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CONSENSUS BUILDS A SUCCESSFUL GIS

Abstract

San Mateo County is developing an enterprise-wide GIS basemap system with great efficiency, through extensive cooperation and planning. Four principal departments have combined their resources, data, and skills, along with several constituent cities, to build a basemap with a minimum of redundant expenditure. Moreover, their cooperation is extending toward ongoing workflow re-engineering that assures faster, accurate map updates and extended service to citizens and taxpayers.

Introduction

With the election of a new Assessor-Clerk-Recorder and some new County Supervisors, San Mateo County – the "Gateway to Silicon Valley" – reoriented itself toward utilizing the Valley's information technology to improve its governmental operations and delivery of

services to its citizens. GIS, long desired by County staff, was made a serious initiative, as was "eGovernment." Learning from other enterprise GIS implementations, this project is achieving success, based on the cooperation of its senior management.

San Mateo County has approximately 200,000 property parcels, covering 552 square miles. Nearly 55% of the area is State parklands, watershed lands owned by San Francisco, and the San Francisco Airport. That leaves about 250 sq. mi. of highly urbanized land at nearly full build-out. A few cities had independently created digital basemaps of varying accuracy, and most cities had their fire-run maps digitized as CAD drawings. The County's objective was to implement GIS effectively and economically. At this moment, the basemap is completed, GIS software is installed, staff have completed initial training, and "early win" applications are coming on-line. The project is on schedule and under budget. This early success can be attributed to several factors:

- Interdepartmental Cooperation
- Cooperative Funding
- Careful Planning
- Organizational Structure
- Integrated Technical Implementation
- Priority Training
- Project Management

Interdepartmental Cooperation

Like most counties, San Mateo's Assessor's Office (AO) and Public Works Department (PWD) each create and maintain parcel-based maps. Historically, this apparent duplication developed because of the distinct uses of each map set. AO's maps are used primarily for verifying and justifying property value for tax assessments. PWD's maps are used for infrastructure planning, engineering, and maintenance activities.

But unlike most counties, the San Mateo County AO and PWD have been cooperating toward an integration of mapping activities for their mutual benefit. To assure more consistency between the two map sets, the PWD's mapping staff has been working closely with the AO mappers on a regular basis, to inform each other of specific characteristics or issues concerning "problem" maps or parcels. The senior mapper in the AO worked in the PWD for almost three years prior to joining the Assessor's Office. During that time, PWD mappers were assisting the AO to keep its map books up to date. Now, AO mappers are trained to follow similar procedures as PWD mappers. Both departments are developing methods to process digital map changes in a coordinated manner. Because GIS maps can be displayed to meet many different graphic standards, the GIS project provides a perfect opportunity to officially combine the mapping staffs and operations. Currently, integrated, digital workflows are being designed.

It is the cooperative initiative of the County Assessor, as well as that of the Public Works management, that re-focused on "serving the County" rather than simply "serving the department." Assessor Warren Slocum was the first to put County government information on the wwWeb in order to extend services to the County's citizens. He sees GIS as another enabling technology to serve San Mateo citizens.

The spirit of cooperation has extended beyond County offices as well. All of the County's constituent cities have agreed to share their map data with the County's GIS basemap project. In return, they will receive a consistent, registered, data-linked, topological GIS basemap from the County. Of 21 separate cooperating entities, 19 had digital map drawings, however, 15 needed better registration, 12 needed linkage to APN identifiers, and 18 needed topological transformation. This cooperation was facilitated greatly by the County's data conversion vendor, Lynx Technologies (Santa Cruz, CA), who had converted most of the digital maps as CAD drawings for the various cities' fire departments.

Cooperative Funding

"Interdepartmental Cooperation" is a nice phrase, but its reality is proven when funding is required for an enterprise-wide project. Different County departments had varying abilities and resources to fund the project. Nevertheless, all were forthcoming with what they had, and no department tried to impose its will based on how much it contributed. Indeed, the Assessor, who contributed the most money to the project, simply encouraged the GIS Steering Committee with, "Just make this project succeed."

Key departments had applied for targeted funds, or had accumulated reserve funds from ongoing programs which require mapped information. These were used to finance the project.

- Assessor - contributed State § 818 funds for modernizing land records and making tax assessment more efficient.

- Public Works - contributed road funds for upgrading county roads and storm drainage

- Planning - contributed permit funds for reviewing the environmental, transportation, and other impacts of proposed development projects

- Information Services (ISD) - contributed in-kind services in lieu of cash

The principal departments had the broad insight to understand that their support for an enterprise digital basemap system was necessary to their mandated functions. They have agreed to share the investment in GIS according to their financial ability without "bean counting" the distribution of GIS benefits. For example, PWD funded the purchase of the enterprise-wide data server even though its "narrow mandate" would have been simply to maintain the basemap. They understand that when every County department uses the basemap, and maintains the data for which they are responsible, it benefits PWD as well as the County as a whole.

