SPATIALMAP 911

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The function of emergency response offices—fire, police, and EMS—is to respond as quickly as possible with qualified staff and resources to calls for assistance within their jurisdiction and to render needed assistance. Everyone knows that, in the event of an emergency, a call to 911 will begin the process of obtaining such assistance.

The process of notifying appropriate emergency response personnel is the responsibility of individuals who work in the local jurisdiction's 911 operations center. These centers are typically operated by a county or municipality, and are most often funded through collection of fees assessed on phone bills. Each of us rests a little easier knowing that needed assistance is only a phone call away, and a 911 call is often the first thought when help is required.

The 911 call centers and the emergency response personnel of the fire, police and EMS departments count on the availability of reliable address information when a call is received. In today's enhanced 911 or E911 centers, an incoming call is coded with a phone number of the origination phone. This coding is provided by the local phone service provider. Until recently, with the proliferation of cellular phone technology and the increasing use of internet-based phone systems (VOIP), it was possible to relate a caller's phone number with a specific location or address. This address is forwarded to emergency response personnel along with information regarding the nature of the emergency by the E911 operations center.
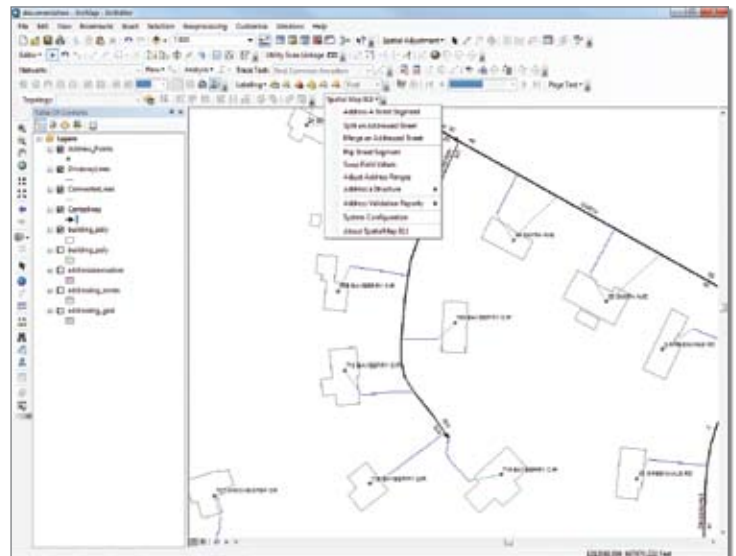
Those of us working in GIS technology recognize that this address is then translated to a location, a coordinate that allows the emergency personnel to respond to the need. The better the knowledge of the location of the need, the location of available response resources, and the road infrastructure that connects the two; the more timely the response can be. In emergency situations, time can very literally mean the difference between life and death. Hence the need to build information systems that can effectively reduce this response time. Key to this process is maintenance of quality information

both with regard to the roadway network and the addresses along those roads.

In most counties and municipalities, the responsibility for maintaining roads falls to a public works or transportation department. At the state level, roadway maintenance is the responsibility of a state department of transportation. Address assignment is most often the responsibility of someone within the planning or permitting department.

Permits and Inspections is responsible for monitoring the status of development projects, including an awareness of the status of occupancy. The diagram below demonstrates these relationships.

While Transportation, Planning and Permits/Inspections is responsible for building and maintaining the data necessary for an accurate topologically built and properly attributed street centerline theme, Emergency Management as a group has a critical need for this data in order to provide timely and responsive service.

Not too long ago, it was common to have within a given jurisdiction two systems for addresses—what became known as city-style and rural addressing. City-style addresses, which most of us are very familiar with, include an address number, road name, city name, and zip code; i.e. 123 Main Street, Anycity, Anystate, Anyzipcode. Rural style addresses included a PO (Post Office) box number and rural route number; i.e. PO Box 123, Route 456, Anycity, Anystate, Anyzipcode. This duality of addressing approach caused enough confusion to emergency response and E911 center personnel that the rural style addresses across the nation have largely been replaced with city style addresses.

