

Analyzing system variability according to modes and states

INCOSE SYMPOSIUM, JULY 18TH 2017

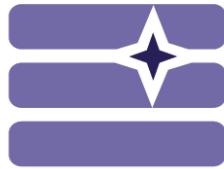
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Capella

Open Source Solution for Model-Based Systems Engineering

A result of the  **Clarity** collaborative project

THALES

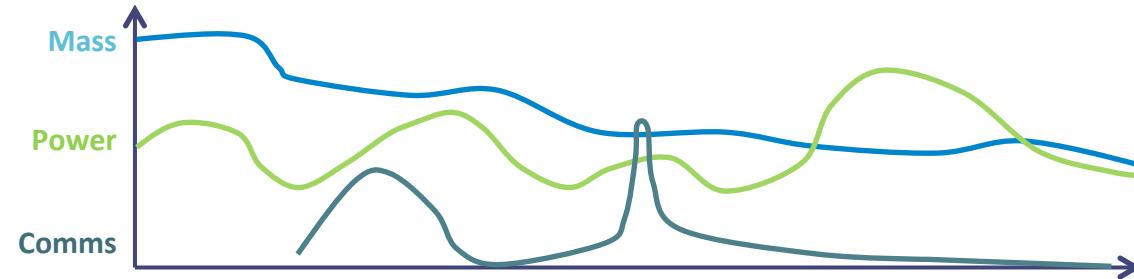
altran

 **arianeGROUP**

Mission		Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
System		Mode 1	Mode 2	Mode 3	Mode 4	Mode 5
Subsystems	1	Mode A	Mode B	Mode C	Mode A	Mode D
	2	Mode X	Mode Y	Mode Z	Mode Y	Mode X
	3	Mode I	Mode J	Mode I	Mode J	Mode I

Similar table with states

Mission		Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
System		Mode 1	Mode 2	Mode 3	Mode 4	Mode 2	Mode 3
Subsystems	1	Mode A	Mode B	Mode C	Mode A	Mode C	Mode A
	2	Mode X	Mode Y	Mode Z	Mode X	Mode Y	Mode Y
	3	Mode I	Mode J	Mode I	Mode J	Mode I	Mode J



How are non-functional and parametric analyses correlated with modes and states?

Mission		Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
System		Mode 1	Mode 2	Mode 3	Mode 4	Mode 2	Mode 3
Subsystems	1	Mode A	Mode B	Mode C	Mode A	Mode C	Mode A
	2	Mode X	Mode Y	Mode Z		Mode X	Mode Y
	3	Mode I	Mode J	Mode I	Mode J	Mode I	Mode J

What is the **expected / actual** functional behavior in one particular combination of modes and states?

1

Capture atomic configurations

Modes and States

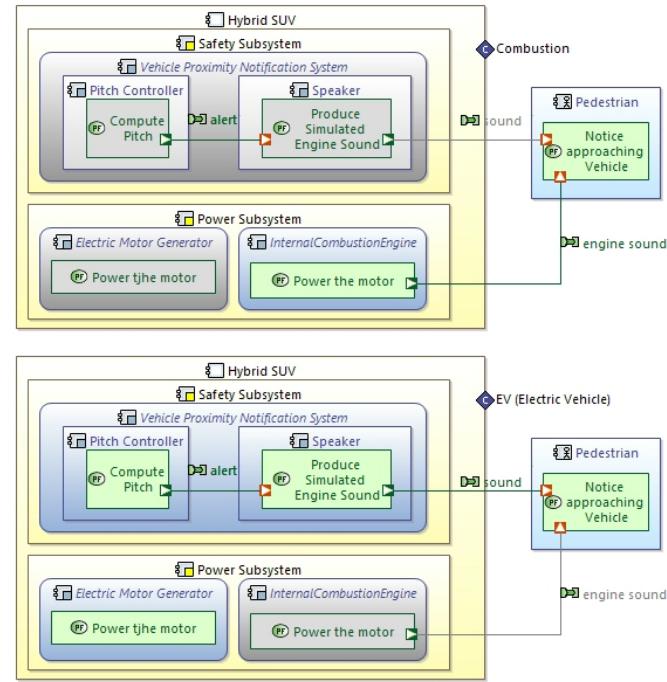
Several modes/states machines
on system, actors, components



**Atomic
configuration
(specified)**

Functions, components,
interfaces, ...

