

Address Management: The Secret Ingredient for Geospatial Success

By Boris Gutkin, Ph.D. and John M. Fisher

ABSTRACT

The goal of this paper is to provide insight into Master Address Management – a complex and challenging component of an overall geospatial strategy. Organizations often find themselves challenged with managing decentralized and disparate address databases resulting in erroneous, inconsistent, duplicated and missing location data records and mismatches of information tied to this location data. Understanding how to apply address standards within an organization can have a dramatic impact on organizational success, because so many vital business activities and business data are tied to addresses. This paper, prepared by location intelligence subject matter experts from DMTI Spatial, will take you through the best practices and leading technologies for managing address data.

This paper aims to explain how applying these best practices will help organizations to make better and more informed decisions, reduce risks associated with location dependent activities, and identify and target additional market opportunities.

WHAT IS AN ADDRESS?

An address is a referencing system. It is an independent object that identifies and links a location to another object in the real world. There are many forms of address, including legal, assessment, postal and E911, to name a few. In everyday business practice, the municipal or civic address, also known as the street address, is the most common location reference, and it is used as a key linking mechanism between disparate pieces of information managed by the business. Addresses are

widely used across different industries and in everyday life both as descriptors and as a referencing system. Examples include (see Figure 1):

- Postal authorities add a delivery index to the address in order to facilitate the sorting and delivering of mail. This index is commonly known as the Zip Code (in the United States) or the Postal Code (in Canada).
- Retailers and service companies link customer identification information to address data in order to better manage customer databases and track services provided to customers.
- Utilities track the location of pipelines and power lines alongside populated areas and use addresses to cross-reference customers, prospects, properties and buildings to infrastructure.

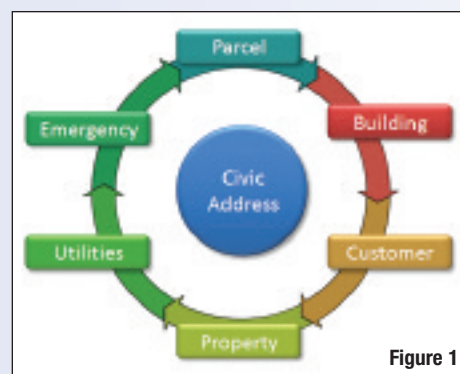


Figure 1

- Emergency services use addresses to identify incident locations. Details about the location of the incident are important.
- Marketing professionals are interested in details about the activities, which happen at particular addresses (e.g. is it a commercial, industrial or residential establishment?)
- Land registration authorities and

assessment authorities tie civic addresses to parcels of land in order to provide fast and easy access to the data and to facilitate communication with the owner and other interested parties.

- Assessment authorities manage property information using an address as a reference.

All these businesses use addresses as mission-critical information to manage their interests. Addresses typically provide the most readily available and comprehensive platform for the integration of different spatial objects.

ADDRESSABLE OBJECTS

Why do we need an Addressable Object?

Addressing has typically been viewed and portrayed in business in relatively simplistic terms: e.g. a place where mail is delivered or where services are performed. In fact, addresses can be interpreted and managed in a far more sophisticated way that yields valuable location intelligence – intelligence that can drive more effective planning, marketing, service dispatch, customer support, and a myriad of other business benefits. Doing this effectively requires insight into the many attributes of a location - factors such as use, occupancy, ownership and accessibility, and how these attributes can be related to each other and represented geographically. A model of Enterprise Address Management is needed in order to effectively correlate and maintain addresses with all of these associated and embedded relationships. How are we to manage and maintain addresses and all of the extensive attribution associated with those addresses? The answer is the **Addressable Object**, the key to

Enterprise Address Management. The Addressable Object is a superclass entity, which encompasses all of the separate object types (e.g. building, parcel), which are typically described with addresses.

