Introduction to Unified profile for DoDAF and MODAF

Benefits of using UPDM

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Speaker

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Works with companies such as **BAE Systems**, **BMW**, **General Electric**, **Bombardier**, **Kongsberg Defense and Aerospace**, **SKA**, **ESS**, **Deutsche Bahn**, etc.

Co-chair and one of the **leading architects** for the current **OMG UPDM standard** development group

Holds the following professional certificates:

- OMG Certified Expert in SysML (OCSMP)
- OMG Certified UML Professional
- OMG Certified Expert in BPM
- Professional Scrum Product Owner

Holds PhD. in Informatics Engineering

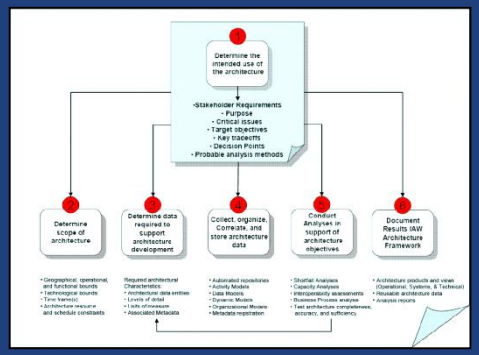
Outline

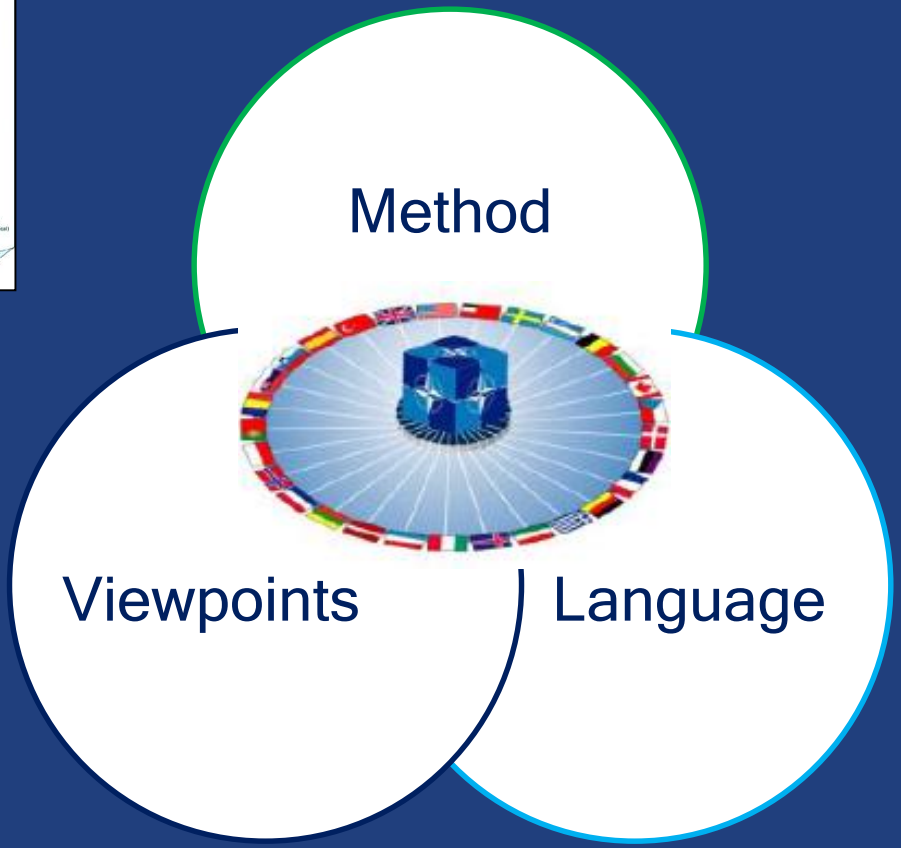
1. Introduction to UPDM

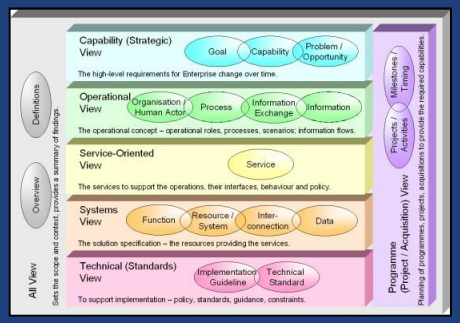
2. UPDM Benefits

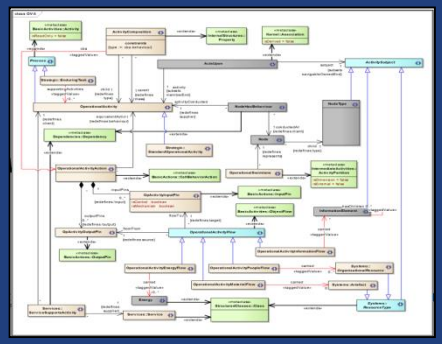
3. Summary

Architecture Framework



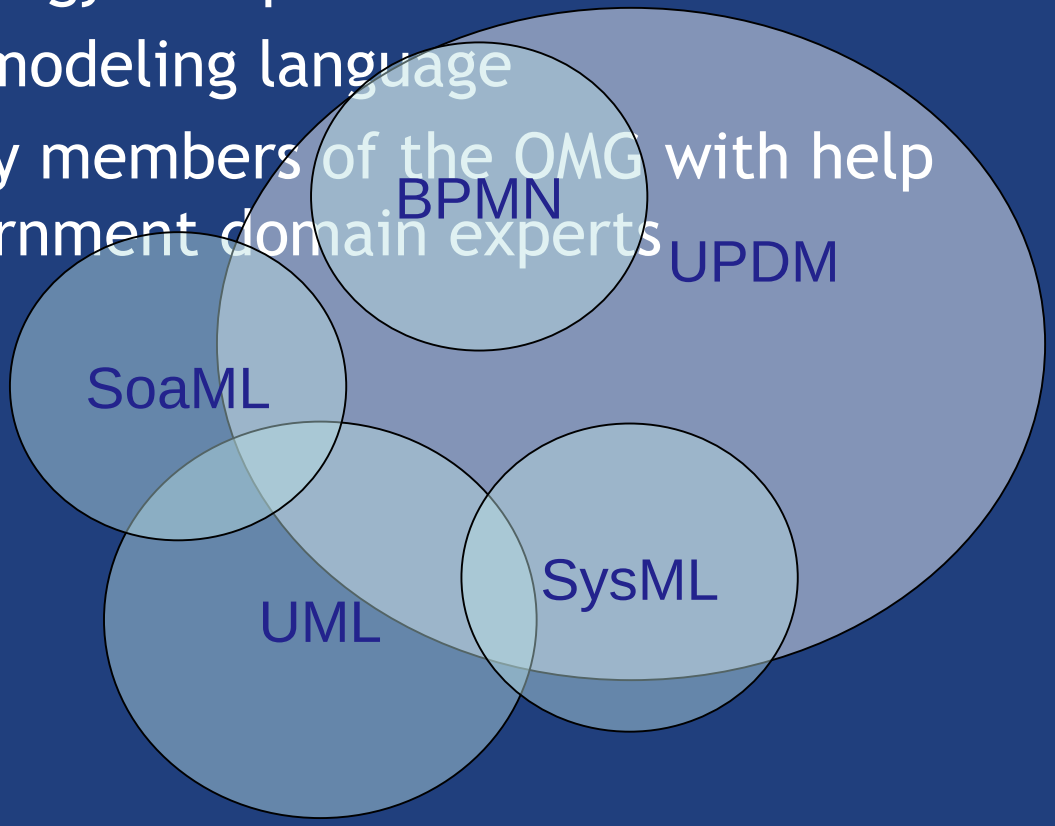




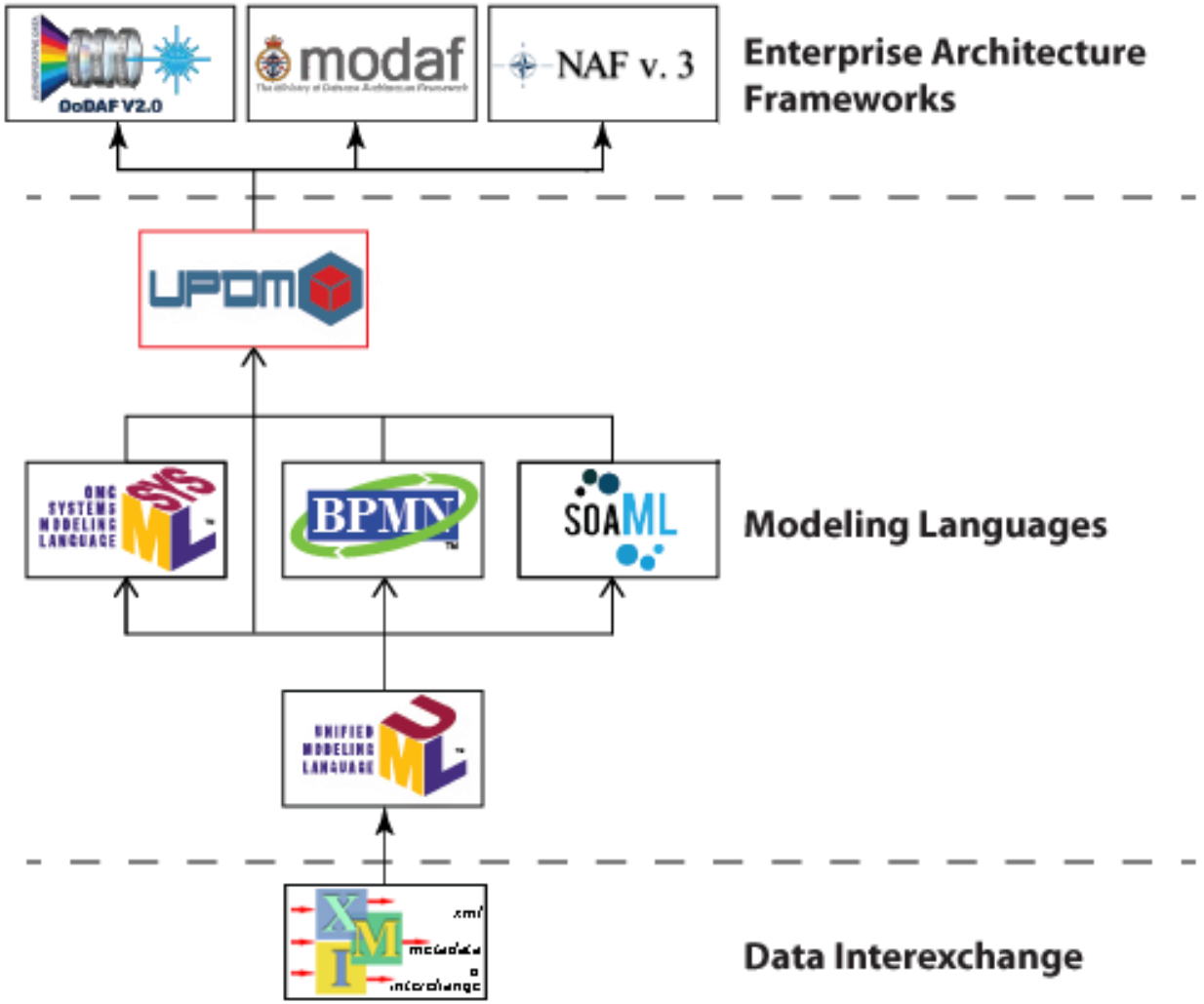


UPDM

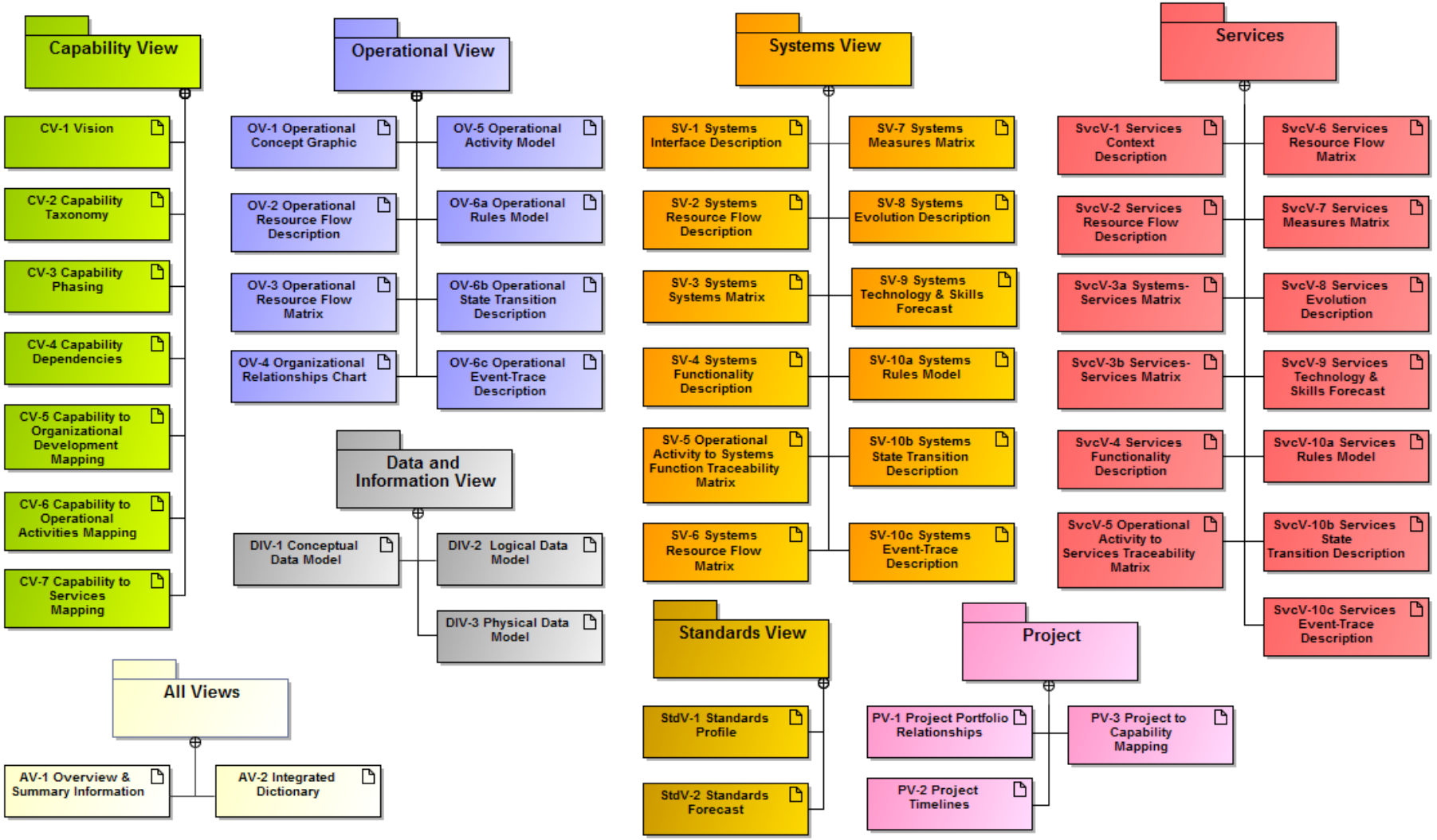
- **UPDM is Unified Profile for DoDAF, MODAF, and NAF**
- UPDM is NOT a new Architectural Framework
- UPDM is not a methodology or a process
- UPDM is an enterprise modeling language
- UPDM was developed by members of the OMG with help from industry and government domain experts



Standards



Viewpoints and Views



Unification

- **Common metamodel to build DoDAF, MODAF, and NAF models**
  - **Viewpoints** (e.g. Capability (DoDAF & NAF) vs. Strategic (MODAF))
