

Viewpoint Modeling and Model Based Media Generation for Systems Engineers

Document Generation and Scalable Model
Based Engineering

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Outline

- 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

Efforts Across Industry

- ESO Open Source Docgen
- JPL MBEE (Docgen, Docweb, View Editor, SysML Database)
- Lockheed Martin Document Generator
- Atos Gendoc

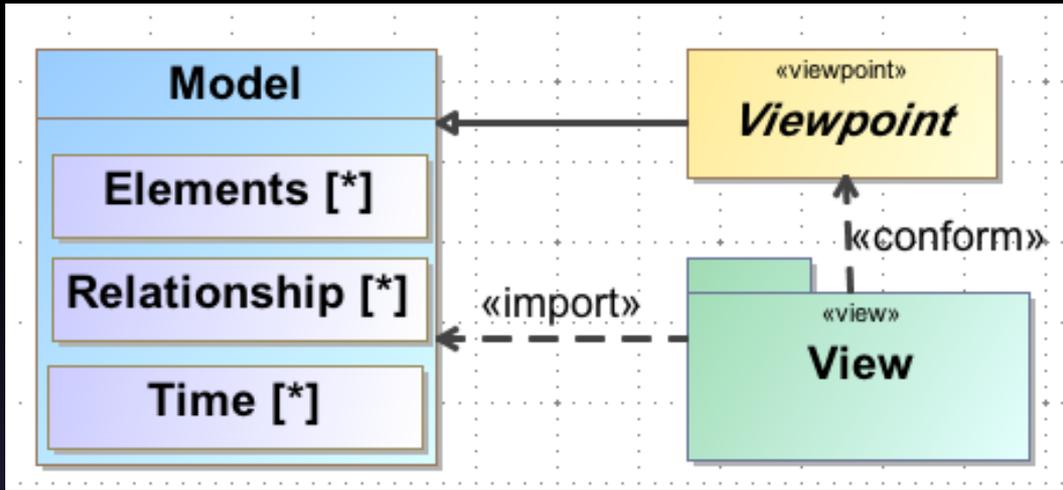
Common Features Across Industry

- A need to communicate with stakeholders
 - According to terms of the stakeholders
- Variety of representations
- Edit the Model Information through multiple UI
- Enterprise integration of multiple applications and modeling tools

