

## APDM Core Schema Change Log

### Change Log

Date	Author	Description
2012/05/17	Pcgv	Initial Document
2013/01/23	Pcgv	Updates and Corrections
2013/01/30	Pcgv	Final Revisions and Clean Up
2013/07/14	Pcgv	Correction to Crossing Easement
2013/08/13	Pcgv	Moved Physical and Logical Models to Enterprise Architect 10.0 Deleted extraneous MetaData Tables
2013/08/25	Pcgv	REmove LineOperationalUse

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## Description and Rationale for Model Changes

APDM 6.0 represents alterations to the core data model. These changes are effected to: maintain compatibility and synchronization with the developments in the PODS ESRI Spatial Data Model and to simplify the model keeping it in ‘tune’ with other ESRI data model templates.

APDM has always considered itself a template; a starting point from which more comprehensive data models could be developed by an operator to match/meet the expectations and requirements of the business for storing and managing pipeline data within an ESRI Geodatabase.

Where possible, changes to the core portion of the model have been additive where core classes have had new attributes added rather than alterations to existing attributes. Subtractive changes include removal of extraneous relationship classes and the designation of certain classes as alternate or non-core.

The optional classes of the model have been greatly reduced keeping the model in-line as a template or starting point not as a de-facto standard or universal repository of all things pipeline. This has been done to better illustrate of the concepts of how the data model core works and to reduce the amount of documentation that needs to be maintained, by what is essentially, a volunteer committee. Reducing the number of optional classes provides a cleaner starting point for organizations removing the need to ‘remove’ classes that will not be populated. Finally, the data model meets the minimum requirements for managing or depicting the location of features on a transmission system but also on a gathering or even distribution system. This data model is streamlined to hopefully meet the most basic GIS needs of a variety of pipeline operators. Since it is a template it can be expanded and modified to meet the needs of the business as required.

The addition of the direct relationship between LineLoop and all online feature types allows non-stationed gathering style pipelines to be captured in the model. Gathering systems can loosely defined as a ‘distribution’ system in reverse and are primarily geometric in nature (position is determined as for offline features by coordinate value or XYZ location first – stationing is an afterthought if it is included at all). All online style feature classes have a direct relationship to LineLoop and the ‘continuous’ route StationSeries feature. This allows a network of features to be related to a single line for the purposes of organization and hierarchy but to exist without the need for an underlying station series feature.

Where possible design notes or rationale are provided for each change are provided in the notes below. Where possible the underlying changes reflect the simplification of the model from a maintenance and comprehension standpoint.

## Schema Changes

2012/05/18

### Corrections to Core Model

Attached Company to NonFacilityObject Abstract Class

Removed the MN Relationship Class – StructureLocationAltRefMeasure

Removed extraneous LineLoopStationSeries MN Object table – not used and showed up in explorer

**Modification Notes:**

These changes are corrections to errors that have persisted in the data model since APDM 4.0

## Changes to the Core Model

Added PipelineID (String, 15) to APDMObject Abstract Class – inline with PODS ESRI Spatial

Added PipelineID (String, 15) to APDMFeature Abstract Class – inline with PODS ESRI Spatial

Added TagID (String, 15) to APDMObject Abstract Class – inline with PODS ESRI Spatial

Added TagID (String, 15) to APDMFeature Abstract Class – inline with PODS ESRI Spatial

### Modification Notes:

PipelineID and TagID are added as attributes to highest level APDM abstract classes. APDMObject and APDMFeature (more on this later in the documents). These attributes allow any feature to be linked to a higher level pipeline tag (replacing the need to memorize GUIDS). The TagID allows for better integration with MAXIMO and other WMS by storing the function and/or location and/or asset identifiers used in these systems to define functional locations for assets. Both attributes attempt to provide a simpler and more system-specific identifier for locations and assets.

Added ActivityCrossRef:

- Inherits from AuditObject and therefore gets ActivityEventID (GUID, FK to Activity.EventID)
- Classname (gnClassName, String, 50)
- FeatureEventID (GUID)
- Comment (String, 2016)
- CommentBy (String, 50, FK to Contact.Email)
- CommentDate (Date)

Added 1..M from Activity to ActivityCrossRef

Removed all Audit classes (in particular):

- ControlPointAudit MN Relationship Class
- ControlPointExternalDocument MN Relationship Class
- StationSeriesAudit MN Relationship Class
- StationSeriesExternalDocument MN Relationship Class
- LineLoopAudit MN Relationship Class
- LineLoopExternalDocument MN Relationship Class
- SubSystemAudit MN Relationship Class
- SubSystemAuditExternalDocument MN Relationship Class
- SiteAudit MN Relationship Class
- SiteAuditExternalDocument MN Relationship Class
- ActivityExternalDocument MN Relationship Class

Added 1..M from <All FeatureClasses/Event-Tables> to ActivityCrossRef

### Modification Notes:

ActivityCrossRef is a single cross reference table between activity and all other classes. This removes the need for a single Audit table for each individual class or table. Comments are stored in this table. Any feature can have 1 or more comments or activities that describe the feature. Any activity can be related to 1 or more features in 1 or more tables allowing features that would normally not share an explicit relationship (other than possible overlapping spatial positions) to be grouped under a single activity. Queries for what features belong to what activities are simplified by having a single CrossRef table.

