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March 2007
Oracle Spatial User Conference

Oracle Spatial User Conference

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Henry B. Gonzalez
Convention Center
San Antonio, Texas USA

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Oracle Spatial and the Utility Business – Things That Go Well Together

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Agenda

- Typical Tasks & Potential Business Benefits
- Old Methods
- How Simple it Now Can Be
- Spatializing Existing Databases
- Specific Examples
- Conclusion

Utility Business Requirements

- Location questions are common
- Where relative to
  - Other physical plant
  - A customer location/address
  - A field crew or repair vehicle
  - Other pending work locations
  - Other utilities
- General polygonal queries
  - Facilities counts/lengths within tax boundaries
  - Facilities within ad-hoc polygon

Example of Old Methods

Location Question Example:

Total wire miles within tax boundary

- From tabular database
  - Obtain list of everything installed/removed and tally
- From map - pre-vector data
  - Manually run measuring wheel over paper map
- From map – vector CAD data
  - Open area of interest, overlay polygon, build queries
- From geospatial database
  - Develop queries in proprietary language

Business Benefits of Oracle Spatial

- Strenuous location questions are now simple SQL
- Extensive documentation & examples from Oracle
- No longer is proprietary language required
- Oracle Spatial is not just an IT thing but becomes the solution for the business user
- It fundamentally changes the way utilities can do business

Business Benefits of Oracle Spatial

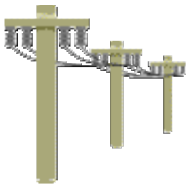
- Simple light weight standard technology rather than third party complex GIS engines
- Requirement for those GIS machines fades away ($$$ Savings)
- Anything spatial question can be asked at the database level and rendered on simple web views
- This is a new paradigm in the geospatial world and will completely change the GIS Landscape

Scenarios We Will Explore

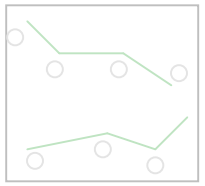
- Modernizing old records
  - Load light data model & convert in db
- Regulatory reporting with spatial intelligence
  - Typically tax district query or some ad-hoc inquiries
- Customer-to-asset validation
  - Data quality - looking for incorrectly connected things
- Customer intelligence – spatial data warehousing
  - All information brought together with the spatial data so that information can be viewed together on mapping backdrop

Modernizing Old Records

- Most utilities have CAD file based mapping data that is not yet converted into GIS

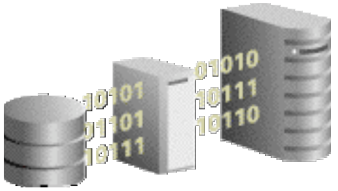


Transmission & Distribution



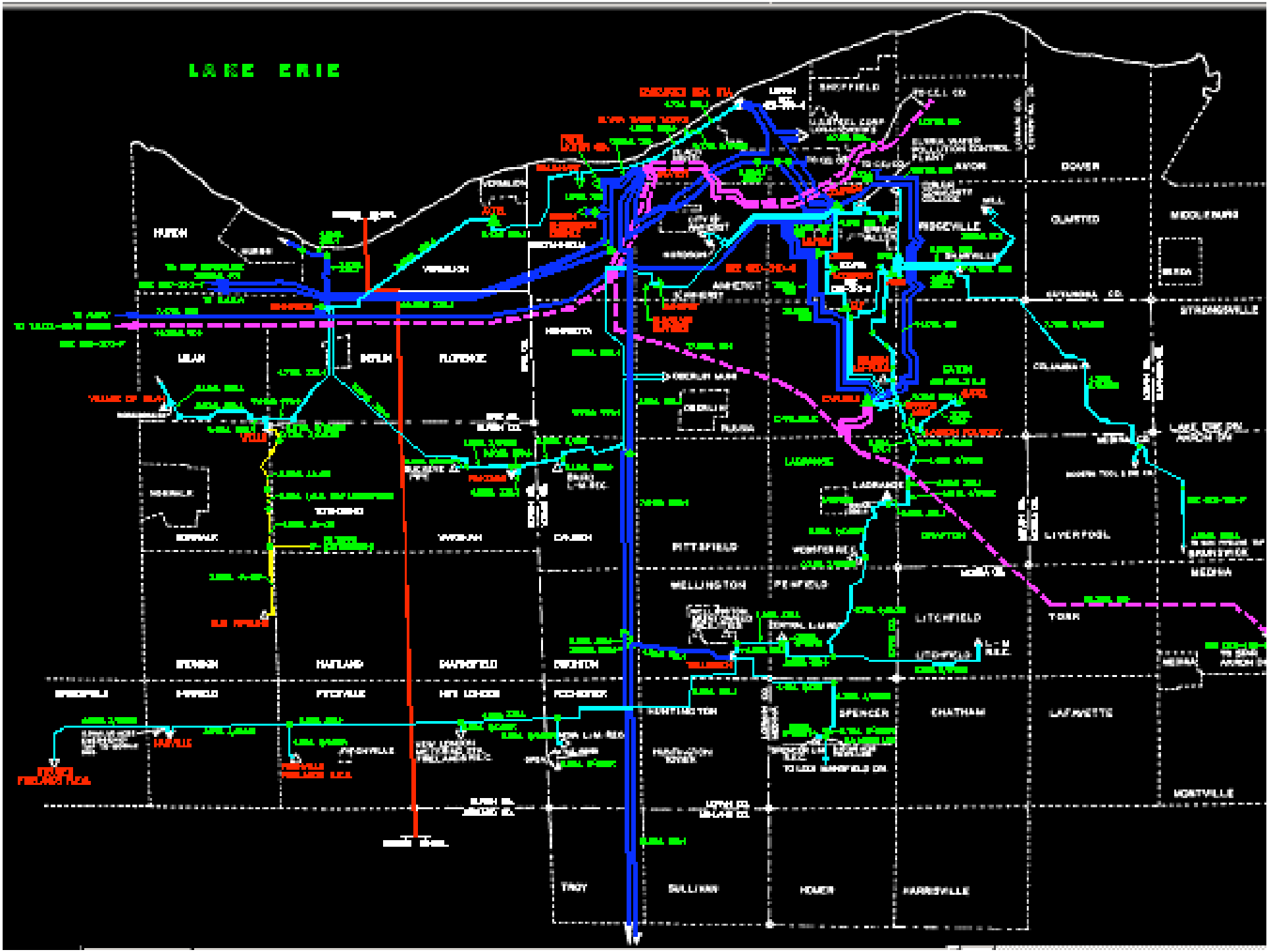
CAD File

- Tools exist in Oracle Spatial to harvest that information and move it to the database



