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Model-Based Systems Engineering

A Pragmatic MBSE Approach of Nissan Powertrain Team to Minimizing Document-Based SE

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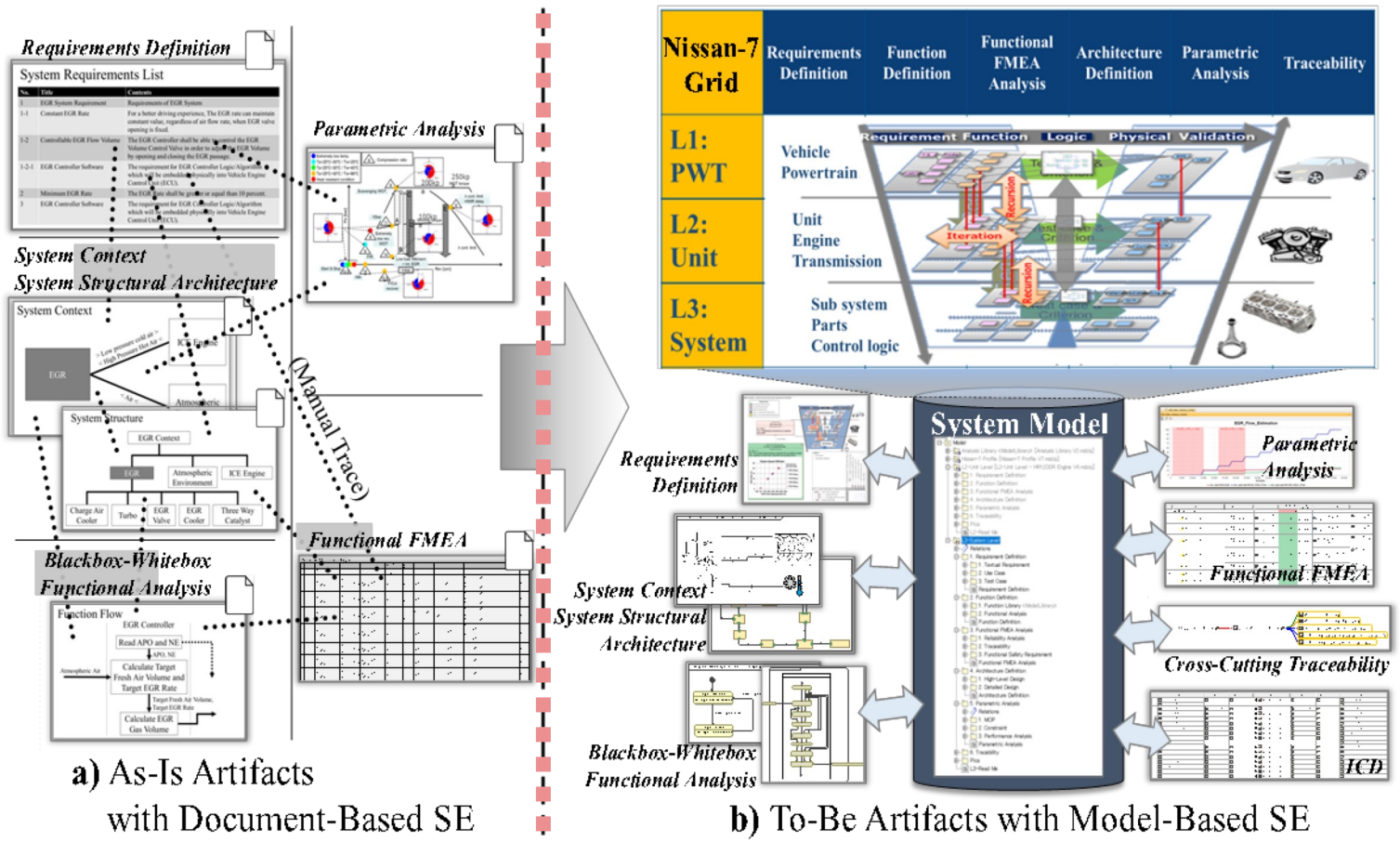
Table of Content

- Overview
- MBSE Motivation
- Steps of MBSE Journey
- Lesson Learned
- Future Works
- Q&A

Overview

A case study of collaboration

between ***Nissan Powertrain*** and ***Dassault Systèmes CATIA Cyber Systems Team***



A pragmatic MBSE approach with Nissan-7 Methodology:

- To encourage the *Nissan Powertrain* SE
- To construct and leverage **System Model** as **a Single Source of Truth**

MBSE Motivation

1. Interdisciplinary Communication

To improve communication among multidisciplinary teams with single source of truth

2. Designing and Managing Requirements and Interfaces

To maintain, synchronize, and ensure in terms of correctness, completeness, and consistency of requirements and interfaces.