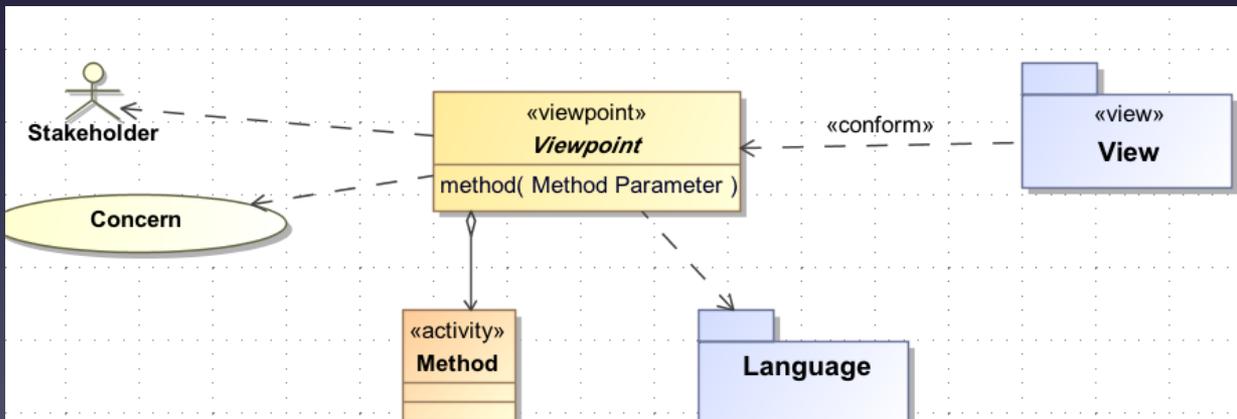
Communication as a Principle

- 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

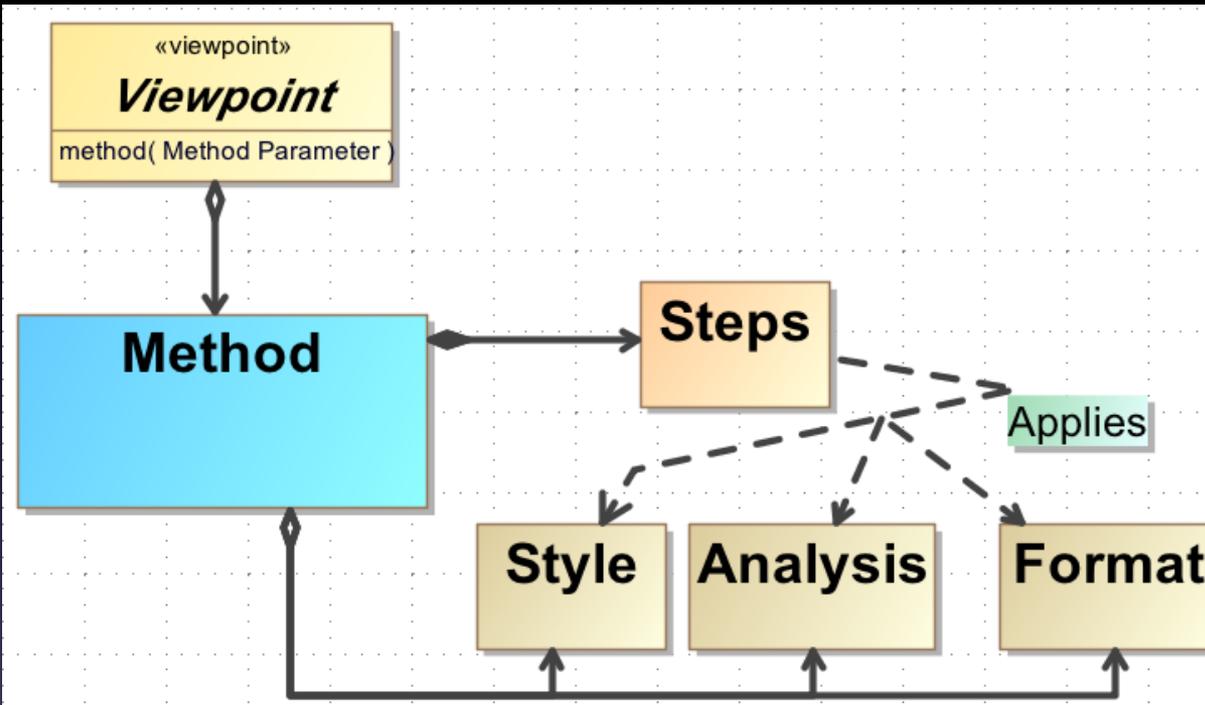
Building the Viewpoint Model



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

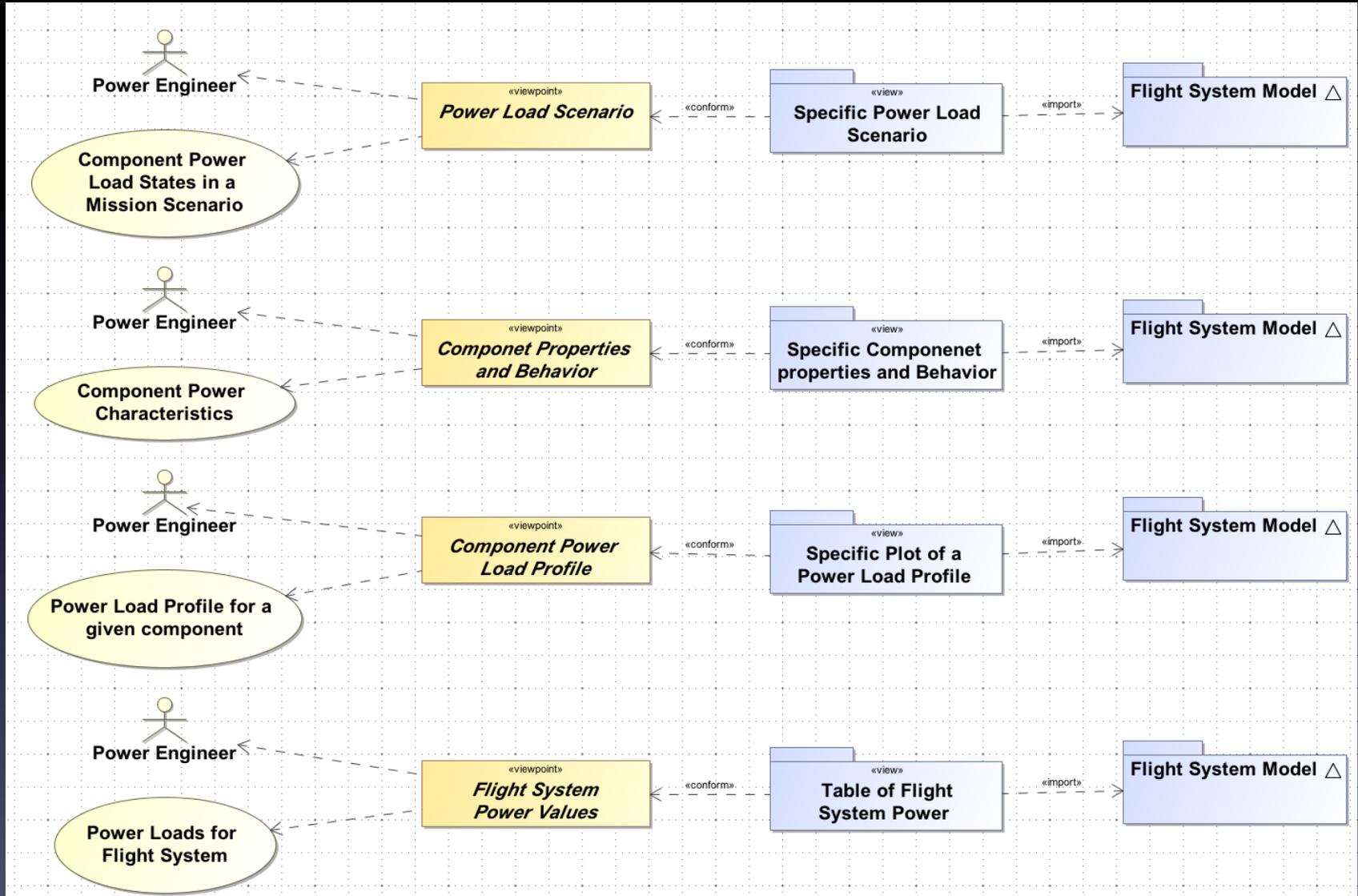


Method and Analysis



