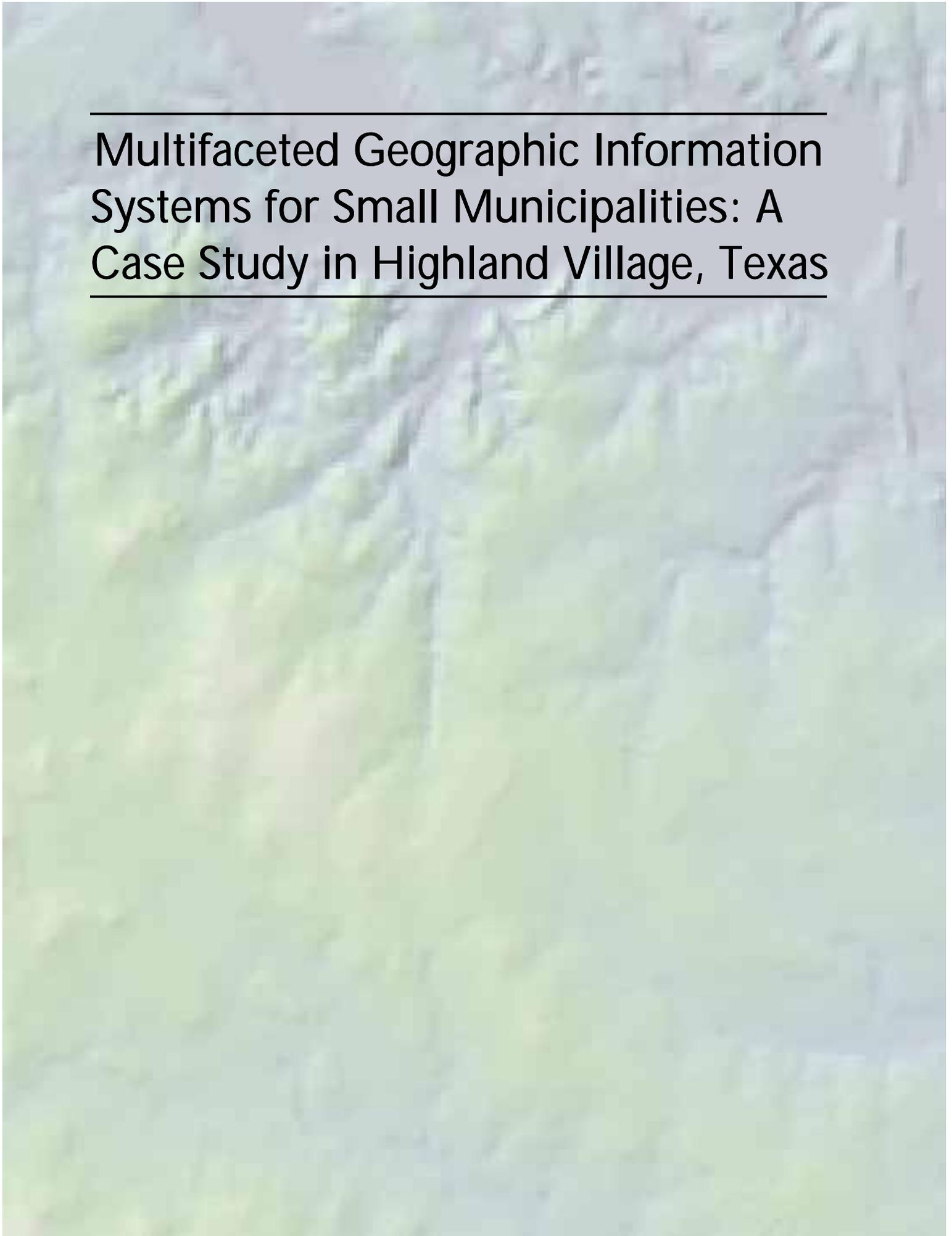

Multifaceted Geographic Information Systems for Small Municipalities: A Case Study in Highland Village, Texas



Multifaceted Geographic Information Systems for Small Municipalities: A Case Study in Highland Village, Texas

Presented at the 2006 ESRI International Users Conference in San Diego, California

June 2006

ESRI Paper UC1457

Author:

Ms. Marikka Williams

mwilliams@highlandvillage.org

City of Highland Village
Public Works
Geographic Information Systems
1000 Highland Village Rd
Highland Village, Texas, USA
Telephone: 972-317-5558 ext 115

Table of Contents

Introduction.....	5
What is a Geographic Information System?.....	5
Defining the Goals of a Geographic Information System.....	6
Community Outreach.....	7
Asset Management.....	7
Emergency Service Delivery.....	7
Accountability.....	8
Dynamically Activated Interactive Maps.....	9
Customized Geographic Information System Applications.....	9
Organizing a Geographic Information System.....	10
Data Creation.....	10
Needs Assessment.....	11
Data Collection.....	11
Data Maintenance	12
Data Organization	12
Information Delivery	14
Representative Maps.....	14
Analytical Maps	15
Digital Interactive Maps	15
Customized GIS Applications	16
Challenges with Implementation	16
Advantages of Implementation	16
Conclusions	18

