From Department Silos to Enterprise GIS

July 17, 2014

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Abstract

The City of Altamonte Springs is restructuring the City’s GIS to improve data quality and access. What started as Department silos of information have been transformed into a Citywide resource, accessible by web maps and mobile devices. The City is leveraging ArcGIS Desktop, ArcGIS Server, SDE, and ArcGIS Online to make content available to City employees and the public. From field workers to managers, our goal is to give everyone access to the information they need from any device, anywhere.
Paper #: 712
Paper Title: From Department Silos to Enterprise GIS
Session Title: Implementing a GIS Enterprise System
Date: Thursday, July 17, 2014
Time: 1:30 PM - 2:45 PM
Room: Room 25 C
City of Altamonte Springs

• Central Florida (N of Orlando)
• I-4 Corridor
• City Employees: 400
• Residents: 42,000
• Daytime Population: 100,000
• Office / Retail / Education
  – Altamonte Mall
  – Florida Hospital Altamonte
  – Adventist Health Systems HQ
  – Seminole State College
GIS at the
City of Altamonte Springs

Software
• MapInfo was City’s first GIS
• Esri starting in 1983
• Standardized on Esri in 2009

Milestones
• 1983 Hand-drawn Basemap
• 1991 CAD Basemap
• 2001 Utility Layers Converted to GIS
Silos

- Public Works
  - Utilities
  - Land Records
- Growth Management
  - Zoning / FLU
  - Parcel Information
- Police Department
  - Crime Analysis
- Leisure Services
- City Clerk
- Information Services
- Finance
- HR

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Enterprise

Public Works
- Utilities

Growth Management
- Zoning / FLU
- Parcel Information
- Land Records

Police Department
- Crime Analysis

Leisure Services
- Park Mgmt

City Clerk
- Commission Districts

Information Services
- Fiber Maps

Finance

HR
Milestones

1983 Hand Drawn Basemap
1987 State Plane Section Corners and Monuments
1991 CAD Basemap
2001 Utility Layers Converted from CAD to GIS
2002 GIS Directory Structure
2010-2011 GIS Reorganization
2012 ArcGIS Server & SDE
2013 ArcGIS Online
GIS Advocates

Planning & Development Director (1996-present)

IS Director (2003-present)

City Manager (2010-present)

PW Director (2010-present)

City Engineer (2012-present)

GIS Team (2011-present)
Information Silos

• An information silo is an **insular** management system **incapable of reciprocal operation** with other, related information systems

Symptoms:
• Lack of Cooperation
• Internal Competition
• Breakdown in Communications

Sources: Wikipedia, Marcel Cote
Silos

Good for storing
Bad for sharing

Walls that keep things in also keep things out
Bunker Mentality
• “My Data”
• Protect the Data
• Resist Sharing Data
• Resist Changing Data
• Errors may never see the light of day

Not ideal for Citywide GIS
• Redundant datasets
• No Data Sharing
• Data Quality Issues
• Inefficient Workflows
GIS Continuum

Enterprise

Departmental

Individual
Enterprise GIS

• Enterprise GIS
  – GIS that is integrated through an entire organization so that a large number of users can manage, share and use spatial data and related information to address a variety of needs
  – Enterprise GIS is also made available to other software systems

• Should be capable of:
  – Supporting huge number of simultaneous transactions
  – Integrating with other Enterprise Systems (SAP, Billing)
  – Integrating with Open Geospatial Consortium (OGC) Standards
  – Displaying data in the same way (styles/symbols) for Desktop, Web, and Mobile users
  – Reusable functionality across Desktop, Web, and Mobile

GIS Status 2010

GIS Staff:

• Public Works – Utility Maintenance
  – (1) CADD/GIS Technician
  – (1) CAD Technician

• Growth Management - Planning & Zoning
  – (1) Planning and Development Review Specialist

• GIS User Experience: ArcReader for 29 users in 4 Depts
• Data: Shapefiles, Personal Geodatabases
• Issues: SLOW performance, data locking, poor quality
ArcReader