This brings APDM in-line with PODS ESRI Spatial – this construct has already been adapted by that model group.

Added ExternalDocument:

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- FileServer (String, 50)
- AltHyperlink (String, 255)

Added DocumentCrossRef:

- Inherits from APDMObject
- Classname (gnClassName, String, 50)
- FeatureEventID (GUID)
- ExternalDocumentEventID (GUID)
- ExternalDocumentReference (String, 255)

Added 1..M from ExternalDocument to ExternalDocumentCrossRef

Added 1..M from <All FeatureClasses, Event-based Tables, and other Tables> to ExternalDocumentCrossRef

Added ActivityDocumentCrossRef:

- Inherits from AuditClass (ActivityEventID FK → ActivityEventID, ActivityDate)
- Added ExternalDocumentEventID (GUID, FK → ExternalDocument.EventID)

### Modification Notes:

The first two attributes were to add more description to a document. FileServer indicates the root name of the server (for UNC file paths) or the root drive name (C:). The second allows for the storage of a file-based URL and an ECM-based URL.

DocumentCrossRef works similar to ActivityCrossRef. It provides a single table for relating feature classes and table to ExternalDocument references. The overall model is simplified by the removal of the M-N relationships between ExternalDocument and every other table. M-N relationships classes are difficult to traverse, edit, manage and query using OOTB ESRI tools.

### DISCUSSION

Should Activity be related to ExternalDocument in the same manner as the other tables? Currently there is an ActivityDocumentCrossRef and this table may be redundant.

Deleted:

- SubsystemHierarchy Object Class (added ParentSubsystemEventID into object class)

OwnerOperator

- Turned into a OnlinePolyline class to show extents of operations and ownership – this is called ProductRange and is described below.

Contact

- Added back to the model as a NonFacilityObject
- Added Name (string, 50) and email (String, 50) as attributes.

**Modification Notes:**

Data model corrections that have been perpetuated since APDM 4.0

**DISCUSSION**

OwnerOperator – this is overly confusing and can be simply modeled by a single range. Typically (although not always) lines are owned and operators by a single owner/operator. This is the common use case and is model simply by multiple overlapping ranges if required. This structure makes it easier to obtain information from the database using OOTB ESRI tools such as Identify).

Who uses the SubsystemHierarchy? IS there a rational for removing LineLoopHierarchy and ActivityHierarchy as well and putting a ParentLineLoopEventID and ParentActivityEventID attributes in the LineLoop and Activity tables respectively. The uses cases show single parentage is more prevalent than multiple parentage. The hierarchy tables are cool conceptually but does that 'coolness' equation to actual usage and understanding?

**Domains:**

- Added gnRelationshipCardinality
- Added gnRelationshipModelState
- Added gnDomainType
- Added gnDomainDataType

**Meta Data Classes:**

- Added RelationshipMetaData
  - Tracks relationships in the APDM
- Added DomainList
  - Lists all values in the domain in the APDM
- Added DomainMetaData
  - Lists information about the domains
- Added DomainClass
  - Lists domains and to which classes they are assigned

**Modification Notes:**

Added meta data tables for tracking relationships (even if they are not explicitly defined with relationship classes), domains, and domain assignments to tables/fields. These metadata table allow for auditing and validation of the data model for completeness, accuracy and for management by custom software. Aligns the APDM with the PODS ESRI Spatial data model.

**Added:**

- SitePoint - OfflinePointFacility
- SitePolygon – OfflineNonPointFacility (Polygon)
- SiteContact – NonFacilityObject
- SiteLocation – Online location for Sites
- SiteLayout – OfflineNonPointFacility (Polyline)

**Online Abstract Classes:**

- Added EventOffset Attribute (Double, 15,2)

Changed clControlPointDirection to clDirection (more generic)

Added OnlineEvent as Object-type to abstract classes

Results in the following Abstract Classes to be defined:

- OnlineEventPoint
  - OnlinePointEventForOfflineFeature

- OnlineEventPolyline
  - OnlinePolylineEventForOfflineFeature
- OnlineFacilityEvent
  - OnlinePointFacilityEvent
    - FittingEvent
  - OnlinePolylineFacilityEvent

### Modification Notes:

SitePoint - Describes the centroid of a site (if that is the only information available). SitePolygon - Describes one or more boundary outlines of a site. SiteContact - Describes in one of the few remaining M-N intersection style classes the contact person(s) for a site. SiteLayout - Describes the storage mechanism for CAD like outline/schematics showing the content/structure of a site. SiteLocation – Describes the online location for a site. Replaces LineLoopSite relationship class by allowing an online link-location for the site plus a relate to the route and lineloop and describes connection information for the site to the line (description of a feature).

