March 2007
Oracle Spatial User Conference
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Oracle Spatial: Narrowing the Gap Between CAD and GIS: A Topobase™ Implementation Case Study
Presentation Road Map

- Organizational Background
  - LVVWD & AM/FM/GIS
  - Our focus in spatial products and services
- Topobase Implementation
  - High level architecture
  - Scalable interoperability
  - Display model
  - Connectivity model
  - Multi-user concurrent editing environment
  - Client-Server architecture flexibility
Scalable Interoperability

- Topobase API meets ArcObjects API
- Push button synchronization.
- Versioned edits performed in SDE.
- Final stopgap before data goes Live.
Demonstration

Interoperability
Synchronization Health

• SQL query to test for synchronicity

SELECT COUNT(1)
FROM tbamfm.waterline a,
amfmsde.waterline_mv_view b
WHERE
a.idfeature = b.idfeature and
MDSYS.SDO_RELATE(
  a.geom, --topobase geometry
  b.shape, --sde geometry
  'mask=EQUALS querytype=WINDOW') <> 'TRUE';
Display Models

• A Topobase Display Model is a Rule Base that Determines Symbolization.

Rule #1
If valve function = gate then display:

Rule #2
If valve function = hydrant then display:
Display Models

• Behind the scenes, CASE statements determine the correct symbol:

```sql
SELECT CASE WHEN vfunction = 10 --Gate Valve
    THEN '$en valve-gate' END ||
    CASE WHEN vfunction = 30 --Hydrant Valve
    THEN '$en valve-hydrant' END AS the_case
FROM valve
WHERE SDO_RELATE(geom,
    (SELECT geom
     FROM tb_viewport
     WHERE id = '129-13'),
    'mask=AnyInteract querytype=window') = 'TRUE'
```
Demonstration
Display Models
Connectivity Model

- Network connectivity is modeled using Topobase server-side feature rules.
- A feature rule is a PL/SQL code block that is compiled as a row-level trigger (BEFORE INSERT, AFTER UPDATE, etc.)
- Example: A valve can have two network states, connected and disconnected.
Connectivity Model

• Row-level triggers manage the valve’s network state, stored in the quality attribute:

```sql
CREATE OR REPLACE TRIGGER valve_bur BEFORE UPDATE ON valve FOR EACH ROW
DECLARE
    hits NUMBER;
BEGIN
    IF UPDATING('geom') THEN
        SELECT COUNT(*) INTO hits
        FROM waterline
        WHERE SDO_WITHIN_DISTANCE(geom, :new.geom, 'distance = 0.001') = 'TRUE';
        IF hits = 0 THEN
            :new.quality := 0;
            ELSIF hits > 0 THEN
                :new.quality := 1;
            END IF;
        END IF;
    END IF;
END;
```
• Waterline to waterline connectivity is also managed via spatially-enabled triggers.
DEMONSTRATION

Connectivity Model
Multi-User Editing

- VPD (Virtual Private Database) aka row-level security was first introduced in Oracle 8i.
- Utilized by Topobase for versioned editing and long transactions.

Edited Waterline
User #1 Sees:

Original Waterline
User #2 Sees:
Rev the Spatial Engine

• Oracle Spatial is under the hood and fully accessible to VB.net

SDO_AREA
SDO_BUFFER
SDO_CENTROID
SDO_DIFFERENCE
SDO_DISTANCE
SDO_INTERSECTION
SDO_LENGTH
SDO_UNION

SDO_FILTER
SDO_NN
SDO_RELATE
SDO_WITHIN_DISTANCE

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'Create the Output parameter
Dim PARM_OUT As Topobase.Data.Provider.DataParameter
PARM_OUT = TBCommand.CreateParameter()
PARM_OUT.ParameterName = "UNION_P"
PARM_OUT.DbType = DbType.Object
PARM_OUT.ObjectTypeName = "MDSYS.SDO_GEOMETRY"
PARM_OUT.Direction = ParameterDirection.ReturnValue

'Declare the data provider and add the parameter
TBCommand.Parameters.Add(PARM_OUT)

'Execute the inline function
TBCommand.CommandType = CommandType.Text
TBCommand.ExecuteNonQuery()

'Extract the geometry
Dim dbGeom As Object, dr As Topobase.Data.Provider.DataReader
dbGeom = TBCommand.Parameters.Item("UNION_P").Value
geomPerim = dr.ToSDOGeometry(dbGeom)
DEMONSTRATION

VB.net △ Oracle
Implementation Benefits

• Immediate user acceptance.
• 82% reduction in managed code.
• More reliable data.
• 20% increase in project completion.
• Half million dollar savings / year.
• Performed 45,000 data edits so far.