



MapleMBSE

An Excel-based MBSE Tool for
Knowledge Sharing and Collaboration across the Enterprise

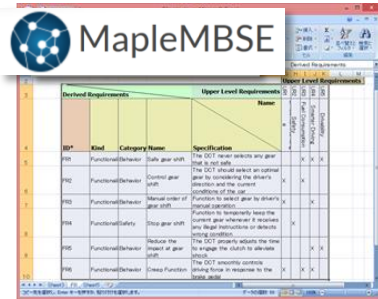
Paul Goossens, VP MBSE Solutions
Bharani Mohan, MBSE Developer



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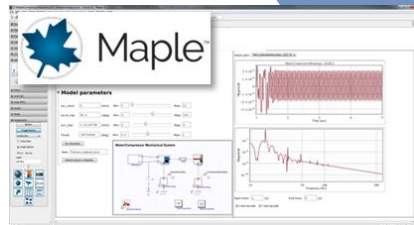
Model-driven Innovation for Engineering Systems Design



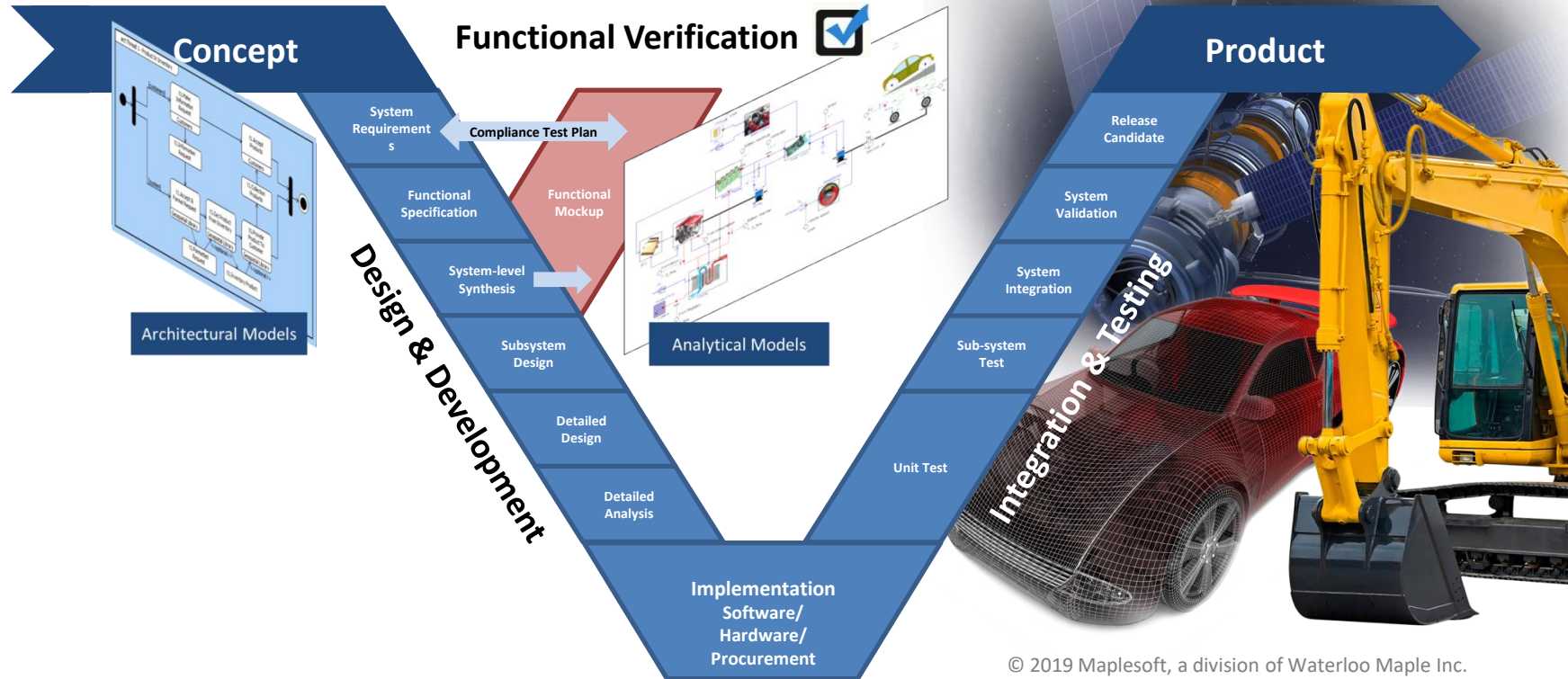
Systems Engineering

System Simulation

