

Is it worth it? Migrating to the ArcSDE Geodatabase

By: Jackie A. Smith

Abstract

Many GIS departments continue to maintain data in ArcInfo coverages (such as Librarian or ArcStorm); despite strong suggestion that they move to ESRI's Geodatabase. They may "convert" their data over to ArcSDE for viewing purposes only; delaying the time, cost and effort to migrating ALL editing processes over as well. At HCAD, we have successfully migrated to the Geodatabase and are currently maintaining our data layers and processes from within it. This paper will outline the benefits of migrating data and processes to the Geodatabase. I will explain the issues discovered in the new geodatabase environment such as issues with data, maintenance, software, GIS staff and application support. I will also describe our high-level migration plan and costs associated with the major undertaking of migrating to the Geodatabase.

The Harris County Appraisal District is responsible for local property appraisal of over 1.7 million properties in Harris County and some bordering counties. HCAD serves over 500 jurisdictions (taxing units) in America's 3rd most populous county.

The number of new subdivisions a year has grown from 400 in 1994 to over 1800 in 2005. The evolution of the GIS at HCAD has developed out of a need for engineer quality maps and the need to get accurate data into the system in a timely manner. The **Migration to ArcSDE** was spawn from the requirements of the growing county and the management's plans for the future, which included an in-house implementation.

The geodatabase conversion consists of a migration from older coverage GIS technology to RDBMS (Relational Database Management System) GIS technology or the "geodatabase". At HCAD, we successfully migrated from the coverage-based software of ESRI's ArcStorm on a UNIX server to the ArcSDE geodatabase on a Windows server.

As many IT professionals realize, migrating to any new data management system, often requires a new maintenance front end for the business processes. While our plan was to use the ESRI ArcGIS suite of tools, we realized the need for additional customization. The GeoEditor is the customization built as an ArcMap extension using Visual Basic and ArcObjects. (See Appendix I for GeoEditor Toolbar.) GeoEditor is a parcel editing toolset, which includes frequently used, out-of-the box commands, plus several built commands and processes specific to HCAD's way of maintaining the cadastral land base. The result was engineer quality maps and more accurate data than ever before. We reached the goals of using

new technology on a Windows based server and implementing the system with our own staff.

The system accomplishes effective and timely maintenance of the Harris county cadastral land base, which local agencies and private industry depend on. The system is exemplary because it has been designed, developed and implemented in such a way that it can continue to evolve effortlessly and with little impact on other HCAD systems. In fact our GIS can now be integrated with our appraisal records in ways that were never before possible. In addition, the system enables our users to become more self-reliant and proficient in GIS technology and productivity.

So why is our migration different from other Geodatabase Migrations? First of all, I do not know of any large scale GIS conversion done *without* the help of expensive contracts with 3rd party vendors. We took this on ourselves and built something that we as an organization can really be proud of. Secondly, we have a great need for engineer quality maps. Our database and maintenance processes had to support this great requirement.

SYSTEM DESIGN

Prior to our implementation, we designed and built our Geodatabase. Jackie Smith covers this in much detail in the 2004 UC paper 1156. There were 2 main design issues we discovered not mentioned in 2004.

Design Issue 1: Coming from the “double precision” of the ArcStorm coverage environment, finding the right precision for which to import the data proved difficult. After testing several scenarios, we finally decided on one set of numbers.

Design Issue 2: The first server we had allocated to handle the geodatabase load became overworked very quickly in initial prototype testing. Each CPU was at a sustained 100% during a trial data load. The infrastructure staff had a new server ordered and set up within days.

IMPLEMENTATION

We had 4 phases in this project.

Scope – Feb 03 – Dec 03; In the scope phase, we asked lots of questions, listened, interviewed, tested, prototyped, learned, tested again, broke things, and made decisions. Other critical items were development team training and gathering pilot data for trials. ESRI support web site, ArcGIS Desktop help, and regional staff provided assistance during many rough patches of this phase. Consequently, this phase took the longest in relation to the rest of the project.

Plan – Jan 04 – May 04; In the plan phase, we designed the geodatabase in a MS Visio diagram. The GeoEditor toolbar and code was specified in a

detailed document addressing the user requirements. A pilot area was loaded into the geodatabase and used to code the GeoEditor.