Migration

Data Management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HURON
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BERLIN
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BRIGHTON
HUNTINGTON
SPENCER
CHATHAM
LAFAYETTE
TROY
SULLIVAN
HOMER
HARRISVILLE
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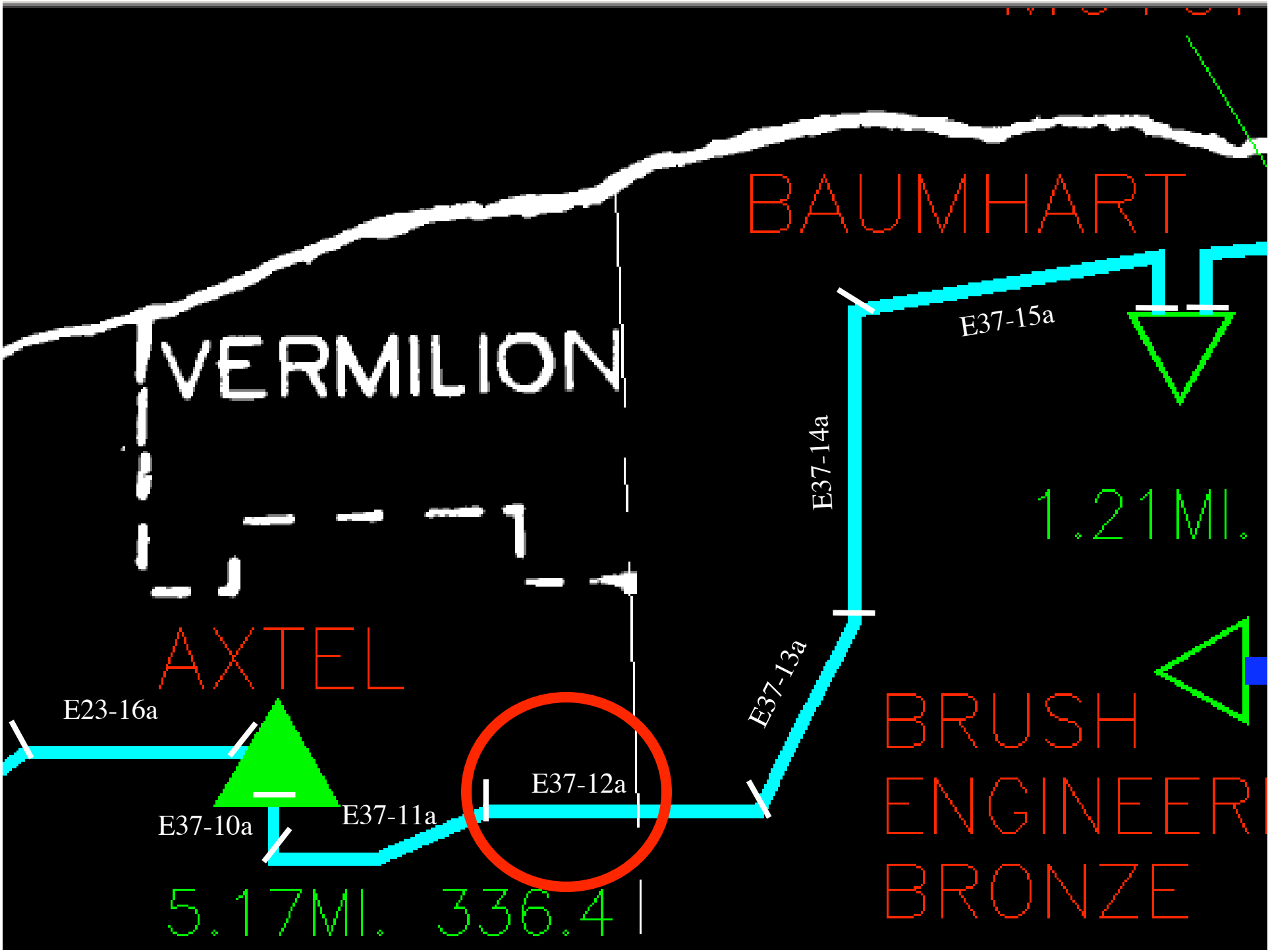
MONTVILLE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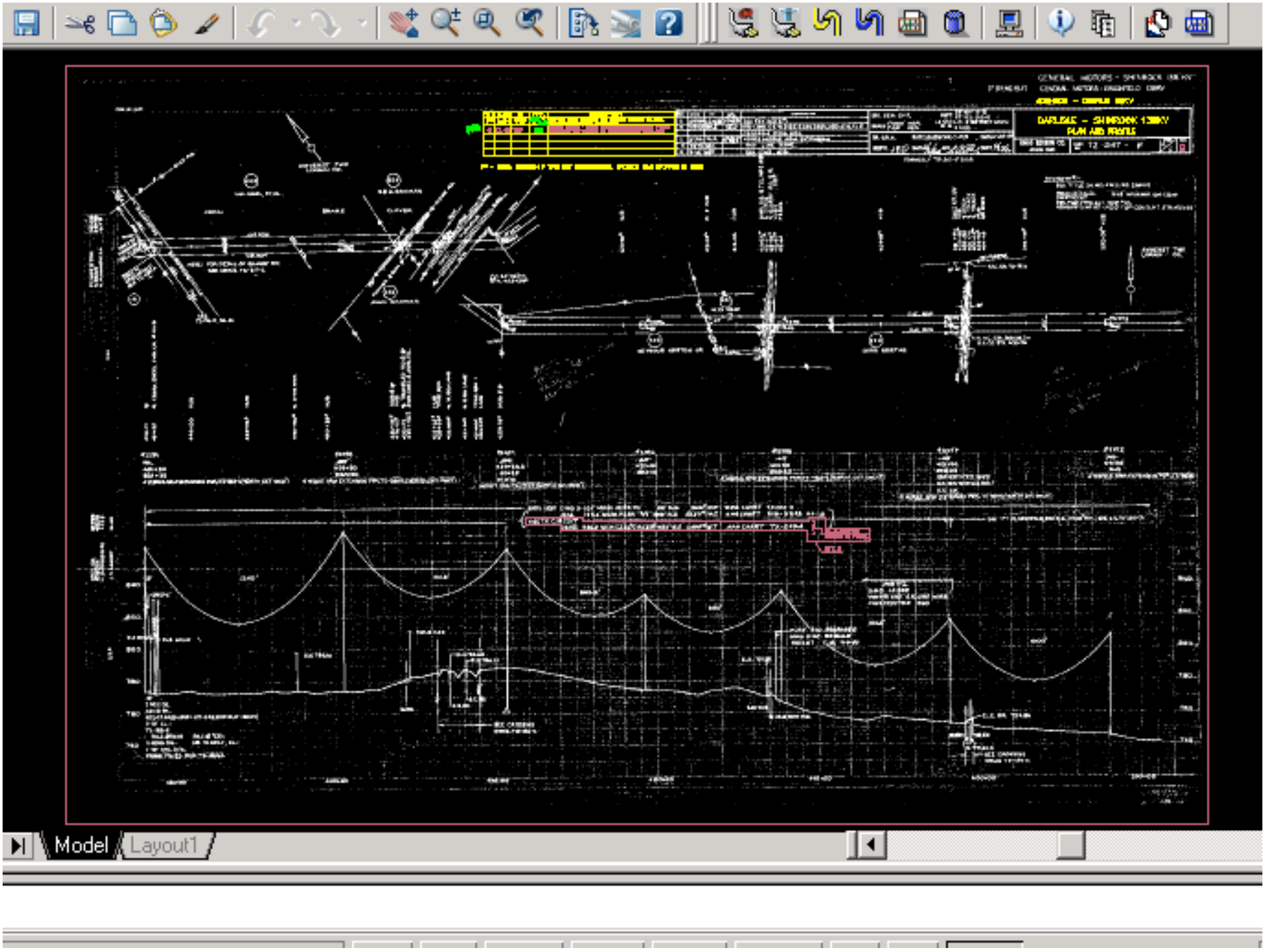
E37-12a
E37-11a
E37-10a
5.17MI.
336.4