Abstract

Organizing, implementing and managing a centralized Geographic Information System (GIS) for a city of any size is a complex and multifaceted process. This presentation outlines the structural design of a GIS tailored for a small municipality, illustrates how the GIS is utilized to facilitate municipal operations, addresses the challenges involved in the process of creating a comprehensive system and proposes avenues for future improvement. The City of Highland Village, a small municipality, located in the Dallas/Fort Worth metroplex, serves as the study area. A GIS is employed by the City of Highland Village to integrate analog data with spatial data for the purposes of maintaining internal system integrity, performing analyses, documenting activity, disseminating information and planning for the future. In order to achieve these goals, a variety of databases, maps and exhibits have been created for asset management, infrastructure maintenance, emergency management, recreational event coordination, economic development and community outreach.

Introduction

Organizing, implementing and managing a Geographic Information System for a city of any size is a complex and multi-faceted process. In this presentation I will focus on describing the basic structure of a comprehensive Geographic Information System that helps facilitate municipal operations. The City of Highland Village is a small, lakeside community located in the Dallas/Fort Worth metroplex and serves as the study area for this presentation. The population of the city is approximately 13,000 and is projected to reach build out at 18,000. When I started working for the city, as a part-time intern, in December 2002, my primary purpose was to build a Geographic Information System for the city from the ground up. On my first day I installed ArcGIS 8 and set out to find all the data that I could. Essentially, I had no time to plan. I was immediately tasked to produce a series of maps and assigned to complete several projects. At the time, I was enrolled in Graduate School, teaching four labs for the University Geography Department, working part-time at the University Library and writing my Masters thesis. As such, the 4 hours I spent at the office each day was the only time I focused on the concept of building a 'comprehensive' GIS. The majority of that time was spent on cleansing data, gathering intelligence about the data, transferring the data to maps and creating exhibits. While attending the 2003 ESRI conference I looked for sessions for advice and direction with respect to building a comprehensive system. However, at that time, there were no tracks directly related to this topic. At the University, we were taught how to utilize a wide variety of GIS tools and software products; to build Geodatabases; to think geospatially; to perform GIS research; and to conduct sophisticated analyses in order to answer research questions with the primary goal of creating intelligent, effective maps. We never really focused on the process of planning or building a 'Geographic Information System' for an organization of any type. I suspect that is probably still the case in most educational settings although I am seeing a bit of a trend toward the planning end of GIS in newly developed academic programs. As such, beginning GIS professionals are often put in a position where they must be creative, innovative and inventive. In November of 2003, the City Manager created a full-time GIS position, which allowed me to contribute more time to focus on the organizational structure of a city-wide Geographic Information System. The experience that I have gained over the past 4 years has been an invaluable learning experience with respect to becoming acquainted with municipal operations, gaining an understanding of the challenges that geographic information technology faces, learning what is required in order to develop an effective, comprehensive Geographic Information System for a small community and discovering how this can be achieved.

What is a Geographic Information System?

One of the key components of building a 'Geographic Information System' is having an understanding of what GIS actually is. In the world community it seems that there is a general disagreement of what a 'Geographic Information System' truly is. There has been a tremendous amount of debate on this topic and it seems that there are many

perceptions regarding the definition of GIS. In my opinion, a 'Geographic Information System' is, not a 'tool' but rather, a system that is unique from both the organizational standpoint and the delivery of the information. As it develops, it takes two dimensional maps to the next level by providing a means to perform multi-layered and sophisticated analyses in a digital environment to create intelligent, dynamic maps. Prior to organizing the GIS data there really is no 'information system' per se because all that is really being done is data projection, map creation and product delivery. The actual 'information system' comes more into play when the full cycle is operating from both the organizational and information delivery aspect. What that means is that the data is logically organized, intuitively accessible, dynamically activated and interactively delivered. When a Geographic Information System is fully operational it provides an intuitive, multi-scalar means to synthesize spatial and analog data so that they may be queried, analyzed, summarized and displayed for the purpose of facilitating informed decision-making processes. In addition, GIS provides a mechanism through which archived databases can be retrieved, joined to spatial data, statistically analyzed, summarized, related to reality and viewed with respect to geographic distribution. This interpretation of the character of a GIS sheds light on the necessity of 'planning' and 'organization' in order to reach a destination from where information can be dynamically activated and interactively distributed effectively. This is important for GIS professionals and their constituents to realize from the outset of creating a GIS. Certainly, a Geographic Information System can be built without such foresight but this knowledge can help increase the efficiency with which a GIS is developed and subsequent success of the system.