Execute – June 04 – October 04; This phase included the critical tasks of building the geodatabase, converting and loading the data, writing all the code for the GeoEditor, testing with the GeoEditor tools and finally training for the GIS technicians to use the new system. In Short, this phase was the implementation of the Migration to ArcSDE.

Conclude – Nov 04; In this short phase, we celebrated and got ready for the evolution to follow.

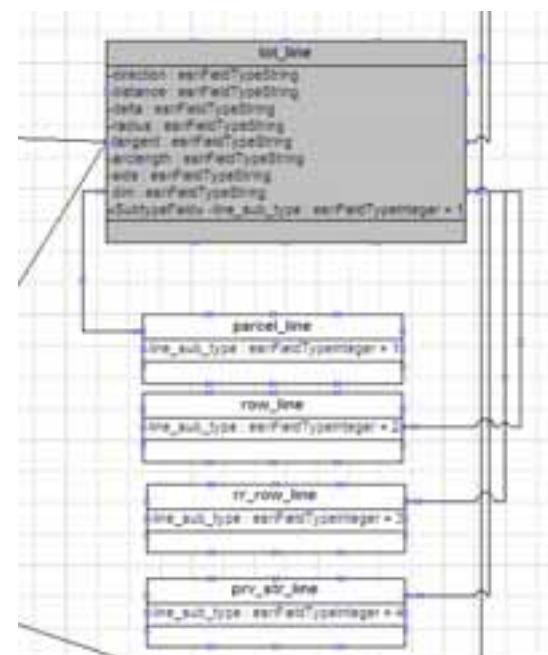
We had 2 main changes that were necessary during implementation.

Modification 1 -- Security level of the Versions: Initially, we had referred “protected” versions for our quality control design. After testing with various editing scenarios, we decided to implement the QC and productions versions as “public”.

Modification 2 – The lot line feature

class was initially going to include subtypes of parcel, ROW (right of way), Railroad ROW and Private Street similar to the old method (depicted in gray box at right).

After testing, we discovered that it was best to separate each of those types into their own feature classes or layers. (depicted in the 4 separate boxes to the right)



BENEFITS

There are many facets on benefits of the Migration to ArcSDE to our organization...

The immediate user group is the 9 GIS technicians that maintain the geodatabase and use the GeoEditor tool daily. Their works sustains the parcel base map. This may seem minuscule; however, over 500 staff view and analyze GIS data and maps for appraisal purposes. Then there are the millions of property owners, including private industries that view maps on-line (www.hcad.org/maps), at the District in person and download the GIS data from the Internet (pdata.hcad.org/GIS).

The GIS technicians are in the Information & Assistance (I&A) Division at HCAD. Adding data to the geodatabase is part of an intricate workflow of how properties are maintained in our records. For example,

when a property is slit out, an I&A clerk will key the split in the appraisal system using a geodatabase map as a guide. Then the split will be passed to a GIS technician in a workflow queue, who will proceed to actually split the parcel in the geodatabase and annotate it appropriately using the GeoEditor tool. Once this is done, the geodatabase is updated for the appraisal staff to work and for the public to view on-line. We also gave the group the ability to retrieve audit information for geodatabase parcels. The "check account information" tool (See Appendix I) allows the user to get time, technician and edit information about the parcel ID entered. This assists in making quick decisions when a property owner is on hold wondering about his or her mapped account.

Many qualitative impacts exist as a result of migrating to ArcSDE. The improvement in the *topology* or uniformity of the various GIS data features is one such impact. For example, with the easy use of topology geodatabase tools, the technician can align the parcel and school district lines in the data. This ensures the right accounts are taxed by the right school districts. Secondly the functionality of multi-versioning, that the geodatabase technology offers, provides more efficient work habits for the individual GIS technicians and IT analysts. For instance, I can edit any area in the county without locking the entire team out of the database, as was the way in the old system.

