UT2539 - In the Map Vault: Using Autodesk® Vault to Manage Maps for Utilities

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Class Summary

This class will provide attendees with a detailed exploration how to use Autodesk Vault software to organize, manage, and disseminate maps stored in DWG™ files. Specifically, you will learn how Autodesk Vault can be integrated closely with AutoCAD® Map 3D software for design, production, and operational maps. We will demonstrate how Autodesk® Infrastructure Map Server software can be used in conjunction with Autodesk Vault to globally visualize the contents of the vault in geographic space. We will discuss workflows that can be configured to ensure secure access to project drawings for engineering, design, field inspections, and construction. Finally, we will explain how Autodesk Vault can complement a GIS-centric implementation that uses Oracle® Spatial or ArcIMS.

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Learning Objectives

At the end of this class, you will be able to:

- Deploy Autodesk Vault in a utility or engineering environment that is mapping and geographically oriented
- Tightly integrate Autodesk Map 3D with Autodesk Vault to provide more than just DWG project management
- Use Autodesk Vault to manage critical drawings to complement GIS implementations
- Configure Autodesk Infrastructure Map Server to visualize the contents of Autodesk Vault on a global basis

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In the Map Vault

In the Map Vault: Using Autodesk® Vault to Manage Maps for Utilities

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Agenda

- Part 1: Business Process Issues – 25 minutes
- Part 2: Technical Architecture – 45 minutes
- Part 3: Prototype Demonstration – 20 minutes
- Q & A

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Topics we will NOT discuss

- No extensive details of Autodesk Vault functionality
  - Only subset of features relevant to a particular approach to utility integration
- No extensive feature descriptions of AutoCAD Map 3D functionality
  - See above
- No meticulous overview of the Vault or Map APIs
  - We are describing an approach and a high-level architecture, not a productized solution

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Part 1: Business Process Issues for Autodesk Vault Document Management in Utilities

How can Autodesk Vault be used to manage the infrastructure lifecycle?

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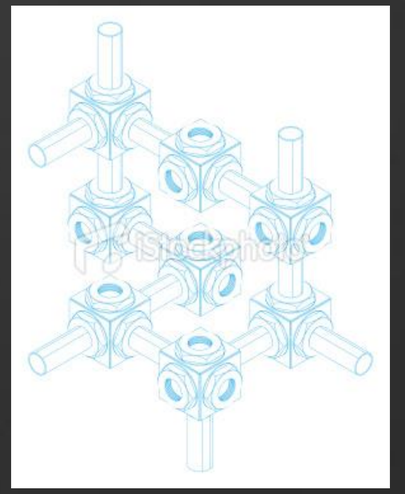
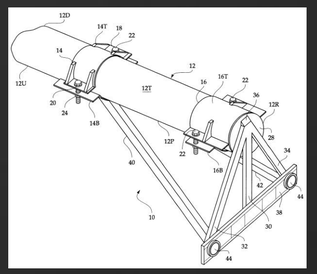
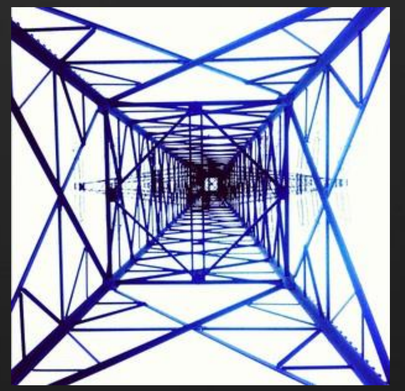
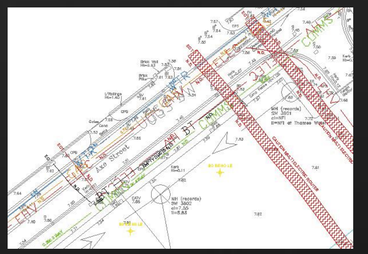
Business Problem

- Store various documents of the infrastructure lifecycle in a scalable, easily managed way
  - Document types
    - Drawings
    - Construction standards etc
    - Permits
- Preserve the attributes, relationships and topology of assets in the seamless geospatial database









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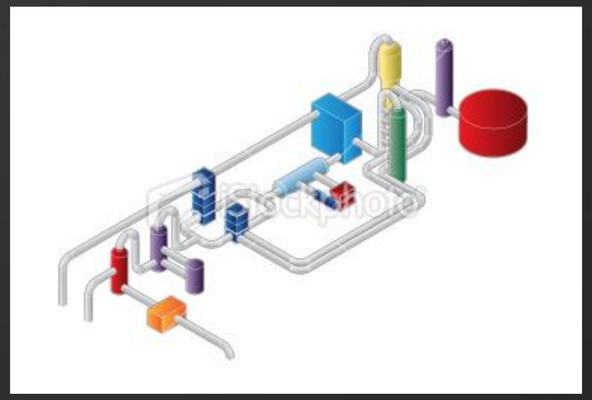
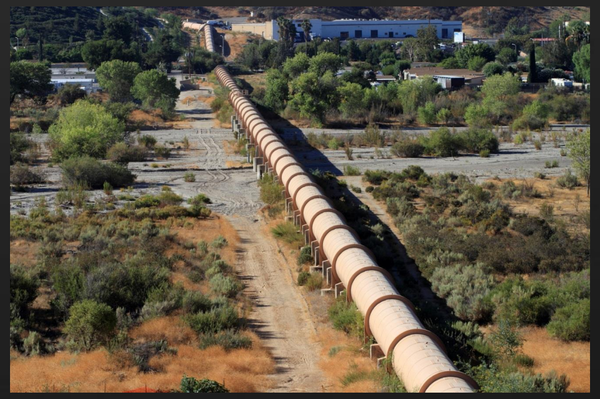
Why is this important?

