MagicDraw SysML Publisher for Rhapsody

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Introduction

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The Challenge

- What do you do when your customer imposes a requirement with implementation details?
  - In this example our customer is requiring Raytheon to use Magic Draw
  - The program’s engineers are fully trained and most efficient with Rhapsody

The Contractor shall design the integrated system model using MagicDraw, as listed in Table 1. The Contractor shall develop and provide the integrated system model to the Government in a format compatible with the MagicDraw tool suite. The Contractor shall develop the integrated system model such that it can be exported in open-standard formats, such as the Physical Exchange Schema (PES) or Extensible Modeling Language (XML), in such a way that the model can be shared between various modeling tools without the loss of data. (CDRL D009)*

*From Section see of a Navy RFP awarded to RTN in 2018

Allow the engineering team to use their most effective tools
Raytheon’s MBSE Process at a glance

- RTN convinced the customer to allow us to use their most effective SysML modeling tool **BUT** still had to deliver in MD format
- Using Rhapsody, RTN can effectively implement this process.

How can RTN make periodic SysML Model deliveries while:
A. Maintaining the same data integrity?
B. Not add extra time to the development process.
Historical – Tool Integration

• For nearly 20 years SODIUS has been providing data connectivity and transformation tools.
  – Providing OEMs products (IBM, NoMagic, Ansys, Jama, etc.)
  – For many large organizations, we support both tool connectors DOORS, UML, SA, MEGA, MATLAB Simulink, RTC, DNG, Jama, PTC Integrity, etc. and custom integrations

• Tool Integrations/Connectors are valuable for
  – Format Migration
  – Reference/Data exchange
  – Publishing/Export
  – Single user/transformation flow

The value of integrations has been focused on the ability to exchange/translate information from one format to another. These transformations are almost always in the same domain.
One Tool. Two Use Cases.

**Migration**

You need to move your data out of Rhapsody and want to further develop in MagicDraw

- Used for tools, process, and methods
- Objective is to minimize manual work of moving data
- Often desire additional changes
- Manual updates due to inconsistency in input is okay
- Action occurs once

**Publish**

You want to maintain knowledge base in Rhapsody but deliver to a customer to integrate in MagicDraw

- Used for different tool/tool version access
- Objective is to have no manual work for moving data
- Wants the same form and function but in a different tool
- No supports for inconsistency in input via manual updates
- Action occurs many times
Beyond the scope of XMI

- Variance in tool capabilities
- Variance in interpretation of the standards
- Variance of openness of tools
- Automatic features in tools (resizing)
- Stylistic changes in tools
- Variances in expectations from Author to the Consumer
  - Do you want it to look like the source or how it would have been created in the target tool?
- Quality of input
Data types are covered by the publisher

- Model elements
- All SysML diagrams including positioning and layout
- SysML profiled elements
- User-defined profiles
Functions Provided By the Publisher

• Model Element transformations.
• SysML Diagram Transformations maintaining layout
• Easy License Management.
• Auto Population of the transformation source with the open Rhapsody Project.
• User defined publish location and naming.
• User feedback during publish with a progress view.
• Environment compatibility warnings with guided user interface for configuration issues.
• Logging both positive and negative actions.
Package Diagrams
Use Case Diagrams
Requirements Diagram

- **Requirement:** Source: Original Statement - Purify Water
  - ID = 51.0
  - The system shall purify dirty water.

- **Requirement:** Source: Original Statement - Boiler
  - ID = 53.0
  - Boil dirty water is performed by a Boiler.

- **Use Case:** Operate Distiller
- **Block:** Structure: Boiler
- **Behavior:** Boil Water

- **Requirement:** Source: Original Statement - Boiler
  - Id = "S3.0"
  - Text = "Boil dirty water is performed by a Boiler."

- **Requirement:** Source: Original Statement - Counter Flow Heat Exchanger
  - - Heat dirty water and condense steam are performed by a Counter Flow Heat Exchanger.
  - - Boil dirty water is performed by a Boiler.
  - - Drain residue is performed by a Drain
  - The water has properties...

- **Activity:** Boil Water
  - **satisfies**
    - **block:** Boiler Structure
    - **activity:** Boil Water Behavior
Activity Diagrams
Statecharts
Block Definition Diagram
Internal Block Diagram
Parametric Diagrams
Results

Achieving full Rhapsody Model Conversion with the push of a button

- Model Data Integrity is maintained
- Conversion on a 18,603 element model takes less than 35 mins! (Walk away and go have a coffee)
  - 6 UCDs (57 Use Cases)
  - 28 BDDs (198 Blocks)
  - 24 IBFs (179 Ports)
  - 159 ACTs (238 Operations)
  - 52 SDs (228 Event Receptions)
  - 38 STMs (160 States)
- Only post processing required: Add diagram frame to ACTs, SDs and STMs (Takes less then 10 mins)
- Caveat: Tables/Matrices do not convert over yet.
Results

BDD Conversion Example
Results

IBD Conversion Example
Creating a Successful Workflow

• Target a specific profile (SysML) to limit artifacts
• Target specific modeling guidelines to maximize the quality of the input
• Optimize for your team’s workflows
  – Consistency
  – Known Good Behaviors
  – Elements of highest Use
  – Teach users what to expect
  – Default rules for good presentation in target tools
• Measure success with your users