There are many positive effects on productivity, the GeoEditor tool allows the users to enter bulk annotation in an efficient manner saving time on data entry and allowing more time for cartographic annotation placement and map readability. This allows GIS to be ready quicker for the appraisers and public. (See improved productivity with bulk annotation tools in Appendix I.) Another factor tied directly to productivity that has greatly improved is moral. The older system was command line driven and limited the technicians in what work they could accomplish. With the geodatabase and GeoEditor, the technicians can use the latest in GIS technology and can work at their own pace in their own county-wide versions without feeling confined to their own sub-sections and feeling rushed to finish. With the new system, jurisdiction boundaries, such as school districts or municipalities, can be maintained by any of the GIS technicians, whereas before only the supervisor could edit these. This improves moral and productivity.

There are other positive impacts as well. Now that the Geodatabase is a reality, all users at HCAD have several applications to choose from in viewing live GIS data from the geodatabase, as before they only had 1 application that displayed live GIS data. One favorite of HCAD users is the ArcIMS based website seen below.



Screen Shot of ArcIMS based GIS website

Furthermore, there have been changes in business process and delivery. Before, our IS staff had to export weekly from Unix and the GIS and appraisal systems were never together in one application. Now that the GIS is a windows based geodatabase, it can easily be integrated into the appraisal system application and it is live data, not a week old. It is also important to mention the improvement in delivery of the geodatabase annotation layers to the appraisal users. (Seen in the picture above.) In the past, live annotation was hardly seen in GIS applications.

One of the unexpected benefits found was the use of the geodatabase to store our extensive library of ortho-rectified aerial photography. Separate tiff files can now be served quickly as one mosaicked/continuous image of our county using the power of the ArcSDE geodatabase. The storage and fast retrieval of aerial photography from the geodatabase assists our legal review appraisal section in providing timely maps for hearings.

RESOURCES

Primary Hardware components --

Database Server: Gateway with Intel Xeon 2.8 GHz Multiprocessor with 4 G of RAM and Windows 2000 OS

Technician's Machines: Gateway Intel Pentium 4 CPU 2.8 GHz with 512 RAM and Windows XP 2002 SP2; 2 LCD Flat screen monitors with multi-headed video card. (See photo below.)



Primary Software Components --

Database Server: ESRI ArcSDE 9.1 and Microsoft SQL Server 2000; ESRI License Manager

Technician's Machine: ESRI ArcGIS Desktop 9.1 with ArcEditor license; GeoEditor Tool (extension to ArcMap)

Data Components --

ESRI ArcSDE and Microsoft SQL Server serve all the system data.

The GeoEditor enables maintenance of cadastral data. Specifically, there are 9 taxing boundary feature layers (i.e. school, emergency, city), 10 cadastral layers (i.e. parcels, row and subdivision lines and boundaries) and 13 annotation layers (dimensions, row and subdivision name, lot and block numbers, etc.) See the picture at the left for a snap shot of a new subdivision.

Within the Geodatabase, we also store GIS layers from local agencies, such as flood plains and street centerlines, as well as all previous years of aerial photography. This data is often used in conjunction with the GeoEditor tool.

Staff Resources & Costs --

FTE are estimated below for the project duration of 2 years or 4000 work hours. All time is from HCAD staff and includes such tasks as consulting, programming, testing, designing, planning and training.

HCAD Staff	FTE
Project Manager	.75
Lead Programmer Analyst	.75
Consulting Programmer Analyst	.6
Programmer Analyst	.5

GIS Supervisor	Technician	.3
8 GIS Technicians		.08 (.01 each)

Other Costs:

ESRI professional Training on-site for 13 staff for 4 days -- \$6100

About \$20 cost savings in moving to Windows ArcSDE and ArcGIS licenses

In Conclusion, data from ArcStorm was converted to the geodatabase format to better serve HCAD as a whole by providing faster access to on-line GIS and quicker analysis via desktop tools. Most importantly, it was intended to allow better integration with the programs at HCAD that are all windows based. Consequently, the GeoEditor tool was created to achieve efficient maintenance of the converted geodatabase cadastral data.

So was it worth it?

A resounding YES!!!!