  - **Views** (e.g. OV-2 Operational Resource Flow Description (DoDAF) vs. OV-2 Operational Node Relationship Description (MODAF) vs. NOV-2 Operational Node Connectivity Description (NAF))
  - **Concepts** (e.g. Performer (DoDAF) vs. Node (MODAF & NAF))
- **Infrastructure for tools to be able to provide different environments for DoDAF, MODAF, NAF – underlying ontology is the same**
- **Easy transition among DoDAF, MODAF, and NAF models**

Scope

- Whole Enterprise (multiple organizations)
- Single Organization
- Department
- Programme/Project
- Mission

Why MBSE?

- **No alternative standardized frameworks for MBSE**
  - You always end-up using an architecture framework whether you want one or not, or whether you intend to or not
- **Integration with existing OMG standards, e.g. SysML, UML**
  - Integrated Architecture Repository
  - Application of engineering analysis methods
  - Interoperability

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Patterns

Structure					Behavior		
Types			Individuals	Tuples	Activities	State Charts	Interactions
Active	Passive						
	Information	Constraints		Traces / Information Flows			

- **Patterns:**
  - Usage – Definition
  - Typical – Actual
  - Behavior – Structure
  - Information Flows
  - Measurements
  - Traceability

OMG Ecosystem

- UML – traceability, extendibility, transition to IT architectures
- SysML – visualizations, parametrics, transition to systems design
- XMI - interoperability
- OCL – constraints
- fUML – simulation
- BPMN – notation
- SoaML – service oriented architecture

Best practices for building, using and governing models

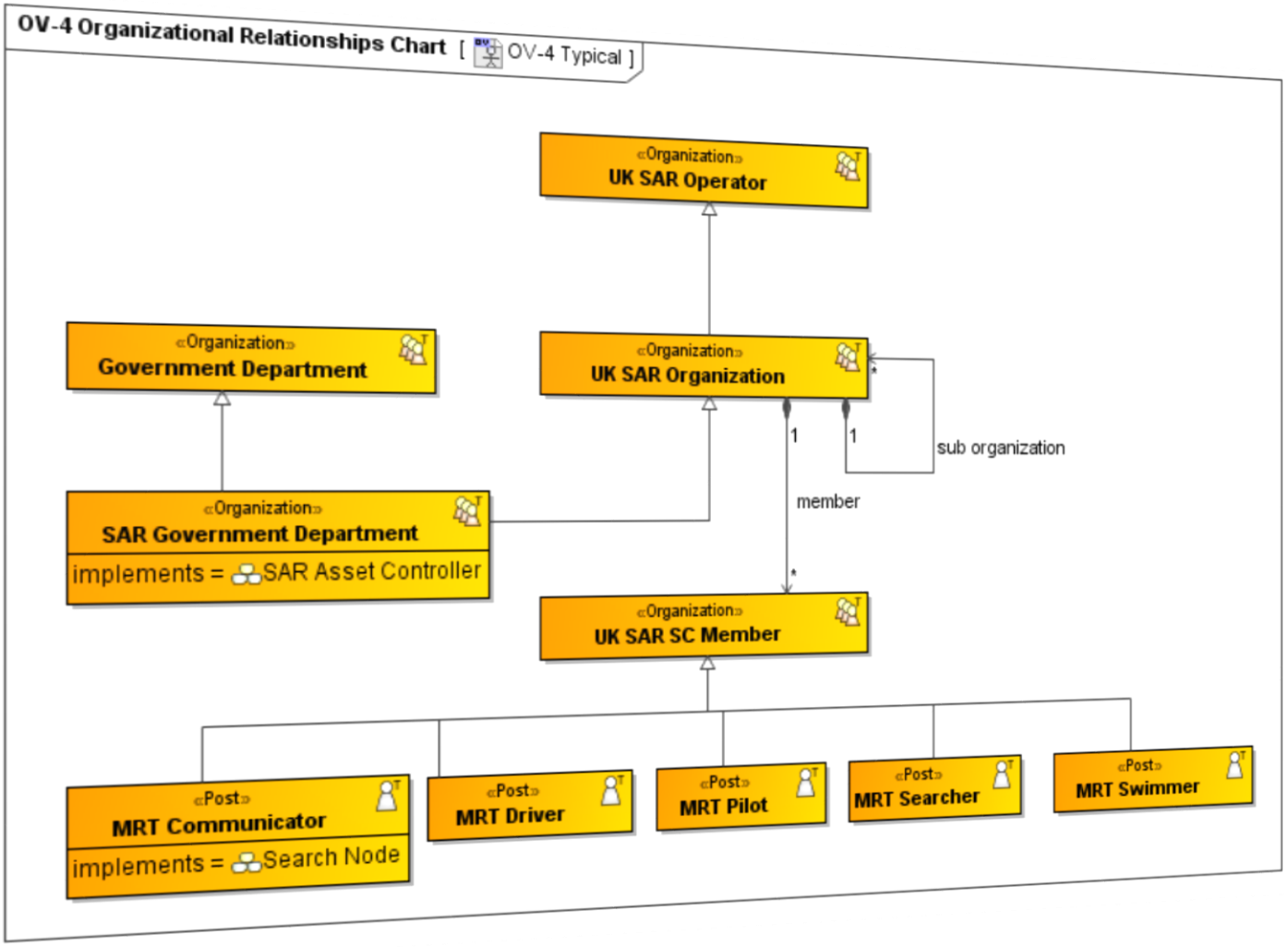
OMG Ecosystem: Benefits

OMG Ecosystem enables:

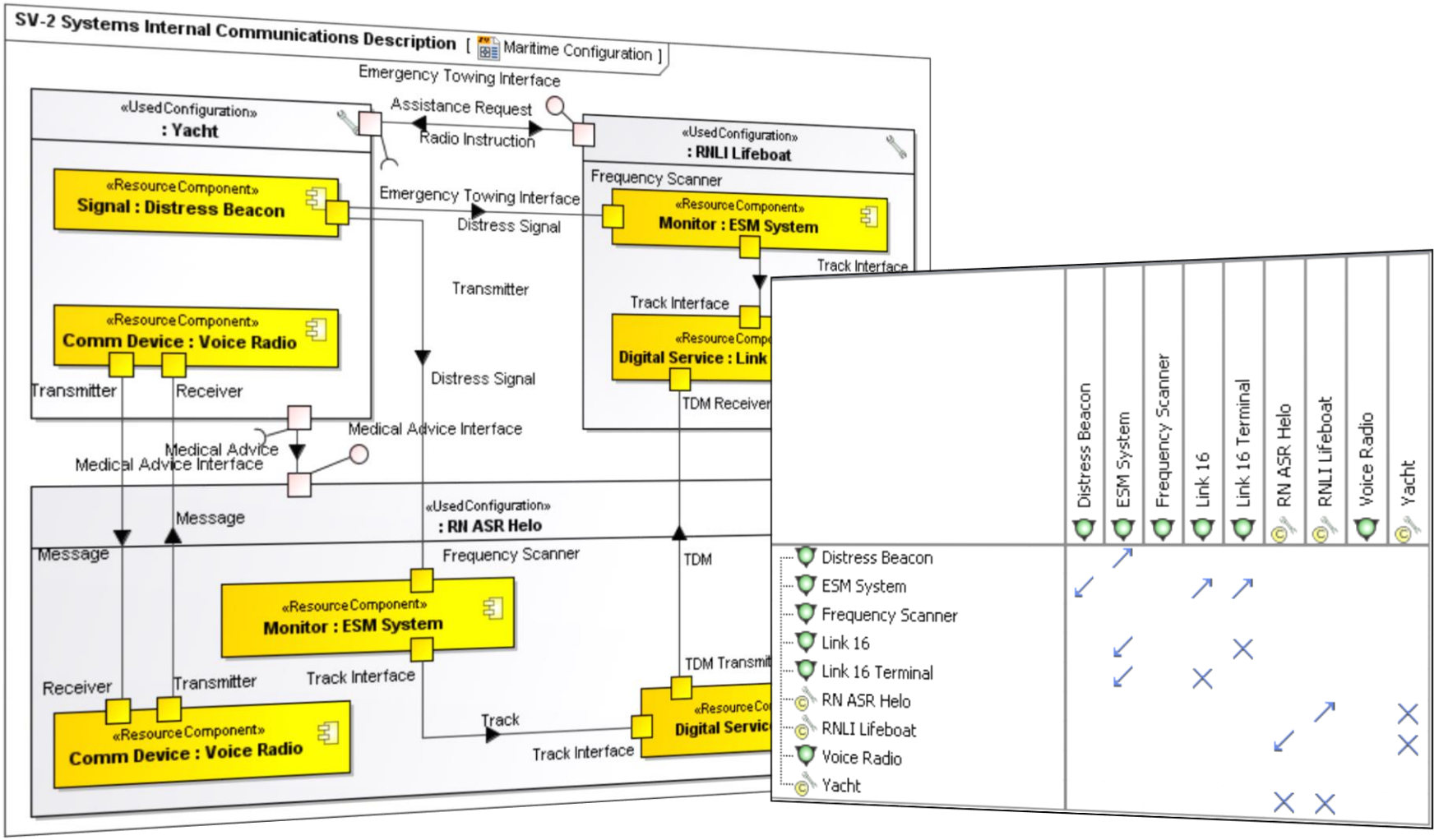
- Standardized Visualizations
- Traceability
- Impact Analysis
- Coverage Analysis
- Requirements Compliance Analysis
- Trade Studies
- Simulation