- Fact: almost all private and public sector utility asset management organizations have the need to
  - Share information with contractors and stakeholders (bi-directionally)
    - Civil engineering
    - County boundaries
    - Subdivision plans
    - Regulatory reports
  - Publish specific map products for
    - Council exhibits
    - Permitting
    - Construction



Logical



Physical

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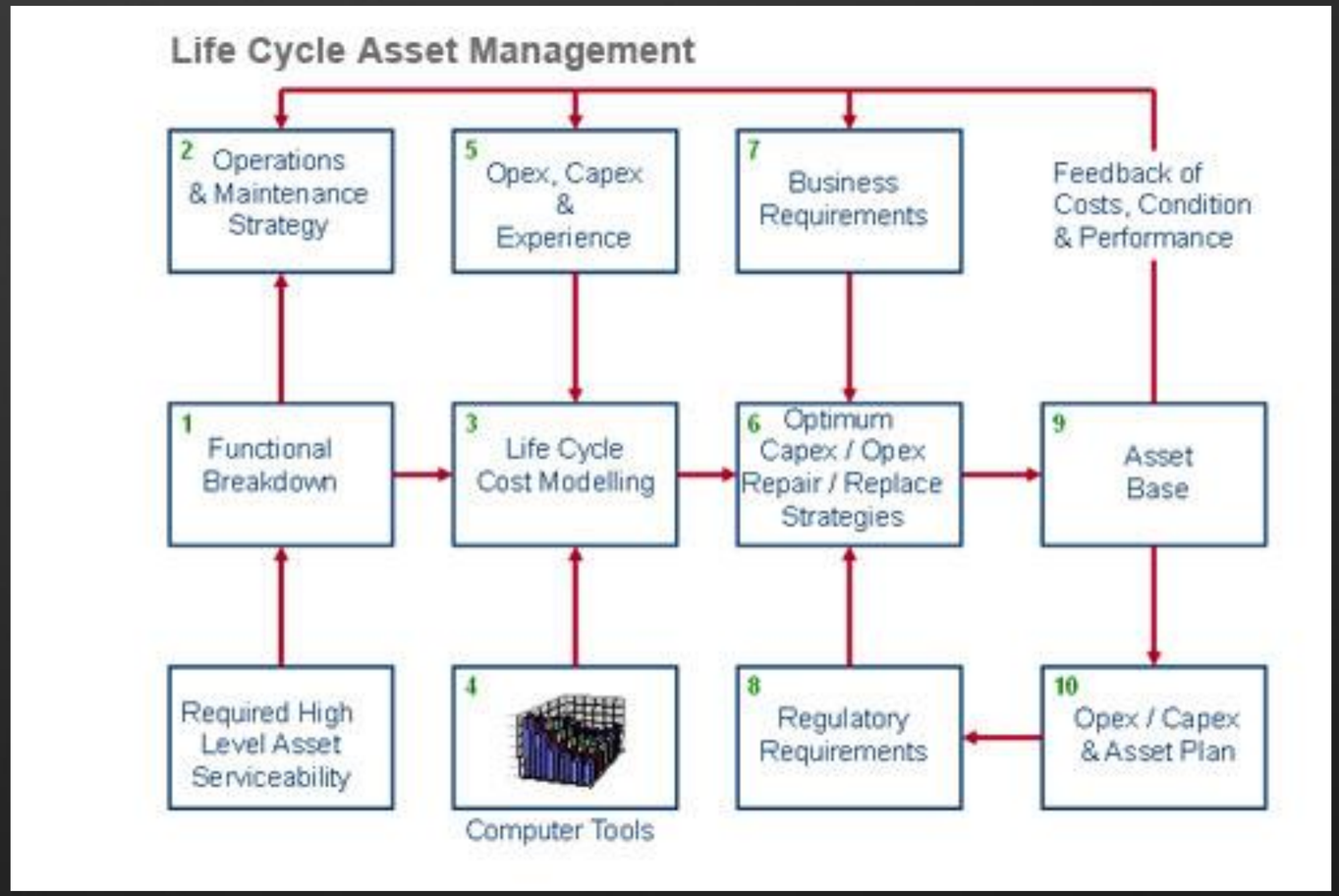
Stakeholders