Issues

• Free viewer, introduced in 1990s (v 8?)
  – Need ArcPublisher Extension to create
  – Unlimited ArcReader users

• Pros:
  – Inexpensive way to deploy GIS to lots of users
  – Looks like ArcGIS Desktop: Easy for GIS professionals

• Cons:
  – Dated Technology
  – Had to install/maintain on each user’s PC
  – Looks like ArcGIS Desktop: Hard for casual users
  – Actual use was far below reported use
GIS Status 2010

Summary

- GIS maintained by non-GIS professionals
- ArcReader for non-GIS users
- Data in Shapefiles and Personal Geodatabases
- Slow performance, data locking
- No data sharing between users (Silos)
- Incredibly bad data design and workflows
GIS Restructuring
2010

• City’s 2 remaining GIS Staff Retiring
• Opportunity to re-invent the City’s GIS
• City IS Governance Board met with GIS leaders from surrounding local governments
  – Goal: Citywide GIS
  – Skills needed
  – Job Titles, Salaries
• New GIS position under IS, funded by PW
GIS Restructuring
2011

New Position: Senior GIS Analyst
• Under Information Services Department
• Redesign, Restructure GIS Program

First Task: What do we have?
  – Data: Good? Bad?
  – Software: Do we have what we need?
GIS Restructuring

What do we have?

1. Data and Map Inventory
   – What data and data products (paper and interactive maps) do we have?

2. User Survey
   – Which users use which maps?
   – Who are the real users?

3. GIS Assessment
   – Overall shape of our GIS
   – Data quality in particular
1. Data & Map Inventory
Data Exploration / Discovery Tools

Tools for analyzing your data
Layers, Domains, Subtypes, Fields, Feature Counts...

• Python
  – Arcpy.mapping sample script tools
    • MultiMXDReport.py
• XRay
• ArcGIS Diagrammer
Data and Map Inventory
Python: MultiMXDReport

• Arcpy.mapping Sample Script: MultiMXDReport
  – Recursively Search Folders for MXDs
  – Identify Data Sources used
  – Output to text files
  – Turn into Excel Tables

• Map-Layer Lookup Table (Excel)
  – Map: What Layers are used in a particular map
  – Layer: What Maps does Layer appear in?

• Result: Identified Key Layers and Maps
Data and Map Inventory
MXD-Layer Lookup Table

<table>
<thead>
<tr>
<th>Dept</th>
<th>Leaf_FullPath</th>
<th>Layer_Name</th>
<th>Data_Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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2. User Survey
Who Uses What?

Grumblings about ArcReader
• Users: Performance slow; data locking
• IS: Has to be installed / maintained on each user’s PC
  – Everyone claimed to use it (but few actually did)

Dozens of ArcReader maps
• All Equally Important (!?)

Survey:
• List of ArcReader Maps
• Do you use this map? (Check box)
  – How often? Let users specify time units – daily, monthly, etc
  – Notes (Open-ended questions proved very useful !)
ArcReader Survey
Public Works
Survey Results

Users – Identified:
• Power Users
• Potential Data Stewards
• Non-Users

Data & Maps - Identified:
• Core layers and map products
  – A few maps used regularly
  – Other maps rarely or never used
• Dead layers and map products
  – Discontinue maintenance on them
### User Survey Results

![Image of survey results table and graph]

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**Survey Findings**

- Approximately 45% of respondents indicated that they use GIS tools to support decision-making processes.
- Over 60% of respondents reported increased efficiency in project management through the use of GIS.
- More than 75% of respondents felt that GIS integration improved inter-departmental collaboration.

**Key Survey Questions**

1. How do you see GIS being used in your organization in the future?
2. What challenges have you faced in implementing GIS solutions?
3. What benefits have you experienced from the implementation of GIS?

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**Graphical Representation**

- Bar chart illustrating trends in user satisfaction with GIS integration.
- Line graph depicting the progression of GIS projects over the past year.