Ongoing support of enterprise-wide computer services will be allocated as annual contributions from each participating County department, much as annual support for other ISD operations is currently funded. Each department will be financially responsible for its own hardware, software, and staffing costs, while technical support will come from the central GIS Support Group. However, some of the "wealthier" departments recognize that the other departments may not make such investments until they actually derive useful

benefits from the GIS. Therefore, some departments will receive a "GIS starter kit" with no internal charge.

Careful Planning

Another success factor for this project is that all aspects of its development were planned and agreed upon before commencement. As a result, the basemap construction, hardware/software purchase, and training are being conducted on a schedule that is bringing every component to completion at the right time for system integration.

The GIS Steering Committee, in consultation with a larger group of County departments, hired GIS Consultants to conduct a Needs Analysis that resulted in a Strategic Plan. They then spent a year to understand the project and build full consensus. Thereafter, a specific Implementation Plan was designed for the basemap construction, followed by detailed and complete specifications and preliminary cost analyses. The Committee obtained multi-year funding approval from the County Supervisors, based on the completeness of the planning and the affirmation from all major departments that GIS would benefit their delivery of County services.

San Mateo County is particularly fortunate to have several staff members who are well-informed about GIS. The ISD Director had conducted GIS projects in two previous Counties. He knows some of the mistakes not to repeat. He also has been open and flexible to suggestions and recommendations from other staff and consultants.

Several members of the PWD staff have been attending the Bay Area Automated Mapping Association's educational meetings for years, while waiting for the tide of progress to reach San Mateo's shore. Their preparation has enabled them to contribute knowledgeably to the planning of this project.

Organizational Structure

Because of the cooperation among principal departments, they have been able to organize themselves into effective working groups to handle the project's policy, management, and technical aspects.

- The GIS Steering Committee, comprised of the four principal departments (AO, PWD, Planning, ISD) acts as a Policy Committee by setting priorities and operating guidelines. A broader-based GIS Review Committee, comprised of all the County departments, meets occasionally to keep appraised on the progress of the GIS implementation and to give its recommendations. Initially, this committee was very active during the Needs Analysis and determination of priority GIS applications. After the GIS basemap implementation is complete, it is expected to get more active as a User Group for each department that begins to make use of the Countywide GIS.

- An Implementation Management Committee was organized by the Steering Committee organized to coordinate specific implementation tasks, budgets, and staff resources. This committee, in turn, spawns ad-hoc work groups as they are needed.

- A <u>Basemap</u> <u>Project</u> <u>Management</u> <u>Group</u>, comprised of staff from DPW, AO, and ISD, has been overseeing the specification, development, and QC of the Countywide basemap and subsequent map layers and datasets.

- <u>Ad</u> <u>Hoc</u> <u>Work</u> <u>Groups</u> are formed as needed to address specific technical issues. Work groups are also formed to oversee the definition, development, and deployment of each GIS application (Redistricting and Notification are the first two applications). Each work group reports to the Implementation Management Committee. Currently, Implementation Work Groups have formed to determine appropriate policies and methods for such operational issues as:

  √ System Management Standards and Procedures
  √ Database Administration and Maintenance
  √ Data Maintenance and Workflow Automation
  √ Funding Central GIS Support, and Development
  √ Data Distribution Policy
  √ Liaison with Cities, Special Districts, Regional Agencies
  √ Organization Structure: Departmental and Committees
  √ Priority Applications
  √ Special Projects

Simultaneously, the principal departments are reorganizing internal staff resources to conduct their department's GIS operations and to interface with other departments' operations where the information flow requires. Within each department, a key person has been selected as "GIS Coordinator" or "System Administrator", and others have been assigned specific technical functions, such as database administration and basemap maintenance.

A detailed listing of job performance requirements has been defined for various GIS responsibilities. However, it is being used as a guideline only, since each department's personnel have unique combinations of skills and interests. Experience will determine over time how these specific responsibilities will be divided among departmental staff. Some tasks, such as spatial database design, workflow analysis, applications development and training are being conducted initially by the County's Enterprise GIS Integrator, Farallon Geographics (San Francisco, CA).

Integrated Technical Implementation

The project was initiated on the promise of access to reliable, accurate, and useful spatial information. By building an enterprise-oriented spatial information warehouse, the County's departmental managers are fulfilling that promise.

The County's spatial information server is capable of delivering geographic information in vector, raster, and tabular formats to a variety of clients, including spatial data developers, departmental GIS analysts, web clients, and end users. While the enterprise GIS server is the "go to" information source for users, it does not "own" all the County's data. In many cases, it provides a secure gateway to other departmentally-maintained enterprise databases.