Defining the Goals of a Geographic Information System

The goals of a Geographic Information System should be defined and revisited throughout the development of the GIS. I recently attended a GIS Server seminar and one of the key points was the idea of creating a 'common operational picture' that different individuals in the organization could refer to in order to have a common point of reference while dealing with a variety of situations. This is the perfect phrase to describe what I have been trying to achieve for the City of Highland Village with respect to 'dynamic activation' and 'interactive delivery' from a centralized location. My primary goal has been to create this common reference point for all departments to plug into. Barriers that I have met along the way have prevented this from being fully realized. Nevertheless, I have created a model by which I can guide the GIS towards achieving this ultimate goal. This common reference point integrates all of the facets of the larger system. In order to assemble the larger picture it is essential to consider the many facets that are involved. As such, the overall Geographic Information System should be designed from a multi-scalar multi-faceted perspective. Goals that are fulfilled by creating such a system include: maintaining communication with citizens and staff through community outreach; maintaining an active asset management system; improving emergency service delivery; ensuring accountability; providing interactive information distribution; and developing customized applications in order to meet specific departmental needs.

Community Outreach

Maintaining communication with the citizens is possible by staying informed of and involved in municipal operations in order to find ways to utilize GIS in this manner. Community outreach involves the creation of a variety of maps in order to facilitate communication with the community at large about historical events, current events and future events. This can occur in a variety of ways. These days one of the most effective means of public communication is through the internet. Another form of community outreach is through large scale exhibits that can be displayed at City Council Meetings, Public Hearings, Town Meetings, and at Voting Locations. In addition, small scale publications included in Utility Bills are an effective means of distributing information. Maps relate a great deal of information with very few words. They draw the attention of the eye, generate questions and provide answers. Maps are effective tools for community outreach and should be incorporated into the workflow of the departments that interact with the community. Community outreach informs citizens of historical and current events; educates citizens and staff about the community; provides reference to facilitate informed voting; and involves the community in informed decision making and future planning.

Asset Management

Another important goal of a municipal GIS is to actively facilitate asset management with future generations in mind. This can be easily achieved within a geographic information system environment by:

- Establishing a record of Municipal Assets and their respective attributes
- Creating a point of reference to facilitate efficient maintenance scheduling
- Evaluating integrity of infrastructure and identifying "problem areas"
- Monitoring infrastructural behavior as it changes through time

Asset management is an important facet of providing high quality service to community in an informed and timely manner. Sound asset management helps understand the dynamic of the city and make informed decisions based on this information.

Emergency Service Delivery

Emergency service delivery is a top priority of the municipal GIS in the City of Highland Village. The goal is to continue to provide high quality information to increase the efficiency of emergency services. This can be done providing improved interactive digital mapping system solutions to EMS Personnel, Fire Department Staff, and Police. Facilitating

EOC can also be achieved through customized interactive digital mapping system solutions. The reasoning behind improving information delivery to Emergency Services is to help save lives. This can be done by increasing navigational intelligence so that services are consistently delivered to local residents and the Mutual Aid Territories with increased efficiency. Improving information delivery will in turn create flexible and dependable information delivery to Emergency Personnel. These efforts will also facilitate EOC from a multi-scalar perspective.

Accountability

Maintaining accountability interdepartmentally and to the community as a whole is an important goal that is geared toward improving services. This involves integrating databases from multiple departments to ensure data accuracy; cross-referencing spatial data with analog data to identify inconsistencies; correcting inconsistencies and providing an interdepartmental built-in system of checks and balances; and maintaining intelligent databases on municipal assets. The added element of tracking municipal activity within the dynamic information distribution system will provide a means to maintain internal and external system integrity. The reasoning behind this is to keep the larger picture in check in order to provide high quality service to community in an informed and timely manner. In addition, understanding the dynamic of the city will help upper management make informed decisions.

Dynamically Activated Interactive Maps

A goal that has not yet been fully realized involves providing a means to actively integrate tracking, documentation, analysis, and reporting of municipal activity from a central location through a dynamic information distribution system, as a facet of the Geographic Information System. This would involve the creation of the following dynamically activated interactive maps:

- Master Incident Map (combination of all of these databases)
- Police Incident Map (citation database, warning database, accident database, crime database, vacation watch database, special event coordination)
- Public Works Incident Map (streets, utilities, code, animal control, inspections)
- Street Incident Map (streets, signs, streetlights) (incidents / work orders)
- Utilities Incident Map (water/wastewater system incidents / work orders)
- EMS Incident Map (calls for service)

- Parks Incident Map (incidents, events, maintenance and open work orders)
- Animal Control Map (lost or expired animals)
- Code Enforcement Map (code breaking incidents)

Providing a means to view this information through a dynamic information distribution system would enable the evaluation of the parts of the whole independently and collectively in order to facilitate informed decision making. While an individual may be intuitive and perceptive it is very difficult to consider all of the facets of a particular situation or the myriad ramifications involved in a particular decision. A well-developed Geographic Information System should allow an individual to step out of the box and view a situation, from a variety of perspectives, with objectivity.