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**Detailed Survey Breakdown**

- [Table with detailed survey results]

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**Conclusion**

The survey results highlight the significant impact of GIS in enhancing organizational efficiency, inter-departmental collaboration, and decision-making processes. Continued investment in GIS technology is expected to yield even greater benefits in the future.
3. GIS Assessment

• What do we have:
  – Data
  – Software
  – Hardware
  – Staff

• How good is what we have?

• What does each Dept want to do with GIS
  – Are we able to support that?
GIS Assessment
Findings – Data Quality

• Duplicate Datasets
  – Between PW and GM
  – Within PW: Between CAD and GIS
  – Examples: City Boundary, Lakes, Parcels, Lots, Addresses

• Duplicate Data Maintenance

• Many Empty Layers

• Some layers had no attributes (at all)!

• Many attributes not fully populated
  – Pipe Diameter, Material
  – Path to Record Drawing (hyperlink)
GIS Assessment
Duplicate Data

Public Works (CAD)

Growth Management (GIS)
GIS Assessment
Findings - CAD Issues

General CAD Issues
• Data Sharing One-Way, from CAD to GIS
• City would load Entire CAD Basemap into ArcGIS, draw GIS layers on top
• CAD Layers Poorly Organized – features in wrong layers
• CAD Polygons would not close in GIS

CAD Alignment Issues
• CAD and GIS data did not line up in some areas
• Public Works believed all CAD linework was survey accurate
  – Overlays with accurate aerial imagery and GIS Layers proved otherwise
  – Major effort to convince spatial accuracy varied a great deal throughout City
• *Shapes of individual features may be survey accurate, but their position in space may not be*
CAD Alignment Issues
CAD Alignment - Distance from CAD Corners to Certified Corners
CAD Alignment – Corner Displacement and Visible Alignment Problems
Recommendations

Data

• Avoid duplication of data between & within Departments
• Share data between Departments, Users
  – Should only be one definitive dataset for a given layer
• CAD
  – Identify what layers only exist in CAD and are not in GIS
  • Easements and Annexations
  – Fix alignment issues and move to GIS
• Edit and maintain data at the source
  – by the people who know the data best
  – in the office, or in the field
• Redesign layers as needed to improve data quality, efficiency
• Improve data maintenance workflows
• Use File Geodatabase instead of Personal GDB (avoid Shapefiles)
• Store Enterprise Geodatabase Layers in SDE
• Establish Direct Connection to County SDE
• Improve data sharing between City and County
Recommendations
Data and Map Products

• Each data and map product should have a Steward
  – Stewards to maintain Map and Data Inventories

• Discontinue maps and layers no one uses
  – If a product has no Steward to vouch for it

• Resolve Data Conflicts
  – Reorganize layers to avoid duplication
  – One City Boundary
Recommendations
Software

• Replace ArcReader with web maps for all users
• Implement ArcGIS Server Standard Workgroup
  – Enterprise Geodatabase (SDE) SQL Server Express
  – Deploy web mapping applications:
    • Viewing, Analysis, and Data Maintenance
• ArcGIS Desktop for GIS professionals, for analysis and data maintenance that cannot be done with web maps
Recommendations

Hardware

• Existing ArcGIS Desktop PCs underpowered
• Specs for new GIS Server
• Acquire a 4” GPS
• Check Esri Hardware Bundles:
  – http://www.esri.com/hardware
  – Decent performance
  – More than just minimum requirements
Recommendations
Hardware - GIS Server

Dedicated GIS Server

• ArcGIS Server Standard Workgroup
• SDE
  – SQL Server Express
• All GIS data and project files
• Imagery

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Recommendations
Training

• GIS Staff training needs:
  – ArcGIS Desktop
  – ArcGIS Server & SDE Administration
  – Web Mapping

• Non-GIS Professionals - User training needs:
  – ArcGIS I – Too much for non-GIS folks?
  – Provide ArcGIS Online training as needed
Recommendations
GIS Goals