Visualizations

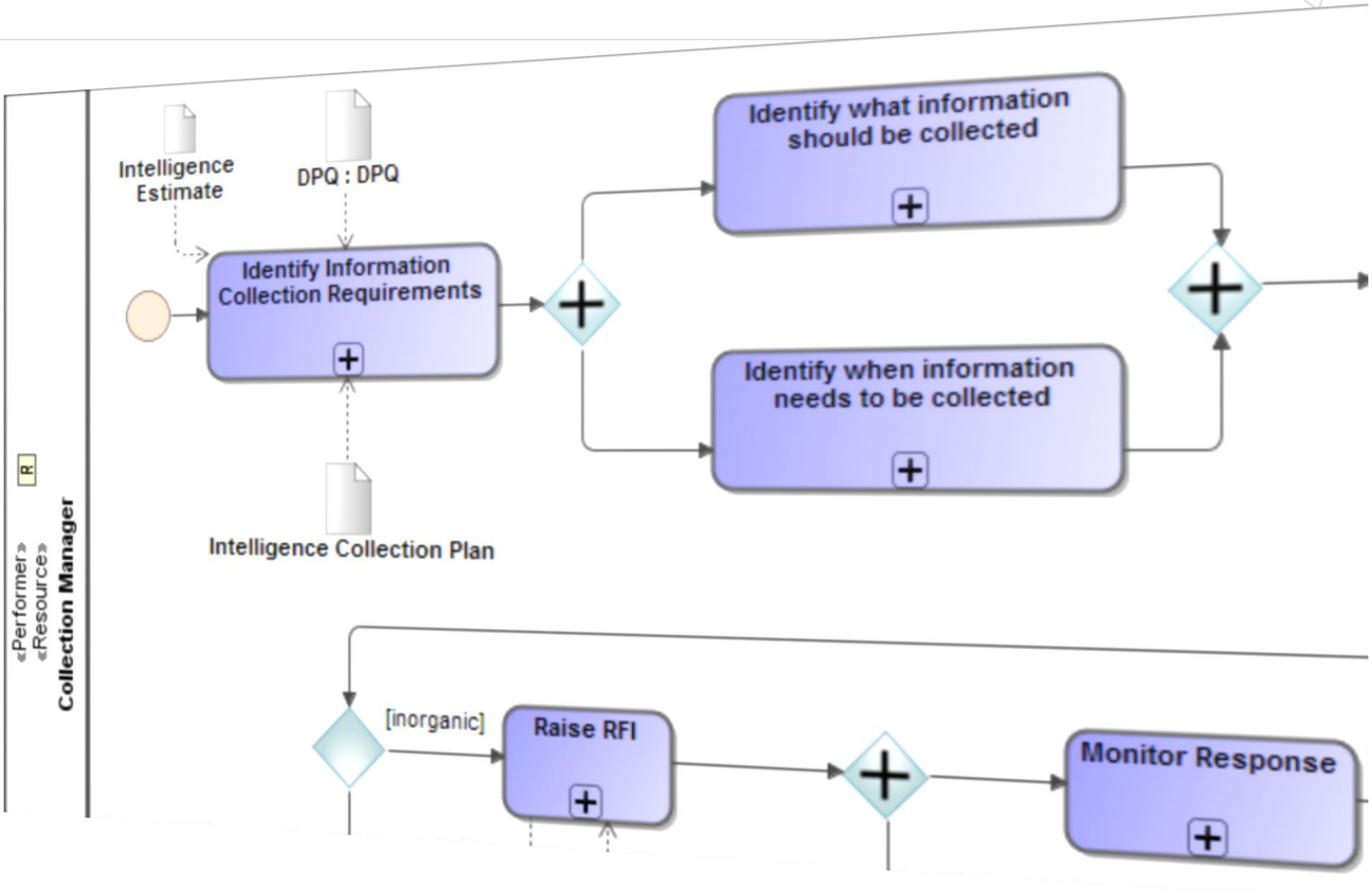
Block Definition Diagram



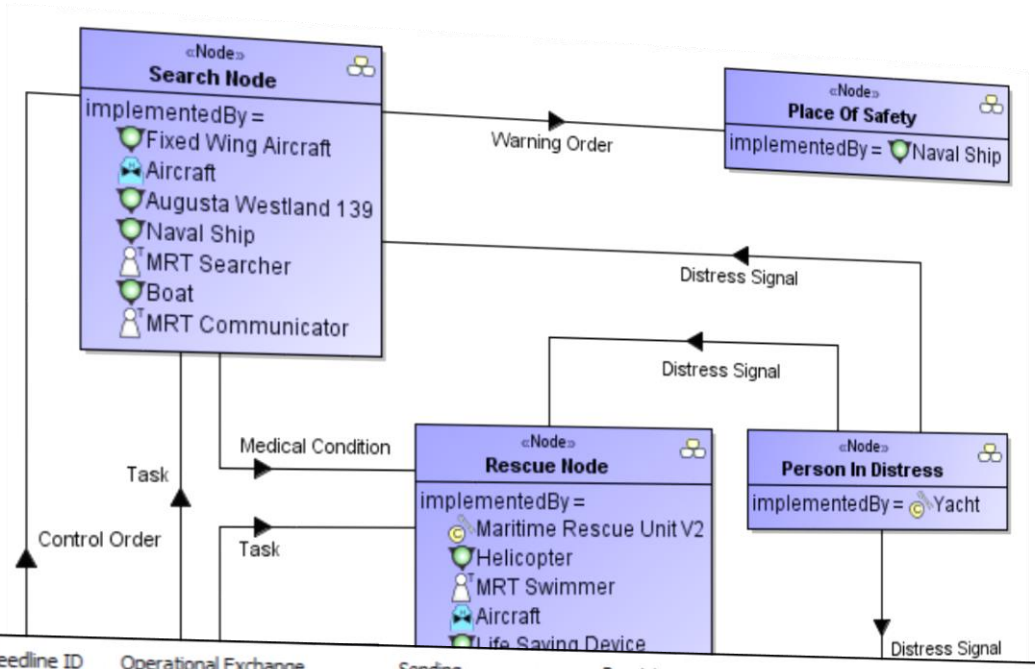
Internal Block Diagram & Matrix



BPMN Process Diagram

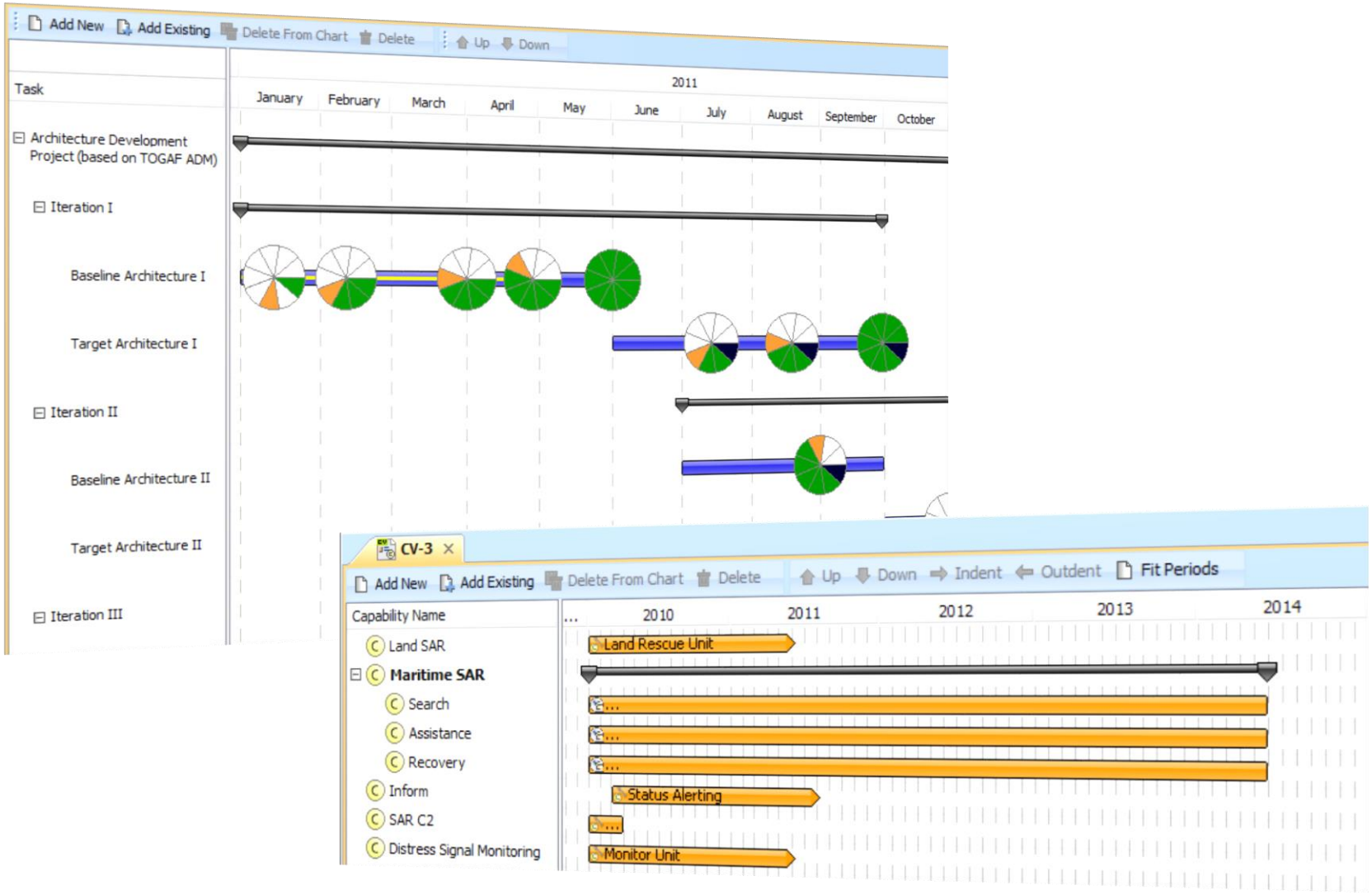


Table



#	Exchange ID	Needline ID	Operational Exchange Item	Sending Node	Receiving Node	Producing Operational Activity	Consuming Operational Activity
1	IE7	7	Control Order	Tactical C2 Node	Search Node		
2	IE8	8	Request	Tactical C2 Node	SAR Asset Controller		
3	IE5	5	Control Order	Tactical C2 Node	Rescue Node		
4	IE1	1	Warning Order	Search Node	Place Of Safety	Send Warning Order	Process Warning Order
5	IE10	10	Task	SAR Asset Controller	Search Node		
6	IE9	9	Task	SAR Asset Controller	Rescue Node		
7	IE2	2	Medical Condition	Search Node	Rescue Node	Monitor Health	Provide Medical Assistance(Status Out : Medical Condition)
8	IE11	11	Distress Signal	Person In Distress	Search Node	Send Distress Signal	Receive Distress Signal
9	IE3	3	Distress Signal	Person In Distress	Rescue Node	Send Distress Signal	Receive Distress Signal
10	IE4	4	Distress Signal	Person In Distress	Monitoring Node		
11	IE6	6	Track Info	Monitoring Node	Tactical C2 Node		

Chart

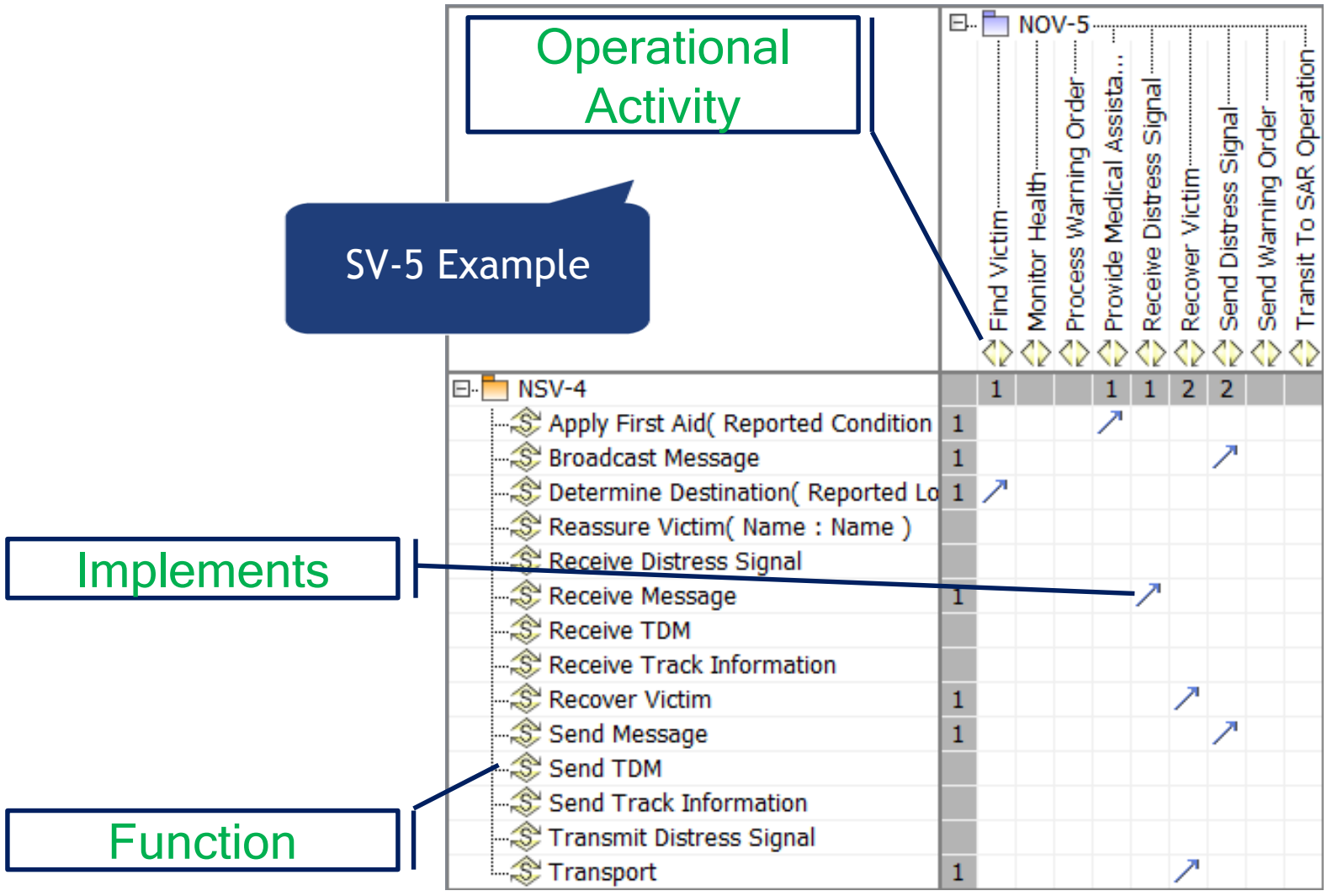


Traceability

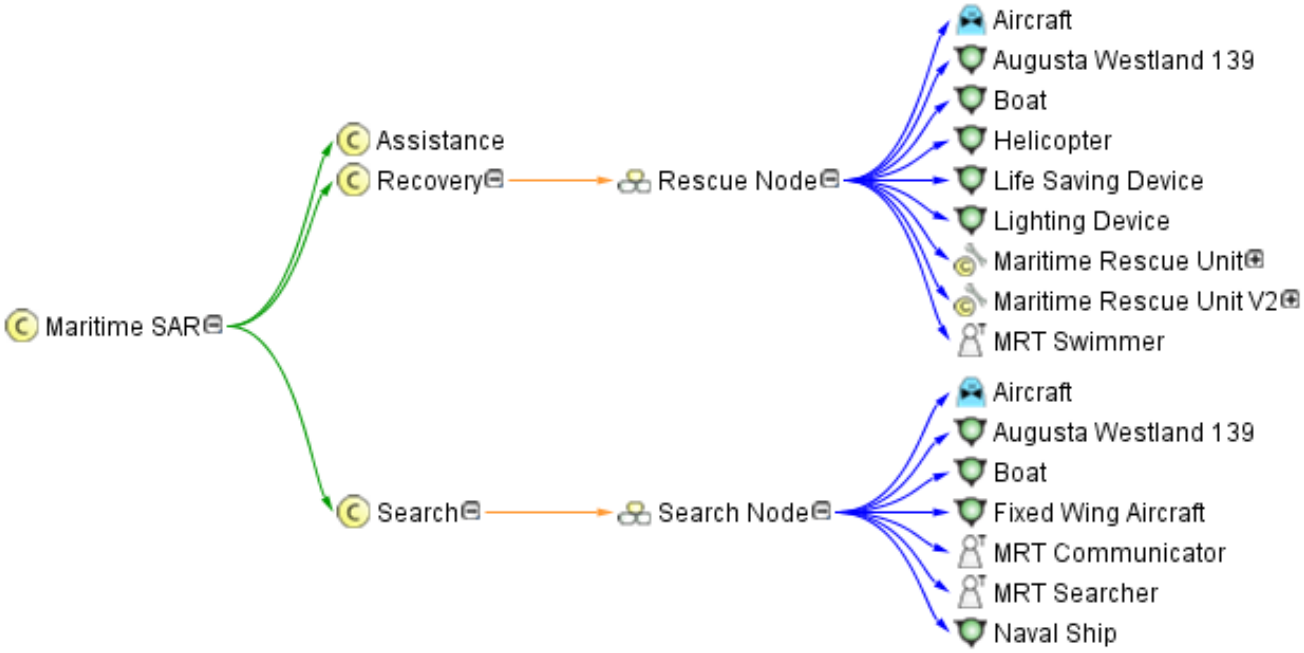
Traceability

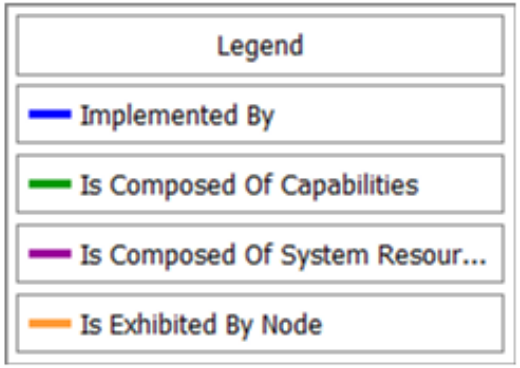
- Traces helps to organize cross-association (mapping) of elements within the various structures or hierarchies of user model
- Trace relationships, e.g. Implements, Exhibits help:
  - Navigate in a model
  - Ensure that various parts of the model are properly integrated
  - Assess user model consistency
  - Direct future model activities
  - Perform impact and coverage analysis
  - Associate different types or different hierarchy elements