- Operations
- Design
- Planning
- Public/Other agencies



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Case In Point: Large Energy Company

- TBD – NDAs not signed may have to change

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Disparate CAD Data Concepts

- Vault – file based
  - (stored in a database not of assets but of drawings of assets)
- Map (for utilities) – database driven
- Both are necessary
  - Design -> Construct -> As-built
  - Table comparing primary uses of each

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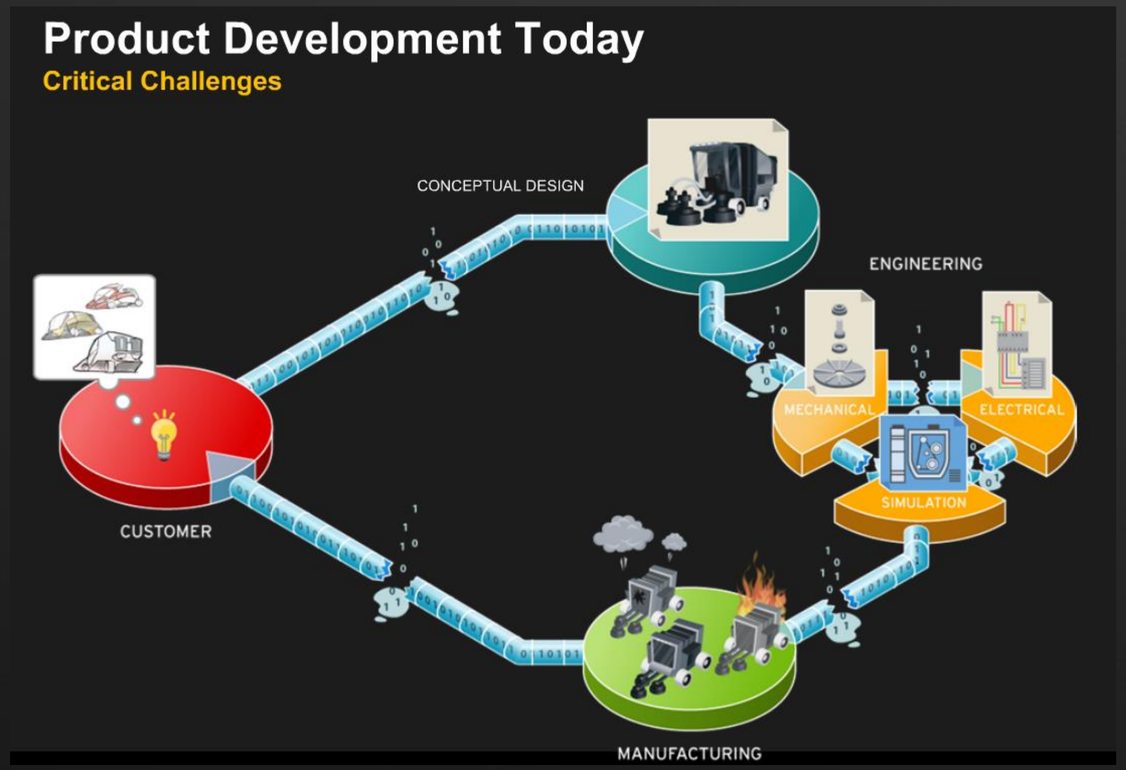
Gap Analysis of Product and Utility Lifecycles

Manufacturing



Infrastructure

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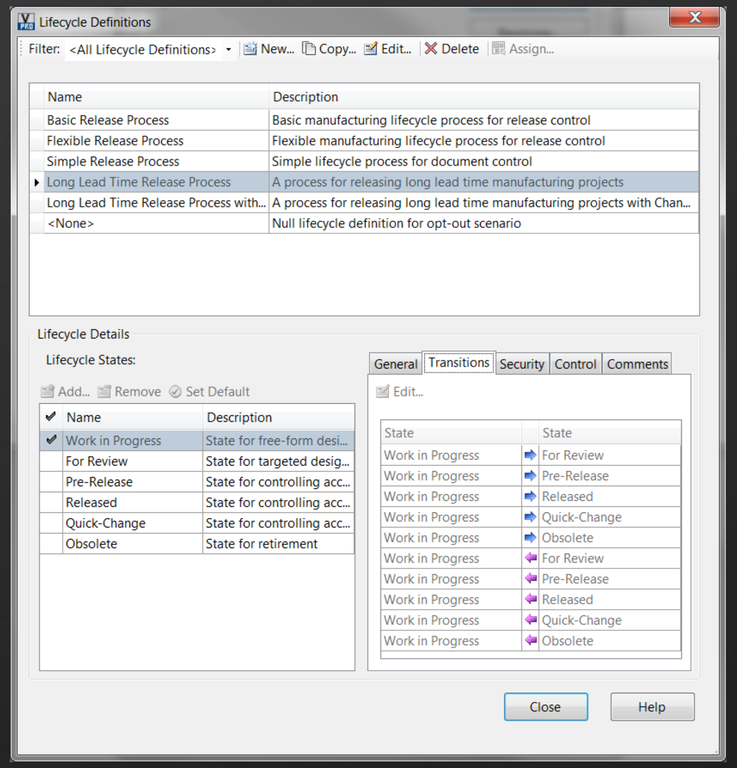
Selected Vault Capabilities for Utilities