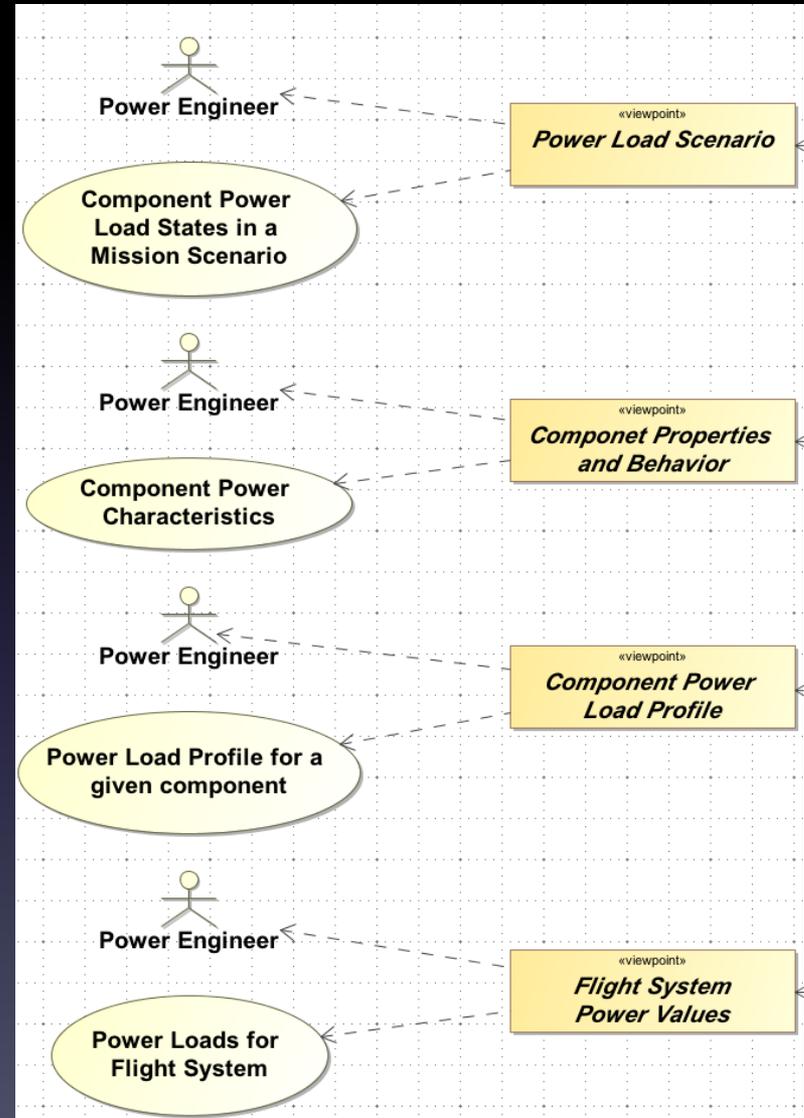
- **Methods**
 - Ordered steps for producing the View
- **Analysis**
 - describe the nature of queries of the model
 - Analytical assertions
 - Rules for completeness and consistency
- **Format and Presentation Style**
 - Describe the conventions styles and formats for how the information is presented in the View

