MADdening addresses – The Indianapolis/Marion County Master Addressing Database

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Addresses are vital components of local government data. However, different government agencies think of addresses differently and store them differently within their information systems. This leads to redundant data and data inconsistencies between and within agencies. Recognizing these facts, Indianapolis and Marion County have embarked on the creation of an enterprise-wide Master Addressing Database. The project’s ultimate goal is to reduce redundancy, improve consistency and enable better integration of City/County information systems. This paper presents key aspects of this on-going project. Points discussed include: database design considerations, organizational issues, data cleanup issues and tools, current status and future goals.

Introduction

Address information has been recognized as one of the key links between GIS data and all other municipal data sets. With good address information and a good address reference layer, nearly any spatially oriented data set may be mapped. Historically, address information has been entered into data sets and maintained by numerous Marion County Agencies and City of Indianapolis Departments with varying business needs and purposes. The result was a confusing array of address information with many overlaps as well as gaps and much redundancy of effort.

In order to deal with these differences, Indianapolis/Marion County is implementing a Master Address Database as a central repository of, and validation source for, all addresses within Marion County. This project has a long history behind it and a long path ahead. This paper will present some of the issues that Indianapolis has had to deal with while implementing this Master Address Database.

Project History

Since the inception of the GIS project in Indianapolis, various efforts have been made in an attempt to address these issues. Specific recommendations have been laid out in several documents: the City of Indianapolis Address Reconciliation Plan, December 1996; the City of Indianapolis GIS Strategic Implementation Plan, June 1997; the City of Indianapolis GIS Parcel
and Address Data Update and Maintenance Work Plan, June 1997; the City of Indianapolis/ Marion County Strategic Plan Update, December 1999. Recognizing that many of the recommendations put forth in these documents had been either partially or fully implemented, but that much remained to be accomplished, the Indianapolis GIS team undertook a renewed effort to define and implement a Master Address Database update project in early 2000.

Address Reconciliation Plan - December, 1996

Current efforts to deal with addressing issues have their roots in work done by the GIS staff and other employees of the Indianapolis Departments of Metropolitan Development (DMD), Transportation (DOT), Public Works (DPW) and the Metropolitan Emergency Communication Agency (MECA) between 1992 and 1995. In December, 1996, the GIS Staff and it's consulting vendor, Convergent Group, held an Addressing Workshop to familiarize themselves with the then current state of affairs and to begin planning future actions regarding addressing. This workshop laid out the broad strokes of the current approach to creating an enterprise addressing system. In particular, the consensus of workshop attendees was that the basic address reference system should be GIS based and include both a point address reference and an address range reference. Efforts were already under way to put accurate address range information on the geographically referenced Indianapolis Mapping And Geographic Infrastructure System (IMAGIS) centerline layer. It was the consensus of the attendees that this layer should form the basis for an address range reference. The nine Township Assessors' parcel data sets were identified as the best initial source for building a point-based address reference. However, it was observed that parcel addresses alone were not sufficient for a point-based address reference as many parcels contain multiple buildings with separate addresses. It was also recognized that the existing parcel address data would not match centerline data due to differences in formats and additional, non-address data stored in "address" fields. Finally, workshop attendees noted that lack of management support was "the primary factor contributing to the lack of consistent address reference data."

GIS Parcel and Address Data Update and Maintenance Work Plan - June 1997

Building on the work described in the Address Reconciliation Plan, Convergent Group worked with City GIS and Township Assessor staff members to develop a detailed work plan to begin resolving some of the address issues. This plan laid out tasks designed to reach two goals:

1. to develop the best GIS based address reference system available from all the existing data sources and
2. to develop the technical and political means of maintaining the reference system.