Customized Geographic Information System Applications

Creating ways of easing data management and analysis in relation to the particular business practices of the departments can be achieved through customized applications. This takes a considerable amount of time and is simply an avenue to raise the bar a little higher. As needed and when possible, customized applications should be created for the various departments in order to push the envelope as far as we can with 'in house' solutions. How far the GIS is able to go is highly dependent on staff needs and priorities. This is a long range goal that should develop after the GIS has matured and is fully operational. On the other hand, in some cases, a useful customized application that is simple and directly applicable to a given workspace is a good way to gather support for GIS development.

Budgetary Challenges

Until ArcIMS came on the scene I think that establishing a 'digital' common reference point from the 'desktop' of people across an organization was difficult to fully achieve. GIS Server is raising the bar and taking this idea to an entirely new and exciting level. Small town GIS professionals drool at the concept of having this kind of technology at our fingertips but the dollar amount for both ArcIMS and GIS Server are like clouds in our budgetary sky. So, then the questions are: What are our options? How can we achieve these ends when we do not have the financial means? How can we deliver top of the line technology to citizens and staff comparable to that of wealthier organizations? How can we organize our GIS data into an effective system? How do we persuade staff, in a small town environment, to embrace our vision and actively participate? How do we overcome the challenges that face creating a centralized comprehensive Geographic Information System? Throughout the duration of this presentation I will answer these questions.

Organizing a Geographic Information System

Organizing a 'Geographic Information System' can be a complex process but it does not have to be. There are two general components that are involved. These include the processes involved in the development of the logistics for the creation of data and those involved in the subsequent information delivery. A conceptual diagram of the processes involved is provided in figure 1. To a certain degree the parts of the process are occurring dynamically. It is often the case that while data creation is occurring information delivery will be expected. As such, this is not a linear process but it is multi-faceted, in action, as well as, in content. The difference will be found in the level of the maturity of the product that is able to be produced to fulfill the particular request. This will change through time as the 'Geographic Information System' evolves and matures.