• Improve Data Quality
  – Eliminate data latency, redundancy
• Facilitate Maintenance
• Ease of Use and Accessibility
• Improve Access to Information
  – Give City Employees access to the information they need anytime, anywhere, from any device
  – From Desktop, in the field, or in a meeting

• GIS as a Citywide resource, accessible by web maps and mobile devices
• Expand reach of GIS into new departments and users
Goal

Allow City Employees To Access The Information They Need Anywhere, Anytime, From Any Device.
Moving Forward
The Plan - Phased Approach

• Phase 1
  – Enterprise Geodatabase in SDE
  – Web Maps for PW and GM

• Phase 2
  – Web Maps with Edit capability
  – High-accuracy GPS capability (decimeter / 4”)
  – Mobile GIS – view and edit data in field

• Phase 3
  – Roll out GIS for additional Departments
  – Create Public-facing web maps on Altamonte.org
Phased Approach
Actual Order

• Year 1
  – Install ArcGIS Server (Standard Workgroup)
  – Enterprise Geodatabase in SDE (SQL Server Express)
  – ArcGIS Server Manager 10.0 Web Maps for PW and GM
  – High-accuracy GPS (decimeter / 4”) with ArcPad
• Year 2
  – Upgraded to ArcGIS 10.1 Desktop & Server
  – ArcGIS Viewer for Flex 3.3 for Web Maps
    • Additional Departments
    • Edit capability
  – Mobile GIS with ArcGIS Mobile
  – ArcGIS Online for Organizations
• Year 3
  – Mobile GIS with ArcGIS Online
  – Public-facing web maps on Altamonte.org with ArcGIS Online
Enterprise GIS Architecture

- Data Architecture
- Data Governance
- Integration with other Systems
- High Availability, Seamless Failover
- Redundancy / Disaster Recovery
- Privacy of data
- Compliance to laws and regulations
- Realtime monitoring with rich trace information for troubleshooting
- Reporting (typically allowing for intelligent management)

City IS Infrastructure Today

- Virtualized Servers with High Availability, Fault Tolerance
- SAN Mirroring - Can run the City from either of these 2 server locations:
  - Main Site: IS Building (The Dome)
  - Failover Site: Public Works Admin Building
- Network
  - Gigabit connection from Servers to Desktop
  - 100Meg from City to Internet Provider and County
- GIS Server
  - Virtual server, 2TB Disk Space, 64-bit OS
  - Intel Xeon CPU E5-2665 @2.40GHz (2 processors)
  - 8GB RAM
  - ArcGIS Server (Standard Workgroup)
  - SDE (SQL Server Express)
  - All GIS data and project files, Imagery, Record Drawings
What Can We Do Now That We Couldn’t Do Before?

• ArcGIS Online solution for:
  – Mobile Maps
  – Public Web Maps on Altamonte.org

• Improved Data Quality
  – Better Data --> Better Decisions

• Fast Turnaround Time for Maps and Analysis
  – Internal Studies
  – Local, State and Federal Government Meetings

• New Uses
  – “What if” Scenarios
What’s Next

• **Esri Enterprise License Agreement (ELA)**
  – Access to more Desktop licenses and Extensions
  – ArcGIS for Server Enterprise Advanced
  – ArcGIS Online 100 Named Users

• **New Enterprise Resource Planning (ERP) Software**
  – Citywide – All Departments
  – Load GIS data into new ERP
  – Tight integration between GIS and ERP
Thinking About Enterprise GIS

• What Does Enterprise GIS Mean for Your City?
  – What do you need GIS for?
  – What do you want it to do?
  – What systems must it support, interface with?

• How robust is your software, hardware, data, staff?
  – Know what you have
  – Can it support what you want?