Viewpoint and View

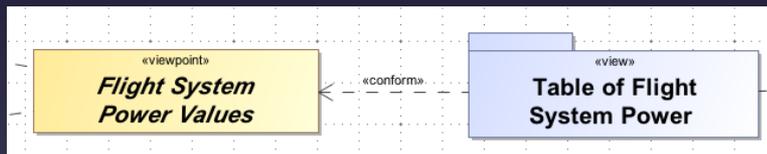
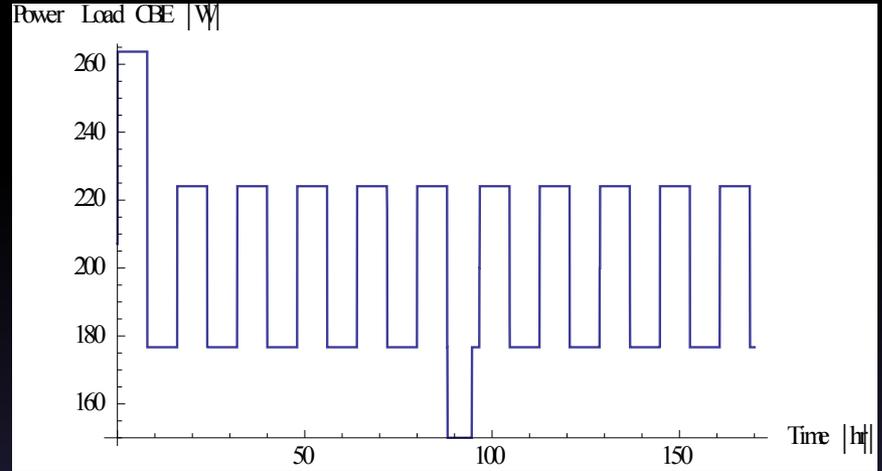
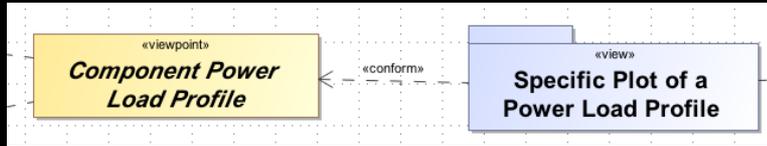


Viewpoints

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

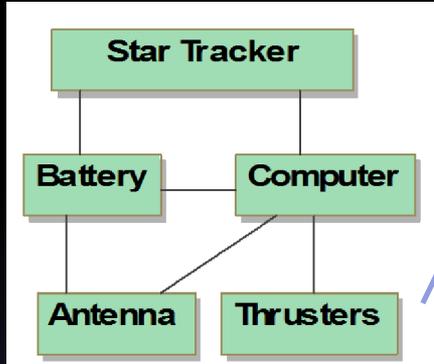


Views of Models

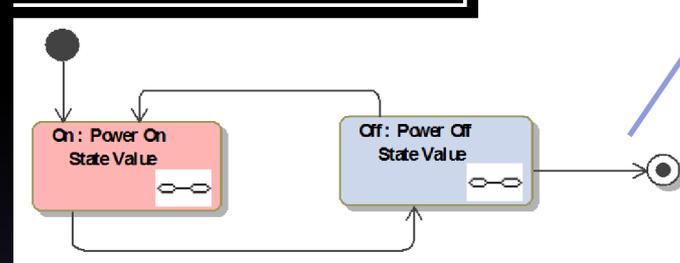
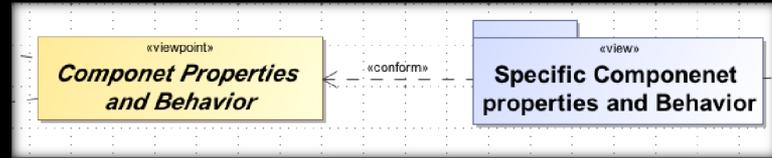