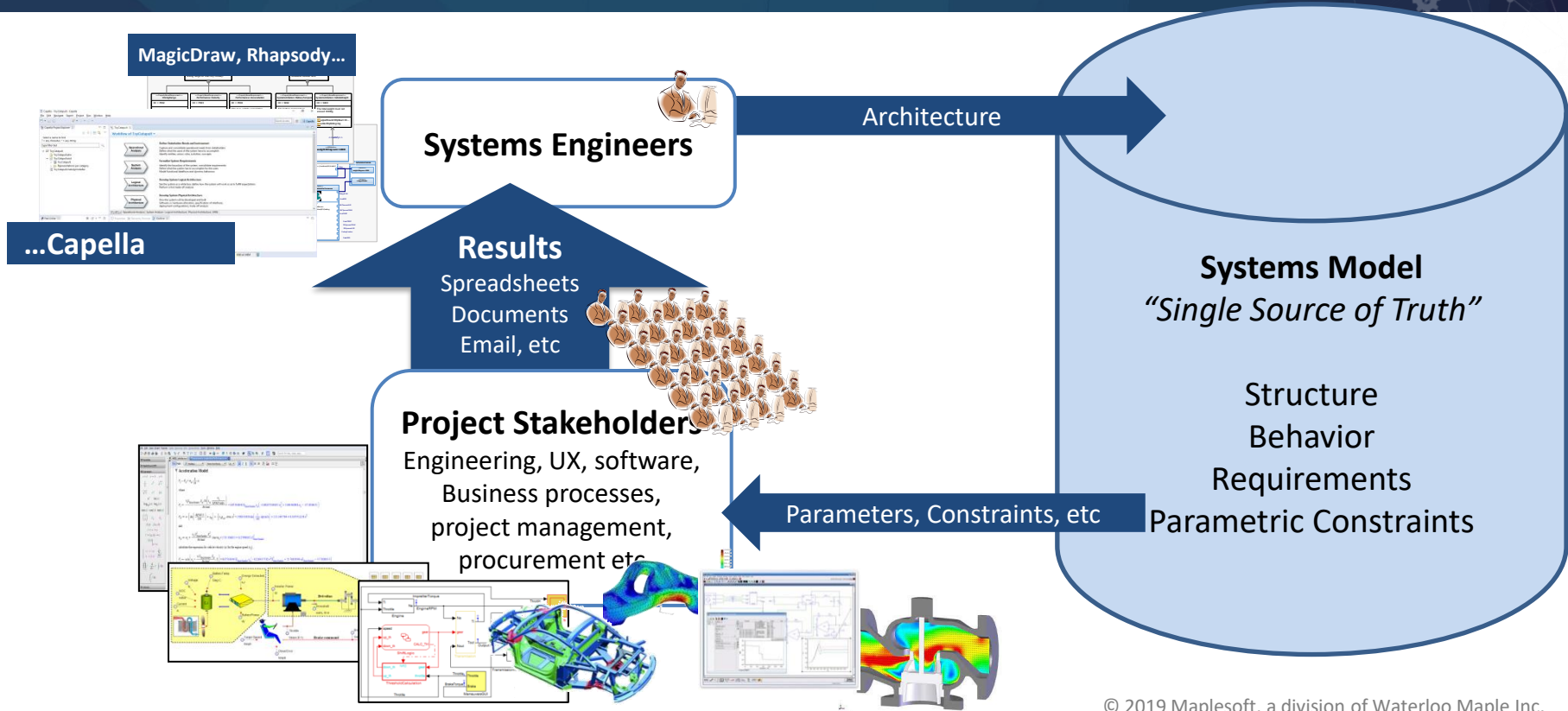
Calculation Management



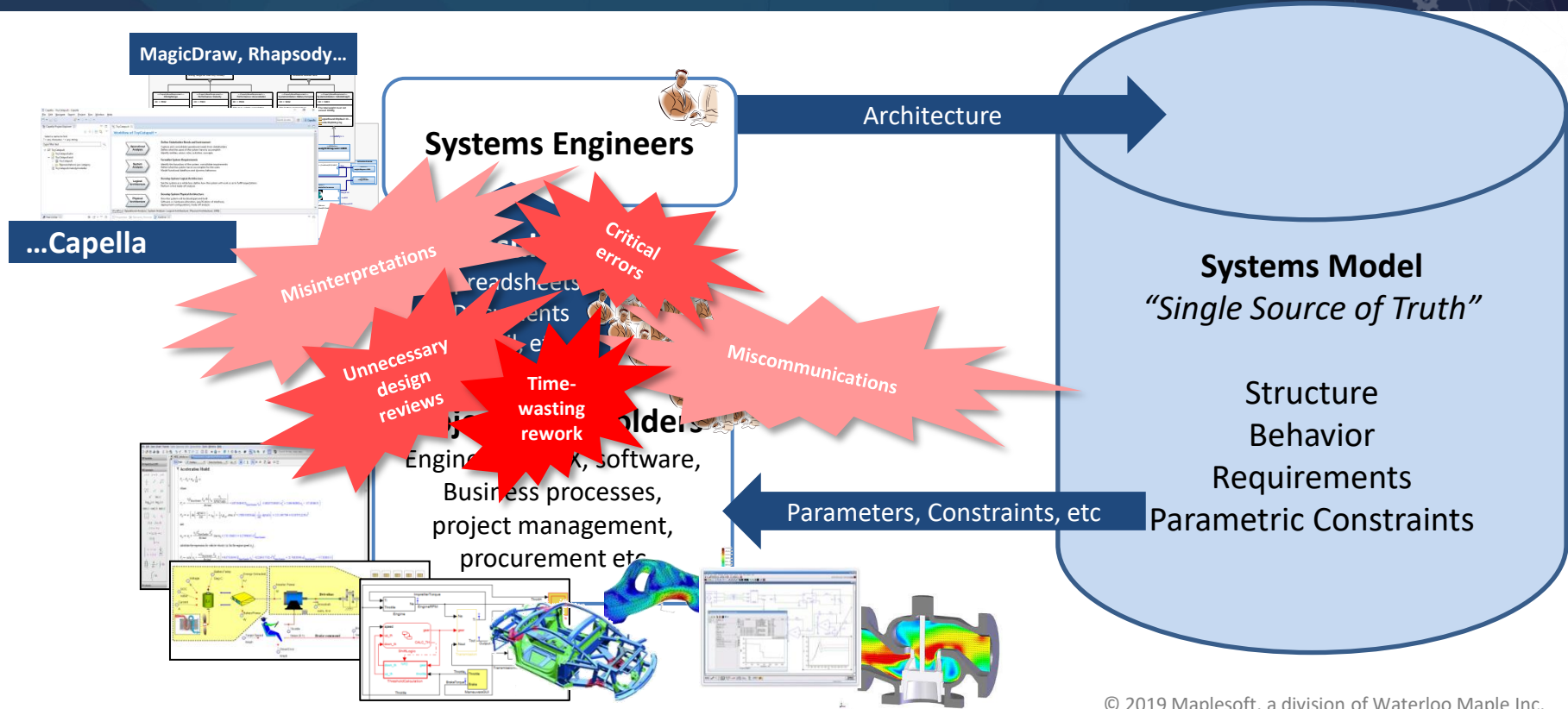
Systems Design & Development Process



How to scale Systems Engineering beyond Systems Engineers?