EventOffset allows events to be shown on a route with an offset. The Display Route Events tool requires a field be specified to determine event offset.

OnlineEventObject formally describes the storage of online features as 'event-tables' rather than feature classes. This change aligns APDM with PODS ESRI Spatial data model.

## Initial Final Review and Cleanup

2013/01/23

### Modifications to Abstract Classes

Added APDMObject to the 'Feature' Abstract Class hierarchy

- Moved the following attributes from FeatureArchive to APDMObject
  - EventID
  - GlobalID
  - PipelineID
  - TagID
- Becomes a standard place for adding company specific meta-attributes

### Modification Notes:

This makes the model more consistent – we have an APDMObject class that can be used as location for putting 'user' level abstract attributes. The same is now possible for 'features'. It just makes the model more consistent.

### Modifications to Online features, Site\Lineloop Interaction

All online classes are directly related to LineLoop.

Deleted LineLoopSite and replaced with SiteLocation

- OnlinePointForOfflineFeature
- Added Attributes
  - SiteEventID (FK to Site).
    - Needed to be added because OnlinePointForOfflineFeature is not a Facility and therefore does not have relationship to Site automatically.
  - ConnectionType (String, 50, clSiteConnectionType)
    - Allows specification of site connection feature (ESDV etc.)

- ConnectionDescription (String, 255)
  - Allows for description information about the site.

**Modification Notes:**

Better describes a geometric relationship between gathering style features (that are not stationing based) and the lines they represent/belong to.

Allows stationing and non-stationing centerlines to be managed in an APDM. Allows PipeSegments to become the centerline (for a feature-based) model without the need for underlying StationSeries feature class.

### Modifications to UML Structure

Moved all metadata classes to metadata package.

Verified that all online event type features (implemented as feature classes or event-style tables) have geometry specification. The Visio/UML/Semantics Checker ignores the Geometry 'Tagged' Attributes of a class if a class is implemented as an event-table.

**Modification Notes:**

Generic Model Cleanup.

### Modifications to Product

Removed M-N LineLoopProduct Range Relationship Class

- Added ProductRange as OnlinePolyline class

**Modification Notes:**

Simplifies this construct.

### Created 'Event-based' Version of Model

Online feature classes are implemented as event tables instead of feature classes.

**Modification Notes:**

In-line with PODS ESRI Spatial. Supports officially an event-based depiction of the model rather than one implicitly referenced by the documentation.

### Simplification of 'Alternate Classes'

Removed alternate classes throughout the model.

**Modification Notes:**

Allows the data model team to focus on the most important classes and the structure of the model without being bogged down in descriptions of classes or attempt to manage 'all-things-pipeline'. Most operators modify the alternate classes or do not implement them 'as-is'. The classes defined in APDM 4.0 and APDM 5.0 still provide a basis for describing alternate classes if required.

## Data Model Corrections

2013/07/14

### Corrections to Classes

Fixed CrossingEasement

- EasementWidth was specified as String - Changed to Double (15,2) with default 0.00

2013/08/13

### Moved Enterprise Architecture

Moved physical and logical models to Enterprise Architect 10.0

- Made corrections to Physical Model as needed during migration

**Modification Notes:**

Enterprise Architect provides functionality to create ESRI XML Workspace documents. Validation rules have been written for model integrity. There is sufficient technology graphics to create a logical model poster. Full data dictionary and model documentation is available in EA.

### Deleted MetaData Tables

- Deleted the following MetaData Tables:
  - RelationshipMetaData
  - DomainClass
  - DomainList
  - DomainMetaData
- Deleted the following domains dependent on the tables above:
  - gnRelationshipCardinality
  - gnRelationshipModelState
  - gnDomainDataType
  - gnDomainType

### Added UnitOfMeasureLookup MetaData table

- Added the UnitOfMeasureLookup Table
  - ClassName (gnClassName)
  - AttributeName (String, 50)
  - UnitOfMeasure (gnUnitOfMeasure)
  - UnitOfMeasureLength (gnUnitOfMeasureLength)

**Modification Notes:**

No one fills out the original metadata tables. Why add new ones? Except UOM because we don't want that in the table level because it breaks third normal form.



## Final Review and Cleanup

2013/08/25

### Removal of Sample Concrete Classes

Removed LineOperational Use

Removed CPRectifier and CPRectifierLocation

**Modification Notes:**

The model already has examples for the OfflinePointFacility (SitePoint), OnlinePointLocationForOfflineFeature (CrossingLocation) and OnlinePolyline (Inspection, RegulatorySegment ...). The purpose of this template is to provide a sample of each Abstract Class being implemented in the model.