- Secure, open document storage
  - For all documents – not just DWG files
    - Site images
    - Construction standards & documentation
    - Design components
- Project Management
  - File versioning – check-in/check-out
  - Lifecycle and revisions
  - Change Orders
- Extensive API – without this, integration is impossible



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Pre-Requisites for Success

- Round-tripping of DWG data requires identifying information for all assets in the DWG.
  - We store a registry of entity id to primary key – not reliable
- Coordinate systems must be assigned or assumed.
- If entities/features are not uniquely identifiable, DWGs must be restricted to a fixed grid.

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Seamless Database Mapping

- At the end of the day, a utility network is a single entity providing a reliable service to many thousands or millions of customers.
- Relationships between assets – over long distances – are crucial to operations.
- A utility network cannot be effectively managed in bite-sized DWG files.

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Associated documents

- Construction standards
- Site surveys
- Site images
- Legal documents
- Use existing Vault URLs to serve these as linked documents to Map

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Drawing Standards

- Only specific asset information needs to be stored in the seamless GIS database
  - Text or other annotation is generally replaced with data-driven labels
  - Paper space models are not migrated
  - A configuration file of layers and properties to be migrated is critical

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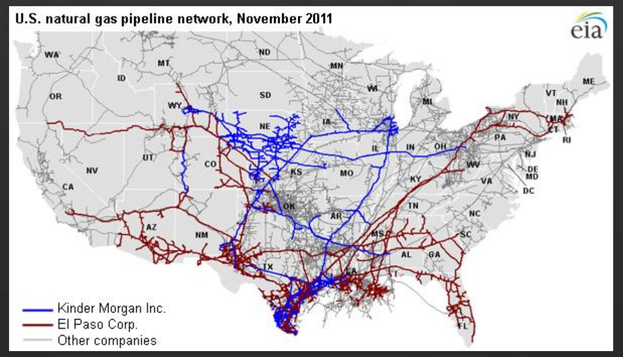
The State of Real 3D Data for Infrastructure

- 3-D visualization of a complete network is not typically appropriate



- Infrastructure Modeler is providing excellent 3-D visualization at medium scales

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Summary of Business Issues

- Not all out-of-the-box Vault processes are appropriate for Infrastructure.

- Drawings and CAD entities must be ready for feature classification
  - Geo-referenced
  - Uniquely identifiable
  - Attribute information

- Design lifecycles must be reconciled

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Part 2: Technical Architecture for a Solution

What are the key elements of an integrated solution for asset management for utilities?

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Architectural Approach

- Verify drawing quality & consistency prior to check in
  - Client side Vault API
- Reliably and concurrently process multiple DWG changes
  - Server side Vault API + Map Industry Model API
- Reconcile and synchronize job state
  - Map Industry Model API
- Secure changes for approval
  - Map Industry Model API
- Publish
  - AIMS
- Comprehensive Logging

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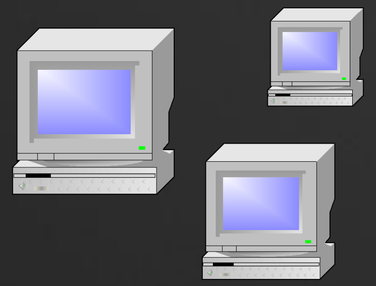
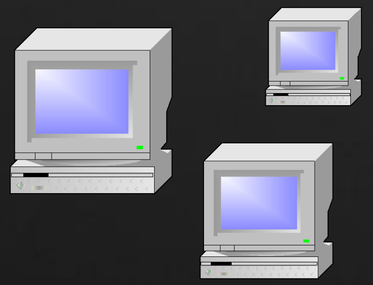
System Architecture (Physical)



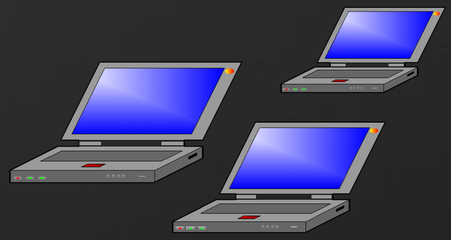
Work Order Design
AutoCAD Utility Design
AutoCAD Map 3D
AutoCAD