	Workpackage	Product	Number of Units	Cruise				
				State	Duration [%]	Steady-State Power CBE [W]	Contingency	Steady-State Power MEV [W]
1	00 Europa Habitability Mission Project					77	0.3	100.1
2	05 Payload System					0	0	0
3	06 Spacecraft System					77	0.3	100.1
4	06.06 Telecom SS					64	0.3	83.2
5				Off, On		64	0.3	83.2
6		TWTA (TWTA)	1	Off	20.0%	0	0.3	0
7				On	80.0%	80	0.3	104
8	06.07 Mechanical SS					8	0.3	10.4
9		SDST (SDST-A)	1	Standby		4	0.3	5.2
10		SDST (SDST-B)	1	Standby		4	0.3	5.2
11	06.10 GN & C SS					5	0.3	6.5
12		Reaction Wheel (RWA)	1	Low Speed		5	0.3	6.5

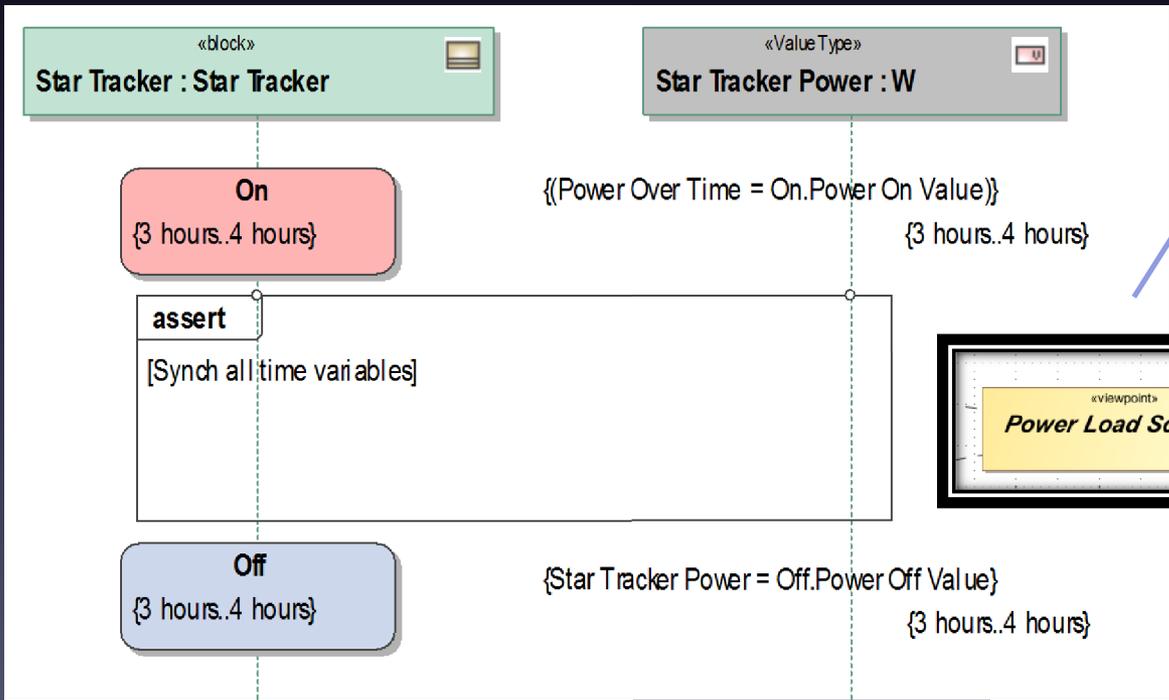
Simple Spacecraft Diagram Views



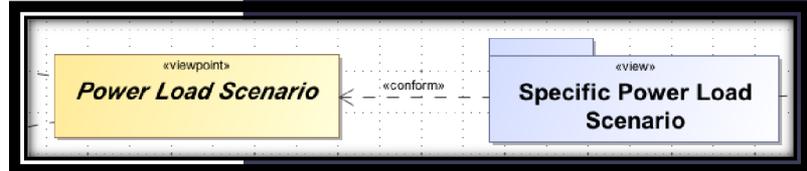
Spacecraft SysML IBD



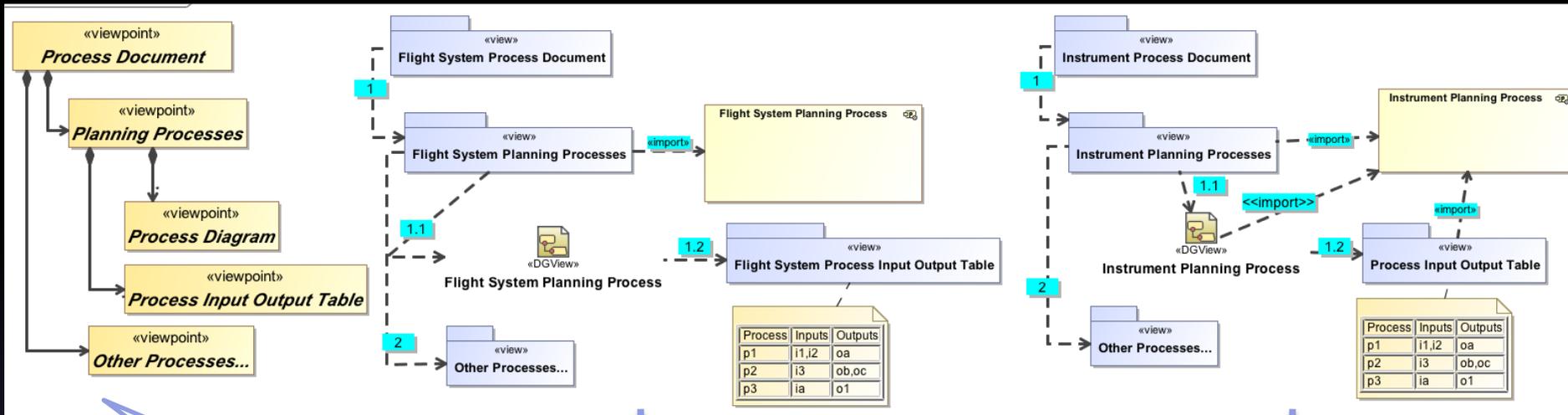
Spacecraft Star tracker Behavior



Star Tracker Behavior Scenario



Linearizing the Views



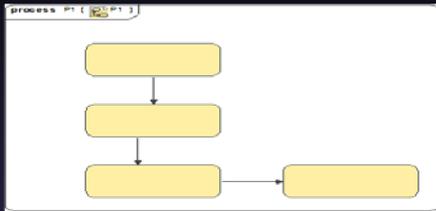
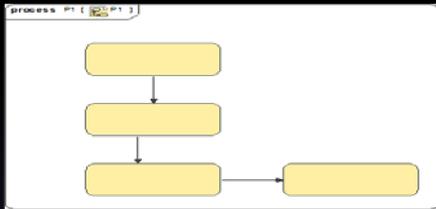
“Template”
Outline of
Viewpoints

2 Model Outlines of
Views based on the
same Viewpoint
Template

- Model of Views
 - Story of Views
 - Outline of Views
 - Template Outline of Viewpoints

