Understanding ArcGIS Pipeline Referencing for Vertically Integrated Gas Companies

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The Asset Intelligence Imperative

The necessity to learn ever more, in as close to real time as possible, about

- your pipe network,
- its condition,
- activity in and around it,
- and the surroundings through which it passes.
Historically

Different technology stacks for different industry segments

Gathering Pipelines

Transmission Pipelines & Storage

Distribution Pipelines

Data Model 1

Data Model 2

Data Model 3
Historically different technology stacks for different types of users:

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Data Models:
- Data Model 1
- Data Model 2
- Data Model 3
Esri Vision for Vertically Integrated Gas Companies

ArcGIS
- works the way your business works
- enabling every employee and contractor in all functional areas and roles
to easily discover, use, make, and share maps
- of all aspects of their entire pipe network from the wellhead to the customer meter, resources, and activities…one source of location truth
- on any device, anywhere, anytime.
- AND for connectivity modeling and linear referencing to operate on the same dataset
One technology stack for all users in vertically integrated gas companies
ArcGIS: The Mapping and Spatial Analytics Platform for Vertically Integrated Gas Companies

Network Management

Linear Referencing

Data
Esri’s UPDM is a geodatabase data model template for operators of pipe networks in the gas and hazardous liquids industries. UPDM is a

- moderately normalized data model
- that explicitly represents each physical component of a pipe network from the wellhead to the customer meter, terminal or delivery point, in a single database table object.
Incorporates Utility Network schema with ArcGIS Pipeline Referencing schema

- Data Dictionary will document schema mapping of gas assets from UPDM 2016 to UPDM 2017
- Integrity and inspection data is relatively unchanged
ArcGIS Pipeline Referencing
Pipeline Referencing Overview

Information Model

• Routes
• Events
• Intersections
Pipeline Referencing Overview

Information Model
- Routes
- Events
- Intersections

ArcGIS Pro
- LRS network editing
- LRS management
- Geoprocessing
Pipeline Referencing Overview

Information Model
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ArcGIS Pro
- LRS network editing
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ArcGIS Enterprise
- LRS web services
- Developer API samples
Pipeline Referencing Overview

**Information Model**
- Routes
- Events
- Intersections

**ArcGIS Pro**
- LRS network editing
- LRS management
- Geoprocessing

**ArcGIS Enterprise**
- LRS web services
- Developer API samples

**Web**
- Event editing
- Event query
- Event QC
Information Model
Location Model
Schema for route centerline management

- **Routes (Network)**: M-enabled Route polyline features
- **Centerline Sequence**: Key table for M-N relationship between Centerline and Route
- **Calibration Points**: Point feature class that stores route measures
- **Centerline**: Line feature class that stores route geometry

Separate feature class for each LRS Network
Location Model
Schema for route centerline management

**Routes (Network)**
M-enabled Route polyline features

**Centerline Sequence**
Key table for M-N relationship between Centerline and Route

**Calibration Points**
Point feature class that stores route measures

**Centerline**
Line feature class that stores route geometry

*Separate feature class for each LRS Network*
Event Location Methods

- Route and measure
- Stationing
- Referent and offset
  - Intersections
  - Events
  - Features
- Coordinates and offset

- Calibration Point: 1 mile
- Event: 1.27 miles

- Station Event: 100+00.00
- Event: 456+25.00

- Intersection Features: US Highway 10 crossing
- Event: 300 feet from US Highway 10

- Event: 45 feet from cell tower

- Cell tower location: 34.0547, 117.1825
When the LRS routes are edited, measure behavior rules can be applied to events.
Time Aware Model

Realignment

Before

After
Industry Data Models

or any schema that implements the location model.
Platform Components
Route, calibration point, and centerline editing.
Geoprocessing Tools

- **Modeling**
- **Loading**
- **Transformations**
  - Event Measure Behaviors
  - Dynamic Segmentation
  - Measure Translation
Quality Control with Data Reviewer

- **Detect measure based errors**
  Event measure gaps, overlaps, invalid measures, Non-monotonic or routes that aren’t calibrated...

- **Detect spatial errors**
  Dangles and overshoots (connectivity), self intersection...

- **Detect mismatches** (SQL checks)
  Invalid combinations of construction materials and operation pressures, event orphans...
Linear Referencing for ArcGIS Enterprise

- **GIS Server**
  - Mapping, Query, Geoprocessing, ...

- **Pipeline Referencing Server**
  - Event editing
  - Coordinate to measures
  - Measure to coordinate
  - Query attribute sets
  - Check events (*gaps, overlaps, invalid measures*)
  - Measure translation
Event Editor

- **Editing**
  - Lines and Points events
  - Tabular selection results
  - Attribute set results

- **Selection**
  - Select by route, attribute, geometry, proximity
  - Single layer results or attribute sets

- **Error Checking**
  - Gaps, overlaps, invalid measures
  - Data Reviewer batch checks
Enough slides…
Let’s see some demos
Pipeline Referencing Roadmap

Future release themes subject to change
Pipeline Referencing Roadmap

Future release themes subject to change

ArcGIS Release Timeline
Pipeline Referencing Roadmap
Future release themes subject to change

- REST-based Network Editing
- Utility Network Integration
- Conflict Prevention
- Modeling Enhancements to ArcGIS Pro