# Issues in Building an Enterprise GIS in Small Local Government

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## Abstract

Two years ago, the Town of Oro Valley GIS Services began a slow and ambitious initiative to move our current single-user based GIS system to a multi-user organization. With tight budgets and a skeptical management, our chances of success did not seem very good, yet through numerous successes and aggressive internal marketing, we are now achieving our goals. Topics of this paper will look into the issues of building management support, addressing budget issues, and implementing an enterprise GIS.

## Overview

In 2001, it became necessary to start expanding the role of GIS in our community as the need and use of GIS increased.  Originally, GIS use was limited three departments with in the Town of Oro Valley: the Planning & Zoning division of the Community Development Department and a few individuals in Public Works and the Police Department.  All GIS use consisted of stand-alone ArcView applications with exception of the GIS Analyst, who used ArcInfo. GIS data was housed on the server used by Planning and Zoning, Parks and Recreation, Building Safety, and public works, while GIS imagery was housed on a different server.  This model was working fine at the time, but a number of issues became evident as the Town grew.

They included:
- Support
    - Management and Departmental Apathy (Personality Conflicts)
    - GIS seen as only a mapping tool, not as a decision making tool
    - High Software Maintenance Costs associated with GIS
- Data Management
    - Variety of data formats
    - Map Quality and Updates were minimal
- User Access
    - Typical User was only using ArcView Apps as Map Viewers
    - Large variations in GIS software versions and vendors
    - Lack of GIS training for staff
- Organization
    - No Centralized GIS Program
    - A draft GIS Plan had been made but never implemented

With the state of GIS at Oro Valley being stagnate, a newly hired GIS staff created a tentative multi-year how many plan to bring the GIS program up to a new level of service. The issues (challenges) addressed earlier needed to be addressed to reach our goals, which will be discussed in this paper.

## Issue:  Building Support

The first issue of our process to enhance the GIS program was to build support with the Town management and departments. Our objectives to accomplish included the following:

- Re-Build GIS Services Group Image
- Improve Product and Service Quality
- Create GIS Training Opportunities

One of the greatest hurdles to expanding the role of GIS in the Town was to sell the idea of a larger GIS influence throughout the Town. In the previous years, a number of personality conflicts and work complacency had made the use of GIS a major hassle. Examples of these issues included; Map requests taking longer than needed, customer relation problems, and a very stand offish relationship with other departments.

With the inception of the new goal of building an enterprise GIS, staff went to work on the effort to market the pros of using GIS and to elevate the GIS Services group's image.

One of the older paradigms in the development of GIS Services in the Town revolved around the idea that creating a large GIS group all at once would produce a large number of results in a quicker amount of time. An effort to accomplish this was in the works when the Town's budget began to tighten. With increased expenses and less revenue, management was less receptive putting a large amount of money into a program that had not yet produced any results.

One of the first objects to change the idea of that a large GIS group can do more than small group was the belief that producing good products and services will eventually create growth in the use of GIS. We had to sell the idea that GIS was good for the Town, and could only get better. Oro Valley Management tended to be more receptive to real results than potential results. By making GIS an everyday tool for normal day-to-day operation, it would be clear that GIS was good for business.

We turned the GIS group's work ethic into a more like business attitude, where we made our customers happy first, and moved our own priorities to second place.

A step toward accomplishing this was to bring up the GIS mapping program up-to-speed.  Standardized maps that had been neglected and not updated for a number of years were now  updated every 2 months.  Map projects that other departments were supposed to maintain, were transferred back to GIS Services.   GIS staff accomplished this by automating the mapping process, by using standard templates, and checking the quality of our data.  Plus, by making the map update process easier, it allowed time to be shifted to other projects.

Next we changed the way we handled map requests.  GIS staff began to complete map requests in shorter amounts of time, and by not turning away map requests.  Past frustrations with the GIS Service group usually revolved around the aggravation of getting map work done.  Non-GIS staff were expected to create maps on their own with little to no training available, which complicated this issue.

