Case Study: Using Geometric Networks with the PODS Model

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Agenda

- Business cases and benefits of Geometric Networks for Pipeline Operators
- Challenges using Geometric Networks with PODS
- DCP Midstream business case
- CenterPoint Energy business case
- Project goals
- Description of the solution
What is a Geometric Network?

http://webhelp.esri.com/arcgisdesktop/9.3/index.cfm?TopicName=What_is_a_geometric_network?
What is the PODS Model?

*Pipeline Open Data Standard – Relational Data Model*
Using Geometric Networks for Pipelines

Business cases and benefits for Pipeline Operators

- Network Connectivity to verify GIS accuracy
- Study service interruption by stopping product flow
- Perform true system MAOP calculations (versus segment MAOP)
- Calculation of more accurate drain-down volumes for liquid pipelines
- Schematic diagramming using ArcSchematics for analysis and illustration of connectivity
Using Geometric Networks for Pipelines

*Business cases and benefits for Pipeline Operators*

- Hydraulic flow simulation
- Class Location analysis using the network approach
- Study product additive flow - such as odorant or corrosion inhibitors
- Study discharge temperature for SCC
DCP Midstream has strong sponsor support and an MLP growth vehicle.
DCP Midstream has a leading industry position in the gathering and processing business ... substantial oil-associated gas production
The Energy Value Chain
From Wellhead to Burner-Tip

Customers
BP Amoco
ExxonMobil
Devon
Kerr-McGee
Apache
Anadarko
ConocoPhillips
Chevron-Texaco

Gathering and Processing

Customers
Utilities
Industrial Marketers
Petrochemical Refineries Industrials Propane Wholesalers

Gas & NGL Marketing
DCP Midstream Business Case

• **Summary of DCP System**
  - PODS 4.02
  - ArcGIS 9.3.1
  - Oracle 10g
  - 62,000 miles gas gathering and transmission pipeline

• **Business Needs**
  - Class Location Analysis using Network Approach
  - WinFlow Hydraulic modeling
  - General traceability through the pipeline systems
Challenges using Geometric Network with PODS

Using Multiple Projection Systems

- Edit Centerline in Different Projection Systems

UTM
- Geometric Network is in One Projection

Geographic
PODS Model Does not Support Connectivity

The PODS data model supports pipeline features on a linear referenced centerline. However, the PODS model doesn’t provide a convenient way to model the connectivity of the centerlines for this a geometric network is required. Using the Geometric Network Synchronizer creates and updates the geometric network derived layer.

The edge feature class associated with the geometric network is a derived layer, built from the PODS centerline, along with attributes from various PODS event tables.

This derived layer is automatically updated whenever users edit data in PODS or make edits to the centerline in ArcMap.
Challenges using Geometric Network with PODS

*Using data from multiple layers in PODS*

- **Dynamic Segmentation of data**

- **Diameter/Wall Thickness**
  - [Bar chart showing division]

- **MAOP**
  - [Bar chart showing division]

- **Hydrotest**
  - [Bar chart showing division]

- **Derived Layer (Dynseg Layer)**
  - [Bar chart showing division]

*Geometric Network must stay synchronized as data is edited*
Engineering - System Optimization
Hydraulic Modeling Using WinFlow
Pipeline Integrity
Identifying Structures Along DOT Pipelines
Class Location Analysis

Using the Network Approach for Class Location Unit

5,280 Feet

1,320 Feet

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Class Location Analysis

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CenterPoint Energy

CenterPoint Energy Gas Transmission

Mississippi River Transmission

• Summary of CenterPoint System
  - PODS 3.2
  - ArcGIS 9.3.1
  - Oracle 10g
  - 8,000 miles gas transmission
  - 3,000 miles gas gathering

• Business Needs
  - Odorant Flow Analysis
  - Discharge Temperature Analysis - SCC
Heat Discharge Analysis

1. Odorant Flow Analysis

2. Temperature Analysis for Stress Corrosion Cracking (SCC)
Project Goals

1. Ability to edit centerline in local projection and store Geometric Network in Lat/Long
2. Ability to select attributes in the Geometric Network from PODS features
3. Dynamic segmentation on multiple PODS linear features for analysis purposes
4. Build one or more Geometric Networks from PODS and keep them synchronized as edits are made
5. Support user-defined snapping overrides
Solution Overview

1. User Edits PODS Centerline in ArcGIS

2. Geometric Network Synchronizer automatically updates Geometric Network(s) to reflect changes.
Solution Description

*Geometric Network Synchronizer – ArcGIS Extension*

- Manual or Automatically rebuild Geometric Network
- Preserves Linear Referencing
- Dynamic Segmentation of Linear features
- Snapping Overrides – Connect and Disconnect
Solution Architecture

ArcGIS Desktop Extension

Server Extension

- Oracle DBMS
- PODS GIS
- ArcGIS Server
- PODS Spatialized with ArcGIS Server
Summary

- Joint Partnership with DCP Midstream and CenterPoint
- Developed solution on PODS Relational Model spatialized with ArcGIS Server
- Many pipeline uses for Geometric Networks
- Data can be edited in any projection
- Geometric Network is dynamically segmented and linear referenced
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