	EV ...	Hybrid	Combustion
safe vehicle approach			
safe pedestrian encounter in combustion configuration X			X
safe pedestrian encounter in EV configuration			
Hybrid SUV			
Safety BCs			
Vehicle Proximity Notification System	X		
Speaker			
Produce Simulated Engine Sound			
sound			
alert			
Pitch Controller			
bus			
Compute Pitch			
BrakeAssist			
Airbags			
Power Subsystem			
Power BCs			
Transmission	X		
PowerControlUnit	X		
InternalCombustionEngine			
FuelTankAssembly			
ElectricalPowerController			
Electric Motor Generator			
Differential			
BatteryPack			

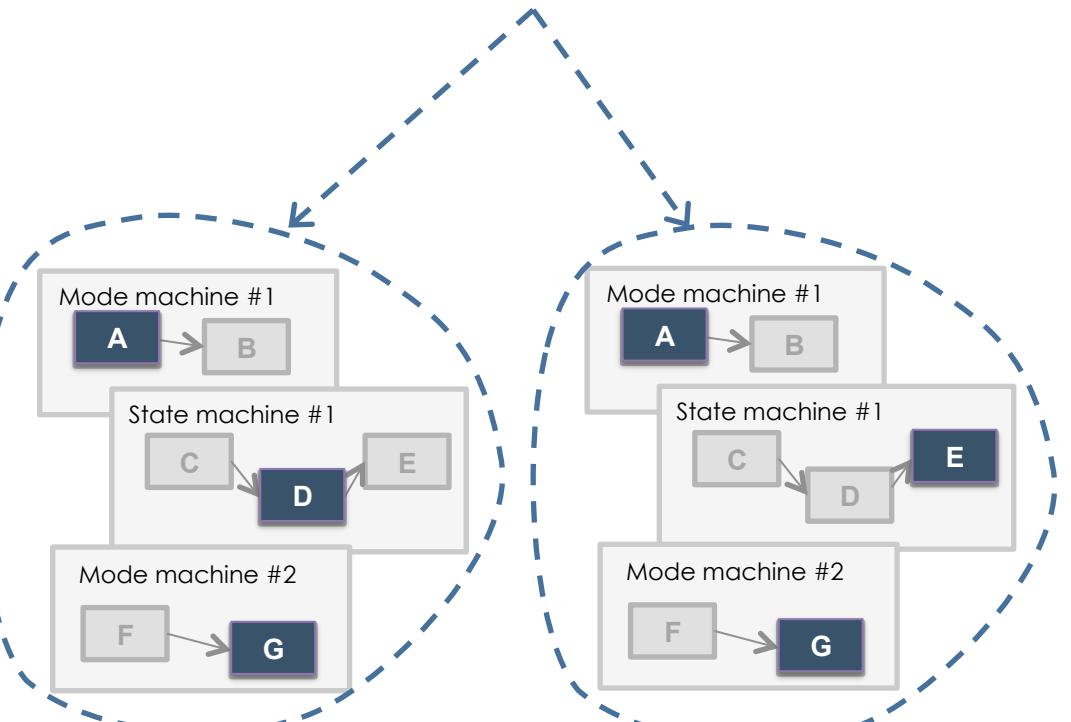


Relate atomic configurations
to specific modes and states

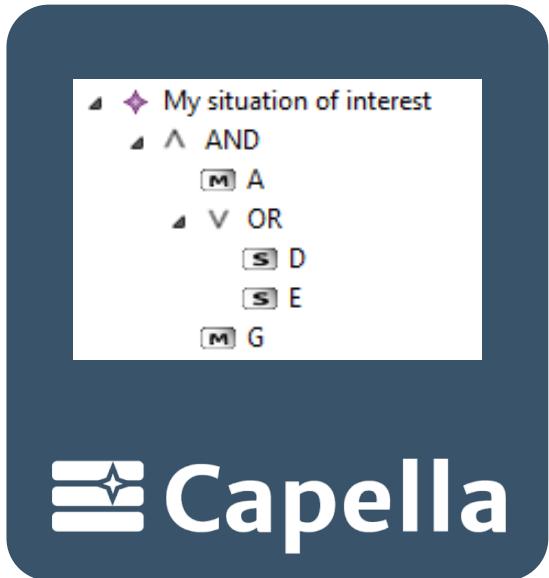
2

Identify situations of interest

SITUATION: Mode A AND (State D or State E) AND Mode G

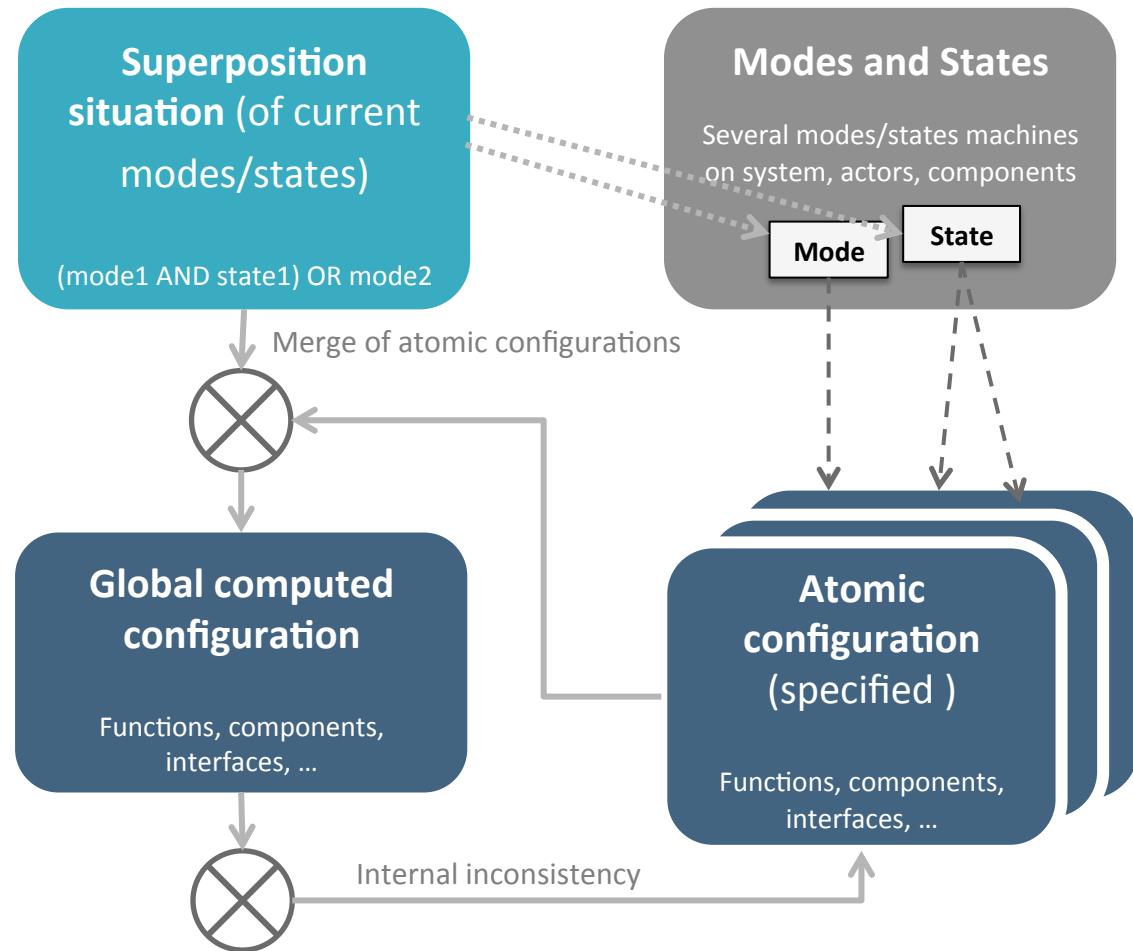


Current mode/state in the mode/state machine



3

Compute the global configuration