For most organizations address information has historically been used for such diverse purposes as billing, delivering products, installing services, or calculating property taxation. Even at this level, managing address information has been a challenge because the data is often collected by separate lines of business or business functions, each of which has different business practices, quality standards and operational biases. As a result, address information resides in data “silos” and cannot easily be integrated and cross-referenced for accuracy, duplication or cross-selling. Data cleansing and integration can involve a major investment of time and resources.

More problems emerge when organizations try to leverage address information for more sophisticated purposes. Largely, this is because a civic address on its own is often insufficient to drive other business processes effectively. It does not, for example, convey property land use, zoning, or co-located infrastructure – potentially essential parameters to consider when determining serviceability for customers and prospects.

Another challenge is the sheer complexity of these parameters. They are not mutually exclusive, nor easily aligned into relationships for which business rules can be readily written. For example, one civic address can have multiple locations, and each location can have many different attributes. The result is a complex web of data and data relationships which are difficult to decipher, much less act upon.

Implications for Business

As can be seen from the examples above, there can be many-to-many relationships between civic addresses and addressable objects. At the same time, constituent addressable objects may have mutually exclusive attributes

associated with them. Without a comprehensive view and understanding of all address attributes, businesses cannot properly target their marketing, accurately price and bill for products and services, efficiently dispatch onsite services, nor properly plan for future services.

Most corporate address data stores are inadequate for making these decisions, resulting in service failures, wasted resources, missed business opportunities and costly mistakes.

Proposed Solution: The Addressable Object Model

To resolve the spatial and non-spatial complexities associated with addressing, DMTI Spatial has developed a data model that better reflects the relationships between civic addresses and their attributes. This model introduces the concept of an “addressable object” as a structure or property associated with an address. This enables multiple entities to be associated with the address, while linking them to essential attributes for business purposes.

For the purposes of this model, a “**Structure**” is defined as any man-made edifice or engineering construction, for example buildings of all kinds, bridges, transformers and power stations. A “**Property**” is defined as an area of land which can be readily distinguished from those around it based upon such characteristics as land use and ownership. Examples include legal parcels, assessment parcels, parks, cemeteries, golf courses, open space, vacant land and easements. Every addressable object (by definition) is associated with a spatial location (in GIS terms - by a point, line, polyline or polygon).

Types of Addressable Objects

Addressable Object types need not be limited to those presented in the current paper. The beauty of this model is the fact that it can be scaled to any size depending upon business needs. The main requirement and benefit is in the correct maintenance of the relationships between different

addressable objects.

The relationship amongst addressable objects can be described as “many-to-many,” but in some circumstances, they can form a “one-to-many” relationship. For example, one building as an addressable object can have many suites or sub-units as separate addressable objects associated with it, but not vice versa.

Conclusion

Location information drives many business processes today, but the inadequacies associated with conventional addressing create many challenges for business, such as ineffective marketing, service failures, operational inefficiencies and errors. Further, without a thorough understanding of the attributes associated with an address, organizations miss out on business opportunities and lack adequate information upon which to plan and base decisions.

By addressing the inherent complexity of address attributes, and by establishing clean one-to-many and many-to-one relationships, the Addressable Object Model enables organizations to tease apart these complex relationships and work effectively with mutually exclusive attributes of an address to acquire a more accurate and thorough picture of their customers, prospects, assets, markets and operations. Clearly, the model’s usefulness is dependent on the extent and quality of the data available. However, DMTI is collecting through its fieldwork, sharing with clients, purchasing from sources and acquiring licenses to data sets that can populate the model’s components with accurate and reliable data. Through the use of this model and these data sets, organizations can begin to leverage location intelligence and drive business performance.

ADDRESS STANDARD

The Need for an Address Standard

An essential part of the Master Address Management system is the

implementation of an addressing standard. In the USA, a national addressing standard has been recently developed as an initiative of URISA, with the support of NENA and the US Census Bureau. This standard is expected to be recognized officially by the Federal Geographic Data Committee. The existence of a standard however, does not imply that it has or will be universally implemented.

