

Beyond the Enterprise...

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Abstract

Building an enterprise GIS has been a strategic goal for many entities in recent years. Reaching this objective requires dedication and a community of resources with skills and knowledge. The City of Fort Worth has developed an enterprise GIS and continues to increase the functionality and accessibility of the GIS. This presentation will focus on the challenges that were overcome in developing an enterprise GIS; the integration of GIS with City business processes; and the vision for GIS beyond the enterprise.

Introduction

The City of Fort Worth is located in North Central Texas covering 348 square miles. Fort Worth has grown by almost 220,000 in the past 12 years reaching a population of about 700,000 people.¹ With the expanding geography of Fort Worth, the use of Geographic Information Systems (GIS) to manage geographic information and provide location-based services has become an important part of the City's everyday business.

History of Fort Worth GIS

The City took its first steps toward establishing location awareness in 1986. A third party was contracted to produce lot and block CAD maps. These maps were then utilized to create CAD zoning maps as well as water and sewer maps. It wasn't until 1997 that the City developed a true GIS implementation plan and created a citywide GIS Steering Committee. During that same year, the existing CAD drawings were converted to a new seamless base map of street centerlines, lots and blocks. In 1999, the City made the decision to utilize ESRI Inc. as the City's GIS vendor.

In 2002, the City became a truly enterprise GIS. Several changes occurred during this year allowing the City to take a more unified approach. Three major changes were pivotal in altering the direction of GIS:

- migrating from single seat software licensing to concurrent software licenses
- rejuvenating the GIS Steering Committee
- implementing a centralized geographic data repository

These three changes were the foundation for a location-based system that houses approximately 450 data layers, is accessed by 15 departments and supplies citizens and companies geographic information from the convenience of their own homes 24 hours a day.

Foundation for an Enterprise

A core group of experienced GIS users existed at the City in 2002. These users had a strong understanding of the concepts and principals of a GIS, they possessed the skills of how to utilize a GIS, and they had the energy and enthusiasm to implement components within departments. While each of these users was able to utilize GIS on a need-by-need basis, there was duplication of effort and a lack of coordination between departments. In order for the City to truly develop an Enterprise approach to location services, a great deal of cooperation, initiative and vision was required by these advanced GIS users. There were several elements that provided momentum in creating an Enterprise GIS.

Common Concerns:

One of the largest driving forces at the City of Fort Worth was funding. Prior to 2001, departments funded a small group of GIS employees in the IT Solutions department. Each department contributed though a monthly fee for access to a centralized file server. In addition, departments were responsible for purchasing their own software licenses. Many

departments expressed concerns about the funding structure and use of the money. These common concerns provided the fuel for action giving GIS users a cause to rally behind.

Steering Committee:

With common concerns as a driving force, the GIS Steering Committee was revitalized. Each department established a representative for the committee. Rejuvenating the Steering Committee created a forum allowing better communication between departments. Steering Committee representatives created enterprise project charters, which were prioritized for completion by the IT Solutions - GIS Team.

Leadership:

Leadership was needed in order for the Enterprise to evolve. While some leadership roles were formalized as positions on the GIS Steering Committee, other leaders filled more subtle roles by organizing things such as GIS lunches and social events or focusing on issues such as data needs and direction.

GIS Community:

The GIS users across the City worked together to share ideas. In an effort to better facilitate communication monthly GIS User lunches were established. This gave the users an opportunity to get to better know one another on both professional and personal levels creating a sense of community. Utilizing the momentum GIS users meetings were setup on a quarterly basis providing a forum for all users to share accomplishments, demonstrate new functionality and identify how departments were utilizing GIS. Additionally, a GIS Day event was created for users to showcase their work.

Developing the Enterprise

Creating an Enterprise GIS did not occur overnight. There were many changes that had to take place in order for GIS at the City to truly have an enterprise approach. Figure 1 shows a timeline of major events for GIS the City of Fort Worth.

In 2001, the City's GIS was distributed across multiple departments. Each department was responsible for their own software licensing and data creation. The first step in pushing towards an enterprise GIS was to combine these licenses into a citywide software license. This removed the software maintenance responsibilities from the departments and reduced the overall costs for GIS software across the City. During this same time frame, multiple copies of data were being stored in varying locations and data stewards were not properly defined. The implementation of ArcSDE (Spatial Database Engine) as a data warehouse allowed for users to share current information while being able to edit and update information at the same time. Additionally, many departments saw the potential for GIS but did not have the proper training. A GIS training committee was created with instructors from multiple departments. This committee provided an introductory class to City employees at no charge increasing the uses of GIS across the City.

