS and Android apps using the cloud registry to learn the beacon's meaning, context, and exact location. The location can be optionally integrated into Google Maps or remain a relative position in a semantic location graph. A good example is Google's pilot app with the city of Portland, through which they equipped each public transit stop with a beacon, successfully providing real-time transit status within half a second of the traveler's arrival.

And the journey continues

So close, yet so far. Maps, and the possibilities attached, are not fully envisioned yet. Google and others are collaborating in this journey hand-in-hand to accomplish this gigantic end goal of bringing the most efficient and seamless way for us to define, explain, and navigate through the world. What’s your contribution? Got any innovation in mind? Or are you already working on something disruptive? Share with us and make it large!
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About the Author
Dibyajyoti Pal is a Lead Business Analyst for Manufacturing Practice and is currently assigned for Warranty-on-Demand product at Tavant Technologies. Dibyajyoti brings in six years of rich corporate and entrepreneurial experience. He founded three startups - iKreta, CoVended and CarMindz - that were into Logistics, Software Services, and Automotives, respectively. Prior to that, he worked in Mercedes Benz India, Daimler AG, Indian Oil Corporation, and Tata Metaliks Ltd. With his sharp analytical skills he builds businesses while his empathetic and decision-making ability makes him a strong leader. In his leisure, he learns new skills, explores new business ideas and sometimes indulges in swimming and gaming.

About Tavant Technologies
Headquartered in Santa Clara, California, Tavant Technologies is a specialized software solutions & services provider that provides impactful results to its customers across North America, Europe, and Asia-Pacific. Founded in 2000, the company employs over 2000 people and is a recognized top employer.