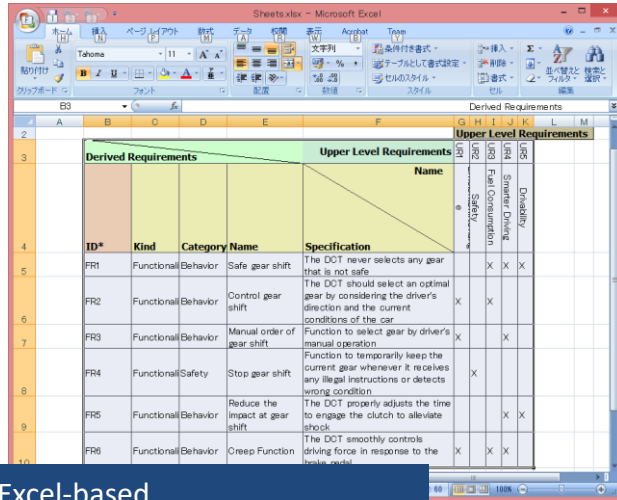
How to scale Systems Engineering beyond Systems Engineers?





MapleMBSE

Systems Engineering for All Project Stakeholders



The screenshot shows a Microsoft Excel spreadsheet titled 'Sheets.xlsx'. The spreadsheet is divided into two main sections: 'Derived Requirements' and 'Upper Level Requirements'. The 'Derived Requirements' section contains a table with columns for ID, Kind, Category, Name, and Specification. The 'Upper Level Requirements' section contains a table with columns for Name, Safety, Senior Driving, and Disability. The table in the 'Derived Requirements' section is as follows:

ID	Kind	Category	Name	Specification
FR1	Functional Behavior	Safe gear shift		The DOT never selects any gear that is not safe.
FR2	Functional Behavior	Control gear shift		The DOT should select an optimal gear by considering the driver's direction and the current conditions of the car.
FR3	Functional Behavior	Manual order of gear shift		Function to select gear by driver's manual operation.
FR4	Functional Safety	Stop gear shift		Function to temporarily lock the current gear whenever it receives any illegal instructions or detects wrong condition.
FR5	Functional Behavior	Reduce the impact at gear shift		The DOT properly adjusts the time to engage the clutch to alleviate shock.
FR6	Functional Behavior	Creep Function		The DOT smoothly controls driving force in response to the brake pedal.