for this situation



The screenshot shows the Capella Project Explorer on the left and a Validation Problems dialog box on the right. The Project Explorer displays a tree structure of logical architecture, functions, capabilities, interfaces, data, and logical contexts. A yellow arrow points from the 'Compare Mission1 with Phase1' node in the Logical Context section to the Validation Problems dialog box. The dialog box lists validation errors related to the comparison between Mission1 and Phase1.

Capella Project Explorer

Select a name to find
? = any character, * = any string
type filter text

Logical Architecture

Logical Functions

- Root Logical Function
 - FunctionalChain 1
 - LogicalFunction B1
 - LogicalFunction B2
 - LogicalFunction A1
 - LogicalFunction A2
 - LogicalFunction C1
 - power
 - position
- Capabilities
- Interfaces
- Data
- Logical Context
 - Mission1
 - Phase1
 - Configuration 4
 - Situation I
 - Situation II
 - Compare Mission1 with Phase1
 - StateMachine 1
 - Subsystem B : Subsystem B
 - Subsystem A : Subsystem A
 - Subsystem C : Subsystem C
 - Subsystem B
 - Subsystem A
 - Subsystem C

Test [MSM] Default Region [LAB] Logical System [PAB] Physical System [LAB] Logical System

Logical System

Validation Problems

Problems encountered during validation

Reason: Diagnosis of Compare Mission1 with Phase1

OK << Details

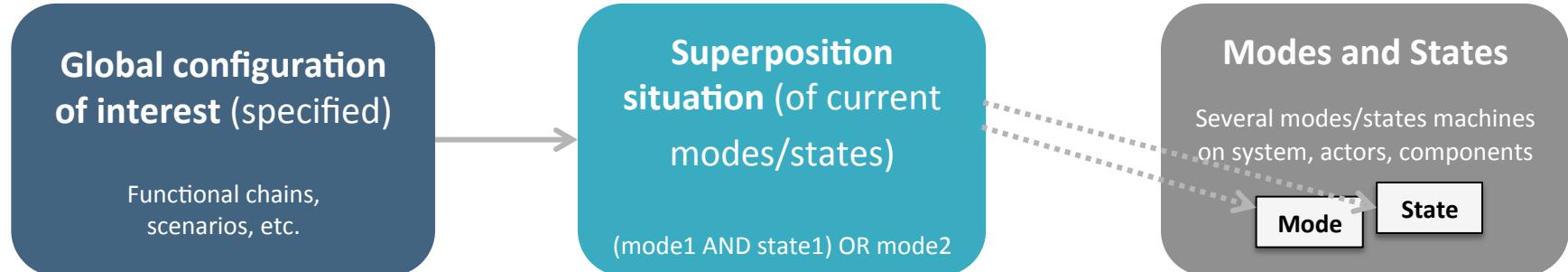
For the Compare Mission1 with Phase1 : The LogicalFunction A1 not exist in the Phase1.
For the Compare Mission1 with Phase1 : The LogicalFunction B1 not exist in the Phase1.
For the Compare Mission1 with Phase1 : The LogicalFunction B2 not exist in the Phase1.
For the Compare Mission1 with Phase1 : The Subsystem A not exist in the Phase1.
For the Compare Mission1 with Phase1 : The Subsystem C not exist in the Mission1.