The use of ESRI's ArcIMS has allowed the City to increase the use of location information without drastically increasing overall software expenses. During 2002, the IT Solutions department launched the first Intranet mapping site for use by City employees. There are now several Internet based mapping options available for citizens and developers to view zoning information, economic incentives and residential information through a mapping interface. In February of 2006, the first wireless mapping application was created for the Code Compliance Department. Code Officers are able to view parcel information as well as aerial photography while creating cases in the field.

In 2005, the IT Solutions department implemented a support line and call tracking for all support questions. The formal approach to support enhances cross training within the IT Solutions department, increases customer service and provides metrics on user needs. One of the most recent developments for enterprise GIS is the introduction of Windows Terminal Services (WTS). Many GIS users are not located at City Hall. Users at remote locations are connected to the City through T1 lines at best. These users have experienced poor performance accessing data. In March of 2006, the

introduction of WTS allowed users to quickly utilize location information by connecting to a server and using ESRI software without experiencing performance lags.

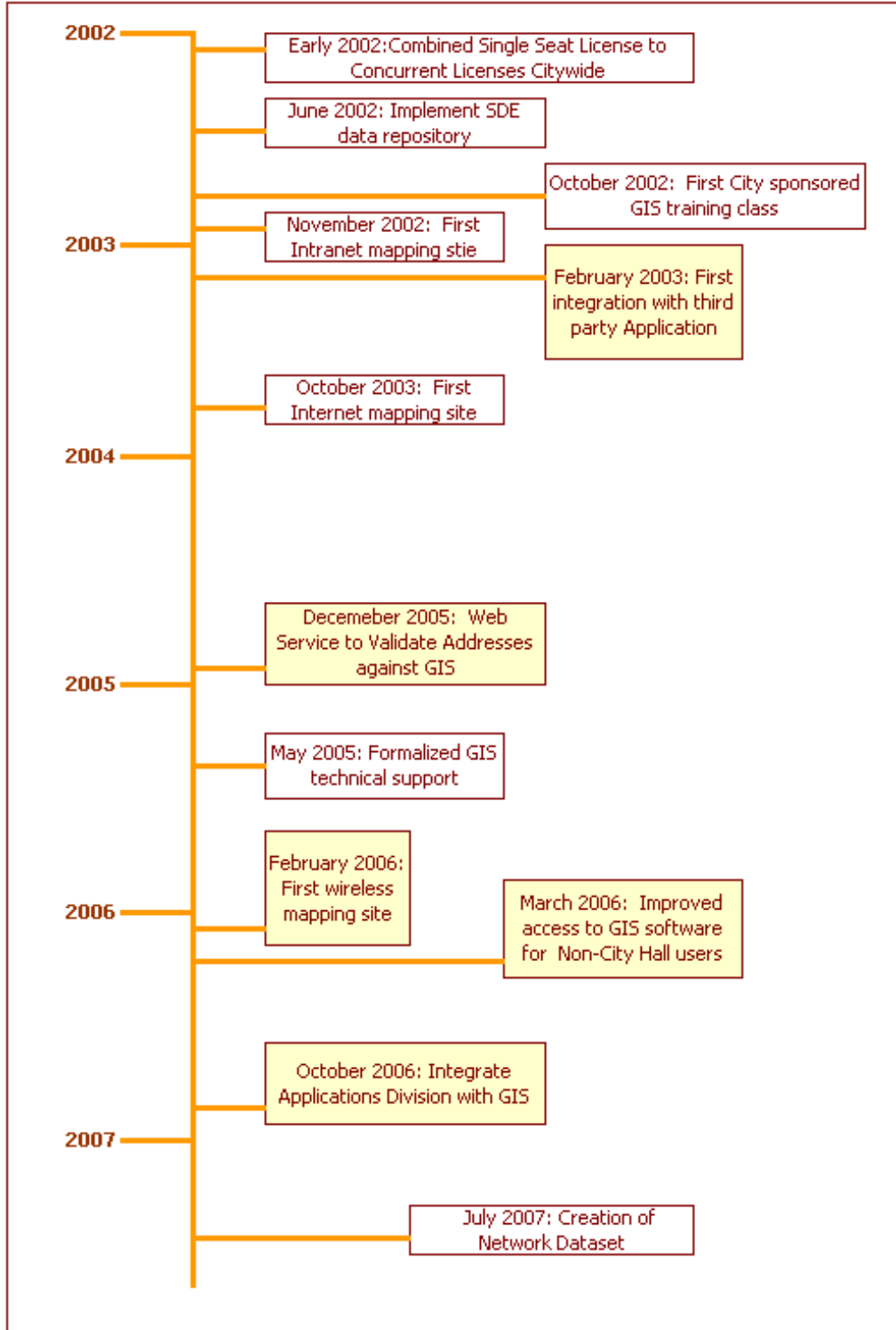


Figure 1 – Major milestones for the City of Fort Worth GIS. The white boxes indicate things that helped develop the Enterprise GIS while the yellow boxes show accomplishments that helped create a seamless integration with applications and everyday business.