Operations Processes and Checklists

Training Document

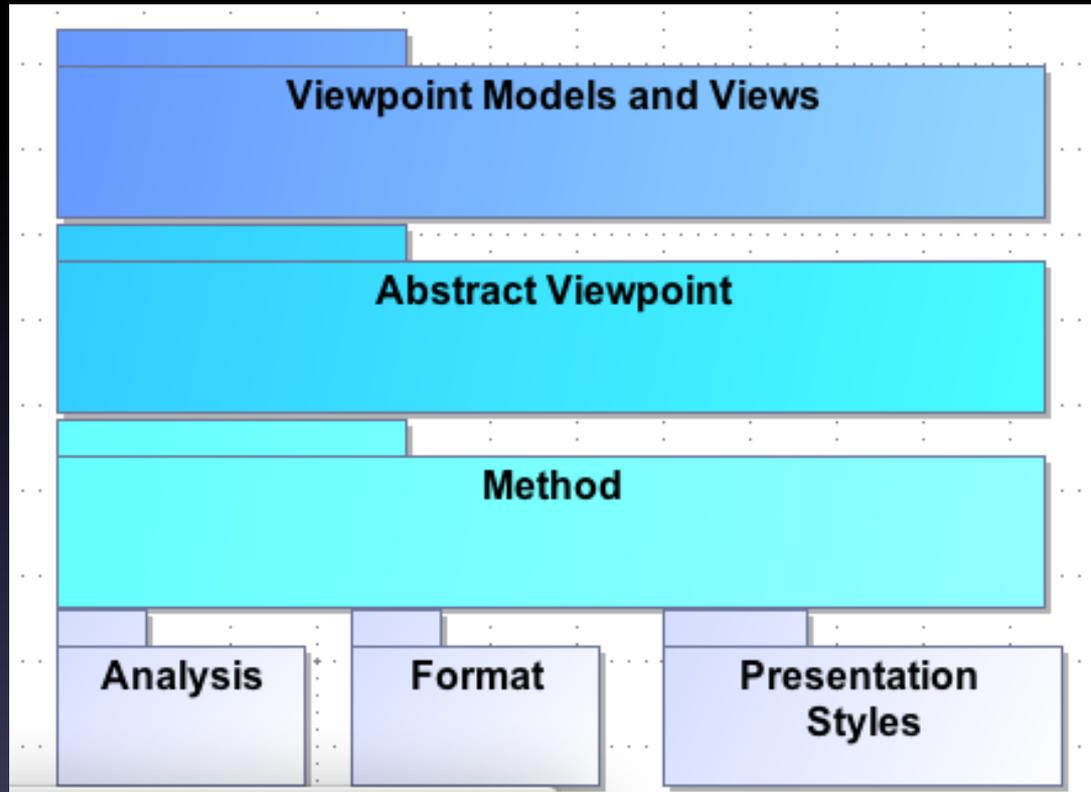


Operational Checklist

1. Step 1
2. Step 2
 1. Sub Step 1
 2. Sub Step 2

- 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

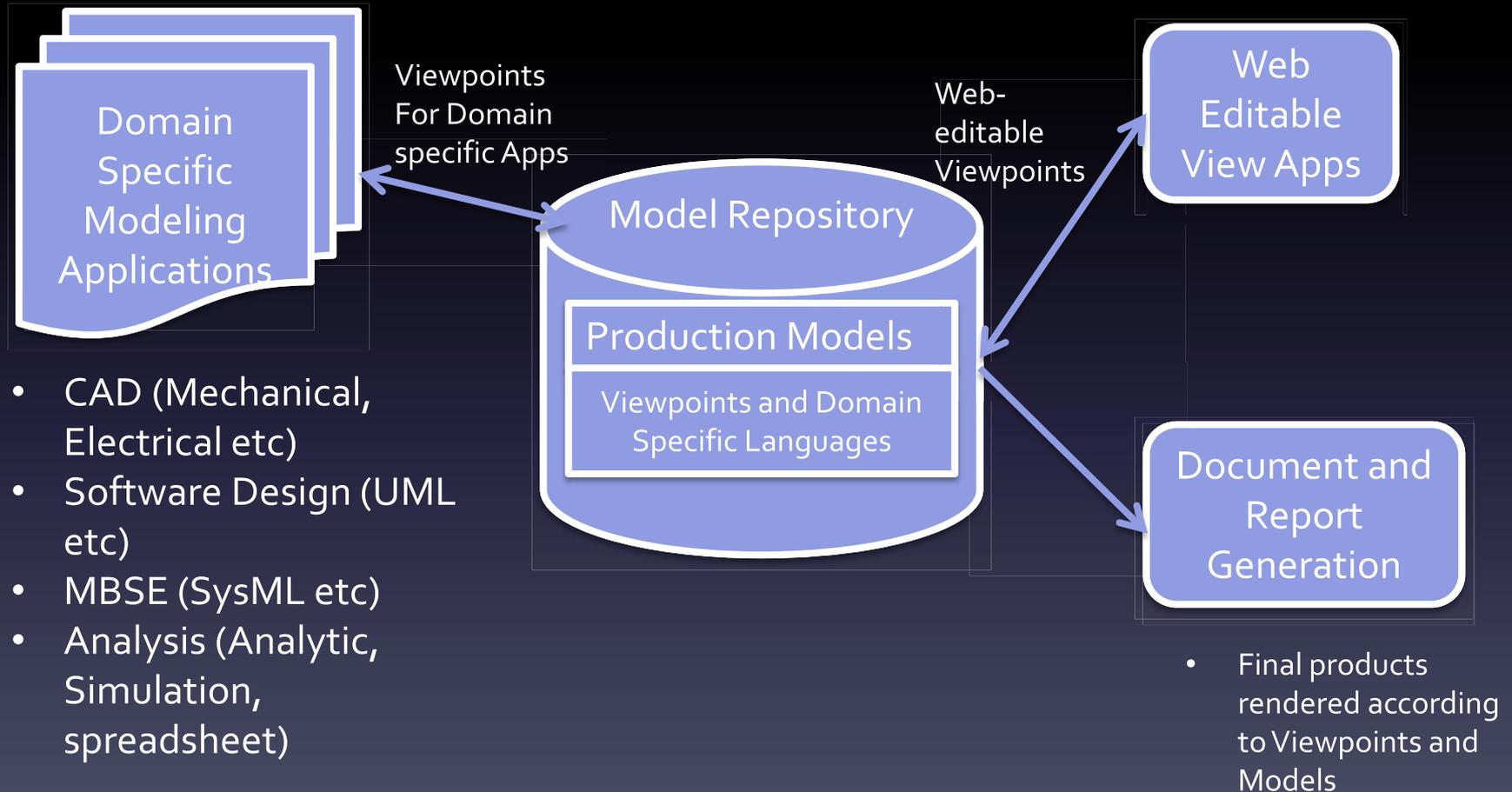


- Viewpoints
 - Collections of standard representations
- Methods
 - Reusable methods for producing different models and representations used in Views
- Analyses
 - Libraries of model analyses, queries and rules for checking models
- Presentation Styles
 - Styles for presenting models and data such as colors, layout schemes, and conventions
- Format
 - Models for formatting information such as Docbook, Office Schemas and modeling languages