Direct Traces

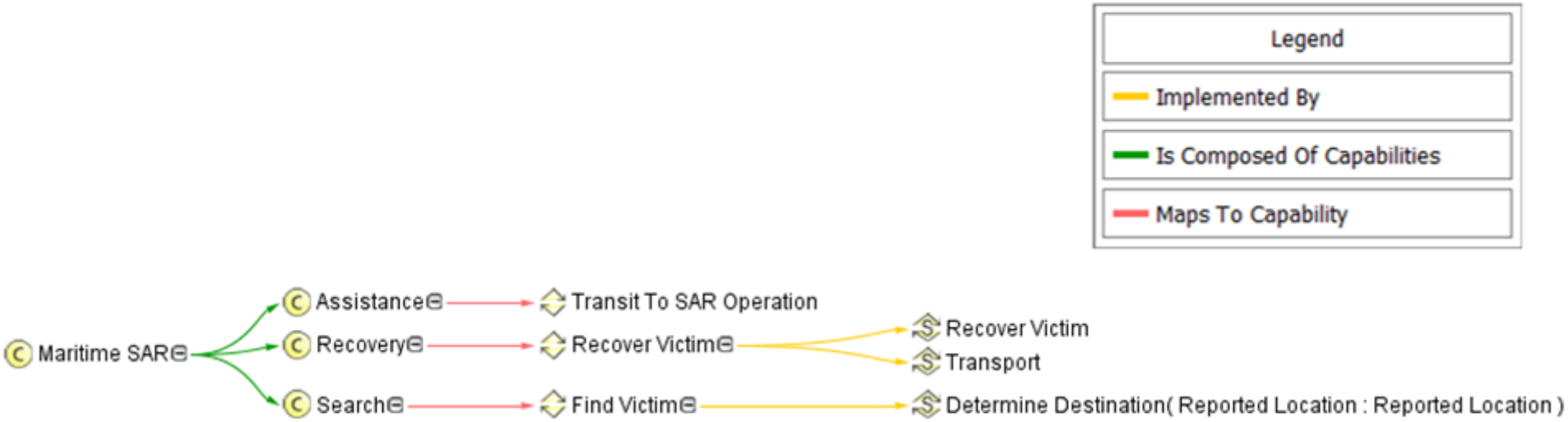


Capability Structural Map Example

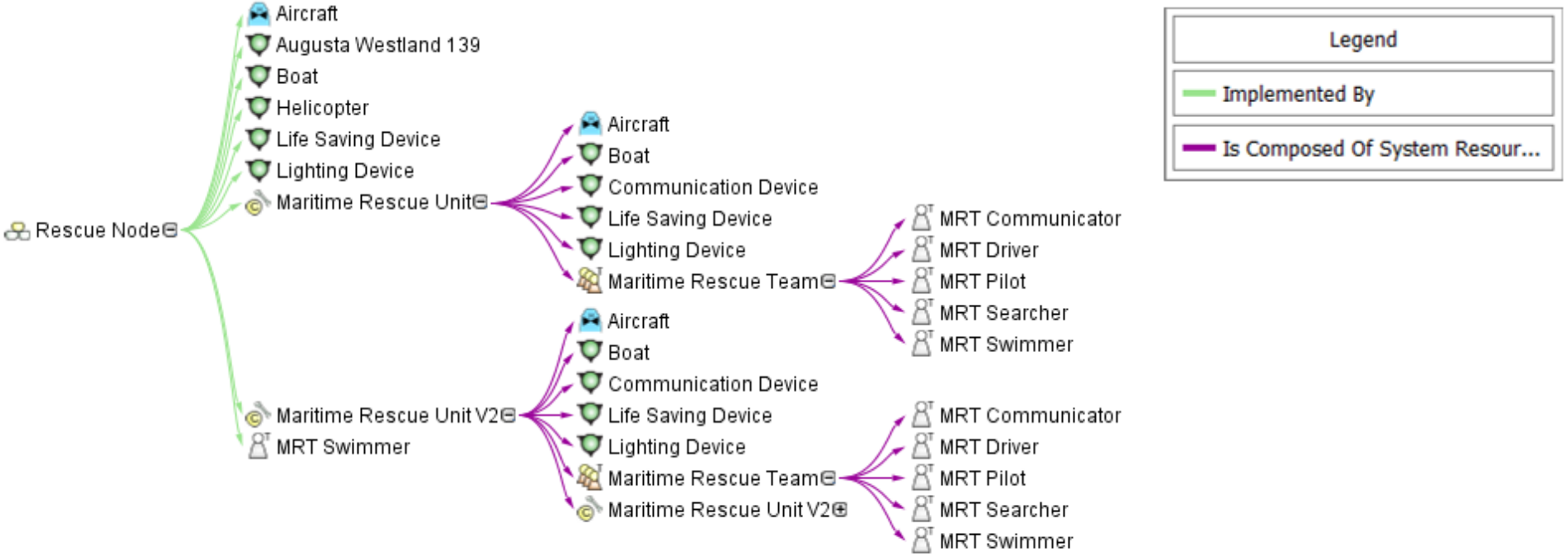




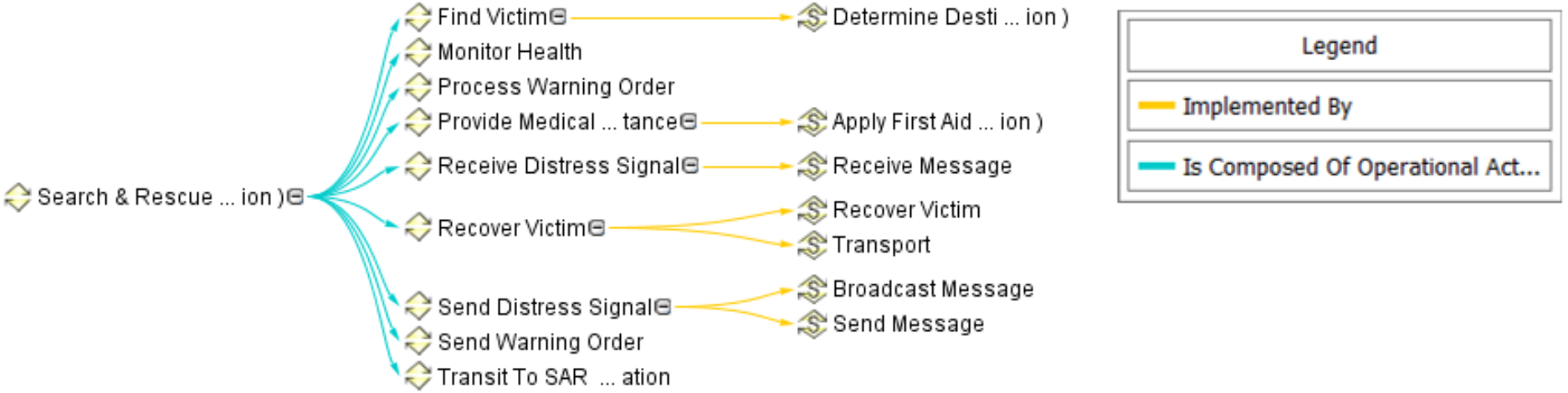
Capability Behavioral Map Example



Node Implementation Map



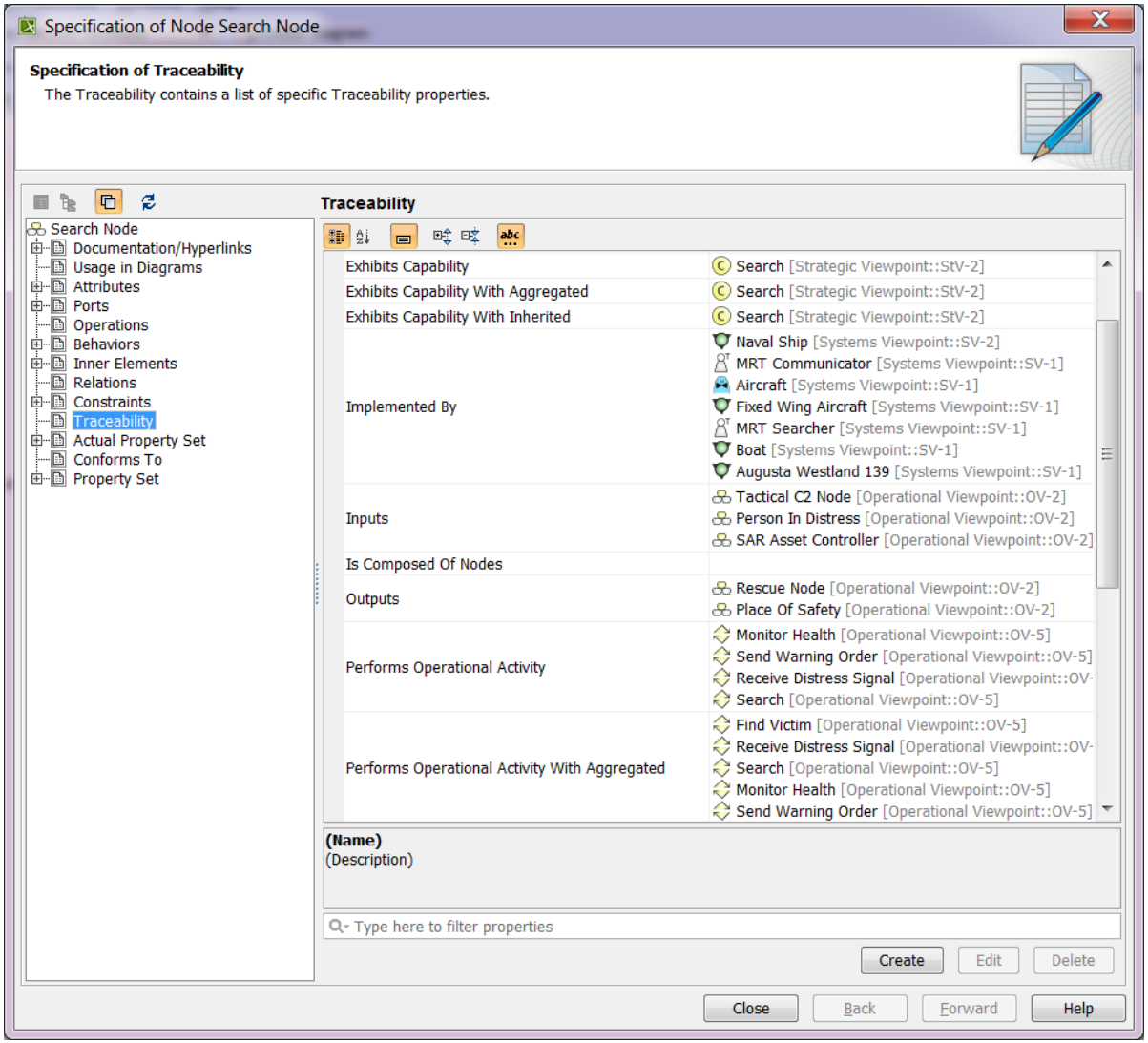
Operational Activity Implementation Map



Indirect Traces

- Indirect traces based on transitive relationships
- There is a number of predefined indirect traces in UPDM
- Indirect traces can be used to:
  - build graphs (visual analysis)
  - construct matrices
  - perform impact analysis
  - navigate in the model