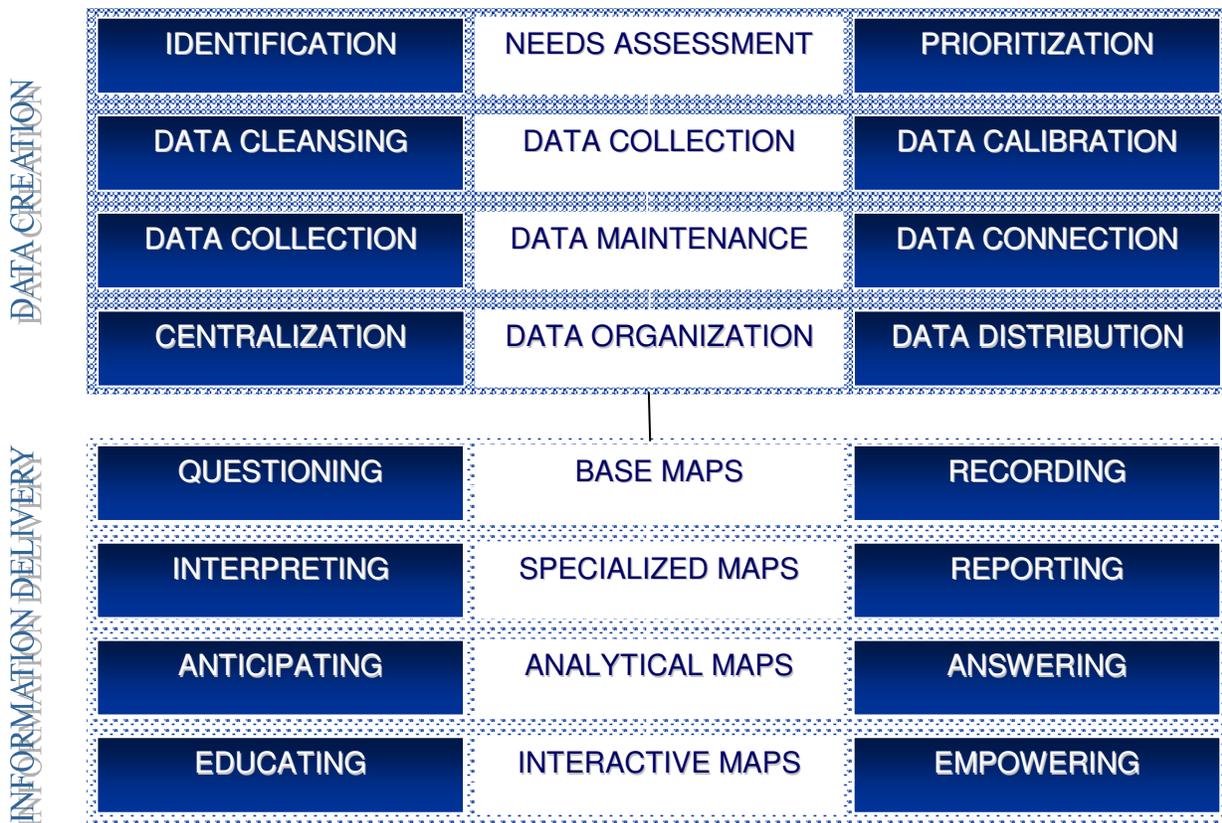


Figure 1. Conceptual Diagram of the Processes Involved in Organizing a GIS

Data Creation

Data creation includes needs assessment, data collection, data maintenance and data organization. The needs assessment should be designed to identify needs, educate staff, reach consensus and prioritize goals. Data collection primarily involves data cleansing and calibration. Data maintenance essentially maintains data collection and connection. Data Organization drives data accessibility and distribution. These processes collectively

provide the blueprint and foundation for the Geographic Information System. However, these are continuous cyclical processes feed the GIS and provide the basis for the content of the information that is dynamically delivered to the end user.

Needs Assessment

The needs assessment is designed to identify the 'stakeholders' so that these 'stakeholders' can become a part of a GIS 'committee' that will ultimately identify departmental needs and work together to prioritize and develop consensus with respect to these needs. Needs assessment also includes generating enthusiasm by gathering consensus and educating staff as to how GIS can address their specific needs. Once this has been achieved the chances of acquiring a commitment from staff to actively participate in bringing the vision to fruition increase. After the 'needs assessment' has been completed it is possible to more effectively prioritize tasks, gather data and develop an organizational scheme to house the data.

Data Collection

Data collection involves research, interaction with GIS professionals from the surrounding municipalities, the county and the region. Aerial Photography projects are very costly. As such, it is often the case that a Regional Council of Governments will coordinate efforts in order to facilitate a cooperative purchase of Aerial Photography for member communities. In my particular situation I am fortunate to be a part of the North Central Texas Council of Governments who is very pro-active in the GIS community. There are many sources for GIS data on the internet. The city and county appraisal districts often have GIS baseline parcel and landscape data. Local and County 911 organizations are viable sources for road and address data. Demographic Information is available through the census website. There are a variety of sources that can provide 'pre-cooked' data that is free of charge but all of the data should be inspected and 'cleansed'. Data collection will often involve converting AutoCAD map layers into GIS shapefiles. However, for the purpose of increasing accuracy, it is the case, that more often than not, many of these AutoCAD maps have to be recreated. Digitization is another way to collect data. This is also referred to as planimetrics which can prove very useful for a variety of projects. GPS field data collection is another way common way to gather data. For some small towns it may be more cost effective to lease a sophisticated GPS unit rather than invest in an expensive product that has a shelf life as far as the municipal assets are spread out across the landscape. As all of the spatial data is gathered and verified for accuracy with respect to representing 'reality' there is another component that must be considered. This component is the attribute data (descriptive data) that is associated with the features, as well as, the metadata (source of the data). In addition, these attributes will need to be standardized in concert with the myriad of other databases across the city in the various departments so that they may be linked. Once all of the baseline data collection has occurred it will be necessary to maintain the data as the city grows and evolves through time.

Data Maintenance

Data maintenance is essentially, data collection revisited. However, there are additions of dynamic layers that generate new data collection which can be handled through geocoding or digitization. Data maintenance involves updating aerial photography; incorporating AutoCAD data from property development; spatial data digitization; spatial field data collection; attribute data; tracking municipal assets; tracking municipal activity and performing regularly scheduled data back up. Even for cities that are approaching build-out data maintenance will continue to occur because the municipal landscape is always changing and rearranging itself. In addition, with the added dynamic 'activity component' which is a part creating a 'common operational picture' data would be collected on a daily basis. This occurs when the Geographic Information System is fully operational, dynamically activated and interactively delivered. As such the data maintenance process is an ongoing process.