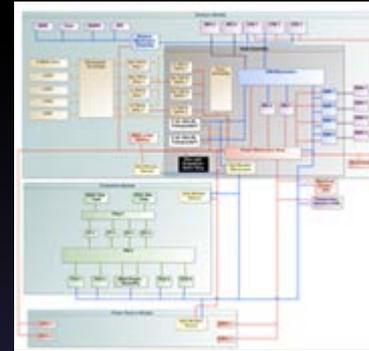
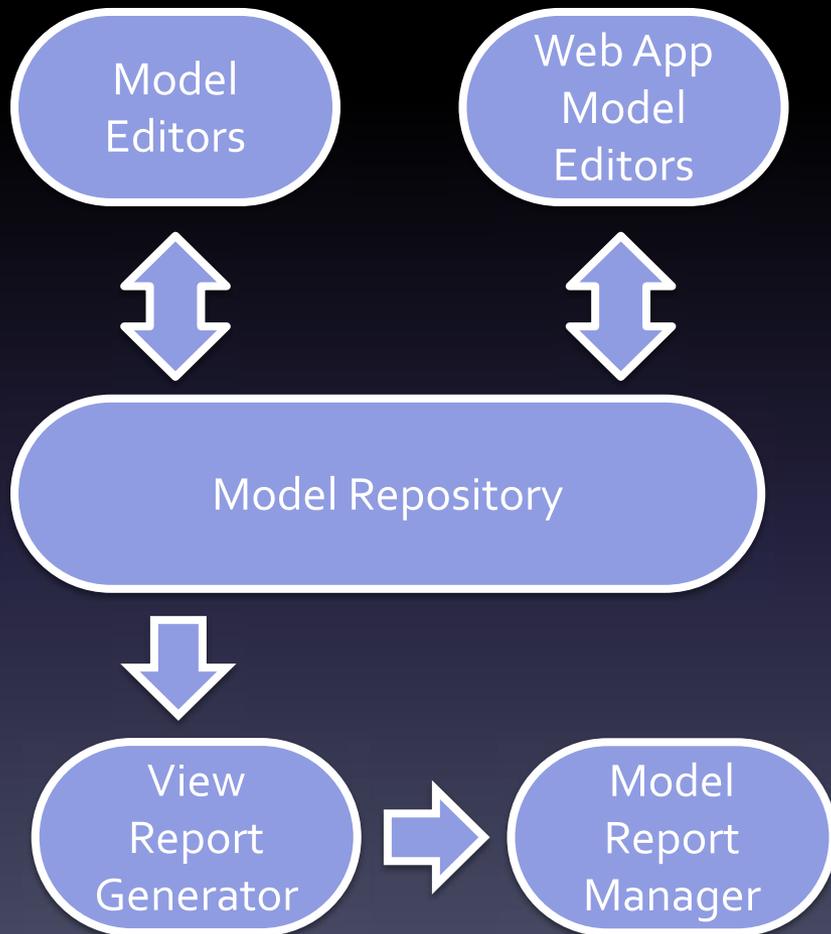
Software Environment for MBSE

- 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



Generating Reports from Models



- Model, Viewpoints and View Models



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

A screenshot of a web-based report titled 'DocWeb PEL Example Document'. The report displays a table of contents and a detailed table of metrics for a mission project.

1.1. Power Multi List	
1.1.1. Power Multi List	
1.1.2. Power Multi List	
1.1.3. Power Multi List	

1.2. PEL (Simplified)						
Table 1.2. PEL Metrics for 50 Europe Habitability Mission Project						
Module	Product	Number of Units	State	Energy State (W)	Energy State (Wh)	Energy State (kWh)
1	00 Europe Habitability Mission Project	11	0.0	100.0		
2	00 Payload System	0	0.0	0.0		
3	00 Spacecraft System	11	0.0	100.0		
4	00.00 Payload System	00	0.0	00.0		
5	00.01 PAYLOAD SYSTEM	1	OK, On	00.0	00.0	00.0
6	00.02 Mission Management	0	0.0	0.0	0.0	0.0
7	00.03 Mission Management	1	Standby	0.0	0.0	0.0
8	00.04 Mission Management	1	Standby	0.0	0.0	0.0

- 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 a the work products systems engineers must deliver.
 - A scalable enterprise for modeling is feasible built around the concept of view point and view.

Backup