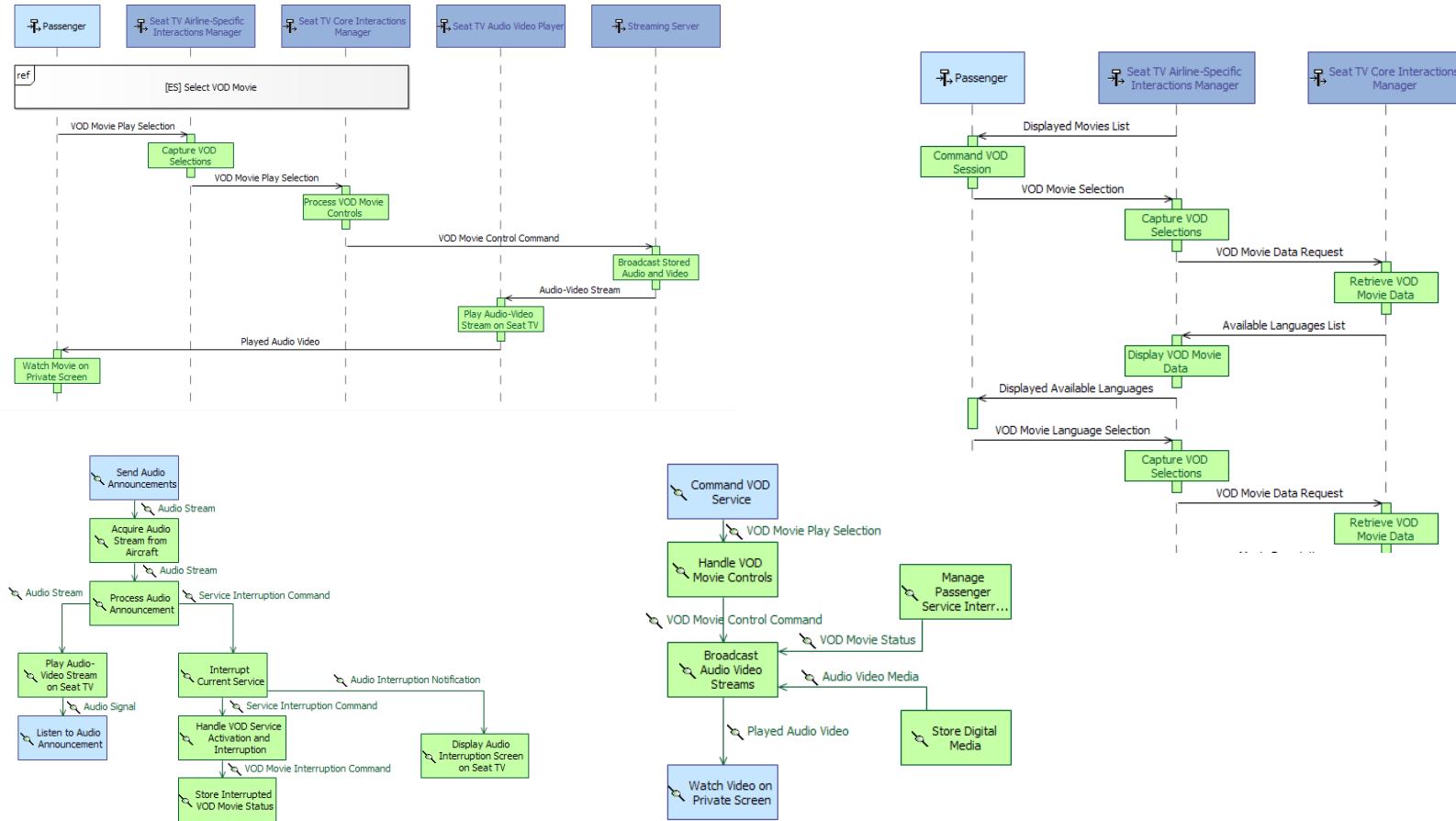
Properties Information Semantic Browser Model requests interpreter Viewpoint Manager Error Log

