May 2012
Oracle Spatial User Conference
May 23, 2012
Oracle Spatial User Conference
Ronald Reagan Building and International Trade Center
Washington, DC  USA
Kristofor Carle
GIS Software Developer
SYNCADD Systems, Inc.
Enterprise
Geospatial Data
Management
Army Mapper
U.S. Army Enterprise GIS
OVERVIEW
• U.S. Army’s Enterprise GIS for Installation Management
• Incorporates traditional desktop GIS and CAD editing workflows with advanced web based GIS capabilities.

CHALLENGES / OPPORTUNITIES
• Need to support large amount of GIS data.
  • 1345 data layers x 200 installations
  • An additional official record copy of each layer
  • All data rolls up into a global aggregate
  • All changes to the official record copy are recorded and archived

SOLUTIONS
• Oracle Database Enterprise Edition
  • Oracle RAC
  • ArcSDE data stored in Oracle Spatial SDO Geometry

RESULTS
• Oracle Spatial allows for concurrent live editing with ArcGIS, GeoMedia, and Bentley Map while still support full ArcSDE capabilities.
• Oracle Spatial with OSGeo MapServer provides fast rendering of dynamic maps in the web while maintaining support for ArcGIS Server and ArcSDE based applications.
• Utilizing Oracle Spatial in a custom PL/SQL data migration process allows to quickly migrate large amounts of data between databases to meet the requires for storing an official record copy while still supporting live editing.
Program Agenda

• Overview of Army Mapper
• Editing and Publishing Data
• Oracle Spatial Data Migration
  – Clean bad geometries
  – Store and archive an official record copy
  – Update a global aggregate dataset in real time
• Web Map Viewer
• Security Model
Overview of Army Mapper

About this Project

• Contracted by U.S. Army to provide development and operations support for the Army Mapper project.

SYNCADD is a technology company that provides strategic planning & asset management solutions that focus on location and context. With a focus in providing geospatial applications and services, we have laser measured 70 Army installations; nearly 70 million square feet of facilities drawn in 3D, automatically calculating net/gross square footages and space utilization ratios.
Overview of Army Mapper

What is Army Mapper?

Army Mapper is the U.S. Army’s enterprise GIS supporting the overall management and resourcing of Army installations worldwide.
Overview of Army Mapper

Data Warehouse

• Installations maintain the data either directly in the system or locally with periodic updates.
Overview of Army Mapper

Database

- ESRI ArcSDE
- Data stored in Oracle SDO Geometry
- Data is partitioned into regional instances
Editing and Publishing Data
Desktop Tools
• Storing ArcSDE data in Oracle Spatial format allows for concurrent editing with:
  – ArcGIS
  – Bentley Map
  – GeoMedia Professional
Oracle Spatial Data Migration

Database

- Oracle SDO_GEOMETRY format (vs. SDE_Binary / MS SQL)
- ESRI-based editing (Reconcile and post)
- Editing with non-ESRI tools
  - Bentley Map
  - GeoMedia Professional
- Custom Oracle Spatial-based procedures for data management and replication
## Oracle Spatial Data Migration
### Army Mapper Columns

<table>
<thead>
<tr>
<th>Column</th>
<th>Purpose/Notes</th>
<th>Population Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>INSTLN_ID</td>
<td>Added to 5 tables where it was not part of the SDSFIE2.6 standard schema</td>
<td>Schema build-out process</td>
</tr>
<tr>
<td>AM_GUID</td>
<td>Unique ID for each individual feature</td>
<td>Reconcile and Post</td>
</tr>
<tr>
<td>INSTLN_ID_ORIGINAL</td>
<td>A backup of the original value</td>
<td>Reconcile and Post</td>
</tr>
<tr>
<td>PUBLISH_DATE</td>
<td>Date feature was published (via the Army Mapper publishing tool)</td>
<td>Publish to R&amp;A</td>
</tr>
<tr>
<td>ARCHIVE_DATE</td>
<td>Date feature was archived</td>
<td>Publish to Archive</td>
</tr>
</tbody>
</table>
1. Did anything change in M&A?
2. Transfer outdated R&A objects to Archive
3. Delete outdated objects from R&A
4. Delete outdated objects from PUB
5. Load new M&A objects into R&A
6. Re-project new M&A objects and load into PUB
Oracle Spatial Data Migration
Automatic Calculations

• Resolve many geometry issues
• Automatically calculate common attributes
• Occurs at reconcile and post step
• Installation ID (5-digit HQIIS code)
• Measurements based on projection (meters vs. feet)
  – Area
  – Perimeter (polygon) / Length (polyline)
  – X/Y/Z coordinates of centroid
  – FROM_X/Y and TO_X/Y
**Automatic Calculations (cont.)**

**Full M&A Trigger Workflow**

- **Polygon**
  - Rectify Geometry
  - Densify Arcs (.005 tolerance)
  - PERIM_U_D
  - PERIM
  - AREA_U_D
  - AREA_SIZE
  - INSTLN_ID_ORIGINAL
  - INSTLN_ID
  - AM_GUID
  - SHAPE.SDO_SRID
  - COORD_X / COORD_Y / COORD_Z (centroid)

- **Point**
  - Rectify Geometry
  - PERIM_U_D
  - PERIM
  - AREA_SIZE
  - INSTLN_ID_ORIGINAL
  - INSTLN_ID
  - AM_GUID
  - SHAPE.SDO_SRID
  - COORD_X / COORD_Y / COORD_Z

- **Line**
  - Rectify Geometry
  - Densify Arcs (.005 tolerance)
  - LENGTH_U_D
  - FEAT_LEN
  - INSTLN_ID_ORIGINAL
  - INSTLN_ID
  - AM_GUID
  - SHAPE.SDO_SRID
  - FRCOORD_X / FRCOORD_Y / FRCOORD_Z
  - TOCOORD_X / TOCOORD_Y / TOCOORD_Z
  - COORD_X / COORD_Y / COORD_Z (centroid)
Oracle Spatial Data Migration
Spatial Data Corrections

- Self-crossing polygons
  - Resolved with self union
- Arcs
  - Generalized ("stroked") to .005 units of measure
- Circles
  - Still somewhat problematic, but solution under investigation
- Null geometries
  - Not replicated, but tabular information is left in M&A
Oracle Spatial Data Migration
Spatial Data Corrections (cont.)

• Bowties
  – Bowtie vertices within .005 units of measure are collapsed into a single point

• Features with more than 300,000 vertices
  – Oracle limitation with 3D features
  – Recommendation is to subdivide these features into smaller features with less than 300,000 vertices

• Interior / exterior rings
  – Repaired automatically
Web Map Viewer
Web Map Viewer
Archived Data in the Web
Security Model

Overview

- Permissions are controlled at the installation/schema level.
- Roles are used to control permissions to groups of tables in each schema (1345 tables in each schema).
- Each user is given a database account for each schema.
  - This is due to exceeding maximum number of roles allowed for a single user.
  - Most users only access the data for their installation.
Security Model

Roles

- Roles are used to control access to individual groups of tables (layer groups) inside each schema.
  - [installation code]_[layer group]_[permission level]
  - Example 40755_DPW_V
    - Where 40755 is the installation code for Ft. Sill, OK
    - DPW is the layer group code for Dept. Public Works
    - V is the code for the “View” permissions level.
Q&A