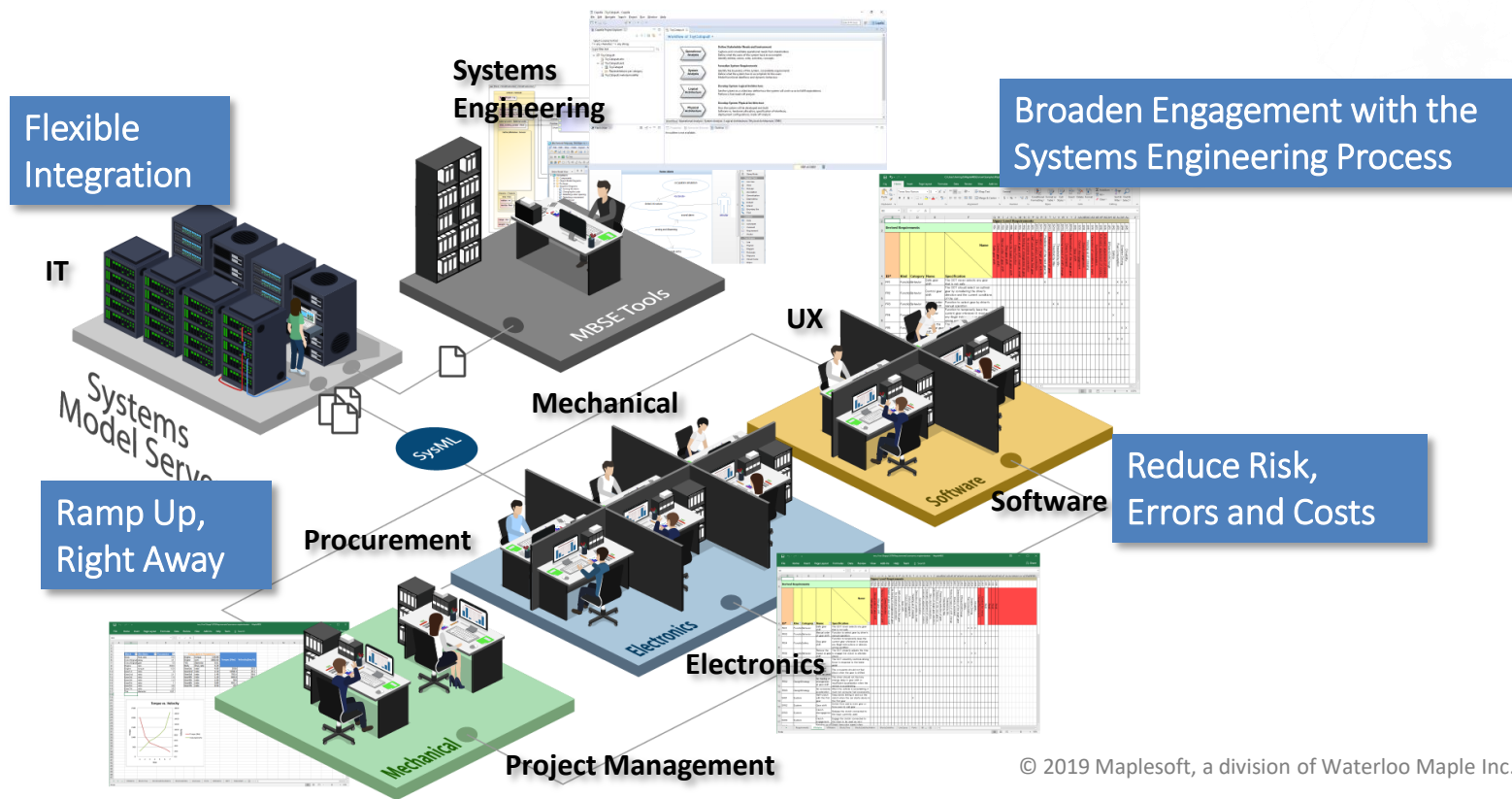
Excel-based development of system designs

- Intuitive, Excel-based UI for viewing, entering, and modifying system design information
- Synchronized updates between Excel and system model
 - Add new structures or modify existing ones
 - Instant impact analysis of design changes, eg conflicting requirements.
 - Perform FMEA, trade-studies, dependency analysis etc
- Customizable UI for task-specific views and analyses
- Integration with standard SE platforms, such as Rhapsody and MagicDraw/Teamwork Cloud (SysML)
- Interfaces and tools for rapid integration with other SE and PLM platforms