Message Level Rule id Rule s

4

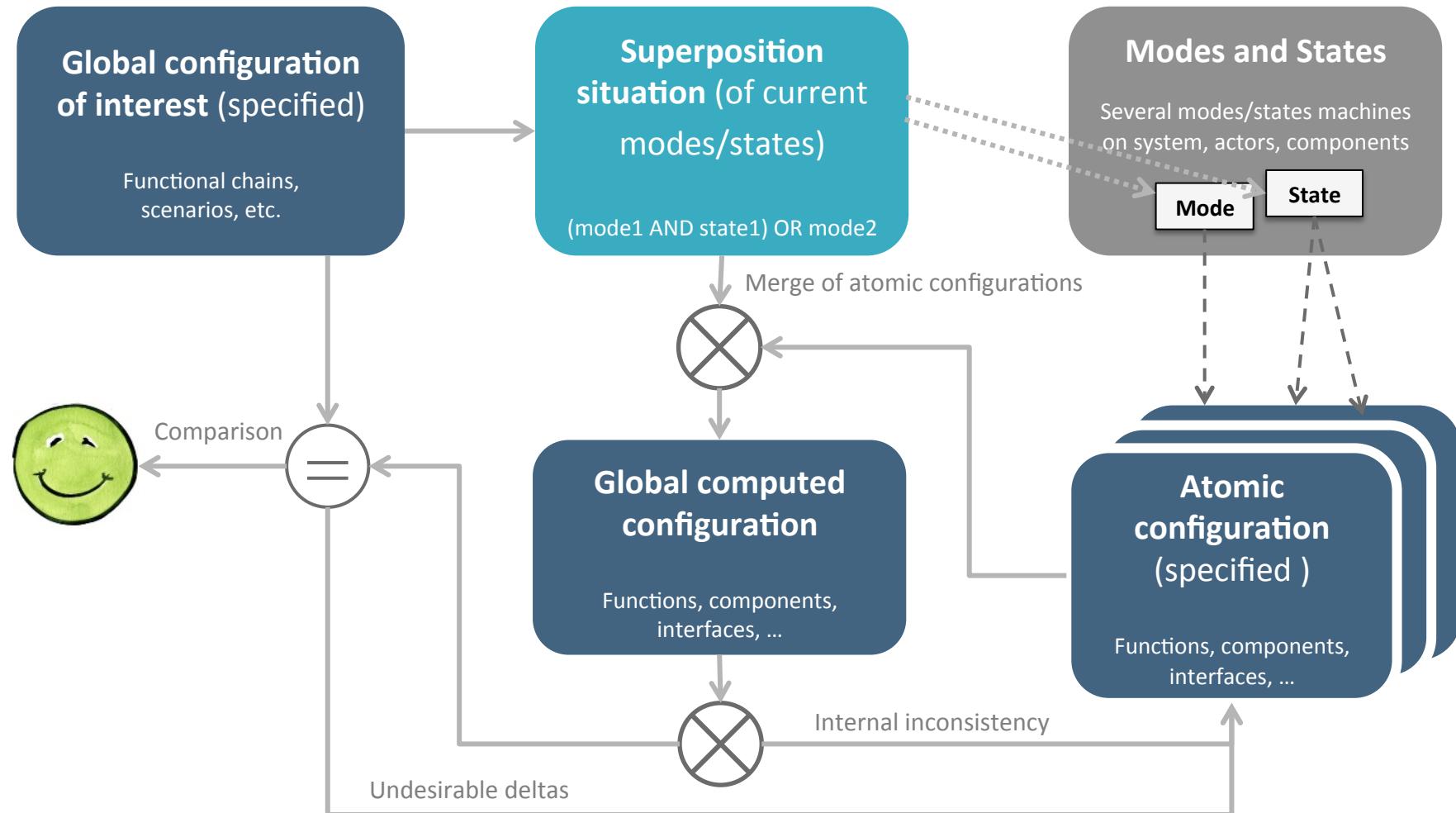
Specify what is expected in term of functional content for this situation