Non-GIS and current GIS user training became our next objective toward building support.  To accomplish this, GIS training courses were created for the current GIS users, concentrating on ArcView basics and by providing training at a more regular interval.  GIS staff also understood that a majority of our future users' knowledge of GIS was very limited.  So with that in mind, courses like "What is GIS?" and "Getting to know your GIS data" were designed to educate our users. The occurrence of GIS training went from a non-existent to a quarterly event.

Our effort to rebuild the communication between GIS and other departments used interviews with department and division heads regarding GIS to place to get a feel of what the rest of the Town's expectation was with its GIS program.  With other departments understanding what we were trying to accomplish, other issues regarding the development of GIS became easier to resolve.

## Issue: Data Management

With marketing GIS to the Town in progress, another challenge to address was the needed to make sure our data reflected confidence in our technology.  Our issue was with our database and its structure.  The main objectives we had to address included:
- Centralize the Town GIS data
- Bring data to more accurate and current state. (Quality Control)
- Influence departmental GIS database transitions

With data spread out on multiple servers and the quality of this information at varying levels of quality, the chances of mistakes due to wrong information could potentially cause roadblocks to selling the usefulness of GIS to Town staff.

Our objective to centralize the GIS data and then improve our data integrity and quality materialized within the two years.   A few stumbling blocks came to light early in this process, they included the use of multiple file formats (Shapefiles, ArcInfo Coverages, CAD Files, Excel Spreadsheets, Access Databases, etc), location of the data, quality of the data, and if the data lined up with our control information (Parcels, and Aerial Photography).

Our first task was to sort through all of this information and locate it centrally. Our original file system on the network had our information on a windows file server (shared by other departments) and a Linux file server, which had many reliability issues with our Microsoft Windows Server Environment.  It was determined , after some discussion, that the best thing to do was to create a new GIS server that could support the initial demands of imagery and file data serving, but also in the future be able to handle some application server roles. With the small size of the Town of Oro Valley, we decided early that any enterprise GIS system in the Town could be handled on a single server.  This of course could change in the future, which our future GIS plan would cover, but our initial projections were based on a conservative growth assumption.  With our hardware requirements resolved, data migration began.

Our next effort in the migration to a centralized GIS system was to deal with our multiple data formats.  We decided early that we would migrate most of our data formats to our current software products paradigm (shapefiles).  We however also decided, for efficiency reasons, that we should begin a process to move our existing data to a more manageable system, instead of a file format system like shapefiles.  With the growth of the popularity of the Geodatabase and its many benefits, we decided t in the course of the next few years to move our data to this format.  We believe that the benefits of using the Geodatabase to manage our information is  a long term goal that needed to be done, even if the design and implementation process is, in the short run, time consuming.  We also decided that it was beneficial for us to start our migrations with CAD data, since a number of our CAD datasets were the most out of date and least accurate.

Our first candidate for migration was the water department, a priority user for migration.  The departments had no GIS managing their information.  All management of the Town's water facilities was based on system design maps, from 3 different water systems and companies.  Migrating the water department's CAD data to the Town GIS was determined to be the most appropriate way to improve their services.  Our next data conversion projects will focus on our Parks & Recreation Division and Public Works Department in the next few years.

Currently our database management efforts also have moved to implementing ArcSDE with SQL Server.  This multi year effort  includes other department's

effort to migrate their information to Microsoft SQL Server (Permits, Water, IT).  It is expected; time permitting, that most of the GIS group's information will be available on these databases long before other departments completely migrate.  Which will facilitate the future integration of GIS data with other Town data.