Workstations

Mapping, Planning
AutoCAD Map 3D

Server Environment
Vault, Oracle, AIMS
Migration & Integration



Laptops

Web & Mobile
Business Users

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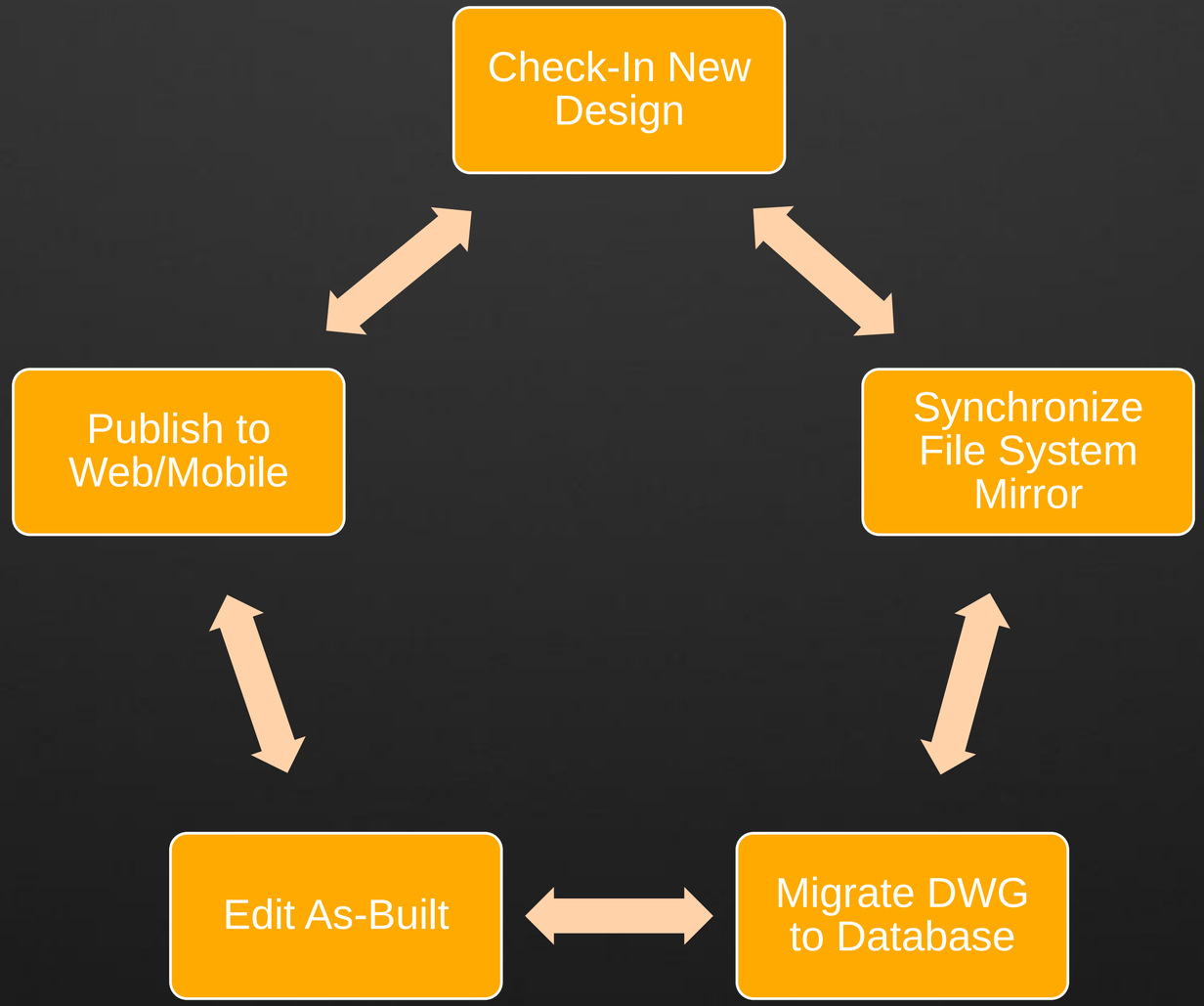
System Architecture (Logical)



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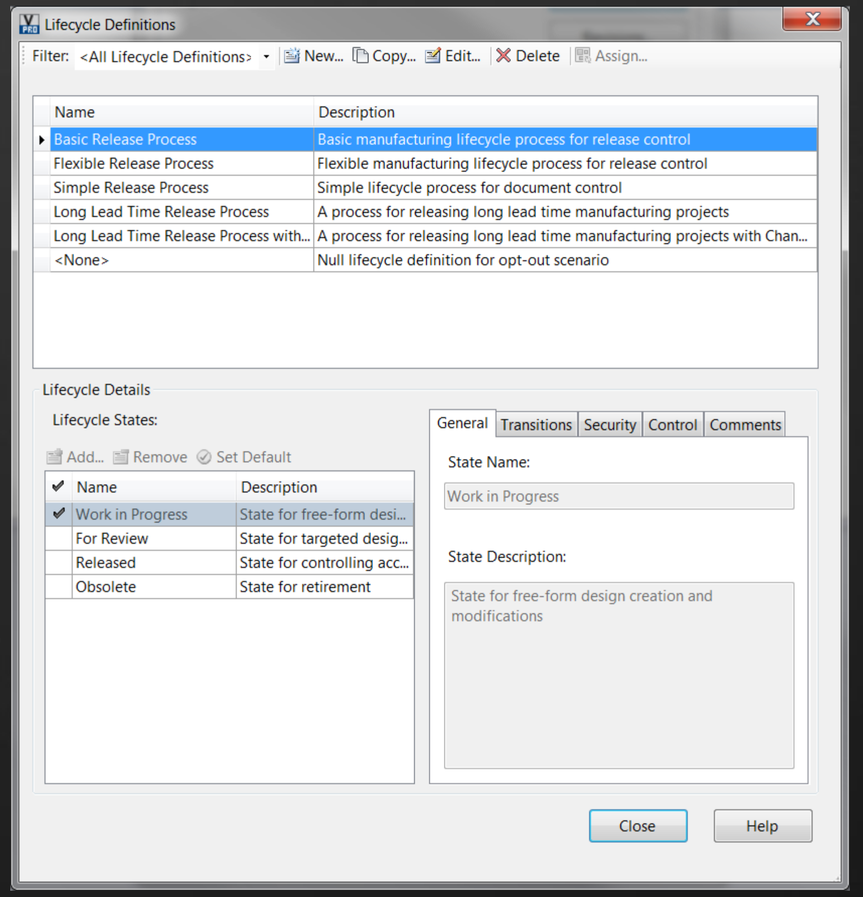
Check-In New Design
Verify Drawing Quality & Consistency