Model
Layout1

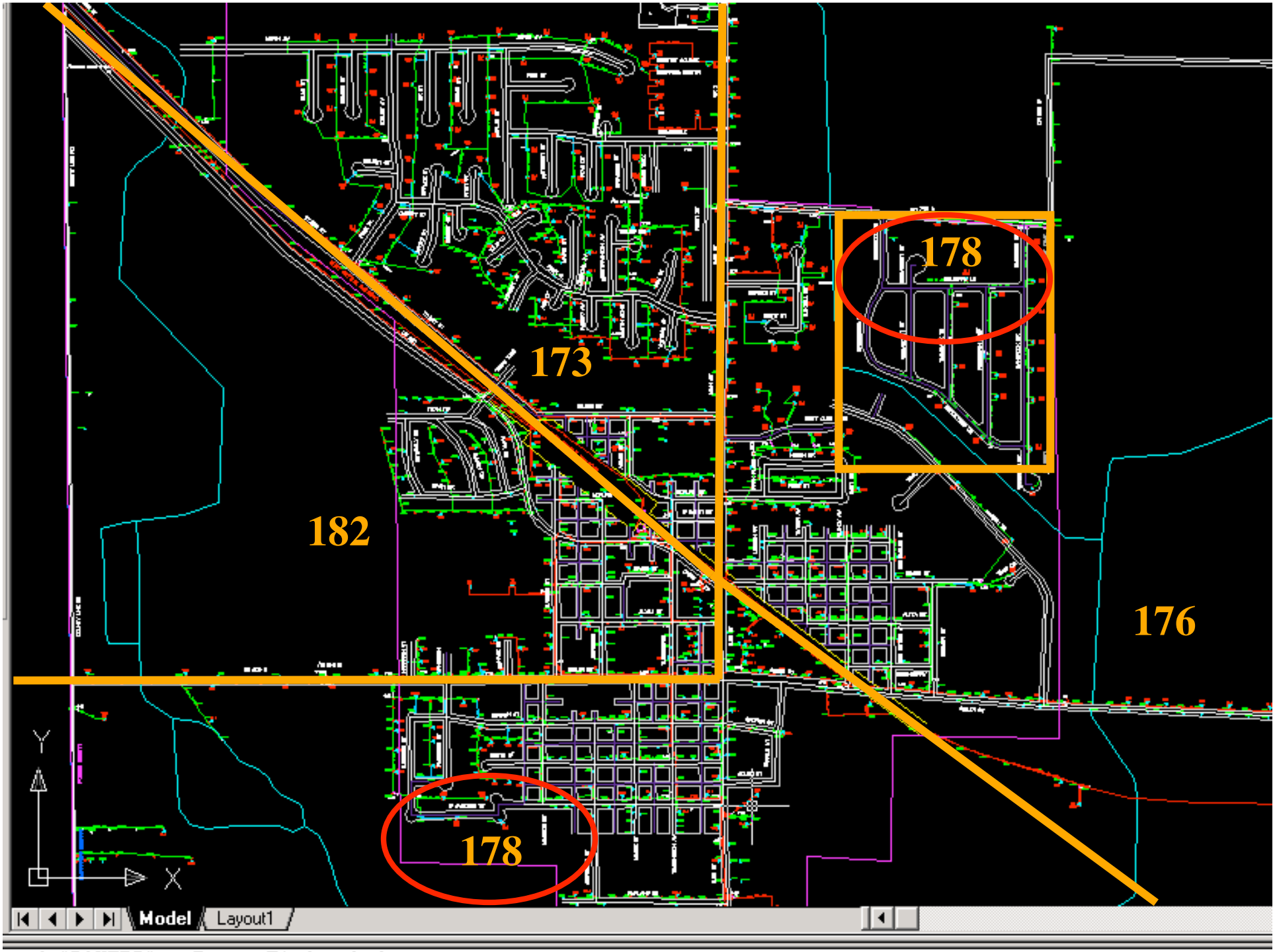
Regulatory Reporting

- All regulated utilities are required to report on their assets
- Investor owned utilities are required to pay taxes – per taxing district on their assets
- Regulatory bodies often required information on an ad-hoc basis
- Utilities have no choice but to respond