## Issue:  User Access

With efforts to build interest in the GIS program growing, our next issue to resolve was to start looking beyond our current user base and introduce our non-GIS users to the technology.  A number of issues in providing GIS to all Town employees came up right away; they included costs, training, and availability.  A number of solutions presented themselves early in the process, these are described below:

| Software Solution | # of Users | Pros | Cons |
|---|---|---|---|
| ArcExplorer | Unlimited | - No Software Costs<br>- Simple Application Interface<br>- Reads Current Data Formats<br>- Little formal training needed | - Requires installation on all computers<br>- High GIS Staff Upkeep/Maintenance<br>- Not Customizable<br>- Semi Dynamic Data Link |
| ArcReader | Unlimited | - Minimal Software Costs<br>- Little Training Required<br>- Semi Customizable | - Requires installation on all computers<br>- Moderate GIS Staff Upkeep/Maintenance<br>- Static Data<br>- Purchase of Publisher Software Extension |
| ArcIMS | Unlimited | - Moderate Software Costs<br>- Dynamic Data Link<br>- Opportunity for Public Use<br>- Customizable<br>- Minimal Maintenance Cost<br>- Centralized GIS System | - Require Internet Application Server<br>- Programming Time Costs |

After reviewing our options, it became evident that our best option became implementing an ArcIMS solution to our future growth.  This decision was based on GIS staff's familiarity with ArcIMS and that this solution created the least amount of conflicts in implementing this solution.  Another benefit to going with an entire web-based GIS system was the beginning development of a Town-wide intranet site with the Information Technology (IT) division.  IT had always envisioned the use of an Intranet in the Town, but it had been ear-marked for a later time.

Yet another benefit of the move to a web-based GIS program is the financial savings to the Town. By removing software license/maintenance, we have lowered our overall software maintenance costs by 30%. With the implementation of our internet mapping program, we also were able to start providing internet mapping access to our citizens.

To introduce the new Intranet Mapping System to the Town, the default applications provided with ArcIMS were initially used in coordination with training workshops. Within a number of months after release, GIS staff began rolling out simpler Active Server Page (ASP) ArcIMS applications to replace the default programs. This provided the same information, but with faster delivery of the information.

The use of the intranet and ArcIMS has become our primary GIS application platform for delivering GIS information to the majority of our users. Even with our implementation, the development of useful web applications will continue to be a challenge in providing GIS access to the Town.

## Issue: Organization

One of our last major issues that we are addressing in our efforts to implement a well designed enterprise GIS is our organization. Currently, the GIS is located in the Planning & Zoning Department where GIS originally began in the Town. Over the last few years, the GIS Group has slowly become more separate from the everyday work that a planning department does due to other Town-wide project work the GIS group is responsible for. With this, and the rise of interest in GIS throughout the Town, a new technology centric organizational structure is planned.

Issues with the current organization structure center around the perception that GIS is a Planning &Zoning only technology, which has stifled some potential GIS development in the Town.

Our new organization model now focuses on a more central GIS with a larger Information Technology Division role. As the Town has grown, IT operations have continued to grow and move to a larger enterprise system. With GIS spear-heading a number of the future technology programs, it only seemed appropriate to look to combine GIS with the IT Division. With this in mind, the merger of GIS with IT has been proposed for the next budget year. Our benefits to a structure like this for the Town would include:
- Centrally coordinate GIS policies
- Reduce duplication of effort
- Enhanced project coordination
- Better GIS products
- Budgetary Synergies

A newly revised GIS plan is in development to support this new structure and set standards any future GIS development.  Having a written plan is becoming a priority for our program as we continue to grow.

## Conclusions

With the development of this GIS program, the Town GIS staff is now starting to show management that with the increased growth of GIS we are creating more inter-departmental relationships, better products for internal and external use, and an overall decrease in overall GIS operation expenses.  It is our belief that, for an organization the size of the Town of Oro Valley, a central GIS program that could support all departments with a single unified GIS model, instead of a variety of different programs existing throughout the Town.   Additionally, this single GIS Model can be an important benefit for the organization and how it supports programs for our citizens with quality decision making methods.  Clearly, we have made progress in addressing issues in developing an Enterprise GIS program, but still have many obstacles to overcome to achieve our goals.

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