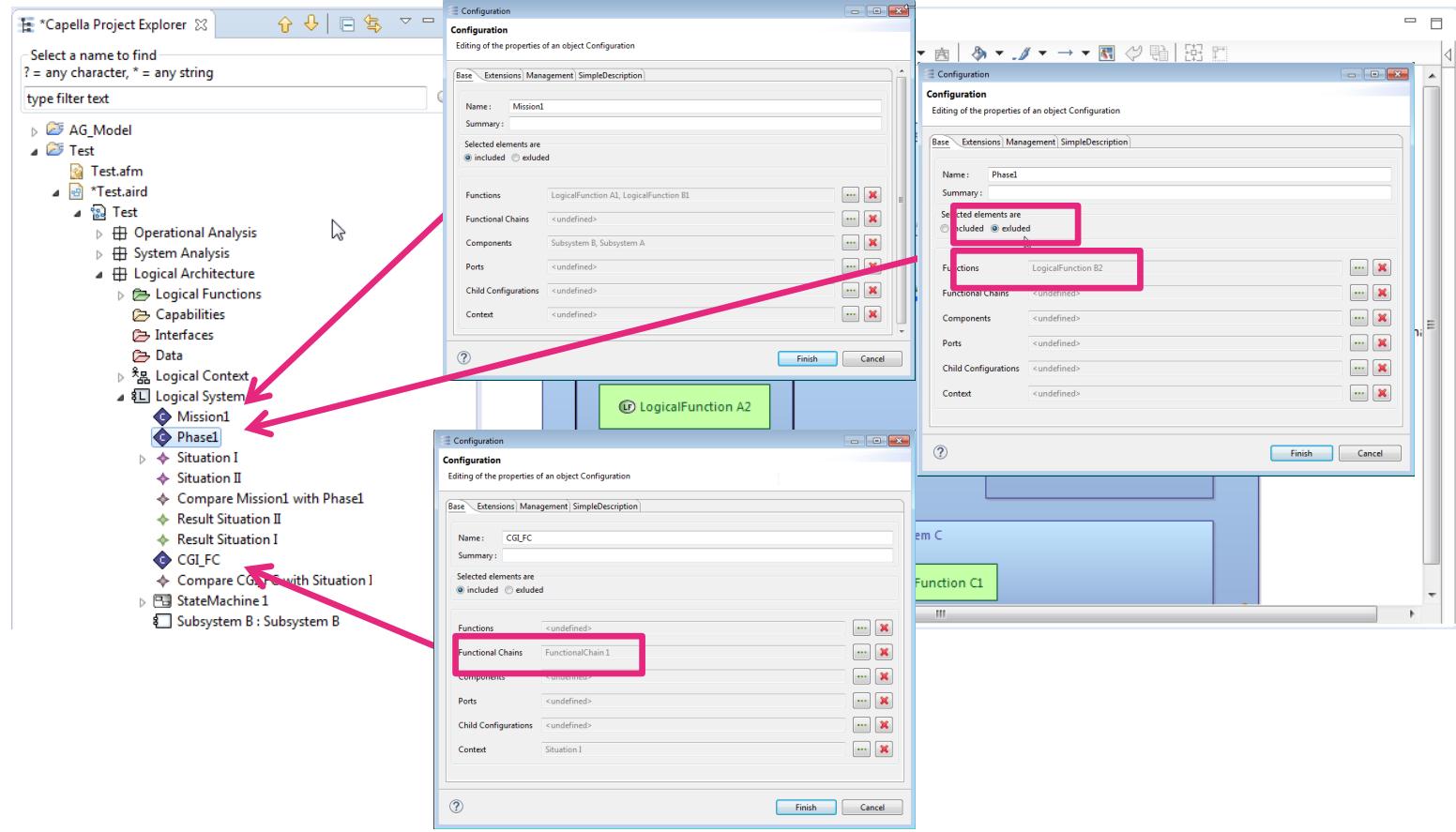


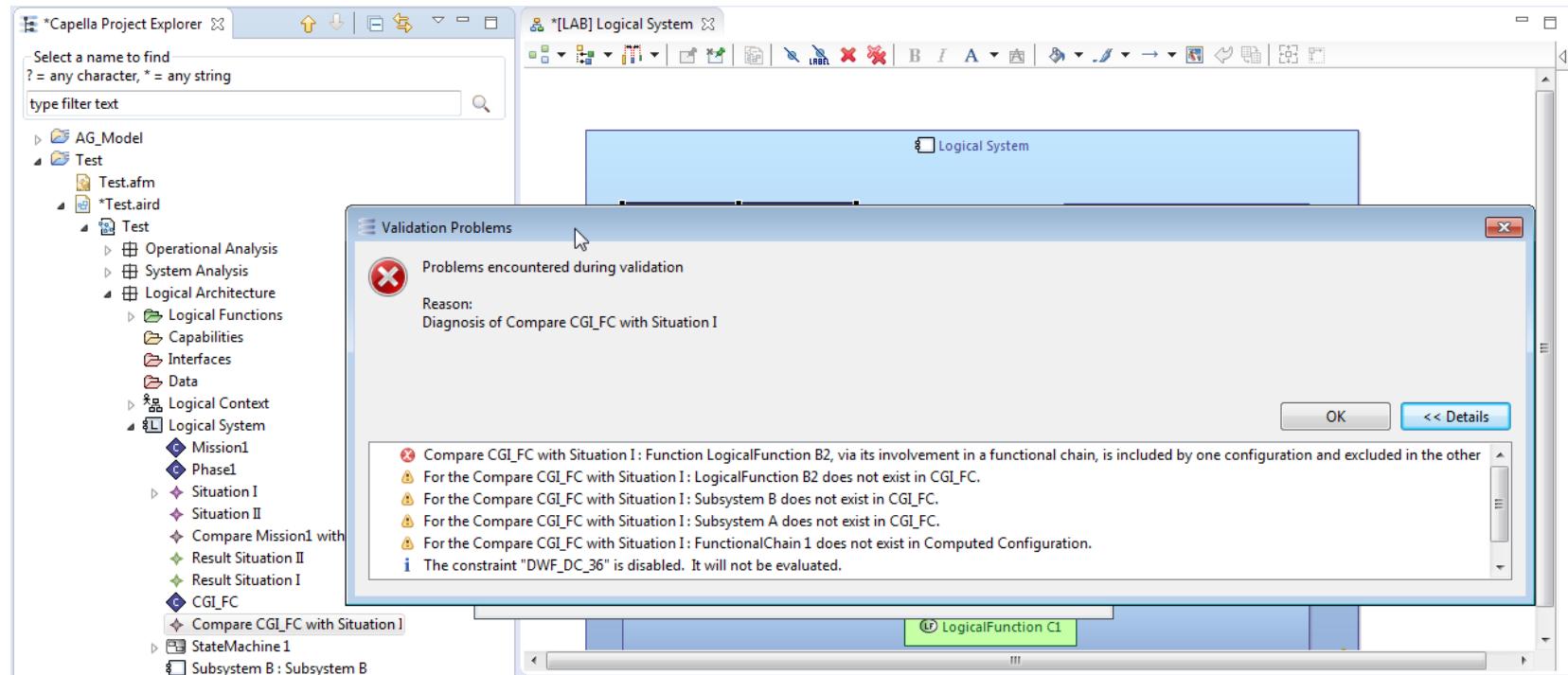


5

Compare expected vs computed









Live demos on the booth!

Open MBSE Solution



Thank You! Questions?

Capella website:

<http://www.polarsys.org/capella/>

LinkedIn 

<https://www.linkedin.com/groups/8605600>

Twitter 

https://twitter.com/capella_arcadia

Arcadia forum:

<https://polarsys.org/forums/index.php/f/12/>

Capella forum:

<https://polarsys.org/forums/index.php/f/13/>

IFE model & doc.:

<http://www.polarsys.org/capella/start.html>

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