- Tied to a specific step in the lifecycle
- Is the drawing geo-referenced?
- Is the geo-referenced information reasonable?
- Does the drawing have consistent layers, object data or db-links?
- Does the drawing overlap one or more existing areas?



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Synchronize File System Mirror

- Uses Doug Redmond’s excellent sample code FullMirrorCommand class
- Runs as a Windows service
  - Periodically polls the Vault for specific state and data changes
  - Only DWGs having specific properties should be processed
- Notifies Infrastructure Model that a change is ready for processing using a simple queue

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Migrate DWG to Database

- Re-uses existing application to migrate massive amounts of DWG data to an Industry Model
- Rule-based intelligent layer-feature mappings
  - Connectivity and other relationships automatically created
- Extensive logging and error notification (allows rapid browsing and correction of either CAD entities or database features)

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Edit As-Built

- Depending on lifecycle integration can be done with CAD or with Infrastructure Model in Map
  - Caution: logical topology and attribute consistency depend entirely on rules that are sensitive to drafting and data quality
  - Best Practice recommendation: edit in Map
    - Requires reverse engineering of CAD changes

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Publish to Web/Mobile

- Automatic as part of the Infrastructure Model
  - There is only ONE industry model
- As soon as the changes are promoted to the life (as-built) state, they are available to web/mobile users
- Mobile users can have local storage and sync on demand

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Why Oracle

- Map Infrastructure Models
- Unmatched scalability
- Functionality for spatial analysis
- Long transactions
- Other databases will be possible to integrate as spatial capabilities and long transaction capabilities evolve

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Bi-Directional Requirements

- Reverse Map database feature -> drawing
  - Requires drawing provenance
  - Reverse rules
  - Avoid recursive updates (i.e. do not process a DWG update you made from the database)

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Security Models

- Need seamless credentials across the applications
- Important for securing asset information and protecting design, workflow process integrity

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Part 3: Prototype Demonstration