There are over 3,000 counties and over 19,000 incorporated places (municipalities) in the United States. Each of these jurisdictions decides for themselves the approach to take for establishing addresses within their jurisdiction. In general, emergency response services are the responsibility of these jurisdictions—each county or municipality will maintain its own police, fire, and EMS capability paid for with local taxes. In most cases, the E911 operations center is also operated by the local jurisdiction, but occasionally multiple jurisdictions share E911 center resources if the population (available phone surcharge revenue) and therefore the level of calls handled regionally does not justify individual centers for each jurisdiction. Often, due to local transportation infrastructure and proximity of available resources, jurisdictions will share responsibility for emergency response. In some cases it is simply more timely for resources from an adjacent jurisdiction to offer emergency response to a particular location. On occasion, due to the nature of the emergency, it is necessary for a jurisdiction to call upon an adjacent jurisdiction for assistance.

In all of these cases, availability of a reliable address for the location of the emergency coupled with well-maintained, topologically built street centerlines with verified address ranges is key to the ability to offer timely response to an emergency. Since the responsibility of providing emergency response falls to the E911 center, the police, fire and EMS resources of the juri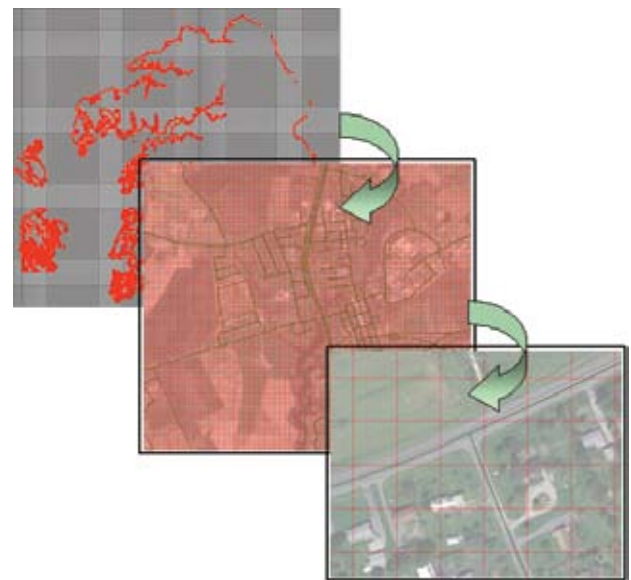sdiction; but the establishment and maintenance of the base data necessary to assist is the responsibility of other departments within the jurisdiction; coordination of this information between departments and establishment of a rigorous process to maintain the data is important.

Addressing Schemes

As stated earlier, most jurisdictions in the nation have now adopted "city-style" addresses. There are a variety of schemes used to determine the address for a particular location when new addresses are being established. The most common schemes can be described as Grid Based, Distance Based, and Century Based.

In a grid-based system, an addressing grid is established that covers the entire jurisdiction. Since "negative" addresses are not allowed, the origin for the grid is normally somewhere outside of the jurisdiction, southwest of the jurisdiction's geographical southwest corner. The grid is established to insure that every potential location within the jurisdiction will have a potential unique address. Address numbers are derived from this grid and appended with the street name, jurisdiction name, state and zip code to establish the complete address for a given location.
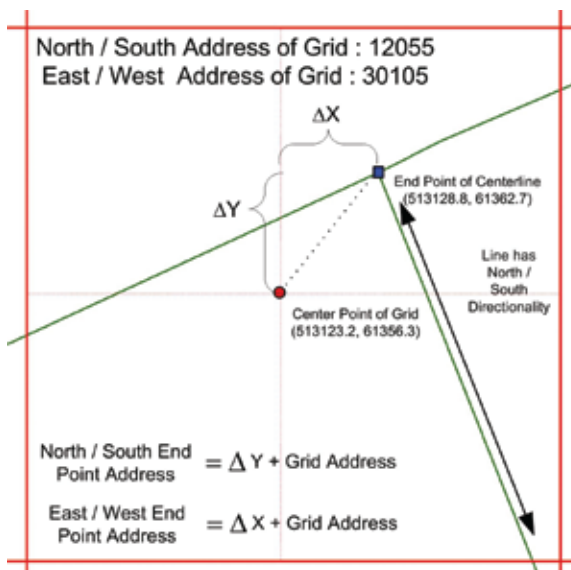
100 Foot Addressing Grid:

