Model driven GIS solution architecture using UML

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Presentation Goals

- Demonstrate how UML-based project development can:
  - Increase Productivity
  - Manage Complexity
  - Promote Component re-use
  - Automate Code Generation
  - Facilitate Geodatabase creation

- Via
  - Introduction to UML concepts
  - Walkthrough project example
  - Reference to additional resources
What is UML?

- **Unified Modeling Language**
  - Unified
    - OMG-backed industry standard
  - Modeling
    - Abstraction and Views
    - Manage Complexity
  - Language
    - Communicating the model
    - Graphics + Attributes
13 UML Diagram Types – Behavioral / Structural

**Behavioral**
- How the system will act in real-world use

**Diagrams**
- Use Case **
- Activity **
- State Machine
- Interaction:
  - Sequence
  - Communication
  - Timing
  - Overview

**Structural**
- Static architecture of the system

**Diagrams**
- Class **
- Object
- Package
- Composite Structure
- Component **
- Deployment **
UML Level of Detail

- Sketch
- Blueprint
- Programming Language

To accommodate chosen SDLC methodology:
- Agile
- Waterfall
- Iterative
Kruchten 4 + 1 View Model

MDA
• Model
• Driven
• Architecture

Kruchten, Philippe: Architectural Blueprints – The ‘4+1’ View Model of Software Architecture
Use Cases

- Actors
- SuD
- As-is vs To-be
- Use Case Scenarios
- ➔ Requirements
Requirements Traceability
Process View
GTI Inspection System

Requirements Document

Version 1.0 • Proposed

Report Date: 7/2/2015
Author: [Signature]

EA Repository: C:sers\pauri\Documents\2_Events_TR\Conference_20150720_EurUC\EurUC2015.mpp
CREATED WITH ENTERPRISE ARCHITECT
Store these user-defined values in an application configuration file that is loaded into program variables during program start-up and initialization. (e.g., app.config in C#)

Each XLSFilterElement Object can have one or more XLSFilterParameter objects when the FilterType is specified. If no FilterType is specified, then there are zero associated XLSFilterParameter objects.

This representation is meant to convey that XLSRetrieveRun will contain an ArrayList of XLSFilterElement objects. It is also important that XLSFilterElement objects in the array maintain their row listing order from the source spreadsheet.
Development View – Component Model

cmp Excel Add-in - Component Diagram

XLSExceldAddIn

XLSExceldRibbon

<executable>
XLSExceldAddIn.DLL

XLSExceldRetrieveButton

<manifest>

XLSFilterRetrieve

IXLSRetrieveRun, IXLSSetupConfig

Invoke record retrieval
(from Requirements - In-house Decision Support)
Deployment Artifacts - Traceability

- Support offline caching
  (from Requirements - Construction Inspections)
- Capture picture(s) of observations
  (from Requirements - Construction Inspections)
- Collect Geolocation by Observation Type
  (from Requirements - Construction Inspections)
- Real-time location of ongoing Construction / Inspections
  (from Requirements - In-house Decision Support)

- Map locations by Date Range
  (from Requirements - In-house Decision Support)
- Map locations by Inspector(s)
  (from Requirements - In-house Decision Support)
- Map Locations by Contractor
  (from Requirements - In-house Decision Support)
- Mark locations by Compliance / Non-compliance
  (from Requirements - In-house Decision Support)
Logical View – Geodatabase generation

ArcGIS GTIISFeatures

«Point»
Construction_Site

+ Audit_Number: esriFieldTypeString
+ Work_Order_number: esriFieldTypeString
+ Auditors_name: esriFieldTypeString
+ Audit_Date: esriFieldTypeDate
+ Contractor: esriFieldTypeString
+ Foreman: esriFieldTypeString
+ Work_Crew: esriFieldTypeString
+ Comments: esriFieldTypeString
+ cSID: esriFieldTypeGlobalID
+ CS_Created_By: esriFieldTypeString
+ CS_Date_Created: esriFieldTypeDate
+ CS_Last_Update_By: esriFieldTypeString
+ CS_Last_Updated: esriFieldTypeDate
+ Station: x1sStations

Support different inspection attributes per observation type
(from Requirements - Construction inspections)

CS_Installation
«RelationshipClass»

+Installation

«Point»
Installation

e.tc. for remaining feature classes
Model Transformation – Geodatabase

1. Export Workspace XML from UML model

2. Import Workspace XML into empty GDB using ArcCatalog
Model Transformation – PIM → PSM

The diagram shows a model transformation from PIM (Platform Independent Model) to PSM (Platform Specific Model). The transformation involves mapping elements from the PIM model to corresponding elements in the PSM model.

- **XLSTransferRunnable**
  - Related to the configuration of XLSTransferRunnable.

- **XLSTransferRunnableConfig**
  - Contains elements like `XLSTransferRunnableConfig.Location`.

- **XLSTransferRunnableRun**
  - Includes methods like `Initialize`, `RetrieveRows`, and `LogMessages`.

The transformation process can be customized through a configuration dialog, allowing users to select which elements to transform and the target package. This dialog provides options for different programming languages such as C#, C++, VB.Net, PHP, DDL, EJB Entity, EJB Session, Java, and NUnit.
Code Generation from PSM

1. Transform

2. Generate Code
using System;
using System.Collections.Generic;
using System.Text;
using System.IO;

using XLSFilterRetrieve;

namespace XLSFilterRetrieve
{
    public class XLSRetrieveRun
    {
        /// <summary>
        /// Implementation of the Class XLSRetrieveRun
        /// Generated by Enterprise Architect
        /// Created on: 03-Jul-2015 8:29:07 AM
        /// Original author: puuir
        /// //</summary>

        // Capture the username of the retrieval operator
        private string PerformedBy;

        // Save a copy of the app.config settings used to execute this retrieval
        private XLSRetrieveConfig RetrieveConfig;

        // Timestamp that is captured when the CCM record retrieval operation is submitted
        // for execution.
        private DateTime RetrieveTimeStamp;

        // A copy of the SQL Select Statement that was generated from the supplied filter
        // and retrieval criteria and submitted to the CCM Source Database for execution.
        private string SelectStatementExecuted;

        // Count of actual rows returned using the filter and retrieval criteria specified
        // by the other properties of this class at the time of object execution.
        private int TotalRowsReturned;

        private XLSFilterRetrieve.XLSRetrieveConfig IsContainer;
        private XLSFilterRetrieve.XLSFilterElement XLSFilterElement;
End Product
End Product
End Product

1. User-configured Filter and retrieve criteria

2. Invoke Custom Add-in

3. Retrieve Results from GDB
From Here

- Level of Detail revisited
- Additional Diagrams
- System Specification Documentation
  - Word/PDF, or HTML
- Team Assignments
Resources

Books
• Learning UML, Miles & Hamilton
  • O’Reilly, ISBN 9780596009823
• Writing Effective Use Cases, Cockburn
  • Addison-Wesley, ISBN 9780201702255

Web
• Object Management Group
  • http://www.omg.org

Software Tools
• Sparx Systems Enterprise Architect
  • http://www.sparxsystems.com/arcgis/index.html

Generating the ArcGIS Pipeline Data Model (APDM) documentation
• Webinar recording Pt. 1
• Webinar recording Pt. 2
Thank You

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