Data Organization

Data organization is a very important part of developing a Geographic Information System. This facet includes centralization and distribution of the data that feeds the system. A general diagram of the parts that are typically incorporated into a geodatabase environment to provide a centralized comprehensive system is provided in figure 2. The grouping to the right is relatively fixed whereas the 'Municipal Events' are ongoing and dynamic. The general idea is that a series of thematic geodatabases would need to be created from several different facets in order to deliver data efficiently. The way that data is organized in the City of Highland Village GIS is within regional, county and municipal geodatabases. The regional and county geodatabases are all-inclusive whereas the municipal geodatabases are divided into several categories. There is a 'Master' geodatabase that contains the base data that all maps and applications would need access to. Sub-categories include parks, public works, planning, public safety, special events, and special projects. Within these sub-categories are specialized geodatabases such as: utilities, parks, future land use, official zoning, thoroughfare master plan, EOC, fire department, police department, annual festival site plans, triathlon routes, directions, economic development, GASB34 and planimetrics study. The specialized geodatabases are utilized with less frequency and provide more of an archival, information retrieval mechanism. Although the ultimate goal is to create a 'common operational picture' there are some parts that particular departments will likely want to mask out of their daily workflow. As such, each department has a geodatabase that is designed to respond to its' particular needs and provides a means for data storage. The master geodatabase serves out base data from a centralized location to all departments. The departmental databases contain only features classes that are unique to the particular department whereas the master geodatabase provides the base data layers. Logical data organization is the key to creating a system that is intuitively accessible. The quality of data organization is intricately interwoven with efficiency of information delivery.



Figure 2. Diagram of Typical Data Components of a Comprehensive Centralized GIS

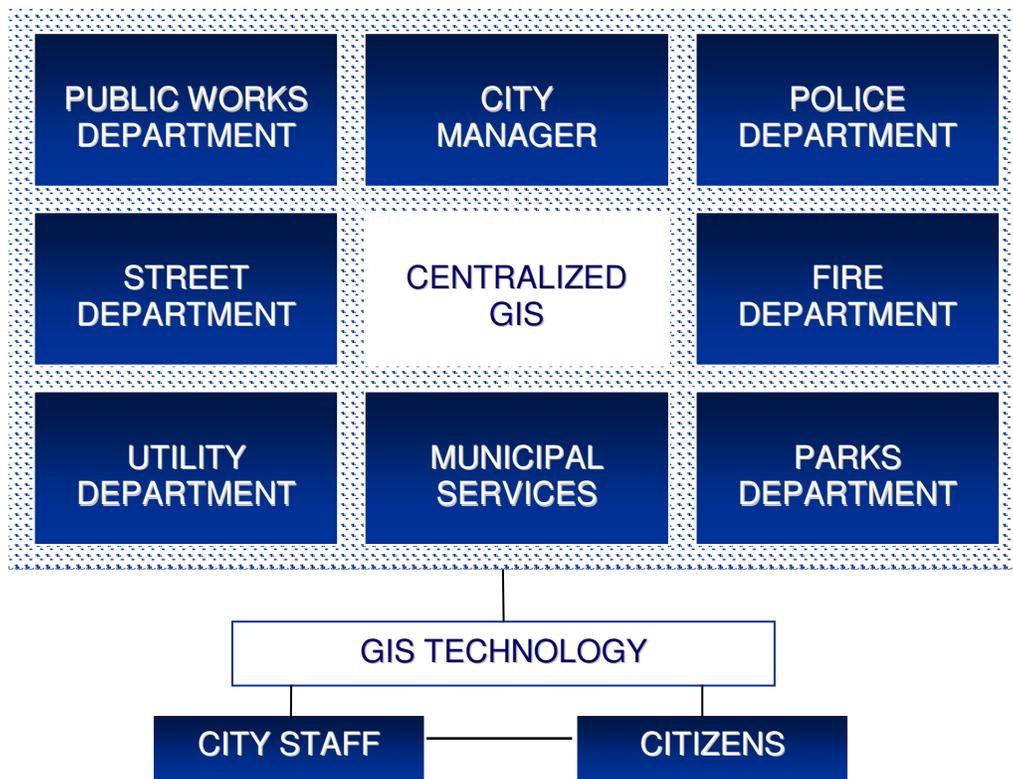


Figure 3. Conceptual Diagram of Data Distribution and Information Delivery

Information Delivery

Information delivery includes several important facets and should be designed based on the particular 'stakeholders' who need access to the dynamically activated and interactively delivered applications. As referenced in figure 1 'Information Delivery' is the second major component in organizing a GIS. In figure 3 a general conceptual diagram illustrates how the information flow is organized with respect to the various departments. Essentially, the data is centralized and then linked to the applications that are available to the various departments. This process needs to be visualized and addressed so that nothing is overlooked during the information delivery process. The delivery of the Geographic Information System products is facilitated through this information flow. The actual products can be categorized into four central types based on the level of questioning that the particular product is subject to. These GIS products are delivered in paper form, digital form or through interactive applications. The type of map combined with the level of questioning will ultimately determine the manner in which the product is delivered. Base maps are designed to simply question the physical features of the landscape and descriptively record the contents. Specialized maps are designed to interpret boundaries and report the relationship between geography and policy or the relationship between geography and organizational units. Analytical maps are designed to anticipate questions and provide answers that will facilitate advanced decision making processes. Digital interactive maps add a third dimension to the data and provide access to data. These maps require an interface application of some sort to deliver the information. Digitally interactive maps are designed to educate the end user as well as to empower them to form questions and interact with the geospatial data. The next level of GIS data collection and information delivery involves the creation of customized applications. These GIS products are of varying complexity and serve a variety of purposes. In this section, each category will be discussed in greater detail with respect to the types of GIS products that have previously been created for the City of Highland Village.