The current GIS street centerline layer and parcel layers have resulted from the work plan laid out in this document. Currently, two individuals carry out maintenance of these layers manually.
In 1999 the GIS Team began efforts to use the address reference layers as part of a larger system and initiated a renewed focus on addressing issues. The team began laying out a plan to continue work on the foundations laid down by the work described above. In August 1999, the following short-term (3 - 6 months), mid-term (6 - 12 months) and long-term (> 12 months) goals were defined:

1. Short-term goals
   - Define data model (keeping in mind ArcInfo 8 and SDE)
   - Finalize Address Guidelines and Standards (AGS) revisions
   - Identify types of addresses
   - Establish comprehensive list of street names
   - Establish base set of parcel addresses
   - Document addressing procedures and publish (probably web-enable)

2. Mid-term goals
   - Obtain buy-in from the participants
   - Identify systems and participants that relate to the database
   - Establish system to maintain the database (including street names, address ranges, point addresses)
   - Assign addresses in digital format
   - Establish communication with excluded cities and airport
   - Identify roadblocks

3. Long-term goals
   - Validate addresses enterprise-wide (source for all other systems)
   - Obtain building addresses
   - Publish AGS on web
   - Enforcement of assigned addresses
   - Establish procedure to keep street name signs in sync with database

At the time, work on using a Master Address Database to validate addresses in other systems had already begun with the Tidemark/FileNET/CIIPS effort described in the appendix. The hope is that the participating Departments and Agencies will work with the GIS team to formulate a plan to expand this process to all systems that use addresses.

The goals of this enhanced Master Address Database were:

- Develop a single enterprise database of valid reference point addresses and street centerline address ranges.
- Develop an integrated set of tools for the maintenance of reference point addresses and address ranges.
- Provide tools for validating/cleaning addresses in external data sets against the reference point addresses and/or address ranges.
- As it is feasible, link existing and new City/County applications that use addresses to the
Progress To Date

This latest plan was formalized in early 2000 and presented to users and management of the Agencies and Departments served by the GIS team. In January, 2000, two events occurred which impacted the success of the Master Address Plan. The first was a change in administration with the election of the first Democrat Mayor of Indianapolis in over 30 years. This resulted in a very comprehensive turnover of executive management in City departments. The other event was the consolidation of GIS team members from several City departments into a newly created GIS Division of the Marion County Information Services Agency. The result of this re-organization was to bring the GIS team into the mainstream of IT work in the City/County enterprise.

While the change in administration meant that old relationships with City executives were severed, inclusion of GIS in ISA meant that the idea of an expanded Master Address Database system was accepted as an enterprise IT initiative. Buy-in on the idea by County officials occurred quickly as well.

Working with ACS, the City/County's IT vendor, the GIS division identified the major applications and systems using addresses. The systems identified included mainframe, client-server and standalone applications. Nearly every system kept addresses in a different format. Those that were the same were generally free-form fields. While a few systems included address validation, most did not. One of the early issues to be dealt with was defining what was meant by the term address. Because there were many opinions, all valid within their respective domains, a list of address types was developed. This list of address types needed to be accounted for within the design of the MAD. Several weeks of meetings and analysis resulted in the development of a new design for the Master Address Database (see Figure 1.)
The MAD team recognized several different roles for the MAD. Applications were divided into three categories: referencing applications, validating applications, and trusted applications. Referencing applications were considered to be applications that did not directly use addresses for data entry, but used them as a display only reference to another item such as a parcel. A validating application is considered to be an application that requires the entry of new addresses, but would submit those addresses to the MAD for validation prior to acceptance. The final category, trusted applications, consist of applications that have good validation algorithms built into them which would serve as a possible source for event or utility addresses.

In order for applications to be able to validate addresses against the MAD, the MAD team recognized the need to build validation tools that would work with the MAD. Tools to maintain the database were also recognized as being necessary as the complexity of the database design emerged. Finally, the team recognized that, in order to begin integrating additional systems or to allow external data to be geocoded successfully, a set of address cleanup tools...
would be necessary. A diagram of the systems architecture envisioned by the MAD team is in Figure 2.
Current Status

Progress has not been as rapid towards obtaining the goals defined in 2000 as the team would have desired. A number of issues have needed to be dealt with. The initial implementation of the MAD was integration with the Tidemark Permit Plan application used by DMD for issuing permits. Initially the MAD was implemented as a set of additional tables within the Tidemark database. A view against the MAD tables replaced the SiteAddress table in Tidemark's schema. This worked well in the early stages of implementation of the Tidemark system. However as more permits were entered into the system, performance began to lag due to the view. To bring performance up to acceptable levels, the SiteAddress table was re-instituted in the Tidemark schema and triggers were put into place to propagate changes in the Master Address Database into the Tidemark SiteAddress table.