DMTI has developed an addressing standard for Canadian addresses along similar lines, which the company is putting forward as a suggestion for a Canadian national addressing standard.

Addresses should be considered in more general terms than just an enabling mechanism for delivering postal and courier services. Addresses are also used for a wide range of public and private sector applications. Examples include the delivery of goods and services, infrastructure planning, the provision of utilities, emergency dispatch, conducting household surveys, serving summonses, and land management.

Addresses are also critical because they provide a reference context for such disparate information as taxation, bank accounts, mortgages, voting results, obtaining employment, conducting household surveys, visiting friends, etc.

Due to political, geographical, cultural and other factors, addresses differ substantially from place to place even though they serve the same basic purposes. Created by different local authorities, addresses represent a variety of different reference systems developed and maintained historically. In the absence of a national standard, these authorities evolved their own independent address creation rules and practises. All of the consequent variations make it difficult to integrate even the different departments of a local government, let alone create one consistent provincial, state or national level source.

Business service providers are suffering from this problem as well:

- Local 911 systems typically are

constrained by the address format dictated by the specific dispatch software they are using.

- Customer databases are created using a different address format structure that leads to unnecessary duplications and mistakes while managing the database.

Federal data collectors such as Security, Statistics, Tax and other authorities are also dependent upon the data collected locally and represented in different forms.

Different industries that use the **Civic Address** as a base for their operations need to have a common standard that allows them to communicate on and across different levels and integrate large, mission-critical address data files into master address repositories.

The answer to all these issues associated with wide variety of address representation is a national, and ultimately international, address standard.

The Goal of a Standard

In order to resolve address standardization issues on a national or international level there is a need for the creation of comprehensive street address content and a classification standard. These can provide a foundation for the quality of the address data across the nation and develop data exchange possibilities between different government organizations and business units.

The following is a list of Address Standard goals and their implication for infrastructure services provided by different businesses:

- Address data must reflect the **real world civic addresses**, not theoretical addresses. The principal addresses to be tracked are civic or street addresses, not postal addresses, which are purposely built to facilitate the efficient delivery of mail. Many organizations and government bodies exist to provide services to physical locations (e.g. water, electricity, garbage collection, telecommunications, heating). The standard of “real world civic address” provides a rigorous foundation

upon which to base effective operations and for business planning (e.g. to establish metrics to monitor market penetration, market potential and size, and cost of delivery/service). Theoretical addresses, created from address ranges, do not provide a reliable foundation upon which to base these business decisions.

- Address data must be up-to-date and unambiguous in order to avoid uncertainty and errors. Although many organizations are advised of address approvals and major nomenclature changes as they occur, rarely are private companies updated each time individual elements within the address change.
- Addresses used within different business units tend to acquire operational biases based upon the specific nature of the way the addresses are used. The attributes that have the greatest impact on that specific business unit receive the greatest attention and are created and maintained to a higher standard than attributes that are simply “nice to have” which are largely ignored. Data definitions change subtly to respond to specific operational needs. Over time data purporting to represent the same customers and assets in different departments drift apart. This causes workflow and management issues within the organization as addresses potentially no longer are recognized as the “same”, are double counted, mismatched, etc. Subsequently, business records do not carry the continuity required for data matching, or for the data mining and deeper customer analysis required in today’s market to stay competitive.
- An address standard facilitates address data exchange between different authorities and business units. Referencing an independent address standard would enable each business unit to apply

addresses to the business requirement as needed (mailing, service delivery, etc.), but adhere to a non-denominational standard when cross-departmental communication or collaboration is required. Workflows depending on a common standard are therefore facilitated, reducing the requirement for manual intervention.

- A defined standard should incorporate data quality testing techniques.

Address Standard Business Implication

Having an address federation capability enables a high level of integration between the different silos of an organization.