Representative Maps

Representative maps are typically two dimensional although most representative maps can be transformed into analytical maps if they are placed within an interactive digital mapping system. The level of analysis depends on the end user. For the purpose of providing examples of maps that are created in municipal settings I have compiled a list of maps that were created without performing any type of geo-spatial analysis. Representative Maps typically include but are not limited to the following: base maps (address, street, elevation, landscape, parks, schools); directional maps (box maps system also referred to as the municipal atlas, HVFD digital mapping system); organizational maps (police areas of responsibility; police districts; voting precincts; solid waste collection schedule; water meter reading routes; event coordination); informational maps (historical annexation, public hearings, community information publications; economic development packet maps and site plan overlays); asset distribution maps (hydrants, signage, crosswalks);

infrastructure management maps (water system; wastewater system; electrical system); planning maps (zoning; thoroughfare master plan; future land use plan, trail system master plan; special event site plans; EOC; regional weather watch and warning; evacuation routes, floodplain maps; natural and manmade hazard distribution); and special exhibits (community events; voting; 4B tax proposal; CIP; inland trail system; veterans day; city hall displays). I have created a plethora of representative maps and exhibits that I would have never dreamed of creating in school. For the sake of brevity I have not included them all but feel that it is necessary to mention how the volume and variety reflects the multi-faceted character of reality in any municipal environment.

Analytical Maps

Analytical Maps include but are not limited to projects that involve geospatial analysis such as buffer analysis, water modeling, surface analysis, statistical analysis, behavioral analysis, network analysis, distance analysis, geocoding analysis and overlay analysis. Buffer analysis is a simple geo-spatial procedure but has proven very useful for a variety of projects including selecting pertinent populations for public notification, illustrating coverage of warning systems and demonstrating fulfillment of regulatory statutes. Water modeling is typically utilized for utilities planning, maintenance and reporting. Surface Analysis can be performed to predict flood sensitive areas, soil erosion behavior and pavement condition. Statistical Crime Analysis can be utilized for planning, prevention and reporting. Behavioral analysis can help gain insight on the possible reasoning behind traffic accidents and citations to facilitate patrolling and provide exhibits for reporting. Network analysis is a means for routing emergency services, infrastructure maintenance and other municipal service calls. Distance analysis helps inform ISO inspectors of potential response times for the delivery of emergency services. Geocoding provides a means for the mapping of events from an address database. Overlay analysis is often employed to gain insight on the correlation of various factors for future planning and emergency management. Analytical maps are created for the purpose of answering complex questions that require geo-spatial analysis to create.

Digital Interactive Maps

Digital Interactive Maps have been created with ArcReader, ArcExplorer and Microsoft Front Page. Each solution had different limitations but offered sufficient functionality to meet the needs of the particular project. A city digital mapping system was created to distribute to upper management and City Council members. This solution included a self contained mapping system that hyperlinks users to adobe reader maps via a centralized index portal and offers GIS interactivity with ArcReader technology. The Highland Village Fire Department digital mapping system is a self contained mapping system that hyperlinks users to a variety of directional, close up hydrant address maps, preplans, landmarks and mutual aid territories through a browser enabled web interface. This solution was created with a combination of ArcGIS and Microsoft Front Page. An EOC

(Emergency Operations Coordination) digital mapping system includes a self contained mapping system that hyperlinks to a variety of adobe reader maps and offers interactivity with ArcExplorer technology. Although there are a number of solutions with respect to interactive data delivery there are limitations with respect to functionality particularly with the free plug-in applications. For a small municipality this is a concern but given that 'necessity is the mother of invention' it is possible to find ways around these barriers. In the future this will extend to include a centralized and dynamically activated interactively delivered digital mapping system.

Customized GIS Applications

This facet of the Geographic System in the City of Highland Village has not been explored to date. However, it is on the radar screen for future consideration. This is an important facet of Geographic Information System development and should always part of the goals that are established at the outset. In an ideal situation all municipal operations would be integrated into a Geographic Information System environment through customized applications that ultimately replace legacy systems if they exist. Within the GIS environment these data can be collectively analyzed and summarized. In small town environments it is often the case that very little technology is in place. As such, this affords a GIS professional with a tremendous amount of latitude and opportunity for customization to ease data retrieval.