Integrating GIS

Many of the major GIS milestones outlined above are maps or can easily be identified as tools to access location based information because of their mapping interface. The value of the geographic information was being realized by employees across the City however, the information behind the data was under utilized. In order for both employees and citizens to better utilize the information we have continued to make the data more easily accessible through web interfaces.

GIS data was integrated with the first 3rd party application to support Police and Fire dispatch in 2003. While extracts had been done previously, this was the first major integration where data was updated on a recurring basis. In 2005, the first web service was built validate address information and ensure the accuracy of data entered into our Courts ticketing application. This tool reduced the number of returned mails saving the City hundreds of dollars a month. This web service is now used with several applications and has been enhanced and tuned as needed.

One additional change was made in the organization of resources in the IT department. The GIS Team was combined with the Applications and Database Teams. This decision was made to facilitate the integration of GIS with new applications; to better allow for cross training and backup support; and to encourage the integration of the information found in GIS with new or existing applications. While these organization changes started out rocky, as time has progressed we are seeing that many developers increase the use of location information and are finding ways to enhance the use of applications. We also have a pool of programming resources to assist with location based projects or tools and the GIS database has a team of database administrators that work together to providing support and backup for one another.

By 2006, the City's location information had been integrated with at least a City applications ranging including applications tied to permitting, emergency response and public safety, water billing and court fines. In 2007, the City added 8 new applications that tie to location information. Five applications have integrated in 2008 with 5 additional applications to be completed by the end of the fiscal year.

Beyond the Enterprise

GIS was once an industry of its own, however location information is now part of our everyday lives. Tools such as Google earth and MapQuest are now part of our everyday lives. When trying to find a location people now turn to the Internet to find locations and directions for anything. The use of navigation systems are an affordable and fun way to get around. You can now receive text messages about traffic information on your cellular phone and news alerts based on a specific geographic area. In 2000, ESRI had a presentation on Enterprise GIS and they touted all the advantages of an enterprise system and the amazing things that could be achieved. Below is a diagram showing there vision of GIS:

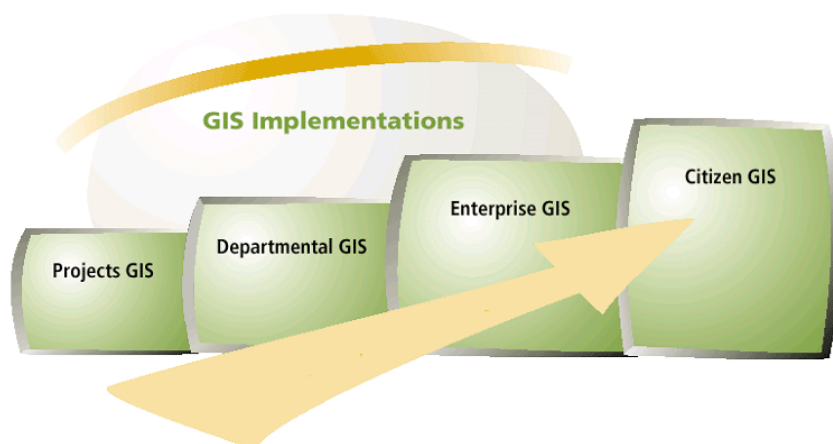


Figure 2 – Diagram of ESRI vision of GIS in 2000.

The City of Fort Worth now provides GIS to its citizens through mapping applications and integrated tools. However, there are several areas where we hope to enhance the use of location information and provide better services for our citizens in the future. We would like to allow both the employees and citizens to make more educated decisions with the information available in the enterprise GIS. In order to achieve this, we are evaluating our current system and make changes to increase speed, security and accessibility. As with any system, time will cause it to be outdated and antiquated. The information will become stale and performance will be impacted. Through this evaluation process we have found several areas we wish to focus on:

Security:

When we set-up our GIS database in 2002, there were not a lot of recommendations or guidance on creating user accounts or allowing access to data. We originally had individual SQL logins for each user accessing the database. We found this to be cumbersome, difficult to maintain and not near as secure as network logins. Currently, we are using network logins to grant access to our database. However, we are looking to take this one-step further by using domain admin groups to grant access to data layers. By using domain admin groups we will be able to better control the varying levels of security; we will have a better understanding of who can access and edit data layers; and we will be able to change editing permissions during regular business hours (since individual access must be granted when no one is viewing the feature class). Additionally, we no longer allow our programmers to access the production database. We now have a team entirely devoted to designing and supporting databases. This group has several database administrators who have been trained and have worked with the GIS system.