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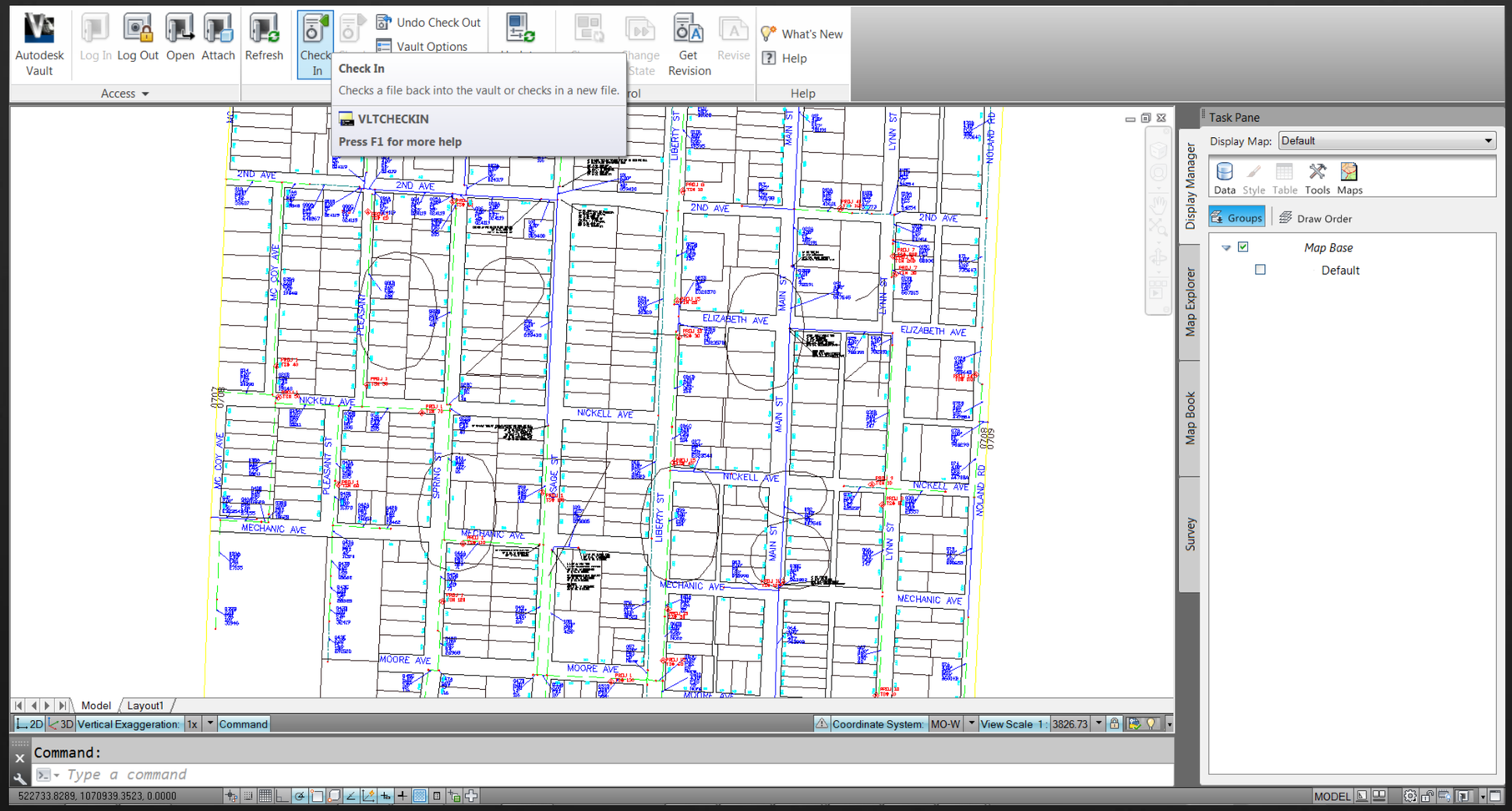
Step 1: Check in a drawing



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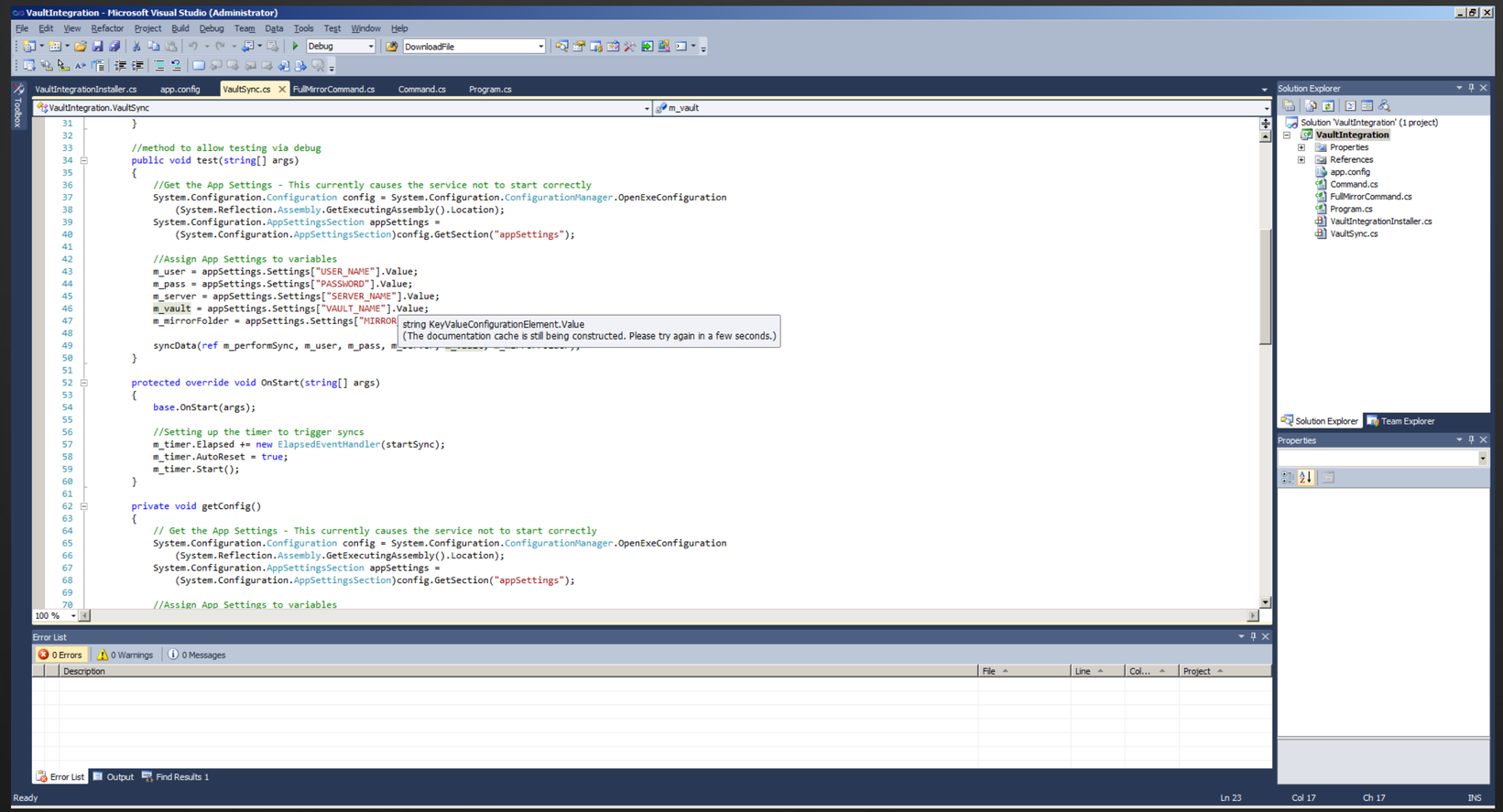
Step 2: Synchronize the file system mirror