Challenges with Implementation

I find that the primary challenges facing the successful development of a Geographic Information System is finding ways to subtly educate the departments as to how GIS could be of help in the present as well as to future generations. There are other challenges in relation to how individuals interpret their 'job descriptions' and a variety of responses to change. In addition, increased accountability, in a small town environment, often creates a certain degree of unrest because of the perceived volume of work and the resistance to what could be perceived as 'micro-management'. Fear of complexity and technology is another challenge to Geographic Information System implementation. There are also budgetary challenges that inhibit expansion of the system. A GIS professional can easily overcome budgetary restraints. It is public opinion that is the greatest challenge. As such, it is important for small town GIS professionals to acknowledge this and find creative ways to educate staff and gather support.

Advantages of Implementation

The advantages of implementing a GIS in a city outweigh the challenges by far. GIS Technology offers the ability to actively integrate tracking, documentation, analysis, reporting of municipal activity from a central location. It enables the evaluation of the parts of the whole independently and collectively in order to facilitate informed decision

making processes. In addition, GIS provides the ability to create, archive and retrieve information in the present and for future generations. Increased efficiency due to reduction of redundancies and increased accuracy is a valuable advantage. Various levels of analysis and their corresponding map products provide a tremendous amount of flexibility. The advantages of the various products that are typically delivered by GIS technology are summarized as follows:

Representative Maps (Paper or Digital)

- Descriptive Surfaces
- Communication Tools
- Decision-Making Tools

Analytical Maps (Paper or Digital)

- Analytical Surfaces
- Communication Tools
- Advanced Decision-Making Tools

Digital Interactive Maps (Adobe Reader→ArcReader→ArcExplorer→Internet)

- Questionable Layers
- Interactive Querying and Display Functionality
- Advanced Querying
- Advanced Decision-Making Tools
- Communication Tools

Customized Applications

- Advanced Querying
- Decision-Tree Functionality
- Advanced Querying
- Advanced Decision-Making Tools
- Communication Tools
- Tailored to meet specific departmental needs
- Designed to integrate seamlessly with centralized GIS

Increased information accessibility, improved customer service and improved city services can be correlated by a successful GIS that is being actively utilized by city staff. In my mind, one of the greatest advantages of a mature Geographic Information System is the opportunity to view the city as a system composed of many parts and to explore the interrelationships collectively rather than the parts in isolation so that problems can be addressed and corrected with greater success.

Conclusions

Small town GIS professionals find themselves in a very different situation than that of large municipalities. Although we are often hired by the Public Works or Planning departments we wind up serving all of the departments in the city. In a larger organization the GIS is often fragmented into departmental focal points. This is not necessarily the most desirable situation because it introduces redundancies (on the geospatial end, as well as, from the departmental attribute database standpoint) and a variety of other challenges when it comes to creating a 'common operational picture'. In a small town there are redundancy issues between departments across the organization but the geospatial component is centralized so redundancies are reduced from the outset. In a larger organization GIS professionals are typically focused on answering a specific set of questions that are related to a particular theme. Small town GIS professionals will find themselves answering questions from all sides of the spectrum so it is necessary to be broad minded and maintain a generalized knowledge base in such a role. The municipal Geographic Information System that is developing in the City of Highland Village is in good form but it is still in the state of becoming a fully operational 'system'. Currently, the GIS data is logically organized and intuitively accessible. I can perform a variety of analyses and create any map but I am still working on refining the dynamic activation and interactive delivery aspect. While I have created some interactive solutions to deliver information these solutions lack the level of interactivity that I desire to deliver. I have utilized ArcReader as an interactive delivery solution within a 'Digital Mapping System' that I created for the City Council and Upper Management. I have also utilized Microsoft Front Page to create an interactive closed circuit mapping system for the Fire Department and Emergency Services Personnel. For EOC I utilized a combination of the two solutions and incorporated ArcExplorer. While these solutions have met immediate needs associated with the requests and provide an interactive means to access data and information they do not provide the 'common operational picture' that I seek to provide. The idea behind this goal of creating a dynamically activated interactively delivered digital mapping system is to bring everything together so that the parts can be viewed in isolation or as a complete system. Each department would have a map viewer that provides access to the contents of a department-specific personalized geodatabase and the contents of the centralized base data geodatabase. The departmental map viewers would be tailored toward the needs of the particular departments whereas the master map viewer would provide a view of all of the departmental databases combined. This vision is my seed to contribute to future development of GIS in a small town environment. While I have limited resources there are a myriad of creative ways to accomplish these goals. Building an effective GIS for a small community depends on several factors. Many of these factors have been discussed in this paper. While these factors will vary between communities the basic framework of building a GIS will remain fairly constant. At the end of the day, it is the enthusiasm, creativity and vision of the GIS professional that will determine the relative success of the Geographic Information System.