3. Functional safety and reliability analysis

To increase efficiency and traceability for functional safety and reliability analysis.

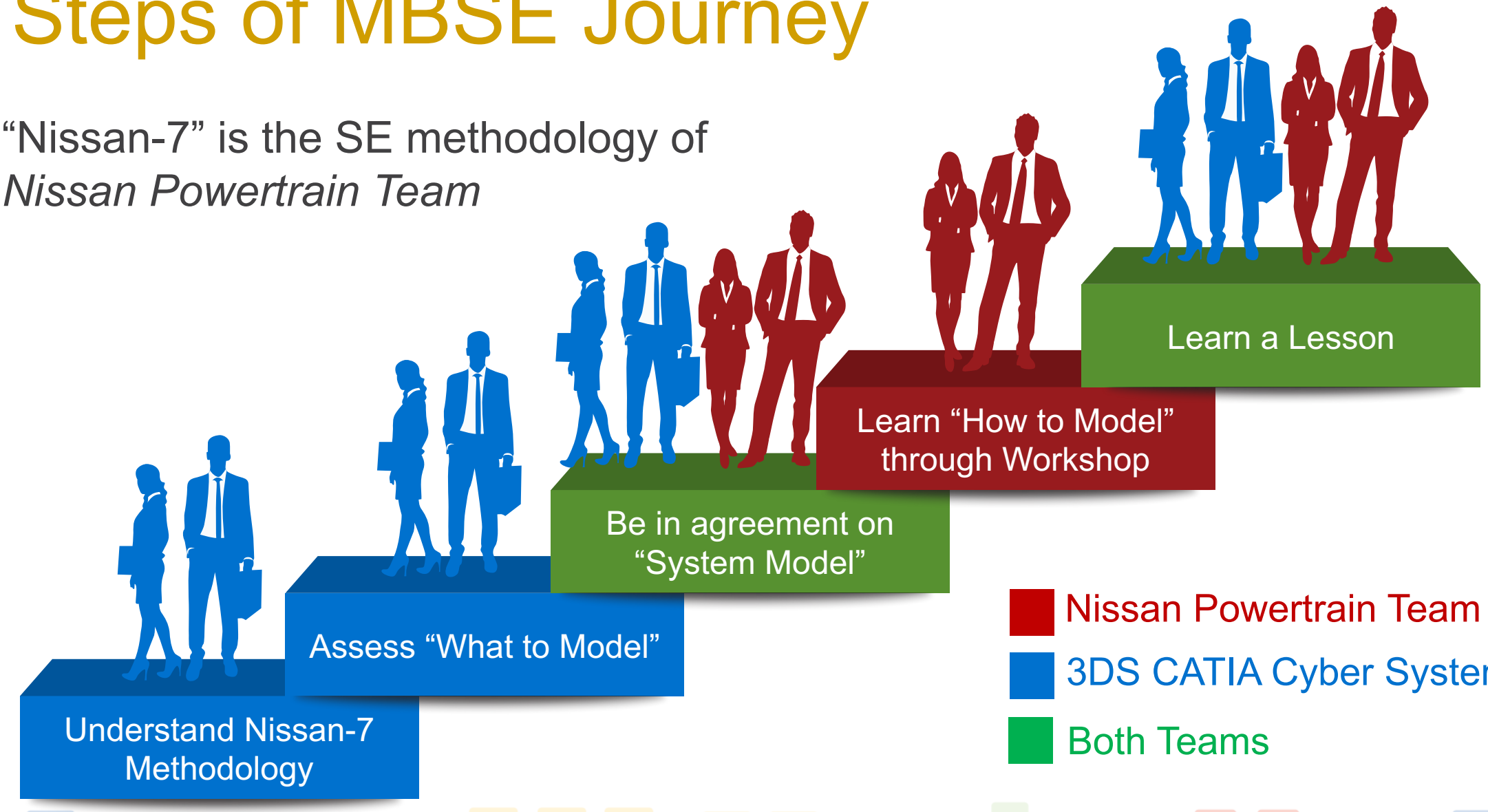
4. Increased Complexity and Knowledge Capture

To manage complexity with holistic system architecture and capture knowledge for technology capitalization.