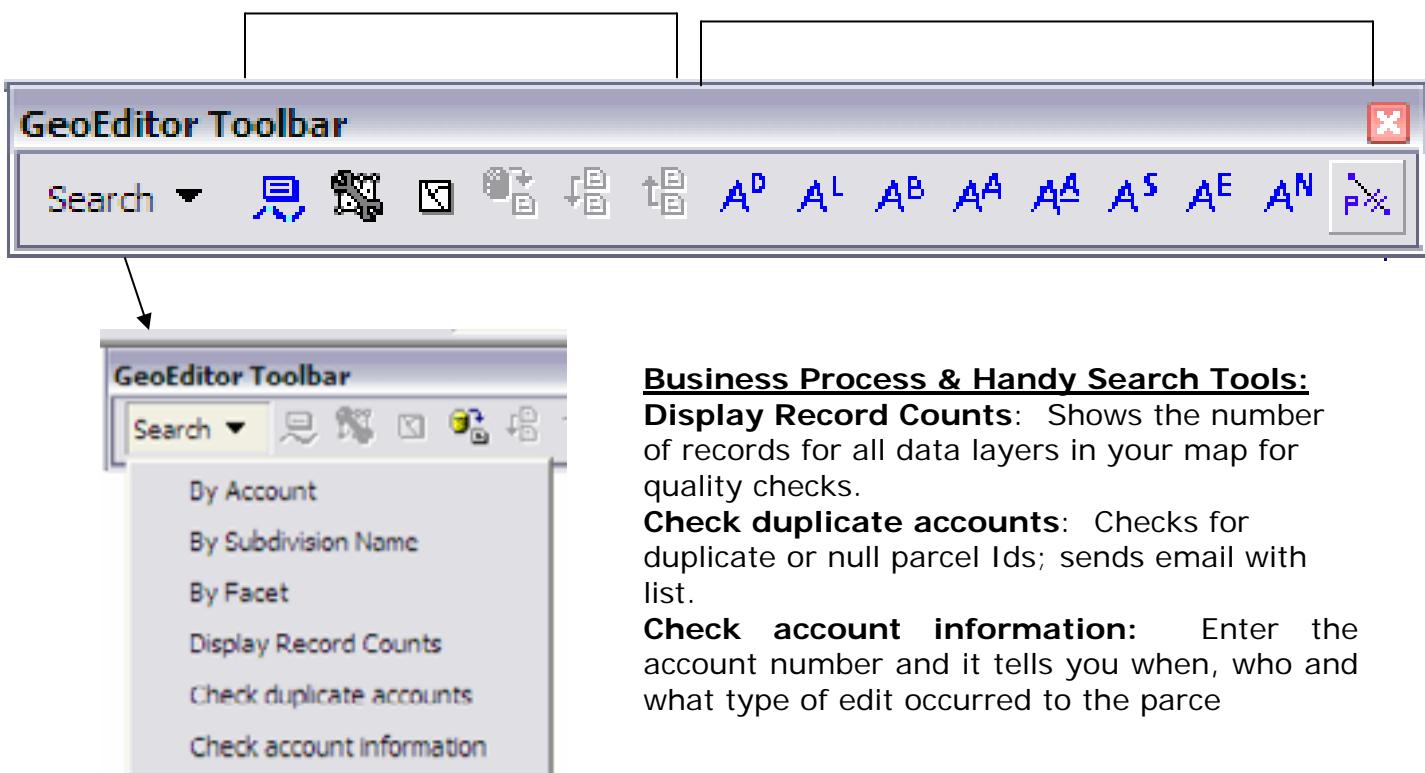
Acknowledgements:

All information, graphics and photos in p1051 originated from Jackie A. Smith.

Appendix I – GeoEditor Toolbar

Frequently used out-of-the-box tools

Customized Annotation & Proportion Line Tools



Improved productivity with bulk annotation tools



Adds Account Number to each parcel in a Block:

After users clicks this button, the "HCAD Acc Num" Form opens.



The form asks for Volume & Page. If a block number has already been entered, it uses Block number, otherwise it will ask for Sub Page. If the lot numbers have already been assigned to the parcels chosen, the lot number text boxes will be populated with the first and last parcel selected.

Then the user hits the "Generate Accounts" button. **An Account number is then calculated for each parcel and annotation is automatically placed on the parcels. This saves lots of time!**

Author Information:

Jackie Smith
Supervisor of Application Development
Information Systems
Harris County Appraisal District
13013 Northwest Freeway
Houston, Texas 77040
Phone: 713-957-7537
Fax: 713-957-7489
Email: jsmith@hcad.org