Analyze Enterprise

Measure

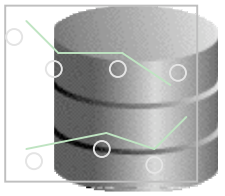
Report


178
173
182
176
178
Y
X
Model
Layout1

Regulatory Reporting

- This process is cumbersome with paper maps or CAD files
- Much simpler/faster against the database
- Report completion goes from weeks to hours or minutes

Analyze Enterprise



Database

Report

Benefits Realization

Customer to Asset Validation

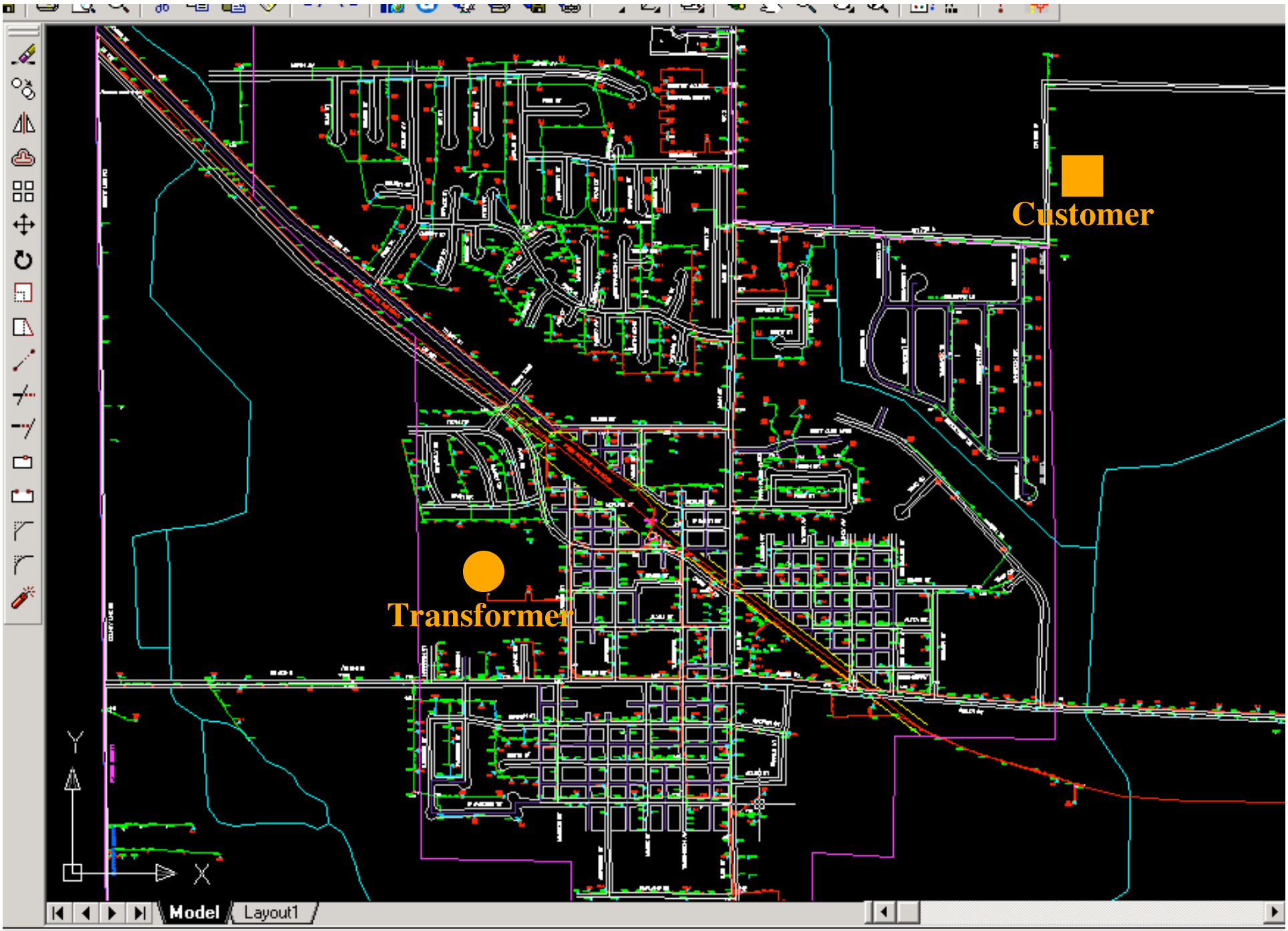
- Utility companies must understand their assets and network
- Assets support operations management activities – Outage Management, etc.
- Incorrect data causes delays in emergencies and lack of organizational faith in the data/system

Analyze Enterprise

Data Quality Inspection

Database Health Check

Benefits Realization


Customer
Transformer
Model
Layout1
Y
X
command "LAYERS". Press F1 for help.