Icons created by Becris - Flaticon

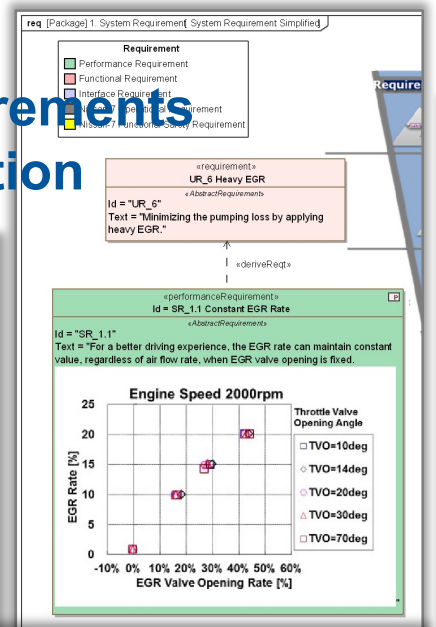
Steps of MBSE Journey

"Nissan-7" is the SE methodology of *Nissan Powertrain Team*

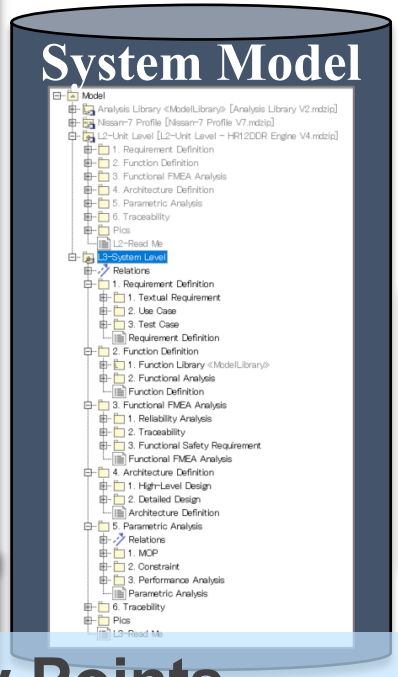


Sample of System Model

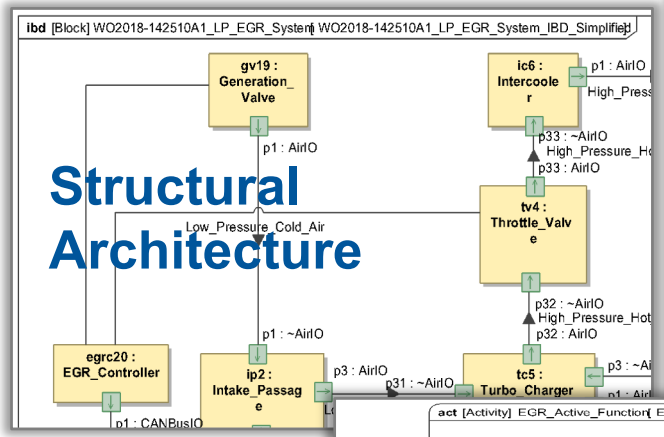
Requirements Definition



System Model



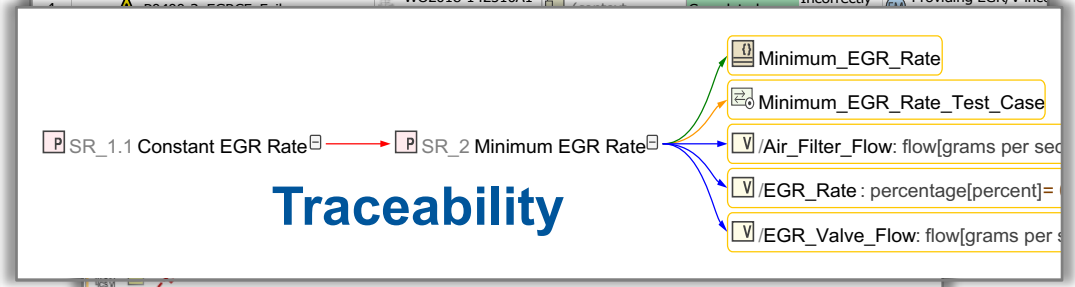
Structural Architecture



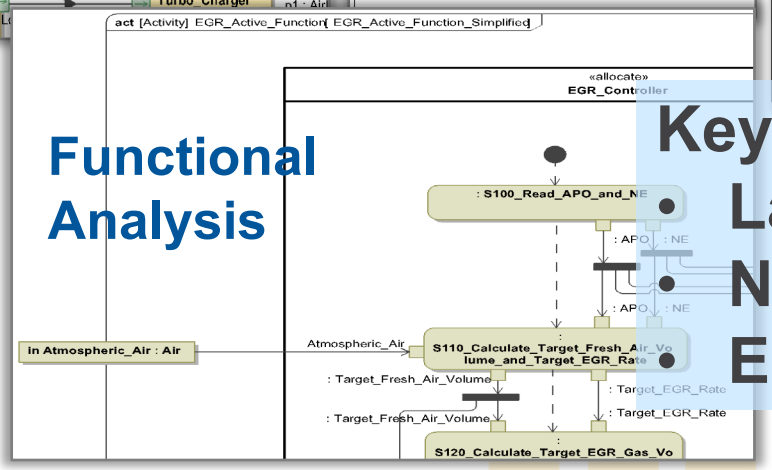
Functional FMEA

#	Name	Subject parts	Function	Guide Word Completeness	Guide Word	Failure Mode
1	P0400_EGR_Control_Function_Failure			Not Completed		
2	P0400-1_EGRCF_Failure	WO2018-142510A1_LP_EGR_System	Control_EGRV (context EGR_Controller)	Completed	Not Provided	Not providing EGR/V signal
3	P0400-2_EGRCF_Failure	WO2018-142510A1_LP_EGR_System	Control_EGRV (context EGR_Controller)	Completed	Not Provided	Not providing EGR/V signal
		WO2018-142510A1	Control_EGRV		Incorrectly	Providing EGR/V inco

Traceability



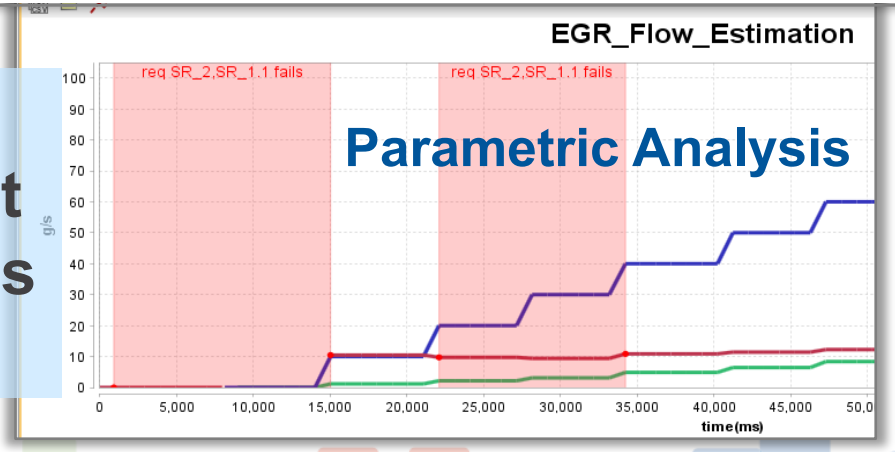
Functional Analysis



Key Points

- Layered Concept
- Nissan-7 Process
- Early V&V

Parametric Analysis