Master Address Management system Location Hub™ technology can help as each database (different silos of an organization) contains an address. If we apply address standardization rules to both databases and assign a unique address identifier to each address, we can end up with the simple operation of a comparison. It will allow a highly intensive analytical process that will lead to important decisions and eventually bring more revenue to an organization. The Master Address Management process allows performing this procedure without changing the regular data workflow in the organization. The address part of the customer service database along with the address part of the billing database will be cleansed and standardized. Making a relationship between two databases using standard address commonality will do the job.

ADDRESS AUTHENTICATION

A Master Address Management system consolidates different views of the real world to create a consistent, comprehensive, current and reliable source of truth.

While the objective of the system is to replicate reality as faithfully as possible, the following major logical principles apply:

- Our picture of reality is derived

from evidence with accumulated weight of the confidence.

- When multiple independent observations (address data sources) agree, the confidence level goes up.
- When there is an ambiguity, additional observation (research for evidence) is needed to resolve the ambiguity.

These principles serve for the major goal of the Master Address Management system to be implemented: the system should be generic enough to support disparate applications and processes.

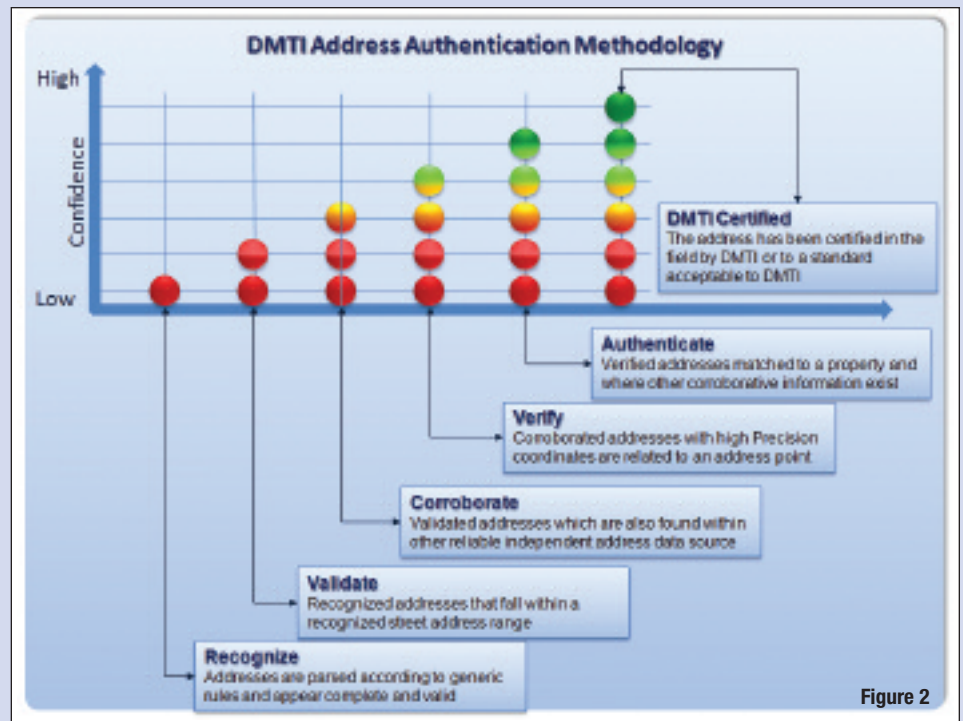
While applying these principles to a Master Address Management system, different levels of address confidence were developed in order to serve location intelligence decisions (Figure 2).

There are 5 progressive levels of confidence we suggest to apply to an address within the Master Address Management System:

- **Recognize** – this level applies

those *recognized* address records that are successfully matched to streets in the reference master street index and to a recognized address range for that street.

