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March 2007
Oracle Spatial User Conference

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March 8, 2007
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San Antonio, Texas USA

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Oracle Spatial: Narrowing the Gap Between CAD and GIS: A Topobase™ Implementation Case Study

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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

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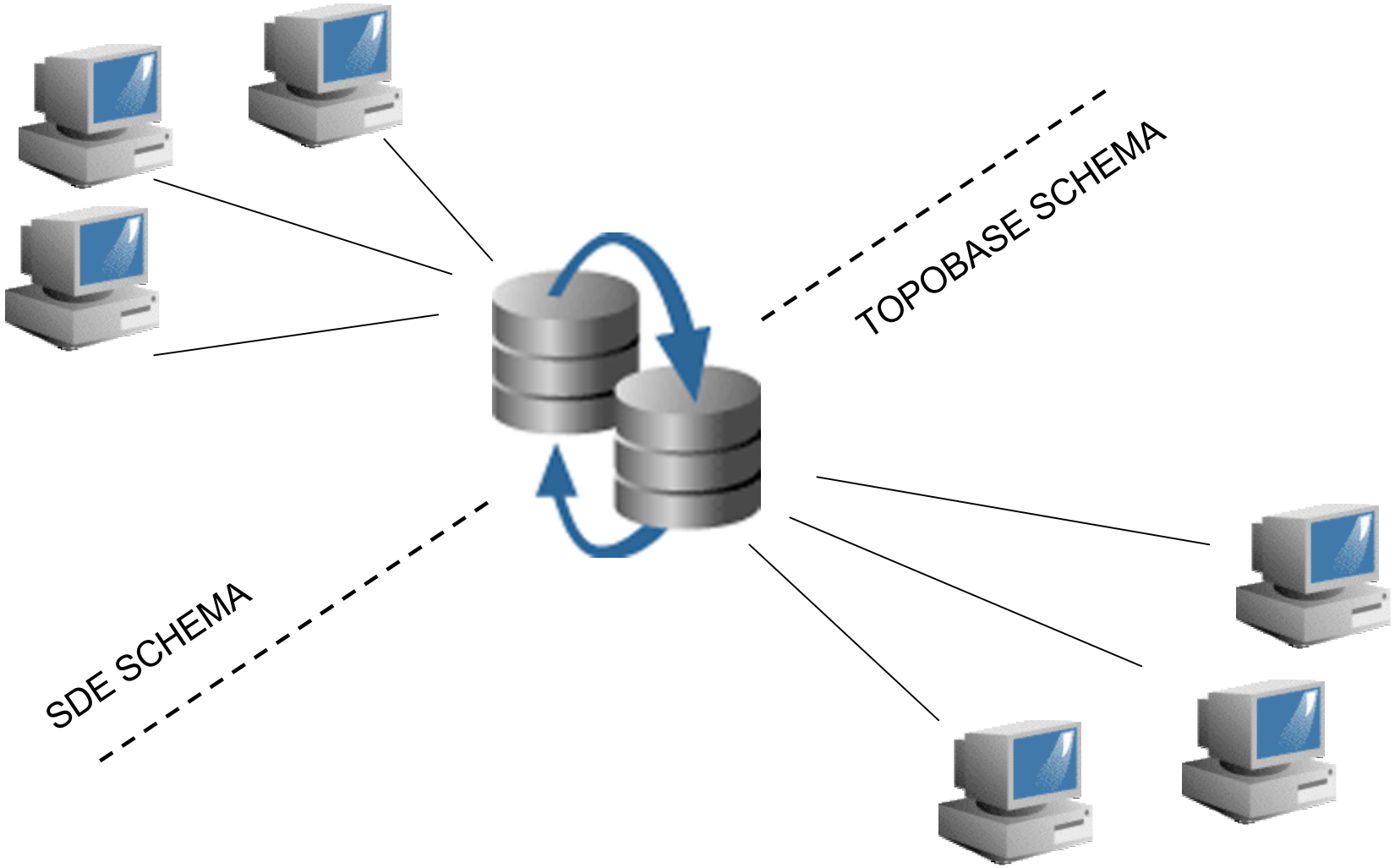
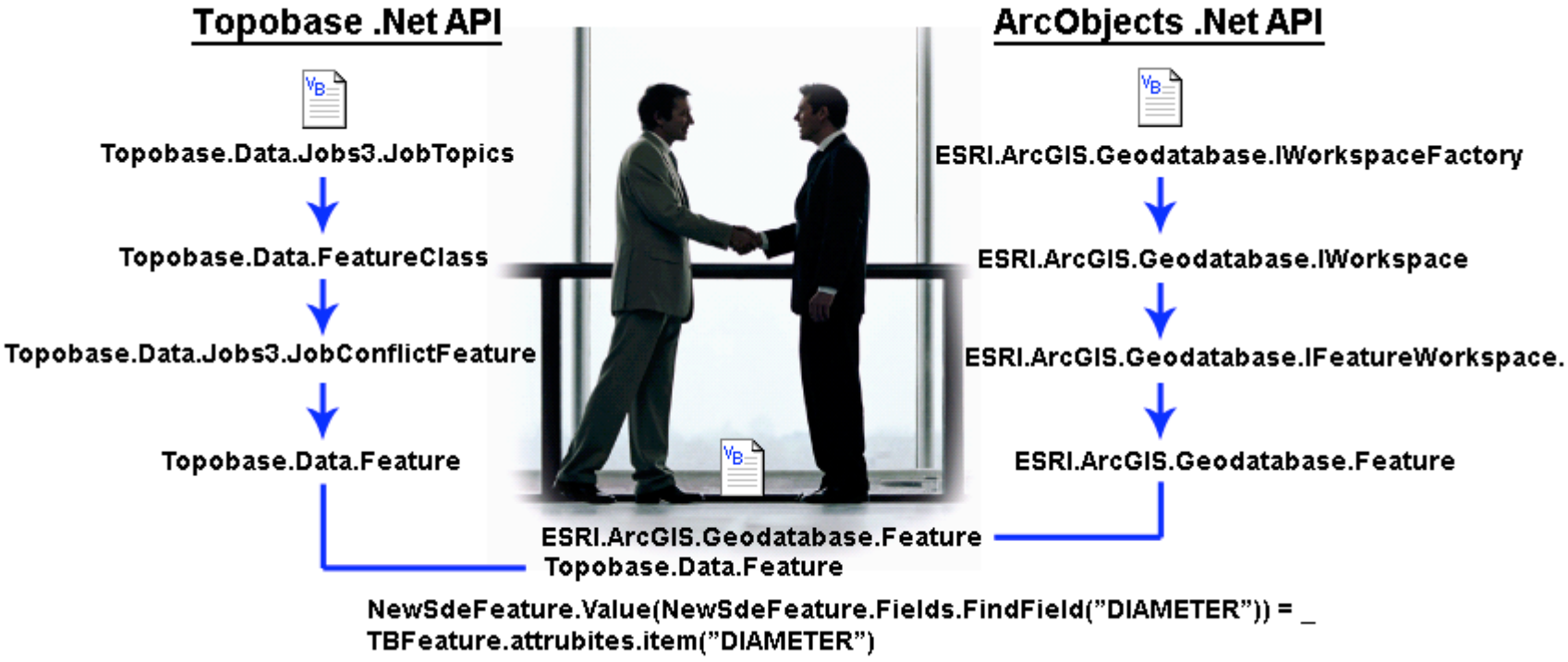
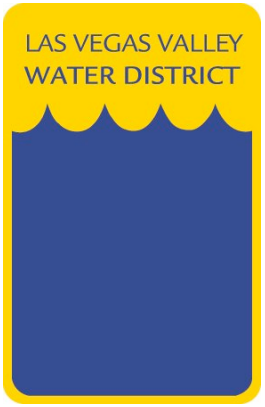
High Level Architecture