S P A T I A L M A P 9 1 1

Steps:

1. Use Existing Addresses to Determine North/South Directionality of Line.

2. Get Address Assigned to Grid.

3. Interpolate Address based on change in X or Y between centerpoint of grid and end point of line, added to assigned address.

North / South Address of Grid : 12055
East / West Address of Grid : 30105

ΔX

ΔY

End Point of Centerline (513128.8, 61362.7)

Line has North / South Directionality

Center Point of Grid (513123.2, 61356.3)

North / South End Point Address $= \Delta Y + $ Grid Address

East / West End Point Address $= \Delta X + $ Grid Address

In a distance-based system, all streets share a common starting address number. Individual addresses along the street are determined as a function of the distance from the "beginning" of the street based upon a defined address density requirement.

In a century-based system, addresses are set to break at 100 number intervals at street intersections.

In all cases, the jurisdiction will determine an odd/even number convention relative to the side of the street and in which direction along the street address numbers will be increasing. In municipal systems, it is common for addresses to increase as the distance from the center of town increases, with road names carrying an east-west or north-south prefix.

Automating Address Assignment

Spatial Systems Associates (SSA) has been providing GIS implementation and support services to county and municipal jurisdictions since 1995. As a result, we have provided assistance to many jurisdictions in the establishment of topologically-built and address-attributed street centerlines in urban, suburban, and rural jurisdictions.

Out of a recognition of the need for tools to facilitate the development and maintenance of addresses, the need for maintaining street centerline themes that include address attribution, and the need for production of street maps for use by emergency response personnel, SSA developed a toolkit which we call SpatialMap 911.

SpatialMap 911 is an advanced address maintenance application for users of ESRI's ArcGIS Desktop. It provides automation tools to maximize efficiency and maximize data integrity.

SpatialMap 911 was developed using ESRI's ArcObjects technology and works with the user's standard ArcView, ArcEditor, and ArcInfo license level. SpatialMap 911 leverages the powerful ArcObjects application programming interface to implement

addressing specific rules and processes that are not available in the native ArcMap user interface.

Using SpatialMap 911, street segment and address features can be stored in a geodatabase or shapefile format. SpatialMap 911 allows for flexible geodatabase design and typically can utilize existing schemas avoiding costly redesign or the adoption of a "proprietary" vendor schema. This is all facilitated by convenient configuration wizards that make system setup easy. The configuration information can be stored on a network and thus multi-user implementations are a snap.

SpatialMap 911 supports standardized and hybrid address ranging systems. Such systems as grid based, distance based, and century systems can easily be implemented and maintained. Through the use of an addressing system polygon layer, different geographic regions within the same dataset can easily follow different addressing rules.

SpatialMap 911 allows the user to make informed decisions based upon their expertise and the existing information. When adding an address range to a road, or assigning a new address to a building, the user always has the ability to review and override the system recommended address values. This is not uncommon when unexpected development occurs or a need arises to accommodate legacy addressing errors that cannot be corrected.

The software automatically recognizes which addressing system is being utilized in the current street centerline file, and provides the ability to select another addressing system when exceptions are encountered.