Indirect Traces Example

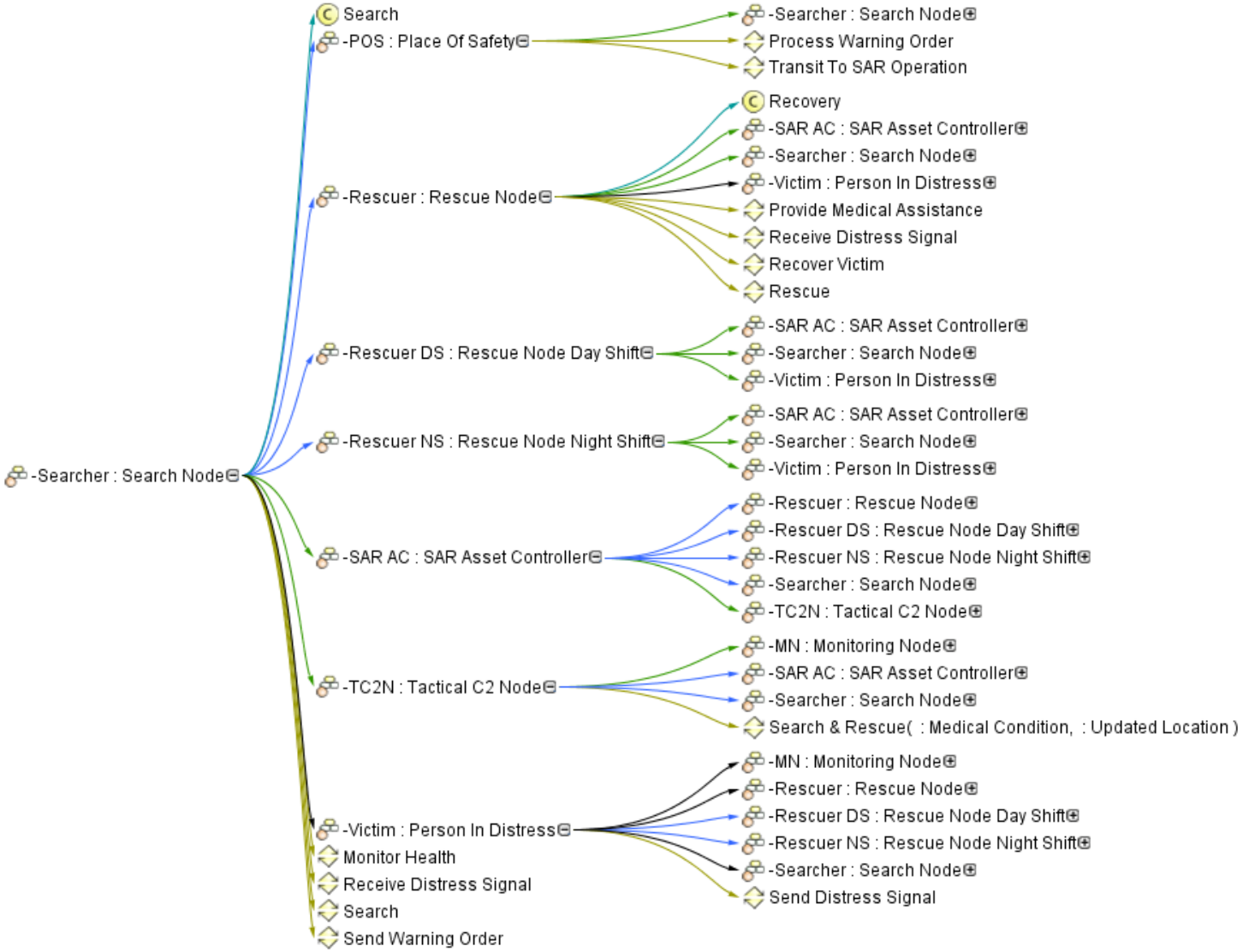


Impact Analysis

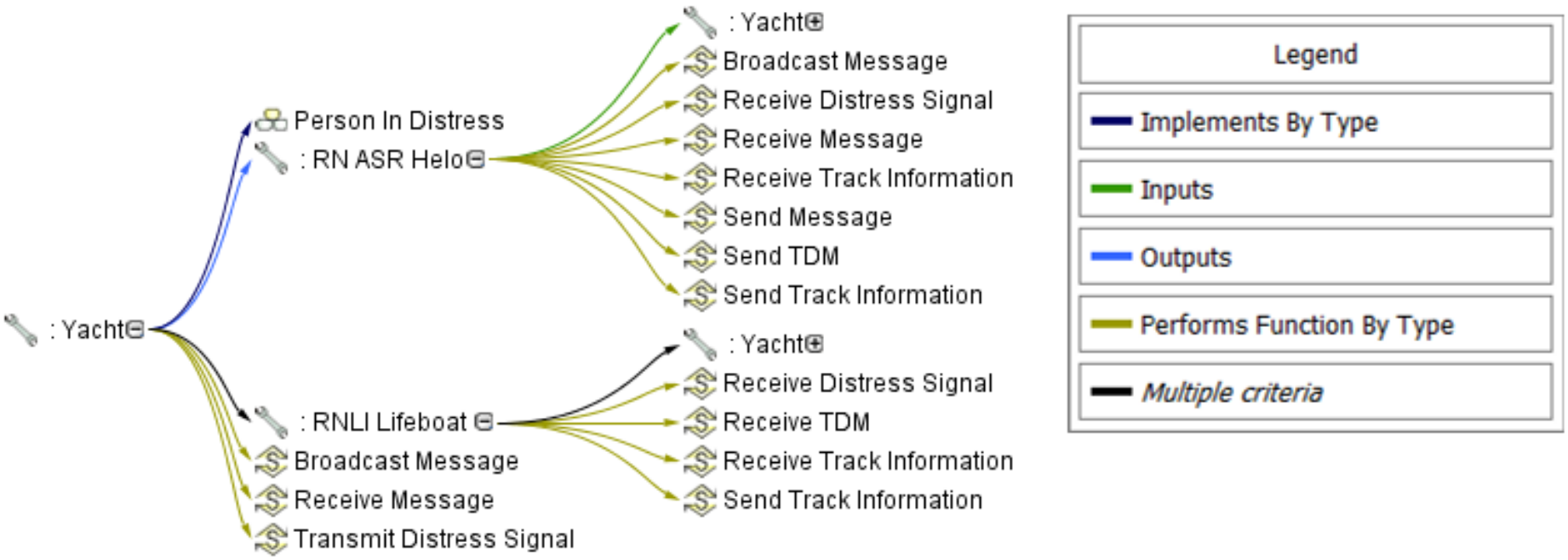
Impact Analysis

- Change impact analysis (IA) is for:
  - identifying the potential consequences of a change
  - estimating what needs to be modified to accomplish a change
- Impact analysis is uasually performed on Requirements, Nodes and Resources
- Analysis identifies all connections and traces from and to the element

Impact Analysis on Node Role



Impact Analysis on Resource Role

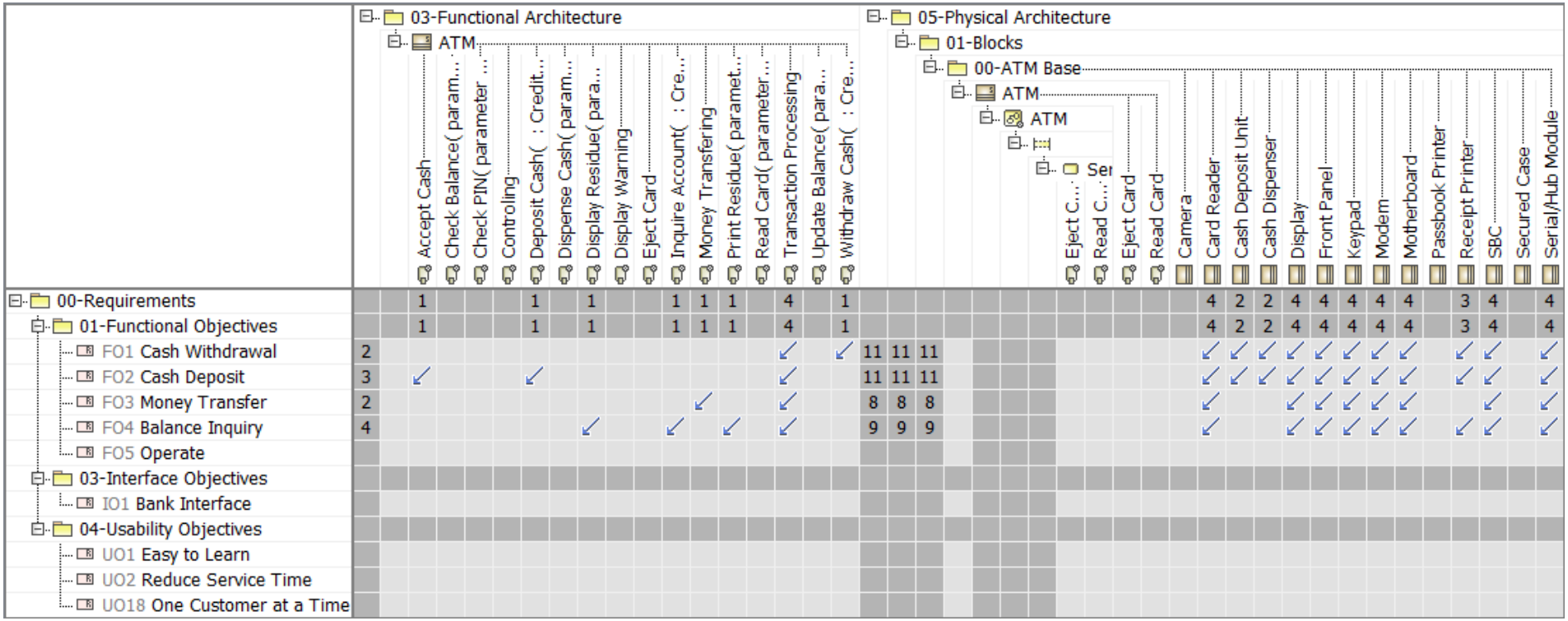


Coverage Analysis

Visual Coverage Analysis

- Visual coverage analysis can be performed using traceability matrices
- It helps to identify:
  - Redundant elements
  - Imprecisely defined elements
  - Missing relationships

Visual Coverage Analysis Example



Numerical Coverage Analysis

- Coverage percentage helps to identify **overall status** of implementation, e.g. implemented nodes, exhibited capabilities, satisfied requirements etc.

#	Date	Capability Count	Capability Covered By Node Percentage	Capability Covered By Node Count	Node Count	Capability Covered By Node Average
1	2014.11.26 00.32	11	18.18	2	2	0.18