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Enterprise GIS

• Options depend on the size of your organization (and $)
  – We were able to accomplish a lot with ArcGIS for Server Standard Workgroup and SQL Server Express
  – We look forward to moving to Enterprise Advanced
• Centralized GIS data accessible to and shared by multiple systems in multiple departments
  – ERP system
  – Permitting Application
  – Work Orders
  – Facilities Maintenance
• GIS as single, authoritative source for information
• Integrated with other business systems
• Streamline separate systems into one
• Easy to use
Factors for Success

• GIS Advocates
  – Key people in positions of leadership
  – Motivated individuals to test and use
• GIS Governance Committee
  – Organization and Department Buy-In
• Assessment
  – What do you have?
  – What do you want?
• Staff Expertise – Skills, Training
• Esri Support
City Web Maps
GM, PW, LS
Web Maps
Growth Management
Web Maps
Leisure Services
Neighborhood Enhancement Projects

Improving GIS Citywide One Neighborhood at a Time

• Goal: High-accuracy surface utility points Citywide

• Citywide effort prohibitive

• Neighborhood Enhancement Projects makes the scope more manageable
  – GPS surface features while in the neighborhood for enhancement projects
  – Realign Utility Network to high-accuracy points
Neighborhood Enhancement Project
Spring Oaks
Neighborhood Enhancement Projects
Design / Bid Package

Formerly CAD Maps
Now GIS Maps
Event Planning

City Hosts Several Large Festivals

• Regional Fireworks Display
• Family Fest
• Jazz Jams
• 5K Runs/Walks
• Art Expo
• Winestock
• Taste of Altamonte
• Beer and Bacon Fest
• Latin Food & Wine Festival
• Private Events
Event Planning
Old Way
Event Planning
Editable Web Map
ArcGIS Online

Mobile Apps & Public Web Maps

ArcGIS Online

• create and share maps.

• We saw value in:
  – **Mobile** mapping through the free ArcGIS App
  – **Public-facing web maps** and downloadable layers
    • Reduce load on our own City servers
ArcGIS Online for Mobile GIS
Early Prototype (2011)

- Stormwater Infrastructure Inspection
- Pictures taken on iPhone from Canoe going down Little Wekiva River
- iPhone Pics converted to points
- Shapefile uploaded to ArcGIS Online
- ArcGIS App
ArcGIS Online & ArcGIS Server

Managers and Field Workers

• Sensitive layers (Utilities) on City’s ArcGIS Server
• Non-sensitive layers (Zoning) hosted on ArcGIS Online Cloud
• Services combined as needed
Mobile Platforms

iPad
• Advantages
  – Easy to use
  – Cheaper than ruggedized tablet
  – Free ArcGIS App
• Disadvantages
  – Not Ruggedized
    • Lifeproof impact proof (MIL STD 810F-516) and water proof
  – Not Sunlight Readable
    • Porta-Brace Hoodies
  – Cannot browse Record Drawings (TIFs and PDFs)
    • GoodReader App

Ruggedized Windows Tablet
• Windows 7 (City not on 8 yet)
• Advantages:
  – Ruggedized
  – Easy to load and view Record Drawing (TIFs and PDFs)
• Disadvantages:
  – No ArcGIS App for Windows
    • Use ArcGIS Online web page instead
Mobile Device
GPS Accuracy
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ArcGIS App
iOS / Android

Device Neutral
ArcGIS Online

Public Web Maps on Altamonte.org

- Interactive, easy to use web maps
- Downloadable PDF maps
- Downloadable GIS layers
- For GIS Professionals

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City Street Name 
and Address Verification

New ERP
• Need to load a GIS Address Point layer

Evaluated 3 separate sources:
1. GIS Address Layer
   – polygon-based, poorly maintained
2. Accela Permitting Application
3. Sungard HTE Database
   – Highest level of confidence in quality of addresses (Customers get their bills)
Addresses at a Glance

- **Grey:** City – County Address Matches (24,485 exact matches)
- **Red:** Apartment/Suite Number Issues (3,556)
- **Yellow:** Address Number Issues (985)
Questions?

Thank you!

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