Design:

Our current geodatabase utilizes SQL Server 2005. When we designed the original system many of the current functionalities of a geodatabase were unavailable. Our GIS user community was used to a file-based system and finding shapefiles listed by type in a directory structure. We created 3 character prefixes for each of the feature classes to emulate a directory within our SDE database. Since this time many things have changed with the functionality of the geodatabase. Topology is now available inside a geodatabase as well as recommendations on ways to configure data. We are currently planning to redesign the existing geodatabase utilizing the topology for many of our key data layers and standardizing column names, types and values. By doing this, we hope to increase the accuracy of the data as well as create consistency across the database. We also plan to outline and create standards and procedures to accompany the database. This will allow for the information to be passed on to new staff, explained as needed and to ensure consistency from administrator to administrator.

Additionally, we would like to create what we are calling an address data mart. The goal of the address data mart will be to store all information that is utilized by varying applications that do not require a spatial component. With the integration of GIS with many of the City applications, we are seeing that the location based information is a critical part of our business. By creating a separate database for this information we will have reduced the load on the SDE server, reduced the impact across the City when there are issues with SDE database and ensured that the geodatabase only stores spatial information.

Accessibility: With the overwhelming increase of location-based service into our everyday lives, many new tools have become available and should be reviewed for feasibility. While the ESRI proprietary tools are part of the City's enterprise GIS approach, the data could be utilized by varying applications. We have already utilized the attribute information with many in-house and third party applications. It is important for us to review and identify what are the best options for integrating the actual spatial data in the future. Currently, our Water department is reviewing Maximo Spatial for asset management. Other internal uses might include permitting, crime reporting and environmental modeling. Additionally, we plan to review ArcServer, Virtual Earth, and Google for our citizen facing applications.

Partnerships/Third Party:

Currently, the City of Fort Worth works closely with the regional 911 and the appraisal districts sharing information. However, there are many areas that we are not taking advantage of as far as partnerships. The City plans to investigate the use of third party tools and data to meet some of our technology needs. The time and effort required to meet many of our future goals are too large and cumbersome (in comparison to previous goals) to tackle with limited staff resources. The additional increase in the number of applications available has dramatically increased the time committed to supporting applications that utilizing GIS information as well. We also hope to enhance current partnerships by sharing application code and data to prevent duplicate effort with local entities.

New Solutions:

As with any technology, there are new ways to view and access location based information. The City of Fort Worth must continue to explore the use of new technology to enhance current and future business processes. There are many location based services we hope to investigate further. These include the use of mobile computing devices, routing through the web, Automatic Vehicle Location (AVL) and potential analysis.

Standards:

The enterprise GIS has allowed us to provide information to the department and our citizens more easily. However, the increased accessibility of the data makes it more important for us to ensure the accuracy and consistency of the data. GIS users across the City are working to create Service Level Agreements outlining the accuracy and timeliness of the data. Additionally, standards are being created to ensure the information is viewed either through the web or on maps consistently.

Metrics:

The last item we hope to accomplish is to increase the metrics available in relation to our GIS. We would like to provide better metrics on the actual usage of our websites and possibly drill down to the layers being utilized. We are currently working to increase metrics internally by collecting information on license usage and peak times as well as the frequency that layers are accessed and the community that uses them. With this information we can provide better tools for our customer by targeting and enhancing their current activity, identify who will be impacted by major data changes, and continually monitor and clean our databases.

Conclusion

The development of a truly enterprise location based system took a large amount of teamwork and initiative across many departments. The energy and efforts of a core group provided the leadership needed to make the necessary changes possible. It is important to realize that no one individual had the knowledge or power to implement an enterprise location based system. Integrating GIS with current business process and tools was at times a daunting task but has helped ensure accuracy for project planning; reduced expenses for many processes and provides better information and services to our citizens. As technology continues to change, the City will continue to evaluate its current system to make improvements with data and accessibility, to look for new ways to integrate with the City's business processes and to review the vision for location based services for Fort Worth.