- **Corroborate** – this level applies to *validated* address records that are found in at least one independent point address source incorporated into the Master Address Management system.
- **Verify** – this level applies only to *corroborated* address records that have been matched to high precision coordinates (e.g. a parcel centroid or building footprint) stored in the reference address data.
- **Authenticate** – this level applies to *verified* addresses that are cross-referenced to other corroborative information such as utility or service lines connected, etc.
- **DMTI Certified** – this level applies to *authenticated* addresses actually visited in the field by DMTI staff or an approved data



when a candidate address string is successfully parsed, has all the necessary address components, and appears to be a valid textual representation of the address.

- **Validate** – this level applies to

collection partner. Time stamps provide additional data on data currency.

Address Authentication methodology has to apply at different levels of integration of disparate address databases.

IMPLEMENTATION

Addressing theory was implemented by DMTI through the creation of the Location Hub™. Location Hub™ is a technology platform designed to enable the power of Location Intelligence within large organizations. Location Hub™ provides technology and data building blocks

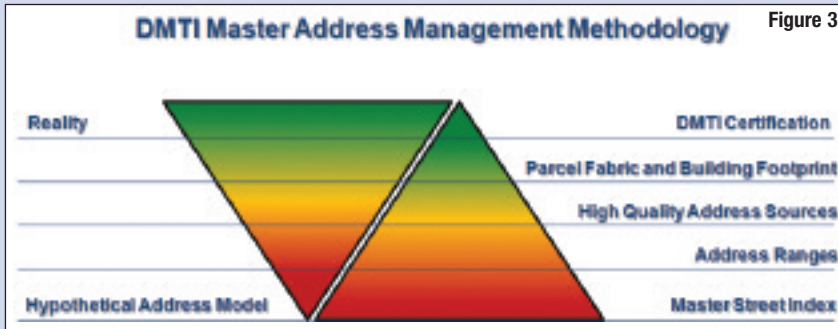
Microsoft .NET framework and managed within an Oracle 10g data warehouse. This technology platform provides the services and data building blocks that are easily integrated into a customer's enterprises information processing environment.

The quality of enterprise data content is the underlying enabler of all enterprise analytic capabilities. The

existing operations will enable a high level of data integrity, business analytics, and location intelligence.

Accurately organized and maintained, standardized and authenticated addresses can help to:

- Connect households to utilities such as water, sewage, telecommunications and electricity.
- Route emergency services, and provide assistance during disaster management.
- Allow retail outlets to provide delivery services to their customers in all areas of the country.
- Plan and execute elections and marketing campaigns.
- Deliver additional attributes needed for making business, planning and analytical decisions.
- Integrate different silos of business into one enterprise level system.
- Integrate disparate address databases created at the local level into the Master Address Management system at national and international level.



that deliver the intelligence needed to solve urgent and pervasive business challenges.

Through the design of the Location Hub™, a Location Identification was invented, which primary purpose is to insure integrity of different pieces of spatial information over time through building comprehensive relationships.

Three major building blocks can describe the Location Hub™ Technology: Create, Use and Maintain.

Block of creation, a comprehensive model of the reality, includes different stages insuring high precision and adherence to a reality at the top (Figure 3). Use and Maintain blocks are implemented through the Location Hub™ technology platform built on the

Location Hub™ implicitly simplifies that ongoing management process. Dashboard interfaces appropriate for command and control activities makes the use of location intelligence easy and pervasive with clearly measurable benefits.

CONCLUSION

Address Management has a significant role to play in the effective and efficient delivery of goods and services to customers. The three major topics in Address Management science discussed in this paper: Addressable Object; Addressing Standards; and Address Authentication provide a high level overview of the subject matter.

Integrating the major principles of an Address Management system into

Sites to See

Google Maps API

<http://code.google.com/apis/maps>

The Google Maps API lets you embed Google Maps in your own web pages with JavaScript. The API provides a number of utilities for manipulating maps (just like on the <http://maps.google.com> web page) and adding content to the map through a variety of services, allowing you to create robust maps applications on your website. The Maps API is a free service, available for any web site that is free to consumers.