Scalable Interoperability

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





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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';
```

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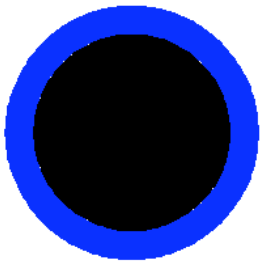
Display Models

- 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:

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Display Models

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

```
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'
```

LAS VEGAS VALLEY
WATER DISTRICT

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Display Models

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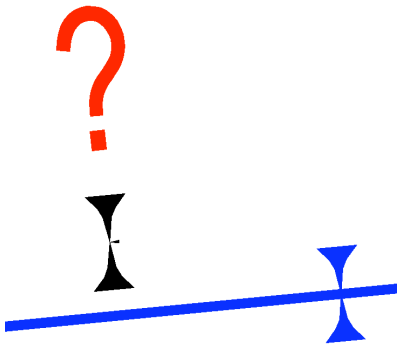
Connectivity Model

- 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.



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Connectivity Model

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

```
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;
```

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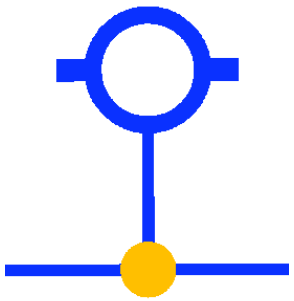
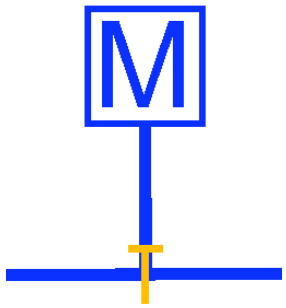
Connectivity Model

- Waterline to waterline connectivity is also managed via spatially-enabled triggers.



3+ PIPES TOUCHING

2 PIPES TOUCHING



LATERAL TOUCHING

END OF PIPE

LAS VEGAS VALLEY
WATER DISTRICT

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Connectivity Model

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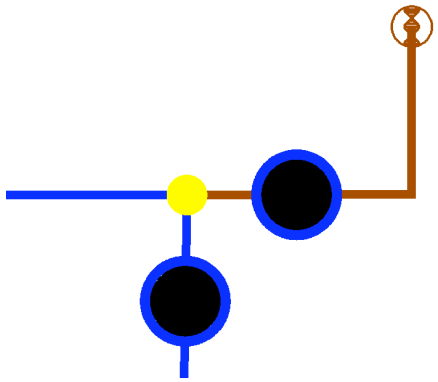
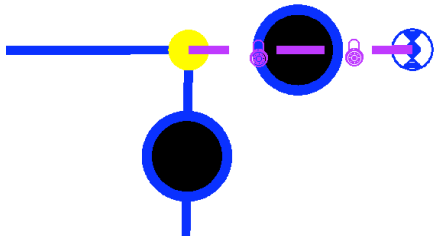
Multi-User Editing

- 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:



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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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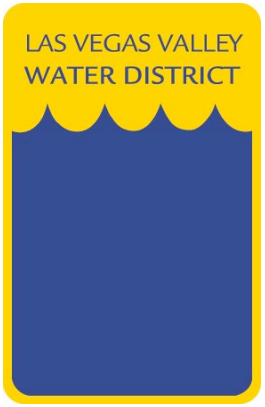
Rev the Spatial Engine

```
'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
Dim TBCommand As New Topobase.Data.Provider.Command("", Me.Document.Connection)
TBCommand.Parameters.Add(PARM_OUT)

'Execute the inline function
TBCommand.CommandType = CommandType.Text
TBCommand.CommandText = "DECLARE BEGIN SELECT SDO_GEOM.SDO_UNION(" &
strOldPerim & ", diminfo, " & strNewPerim & ", diminfo) INTO :UNION_P FROM
user_sdo_geom_metadata WHERE table_name = 'jobperimeter' AND column_name = 'geom';
END;"
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)
```



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VB.net Δ Oracle

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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.


Q&A