A major benefit of this enterprise data management approach is that it provides a single, reliable source to GIS application users. This reduces data redundancy, lowers data maintenance costs, and provides spatial information in a scaleable environment for deploying GIS applications. As a result the County is about to deploy an "early-win" web-based property owner notification application based on the recently loaded parcel layer, while many additional spatial data layers are still being developed. With it, the GIS can begin delivering useful services while continuing to augment the enterprise data. As new layers are brought online, users will simply request additional information from the integrated data warehouse, as opposed to requesting access to spatial data from multiple departmental providers.

Because the County's enterprise spatial warehouse represents a new way of storing, managing, analyzing, and publishing spatial data, we have adopted an integrated implementation method to put each department in control of its spatial information needs. For example, the "Parcel Maintenance Work Group" is guiding PWD and AO personnel to define new workflows for capturing and maintaining property layer data that leverage enterprise GIS technology. An "Enterprise Database Work Group" is designing update procedures to keep Assessor's database and the GIS data warehouse fully synchronized. Similarly, ISD staff are mastering new vocabulary and data management techniques required to maintain an enterprise spatial information system.

By taking a formal and well-planned approach to building an enterprise GIS, the County has embraced the re-engineering of out-of-date data workflow practices, and has committed to transferring the required data management skills to its in-house staff. This commitment is critical to the long-term success of the enterprise GIS.

Priority Training

Educating County staff to use the GIS and maintain the digital data has been an integral part of the GIS plan. As soon as the GIS software was installed, training classes were conducted by Farallon Geographics. This training began even before the digital basemap delivery was completed. Initially, we used another agency's data just for training purposes; then, we used preliminary deliveries of San Mateo County's data until it had been fully QC'd. The idea is to have a core staff ready to maintain the basemap as soon as its final delivery and acceptance.

General "GIS Use" classes were provided to a large number of people in each department, and more specific "Basemap and Database Maintenance" instruction is being given to staff specifically tagged with those responsibilities. The basemap maintenance instruction is integrated with the basemap workflow design and development. As County staff re-engineer the data maintenance workflow, they also learn the GIS commands necessary for its implementation.

Some County staff are beginning to assist others in basic use of the GIS. The goal is for staff people who understand their department's workflow to show their colleagues how to use the new GIS tools. This is more efficient than teaching everyone general GIS.

Project Management

As the GIS implementation tasks are conducted, the project has had to deal with myriad technical issues, each one important to the schedule, cost, and usefulness of the product. Problems with the data, and with the creation of final basemap products were anticipated generally (it is impossible to know everything about the data until they are actually processed), but specific issues constantly arise. They are addressed in monthly project management meetings, and in special purpose meetings when necessary. A close team relationship has developed among DPW's project manager, along with selected staff from the principal departments, the GIS implementation consultant (GIS Consultants), and the basemap service providers.

Problems are presented and solved in a collaborative manner. For example, Farallon Geographics, assigned to perform the Quality Control on the conversion vendor's work product, has been deeply involved with the design of the spatial database schema and basemap specifications. The QC checking procedures were developed in collaboration with Lynx Technologies from the start. The idea is to catch a problem as early in the process as possible; with no recrimination toward the conversion vendor. We're catching the problem, not the vendor.

Similarly, a detailed GIS software acceptance testing process was conducted in which any problems found with the GIS' functionality were used to produce mitigation methods, not to embarrass the software vendor.

The project management reports contain an updated project schedule with percent complete of each major task, and discussion of specific technical issues. We are tracking a multi-phase conversion process as it is completed for each of 21 areas in the County. The integrated schedule also includes database design, development of workflows, procedures, standards, and application programs, Notes from each meeting which highlight specific tasks assigned during the meeting are distributed to the participants via a web-based project management information site.

Conclusion

Cooperation and careful planning have enabled this countywide GIS implementation to proceed with a minimum of redundant expenditure or time-wasting missteps. Existing digital map resources throughout the County were used to upgrade to a consistent countywide standard. Basemap construction started with detailed assessment of existing map status in each city, detailed conversion specifications, a database design that anticipated ongoing operations, and integrated quality control checking. This integration is creating an enterprise GIS that will benefit all the County's departments, and its citizens, by reducing redundant workflows and increasing the level of services available with location-based information.

Illustrations

1) Typical active GIS parcel layer, registered over the digital orthophoto

2) County Project Organization diagram, showing the reporting relationship of the various implementation work groups.

3) Parcel Maintenance workflow diagram (partial)
   This blow-up of the workflow diagram illustrates the information flow decision tree for each type of map update source document.

4) Project Management schedule diagram (partial)
   The schedule indicates the priority of project tasks as well as their completion status. This diagram is made available on the wwWeb for all Team members.

5) Project Management information website provides a single, web-based source for all project correspondence, made available to all Team members.

6) Parcel Maintenance workflow diagram (complete)
   This complete workflow diagram illustrates the information flow processing for each type of map update process.

7) Photo of the San Mateo County management team:
   Luther Perry (ISD)
   Mike Jackson (PWD)
   Warren Slocum (Clerk-Assessor-Recorder-Elections   CARE)
   Terry Burnes (Planning)