Customer Intelligence

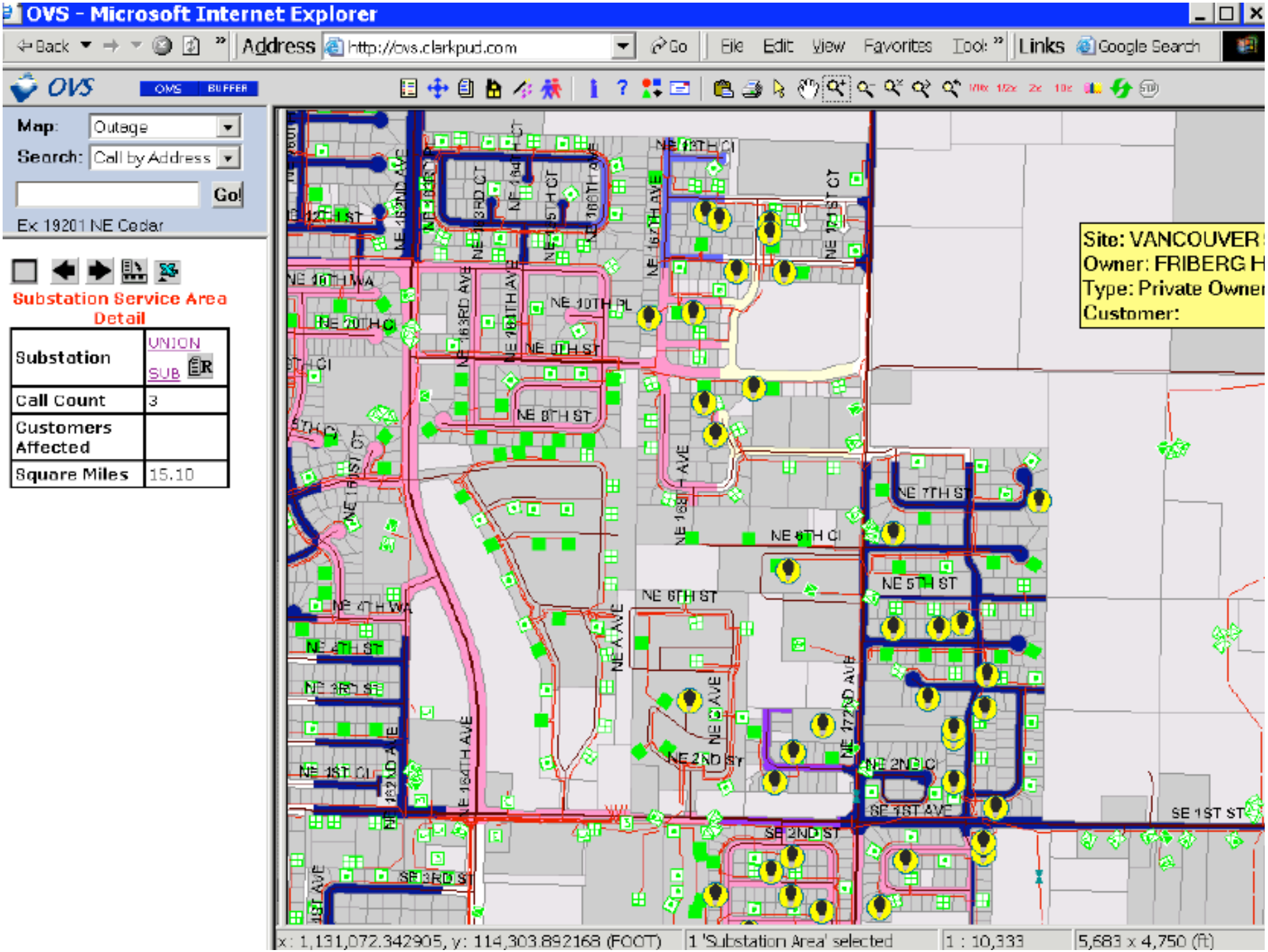
- Spatial data warehousing provides view of all enterprise data with mapping backdrop
- Geographical view adds positional relativity and enhances understanding
- Can provide significant operational benefits from single user interface

Enterprise Database

Business Intelligence & Spatial Data Warehousing

Benefits Realization

Analyze Enterprise

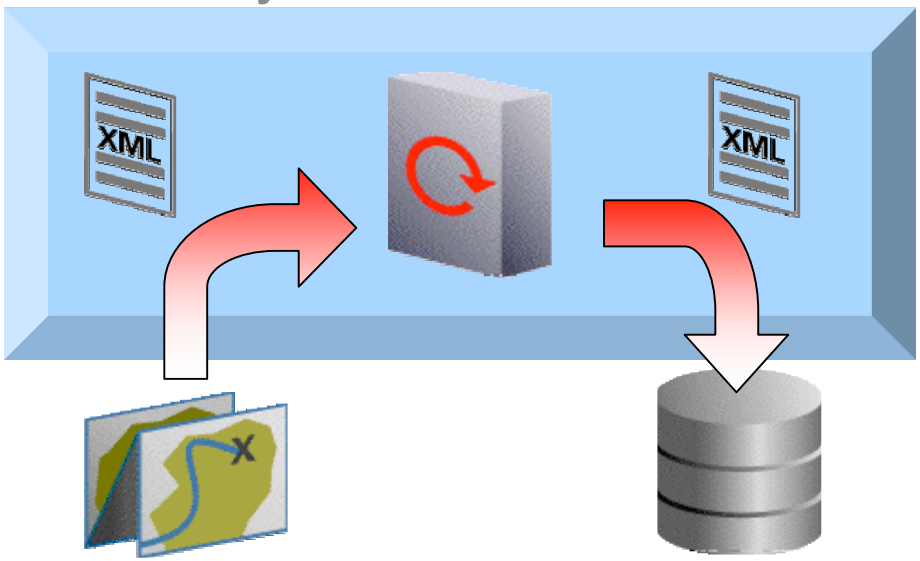

OVS - Microsoft Internet Explorer
Back
Address
http://ovs.clarkpud.com
Go
File
Edit
View
Favorites
Tools
Links
Google Search
OVS
OVS
BUFFER
Map:
Outage
Search:
Call by Address
Go!
Ex 19201 NE Cedar
Substation Service Area Detail
Substation
UNION SUB
Call Count
3
Customers Affected
Square Miles
15.10
Site: VANCOUVER
Owner: FRIBERG H
Type: Private Owner
Customer:
NE 10TH WA
NE 10TH PL
NE 8TH ST
NE 7TH ST
NE 6TH CI
NE 6TH ST
NE 5TH ST
NE 4TH WA
NE 4TH ST
NE 3RD ST
NE 2ND ST
NE 2ND CI
NE 1ST CI
SE 1ST AVE
SE 1ST ST
SE 2ND ST
SE 3RD ST
NE 162ND AVE
NE 163RD AVE
NE 164TH AVE
NE 166TH AVE
NE 167TH AVE
NE 168TH AVE
NE 172ND AVE
NE A AVE
NE C AVE
1ST AVE
x: 1,131,072.342905, y: 114,303.892168 (FOOT)
1 'Substation Area' selected
1 : 10,333
5,683 x 4,750 (ft)