Lesson Learned

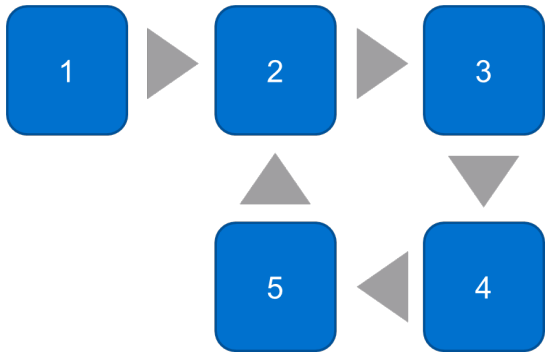
Feedback from Nissan Powertrain team about main benefits of system models:

- *"Utilizing holistic system architecture in design and technical studies helps to prevent information loss and perform impact analysis between an SoI and its external systems."*
- *"Utilizing a system model in technology capitalizations helps to structure engineering know-how and capture knowledge of experienced engineers to reuse, transfer, and adapt that knowledge to new technologies, e.g. electrification in automotive transformation."*

Takeshi Morita, 2022

Conclusion

Nissan-7 Layered Concept



Nissan-7 Tailored Process

Early V&V

Future Works

Reduce Learning Curve

Overcome it through discussions, trainings, and workshops.

Replicate the Benefits

Replicate the benefits of the MBSE approach in the actual development process.

Include Trade-Off Study

Include Trade Study Analysis with Nissan-7 Trade Off Matrix.

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Q&A

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