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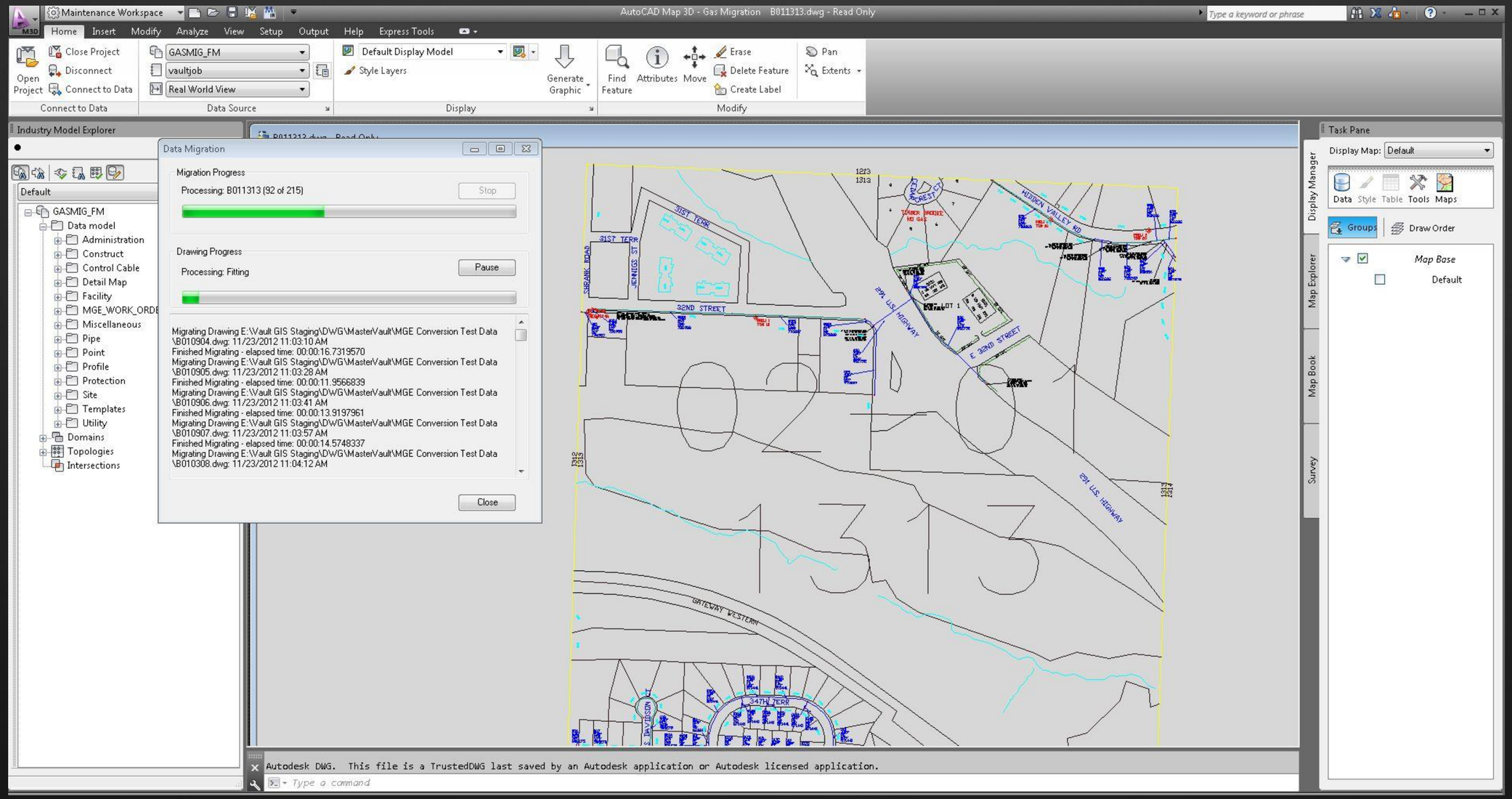
Step 3: Migrate the drawing



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Step 4: Visualize the data

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