Technical Aspects

Stephen Brockwell
Director, Systems Integration
Gatekeeper Systems

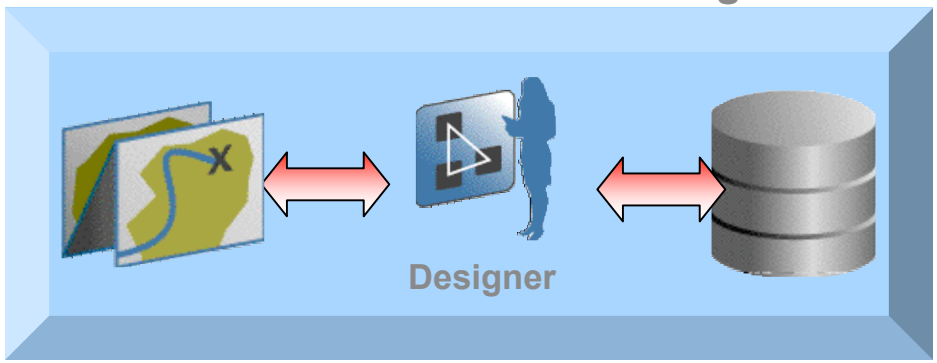
Spatializing Existing Data

Third Party ETL-like Periodic Translation



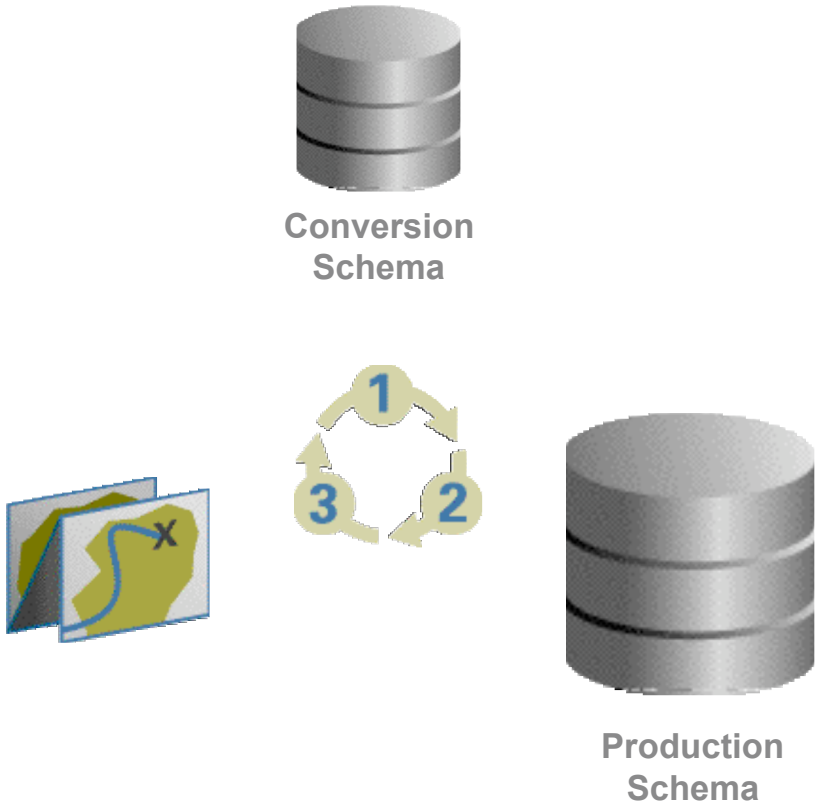
Strength	Weakness
Inexpensive tools	Manual or batch
Happy CAD users	Data always out of date
	Expensive to maintain

Database Centric Incremental Migration



Strength	Weakness
Improving data quality	CAD user change
Repeatable	SQL/ Spatial expertise
Design quality	

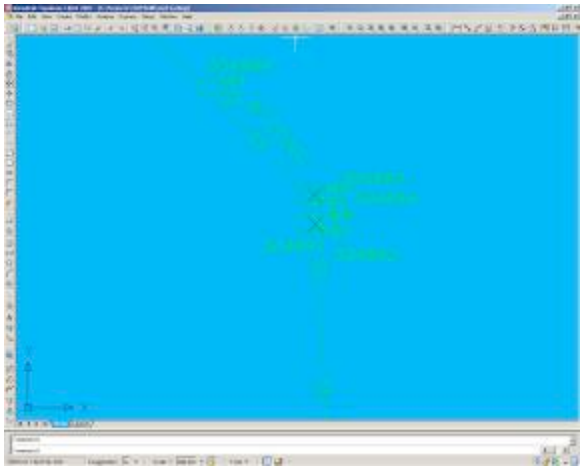
Data Structure Process



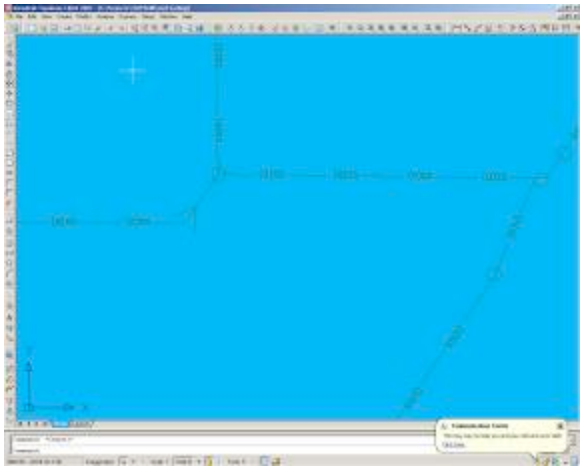
- Create a conversion schema
- Load clean CAD data
  - Consistent
  - Unstructured
- Add structure using Oracle
  - Tagging text attributes
  - Building connectivity
  - Verifying geometry