SpatialMap 911 improves the address maintenance workflow process by reducing errors and increasing efficiencies while the user:

- Assigns/suggests address ranges for individual street segments

- Assigns/suggests house numbers to be assigned to individual structures

Typical errors that can be avoided through the use of SpatialMap 911 include:

- Creation of non-unique address ranges

- Assigning an odd or even number range to the wrong side of the street

- Assigning a street an invalid (i.e. misspelled) street name

- Not allowing for enough addresses along a new street segment

- Manual data entry errors

- Incorrect interpolation from an established addressing grid

In addition, SpatialMap 911 improves efficiency of the individual(s) responsible for maintaining street centerlines and addresses by:

- Automatically discovering overlapping address ranges

- Automatically allocating address ranges when splitting a street into multiple segments

- Establishing a GIS-aware address grid along with a database of "valid" street names

- Automatically correcting and updating misspelled street names in the attribute tables

- Providing the ability to automatically maintain attributes, i.e. swapping field values such as left ZIP code and right ZIP code without manual entry.

- Simultaneously assigning house numbers to structures from multiple feature classes

SpatialMap 911 utilizes a "road name list" to ensure that road names are spelled consistently throughout the dataset. This greatly reduces the potential for keying errors during data entry.

SpatialMap 911 street segment maintenance tools assist in managing the addressing attributes including road name, address range, ZIP code, and
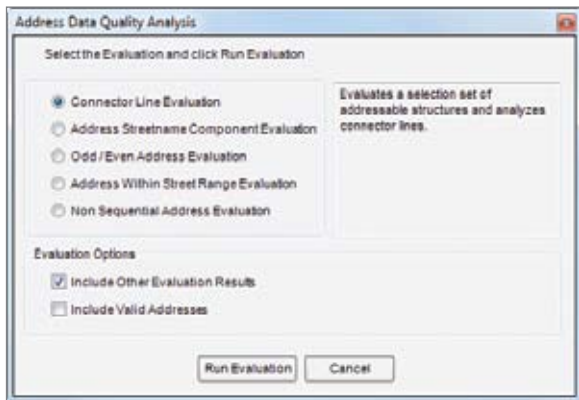
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other user defined fields. Operations such as splitting an addressed street segment are simplified because the application automatically suggests the new address values of the resulting features, and allows the user to adjust the suggested address values efficiently and accurately.
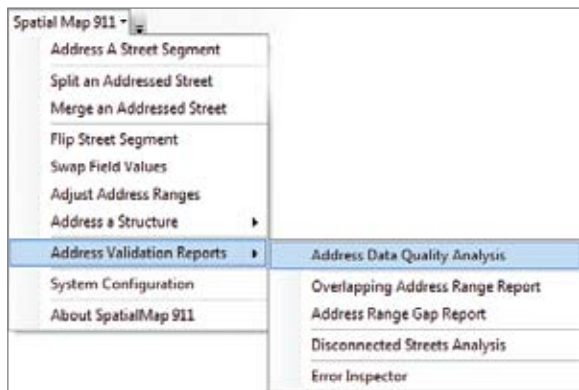
In addition, SpatialMap 911 provides a mechanism to quantitatively measure the quality of the resulting data. Evaluations can be performed on individual streets, subdivisions, or the entire jurisdiction.

Examples of the types of errors automatically detected by SpatialMap 911 include:

- Overlapping street address ranges

- Gaps in street address ranges

- Structures that do not connect to a street via an access road (line)

- House numbers that are on the wrong side of the street

• House numbers that are outside of the valid address range of a street

• House numbers that are out of sequence

SpatialMap 911 has been designed based on the input of our county and municipal clients. It is licensed on a per user basis, but most jurisdictions only have a need for a single license.

SpatialMap 911 is a tool that allows a single individual within a county or municipal jurisdiction to develop, manage, and maintain addresses and attributed street centerline layers in an ESRI GIS environment consistent with local standards.

For More Information

For more information on SpatialMap 911 or to arrange for a demonstration,
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SSA
GIS & FMIS

» SpatialMap 911 works with the user's standard ArcView, ArcEditor, and ArcInfo license level.

» SpatialMap 911 supports standardized and hybrid address ranging systems.

» SpatialMap 911 improves the address maintenance workflow process.

» SpatialMap 911 improves efficiency of the individuals responsible for maintaining street centerlines and addresses.

» SpatialMap 911 utilizes a "road name list" to ensure accuracy.

» SpatialMap 911 quantitatively measures the quality of the resulting data.