Viewpoint Modeling and Model Based Media Generation for Systems Engineers

Document Generation and Scalable Model Based Engineering

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Outline

• Docgen at JPL and Across Industry

• Communication
  – Models and Views
  – Methods and Analysis
  – View Models and Linearization of the Story
  – Libraries and Reusability

• Viewpoint as an Architecture for a Scalable Model Based Engineering Environment
Modeling and Document Generation at JPL

• Developed on the Multimission Ground Systems and Services Ops Revitalization Task
  – Based on previous MBSE pilots at JPL
  – 200 users
  – ~20 projects and tasks
  – Removes barrier to using models in real engineering products
Efforts Across Industry

• ESO Open Source Docgen
• JPL MBEE (Docgen, Docweb, View Editor, System Database)
• Lockheed Martin Document Generator
• Atos Gendoc
Common Features Across Industry

• A need to communicate with stakeholders
  – According to terms of the stakeholders

• Variety of representations

• Edit the Model Information through multiple UI
  – Views at the stakeholder level

• Enterprise integration of multiple applications and modeling tools
  – Views that facilitate integration between applications
Communication as a Principle

• Communicating through understanding point of view
  – Understanding the Point of View of Stakeholders
    • Concerns
  – Describing the model from that Point of View
    • Identifying parts of the model that address concerns
  – Telling the story of the Views
    • Linearization of the Views of the Model
Engineer

“The glass is twice as big as it needs to be”
Building the Viewpoint Model

- Viewpoint Model
  - Purpose informed by Stakeholder Concerns
  - Methods and Analysis for constructing the View from the Model
  - Presentation Rules
Method and Analysis

- Methods
  - Ordered steps for producing the View

- Analysis
  - Describe the nature of queries of the model
  - Analytical assertions
  - Rules for completeness and consistency

- Format and Presentation Style
  - Describe the conventions styles and formats for how the information is presented in the View
Viewpoint and View
Viewpoints

- Power from the point of view of:
  - Scenarios of component states
  - Components and properties and behavior
  - Power Load Profiles
  - Flight System Power
Views of Models

- Component Power Load Profile
- Specific Plot of a Power Load Profile
- Flight System Power Values
- Table of Flight System Power

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<th>Number of Units</th>
<th>Cruise State</th>
<th>Cruise Duration [%]</th>
<th>Steady-State Power CBE [W]</th>
<th>Contingency</th>
<th>Steady-State Power MEV [W]</th>
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Simple Spacecraft Diagram Views

- **Star Tracker**: Component Properties and Behavior
- **Battery**, **Computer**, **Antenna**, **Thrusters**
- **Flight Scenario**: Interaction
  - Star Tracker : Star Tracker
  - On: {3 hours..4 hours}
  - Off: {3 hours..4 hours}
  - Star Tracker Power: W
  - Power Over Time = On.Power On Value
  - Star Tracker Power = Off.Power Off Value
  - Synch all time variables

- **Spacecraft Star tracker Behavior**
- **SysML IBD**
- **Power Load Scenario**
  - Specific Component properties and Behavior
  - On : Power On State Value
  - Off : Power Off State Value

- **assert**
  - [Synch all time variables]
Linearizing the Views

- Model of Views
  - Story of Views
  - Outline of Views
  - Template Outline of Viewpoints
Operations Processes and Checklists

- **Training View Models**
  - Layered Story through process
  - Understand bigger picture down to smallest detail

- **Checklist Views**
  - Single thread through entire process
  - Layout the clean step-by-step
  - Minimum amount of information to do the job
Libraries

- **Viewpoints**
  - Collections of standard representations

- **Methods**
  - Reusable methods for producing different models and representations used in Views

- **Analyses**
  - Libraries of model analyses, queries and rules for checking models

- **Presentation Styles**
  - Styles for presenting models and data such as colors, layout schemes, and conventions

- **Format**
  - Models for formatting information such as Docbook, Office Schemas and modeling languages
Software Environment for MBSE

• Model Based Engineering Environment
  – An environment for developing mutually correspondent and consistent engineering models

• Engineering Modeling Information Systems
  – A class of Information Systems design to enable the development of engineering models
Information Rendered According to Viewpoints

- Domain Specific Modeling Applications
  - CAD (Mechanical, Electrical etc)
  - Software Design (UML etc)
  - MBSE (SysML etc)
  - Analysis (Analytic, Simulation, spreadsheet)

- Viewpoints For Domain specific Apps
- Web-editable Viewpoints
- Document and Report Generation
  - Final products rendered according to Viewpoints and Models
Generating Reports from Models

- Model, Viewpoints and View Models

- Model transformation from SysML to Documents (HTML, PDF etc)

- Reports output using styles and formats specified in the method
Conclusions

• MBSE Success has a strong dependence on the capability to communicate with stakeholders and system implementers.
  – SysML provides the basic semantics to model and generate these artifacts
  – Use of web applications can provide an accessible mechanism for interacting and data collection from stakeholders
  – Model based document generation from View models puts the value of models into the work products systems engineers must deliver.
  – A scalable enterprise for modeling is feasible built around the concept of view point and view.
Backup