Verifying geometry

Structured



Unstructured



CAD Quality	Structured	Unstructured
Block or cell attributes	Yes	No
Consistent line styles and layers	Yes	No
Text label layer predictability	Yes	No
Geometric precision, snapping	Yes	No
Meaningful geometry	Yes	No

Geometry Validation

- SDO_VALIDATE_GEOMETRY
- Provides detailed messages for bad data
- Allows predictable fixes for many problems

Fixing duplicate vertices

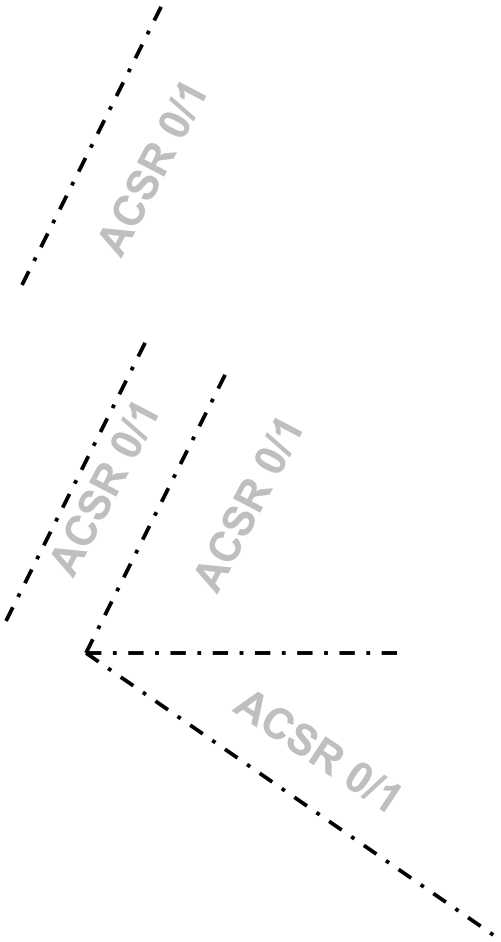
- Remove the duplicate ordinates
- Update the geometry
- Check for lines compressed to a point
- Oriented points

Check for Lines Compressed to a Point

```
select chan_id from z_channel c where
Rowid in (select sdo_rowid from errors where
   substr(result, 1,5) = '13356')
And  (select count(*) from
   TABLE(removeduplicateordinates(simple_geo
   metry).sdo_ordinates))=1
```

TO BE CHANGED

Structuring – linking text



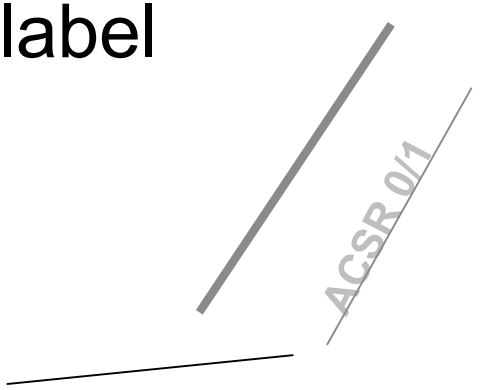
- Simplest case
- Slightly nasty cases

Linking text – Oracle tools

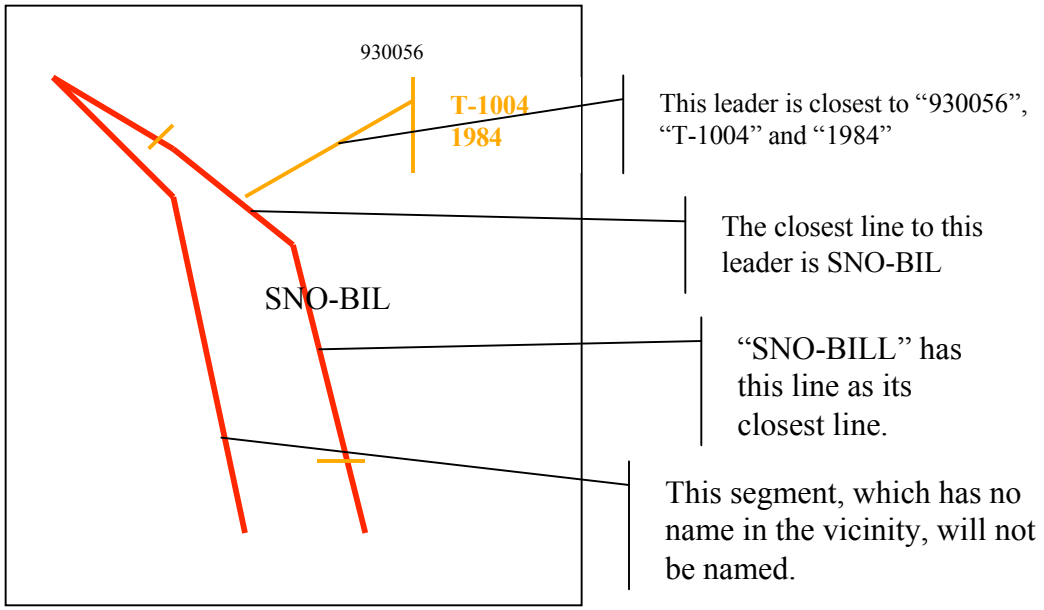
- SDO_NN used with care
- SDO_GEOM and SDO_UTIL

- Text is either a line or an oriented point
- For a set of nearest lines to a label
  - Rules for angles

- No solution is perfect



Text linking – leaders



- Build a tree of text links
- Filter with sdo_anyinteract
- Always link lines to the text, not the reverse

sdo_nn(line, text)