An Address Cleanup Tool was developed by Fall, 2000. This wizard based tool works well with small to medium sized datasets, but is very resource intensive when used with larger datasets. It has also proven not to be as easy to use as its designer anticipated.

Project priorities put implementation of the new MAD design on hold for over a year. The new design was completed in April, 2001 and submitted to SchlumbergerSema (the City's main GIS vendor at the time) to determine what changes needed to be made to the CIIPS system to implement the changes. While waiting for the impact to be determined, DMD made the decision to implement a new version of the Tidemark system. Since that change also impacted the CIIPS project, a decision was made to do the Tidemark upgrade first. Between the CIIPS/Tidemark upgrade and other projects being undertaken by SchlumbergerSema, resources were not available to work on the MAD implementation until the next year. SchlumbergerSema completed the necessary upgrades in late 2002.

Development of an addressable buildings layer has taken considerably longer to develop than anticipated. This is primarily due to the lack of a comprehensive source for building information in Indianapolis. The MAD team has had the cooperation of several public safety organizations in the County to help develop this layer, but as yet has not been able to utilize this cooperation effectively to speed the completion of this layer.

Due to the complexity of the MAD design, the GIS division recognized that maintenance tools needed to be in place prior to implementing the new design. For the prior design a series of
AMLs were developed internally and used by the address technician in DMD to maintain the parcel addresses. Modification of these tools to include maintenance of centerline address ranges was seen as unwieldy. The GIS division has been working with Woolpert, the City/County's current primary GIS vendor, to develop a set of maintenance tools based on the ArcGIS 8.x technology. Woolpert is initially concentrating on centerline maintenance, but will be adding in additional tools later. Concurrently, the AMLs used to maintain the parcel addresses in the old design are being modified for temporary use in the new design.

Future Plans

At the time this article was written, good progress is once again being made on the MAD project. The maintenance tools are scheduled to go into acceptance testing in late July, 2003. Once the maintenance tools have been tested the new database design will go into production. DPW has been pressing to integrate the MAD with the Hansen Infrastructure Management System (IMS) for nearly a year. A project to do that integration is scheduled to begin testing in August, 2003. The City is in the process of selecting a new Citizen Relationship Management (CRM) system this year. One of the requirements for the new CRM system is that it integrate with the MAD. Additional systems at the City/County are undergoing studies for replacement and management assumes that the new systems will integrate with the MAD. Whereas in the past it was difficult to get management to see the benefits to an enterprise-wide MAD, now the GIS division is faced with the opposite problem of managing the expectations of how quickly integration can be accomplished.

Appendix

Tidemark/FileNET/GIS integration

The Master Address Database is currently integrated with three systems: Tidemark, FileNET, and GIS/CIIPS. This environment enhances data consistency and increases usability of data throughout the enterprise.

Historically, Tidemark's functionality allowed users to input addresses, without any validation. As a result, the data includes un-standardized addresses and fictitious parcel numbers. With the new version of Tidemark online, users no longer have the ability to create addresses. In the new environment, a link is established with the Master Address Database. Through this process, addresses updated in the GIS are readily accessible by Tidemark users for permit issuance.

The second system, FileNET, manages a digital document library. Here, documents are available for upload as well as retrieval for viewing throughout the enterprise. Documents are retrievable by unique case numbers and address codes that reference specific addresses in the Master Address Database. Only documents having a valid address code assigned from the Master Address Database may be saved to the repository. The address codes are assigned and
Like Tidemark and FileNET, CIIPS (City of Indianapolis Integrated Permitting System) also links with the Master Address Database. The Current Planning and Permitting staffs in DMD use CIIPS to maintain land use petitions and permits respectively in the GIS. Prior to issuance of a new petition or permit, the address is validated against the Master Address Database.

The address links established between these systems have greatly enhanced user capability. Users may now toggle between the Tidemark/GIS and CIIPS/FileNET environments and share data between departments. As a result, customer service at the Permits counter has improved dramatically. With the new technology in place, staff members are no longer required to leave the customer to research the property history; additionally, customer wait time has been cut in half.

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