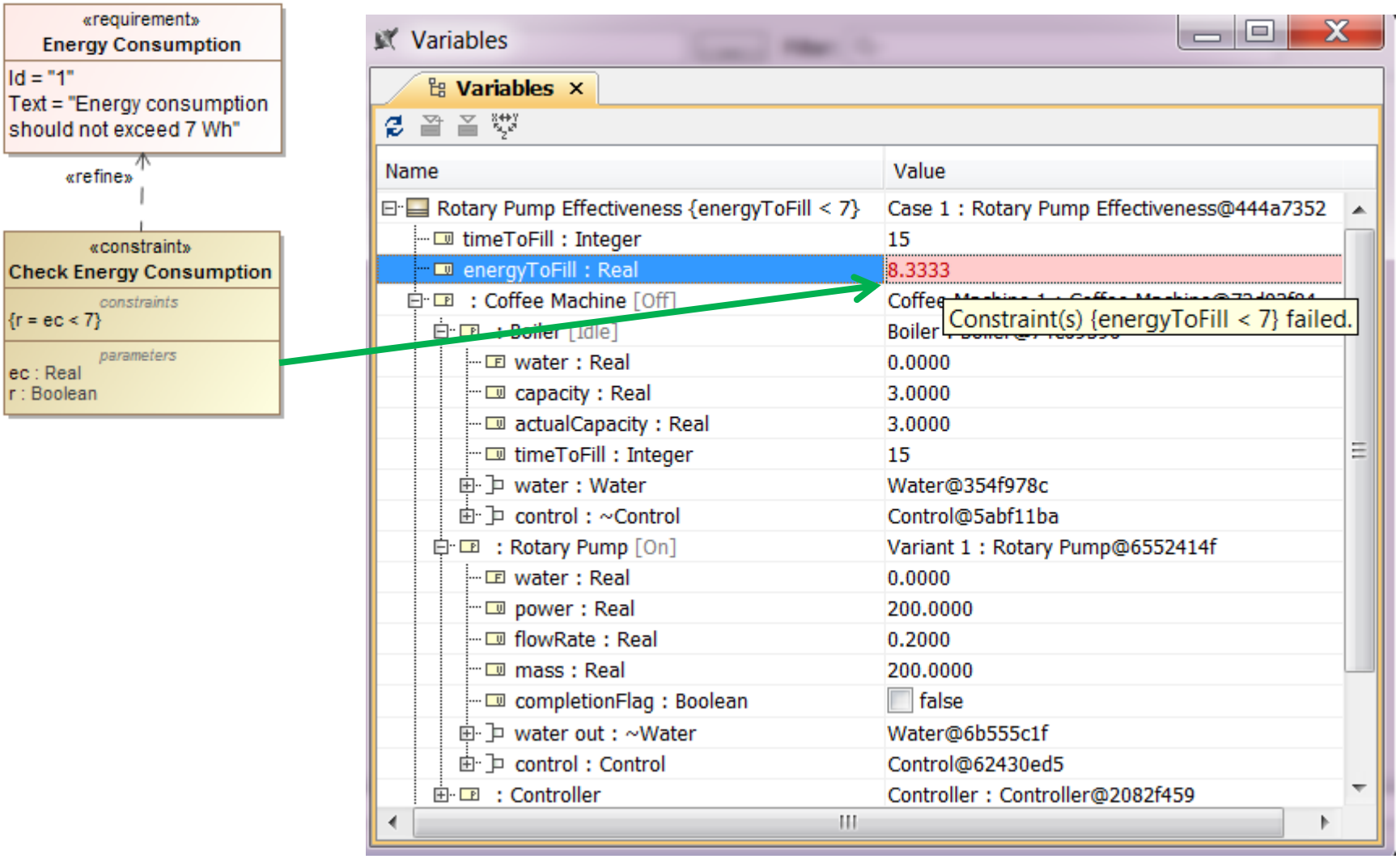
Requirements Compliance Analysis

Requirements Compliance Analysis

- Automated constraints, e.g. OCL (Object Constraint Language) to verify Capability Requirements

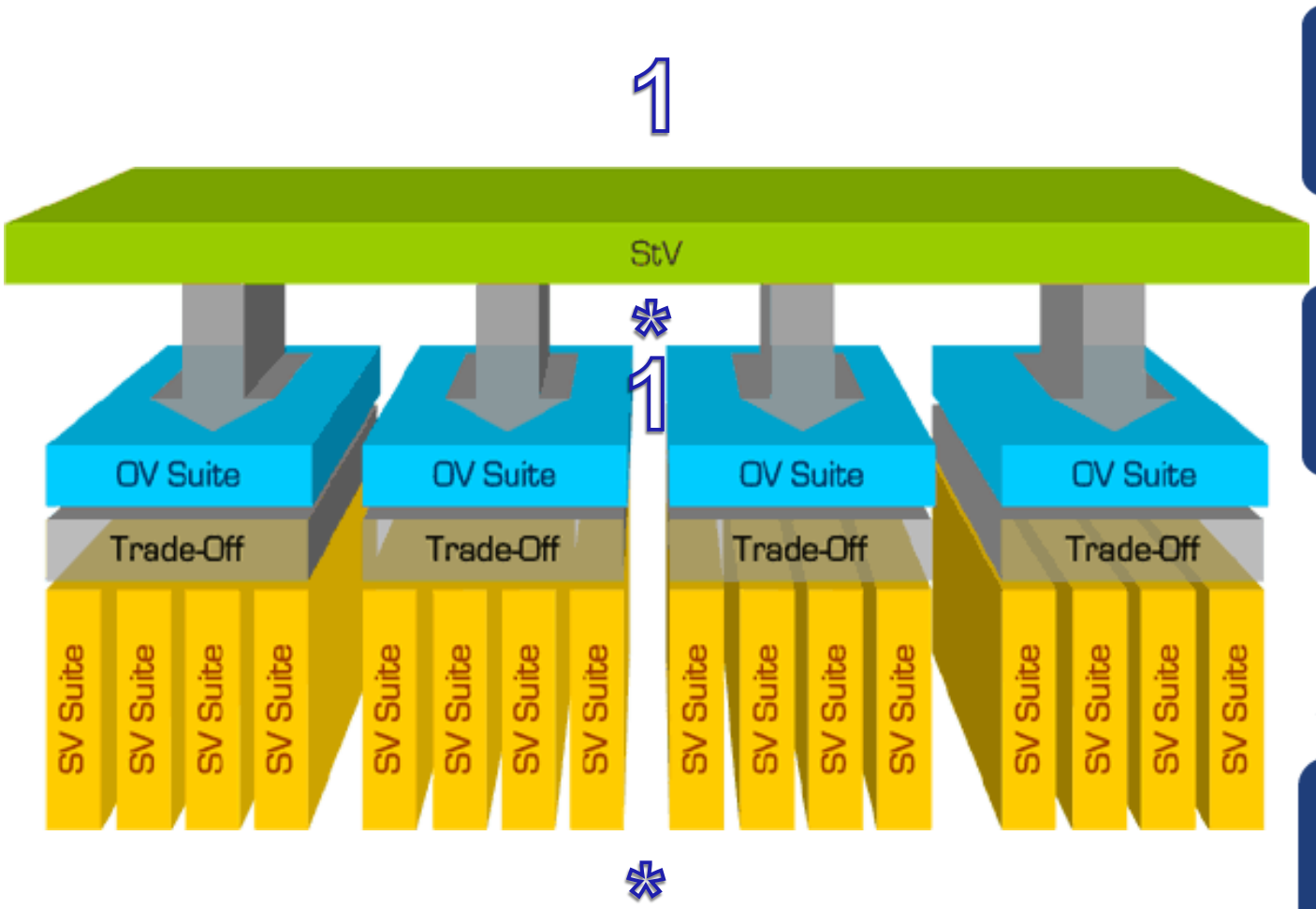
#	Resource	Performance Requirement	Measure	Metric
1	Quality Control	Price	500	$
2	Testing Pallet	Price	600	$

Constraints Verification



Tradestudies

Why Trade Studies?



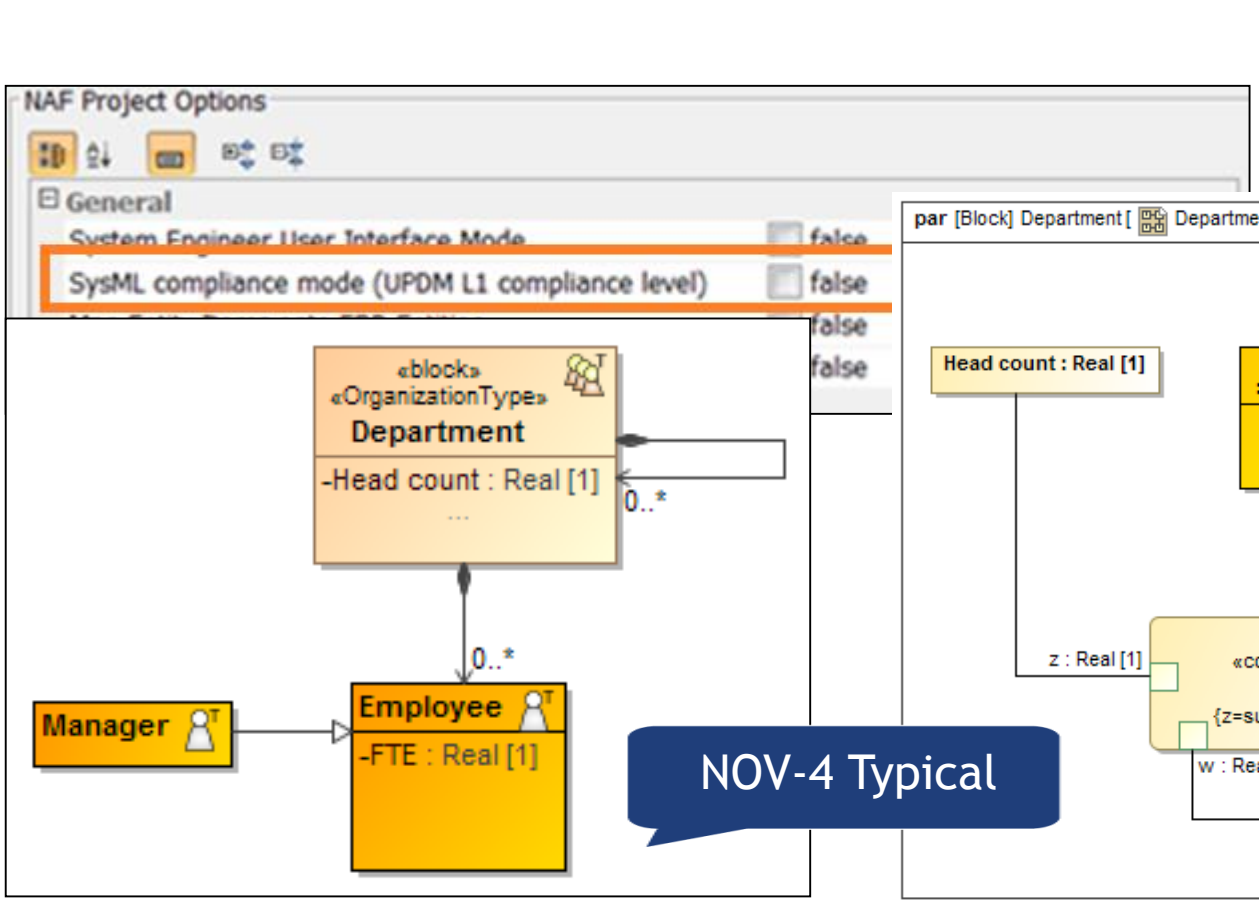
Capability

Operational Scenario

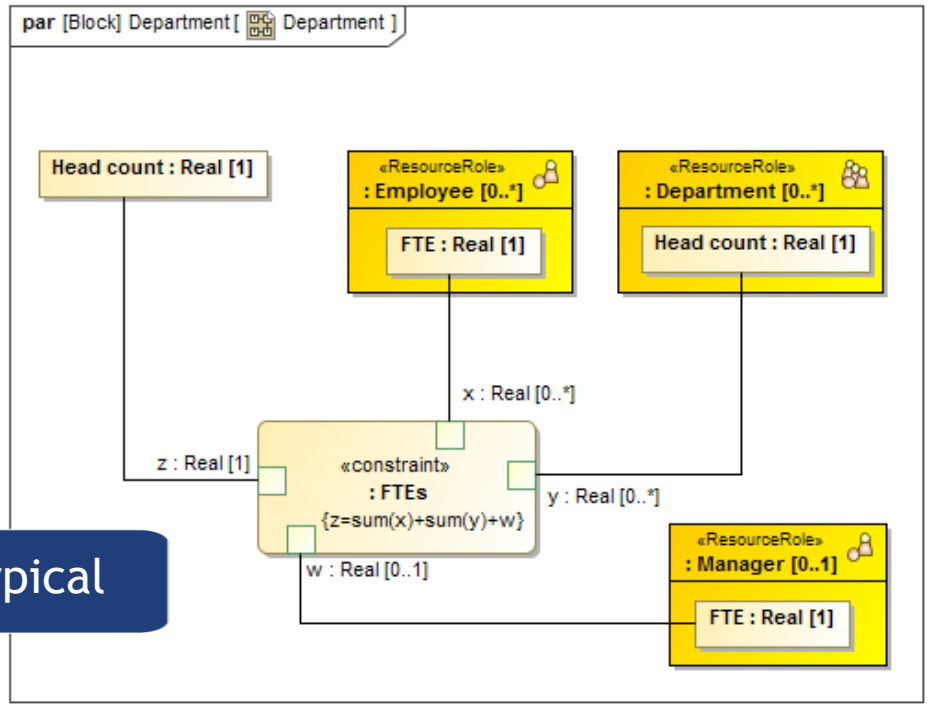
Capability Configuration

UPDM Compliance with SysML

- **SysML engineering analysis methods** onto UPDM models, e.g. parametrics, behavioral execution, trade studies etc