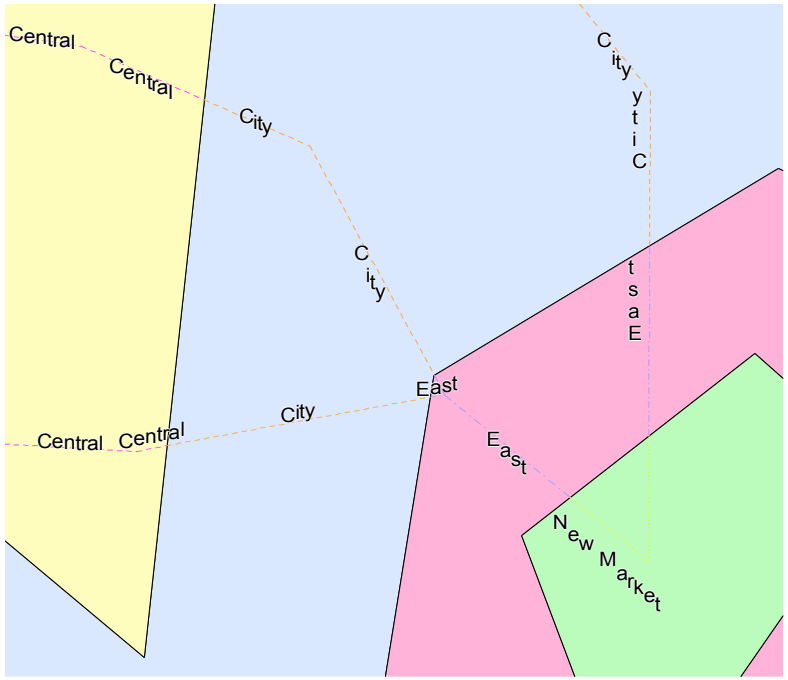
Structuring – building connections & associations

- Data model sensitive – the data model helps
- Find compatible devices closest to the end points of linear objects
- Insert into connectivity table

Tax district asset reporting

- Sum cable lengths clipped by tax district
- Tax districts are arbitrarily complex
- Use in-situ asset data
- Don’t (permanently) split cables!
- No redundant data
- Simple web reporting

Tax District	Total Length
Central	33.7156611
City	81.0996963
East	15.8901459
New Market	9.27585667



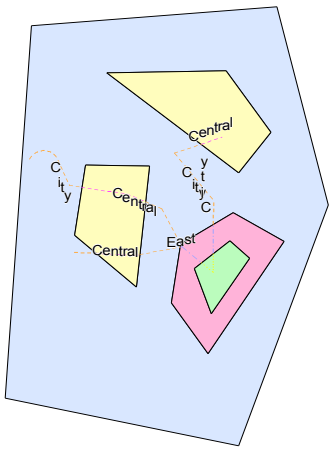
Model

Cable
FEATUREID
GEOMETRY
TYPE
MATERIAL
PHASE

?

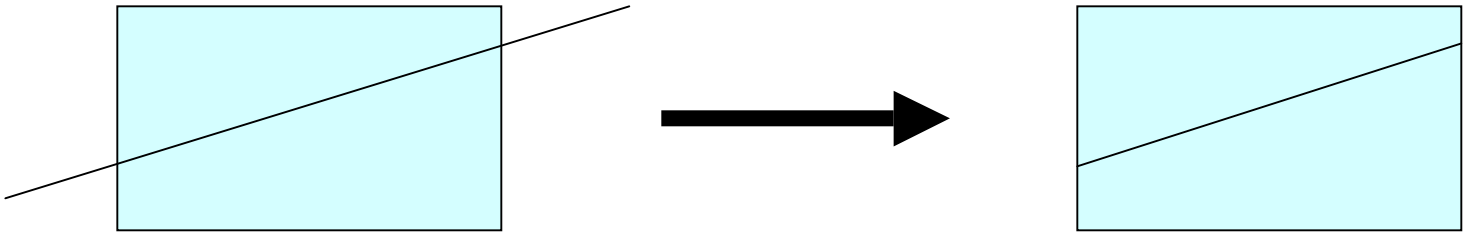
Tax Boundary
FEATUREID
NAME
GEOMETRY
…
…

- Relationship is geospatial
- Cable segments *contained* by each tax boundary
- Tax boundaries are multi-polygons



SDO_GEOM package

- SDO_GEOM performs geometry manipulation
- Intersect two geometries
  - SDO_GEOM.SDO_Intersect



- Calculate length of a segment
  - SDO_GEOM.SDO_Length

Here's the SQL

```
create or replace view pipe_intersect as select
   c.gid, sdo_geom.sdo_intersection(c.geometry,
   t.geometry, 0.01) INTGEOM, t.muni_code,
   c.geometry from sp_watpipe c, sp_municipality t
where sdo_filter(c.geometry, t.geometry) = 'TRUE'
```

- Compare this to the traditional GIS way of performing overlays
- *No* permanent data created. View is *always* correct.
- In this case it would be wise to try to handle NULL geometry
- SDO_GEOM.VALIDATE_GEOMETRY_WITH_CONTEXT function finds geometries that are invalid.
- Computed geometry is not indexed

Municipality	Total Clipped Length	Total Unclipped Length
0001	125570.099	160250.851
0002	61460.3655	93874.4599
0003	22337.883	76879.0529
0005	66842.2133	133091.796
0006	179409.986	269123.863
0008	29869.098	80398.0155
0015	29598.3888	66515.0589
0020	40495.0602	86469.3906
0180	20325.1144	38329.9211
0200	48654.1832	105008.725

Details

- Composite geometry

  SDO_GTYPE = 2006

- These multiple element geometries cause some GIS or CAD clients problems … get ready for the solution

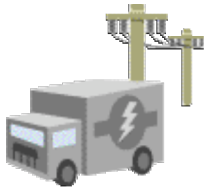
- Pipelined PL/SQL functions

Pipelined Disaggregation

```
create type geomarray as table of
  sdo_geometry;
create or replace function disaggregate
(geometry in sdo_geometry)
  return geomarray pipelined as
  i integer;
begin
  for i in 1..sdo_util.getnumelem(geometry)
      loop
      PIPE ROW(sdo_util.extract(geometry, i));
  end loop;
end;
```

Customer-to-asset assignment

- Access spatial services from other systems
  - Potentially on different machines
- Maintaining data integrity in a OMS is sometimes difficult
- Use Oracle Spatial services to
  - Locate nearest device to a customer
    - Connectivity is often not to the premise level
  - Geocode customer from address
- Publish as web services or remote PL/SQL procedures



Conclusion

- Oracle Spatial – A New Paradigm in the Industry
- No More Requirement for Large GIS Machines
- True and Significant Business Benefits
- Simpler is Better, Faster, Cheaper, Smarter…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Q&A


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