SysML Parametric Diagram



NOV-4 Typical

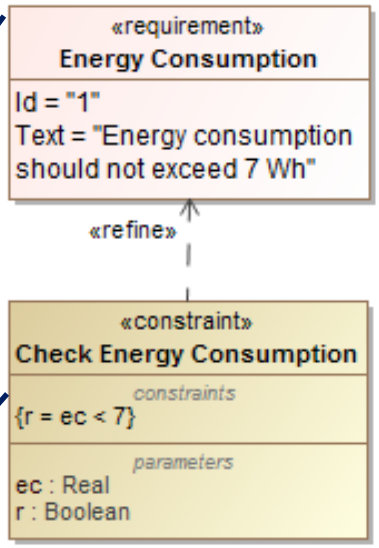
Trade Studies

- **Examining** various design alternatives by comparison
- Serve as a basis to integrate with more advanced analytical tools and techniques in accordance with the INCOSE Model-Based Systems Engineering (MBSE) vision in which all the analysis is carried out in the context of design models.

Rotary Pump **variants**

#	Name		Flow Rate : Real	Mass : Real
1	Variant 1	200.0	0.2	200.0
2	Variant 2	180.0	0.19	202.0
3	Variant 3	300.0	0.5	500.0
4	Variant 4	150.0	0.14	250.0
5	Variant 5		0.34	300.0

Requirement



Energy consumption **tests**

Formal Constraint

#	Name	: Coffee Machine	Time To Fill : Integer	Energy To Fill : Real	Satisfied : Boolean
1	Case 1	Coffee Machine 1 : Coffee Machine	16	8.88888888888889	false
2	Case 2	Coffee Machine 2 : Coffee Machine	16	8.0	false
3	Case 3	Coffee Machine 3 : Coffee M		5.0	true
4	Case 4	Coffee Machine 4 : Coffee M		9.583333333333332	false
5	Case 5	Coffee Machine 5 : Coffee M		6.111111111111111	true

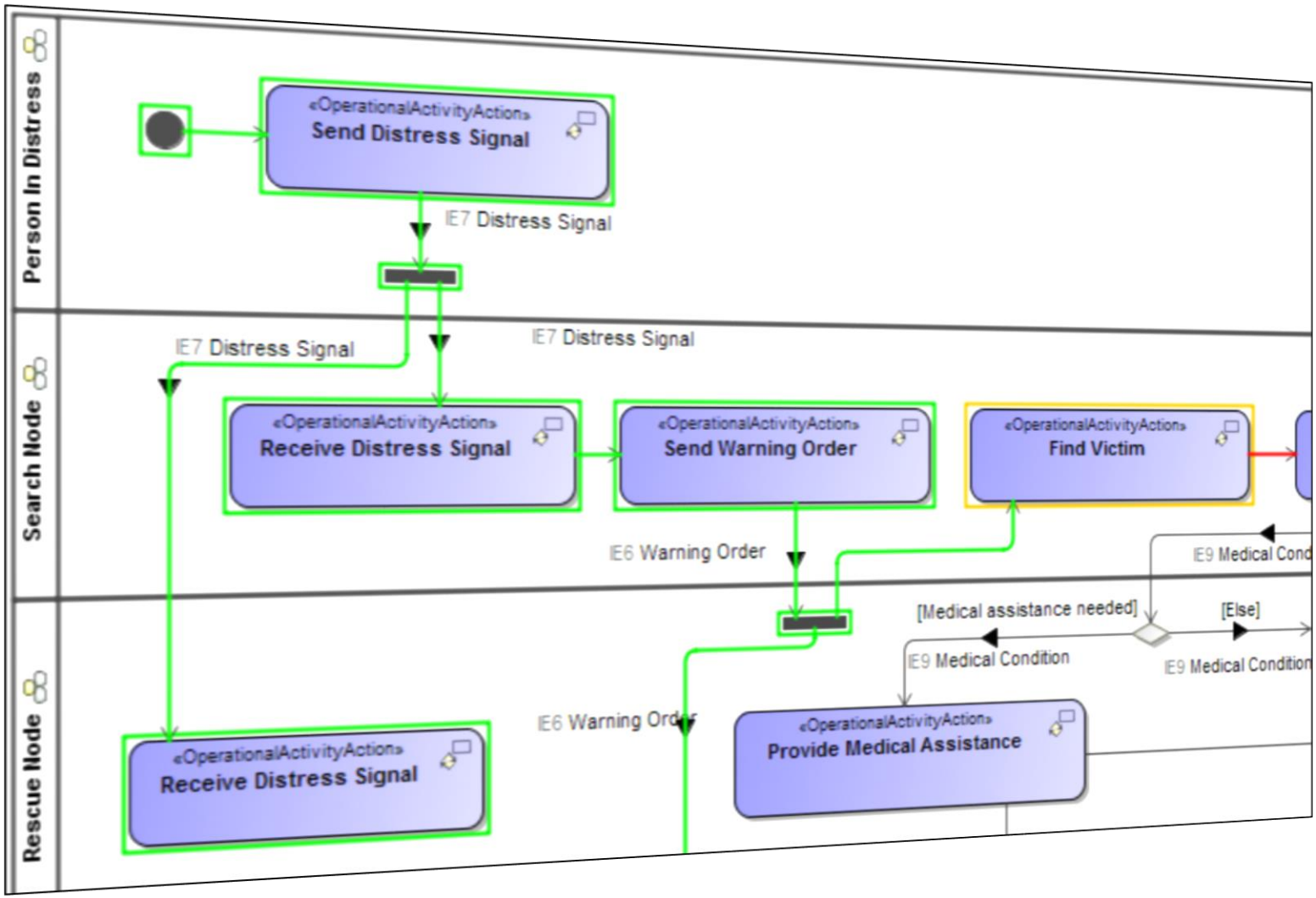
The **best** alternative

Simulation

Simulation

- The purpose of a **simulation** is to gain system (Organization, Hardware, Software, Data, Procedure, Facility, Person etc.) understanding without manipulating the real system, either because it is not yet defined or available, or because it cannot be exercised directly due to cost, time, resources or risk constraints
- Functional Simulation on UPDM models is performed using OMG **fUML** standard
- fUML can be used to validate system behavior by executing, animating, and debugging UPDM UPDM Activity (OV-5, SV-4) Diagrams

Simulation



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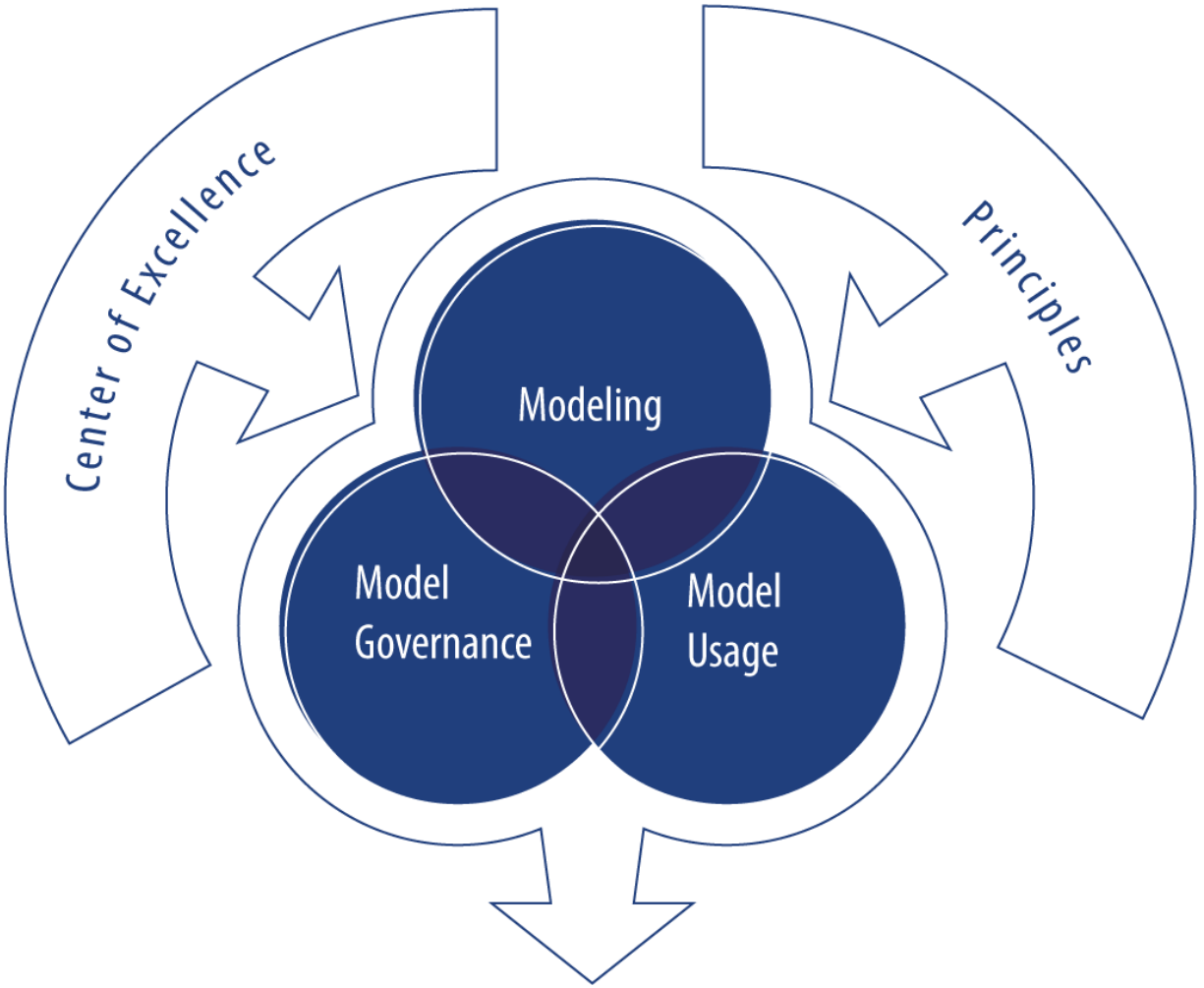
Method. Language. Toolset

Modeling Solution is a combination of a modeling language(s), a methodology and a modeling tool that together provide a productive infrastructure for applying model-driven development in the context of a particular organization.

Modeling Culture



High Value from Modeling and Models

Thank You!

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