www.maplembse.com

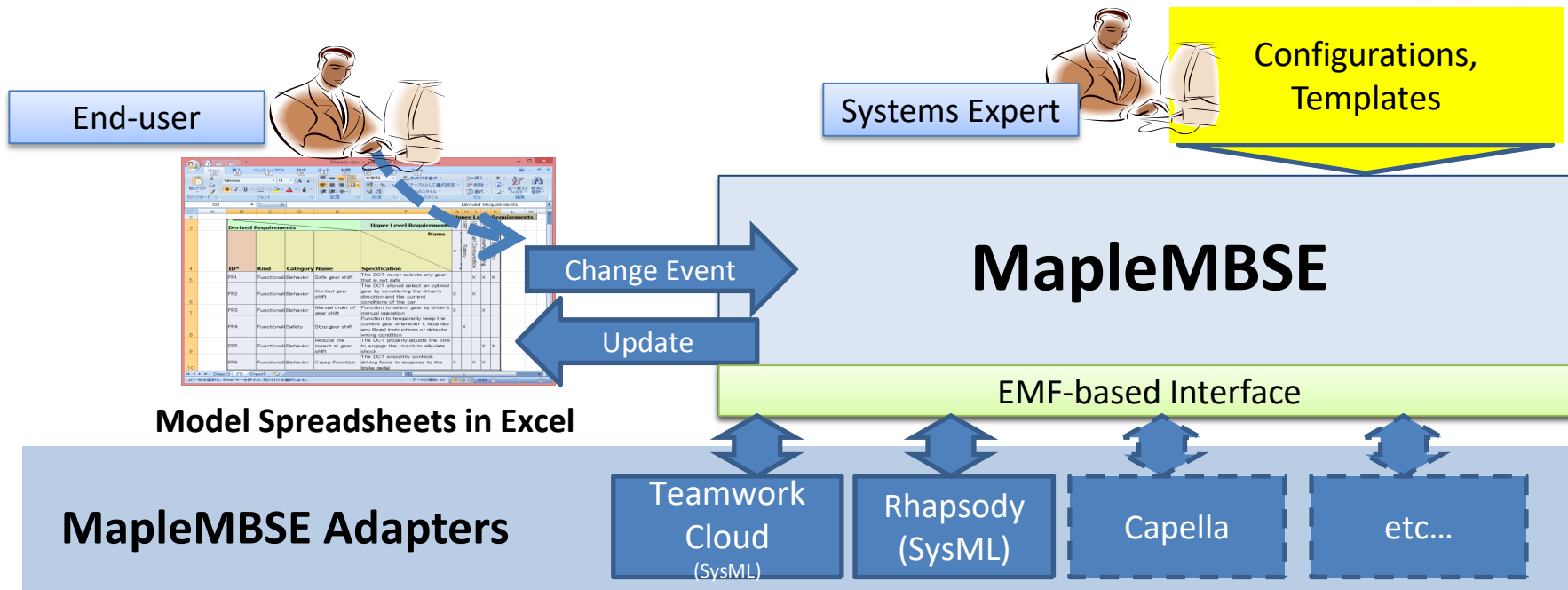
MapleMBSE

Facilitate Design Collaboration Across the Enterprise



MapleMBSE Architecture Overview

MapleMBSE enables systems-model development Excel. Since it is built on top of EMF, we can integrate many modeling tools by providing Adapters



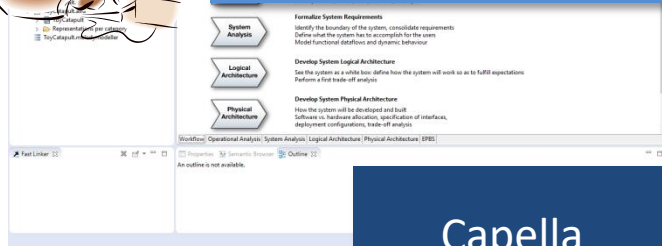
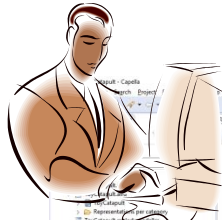
Demonstration work-flow: FMEA

Systems Engineer

- System architecture
- Requirements
- MapleMBSE Templates & Configurations

Safety Engineer

- Identify failure modes
- Determine severity, frequency, ease of detection
- Determine RPN
- Recommend mitigation action



Capella

A screenshot of an Excel spreadsheet used for FMEA. It contains a table with columns for ID, Failure Mode, Effect, Cause, and Detection. The table lists several failure modes related to a car's manual operation, such as 'Manual order of gear shift' and 'Function to temporarily keep the current gear whenever it requires any legal instructions or detects wrong condition'. The table is organized into rows and columns, with some cells containing 'X' marks indicating the presence of a failure mode or its detection.

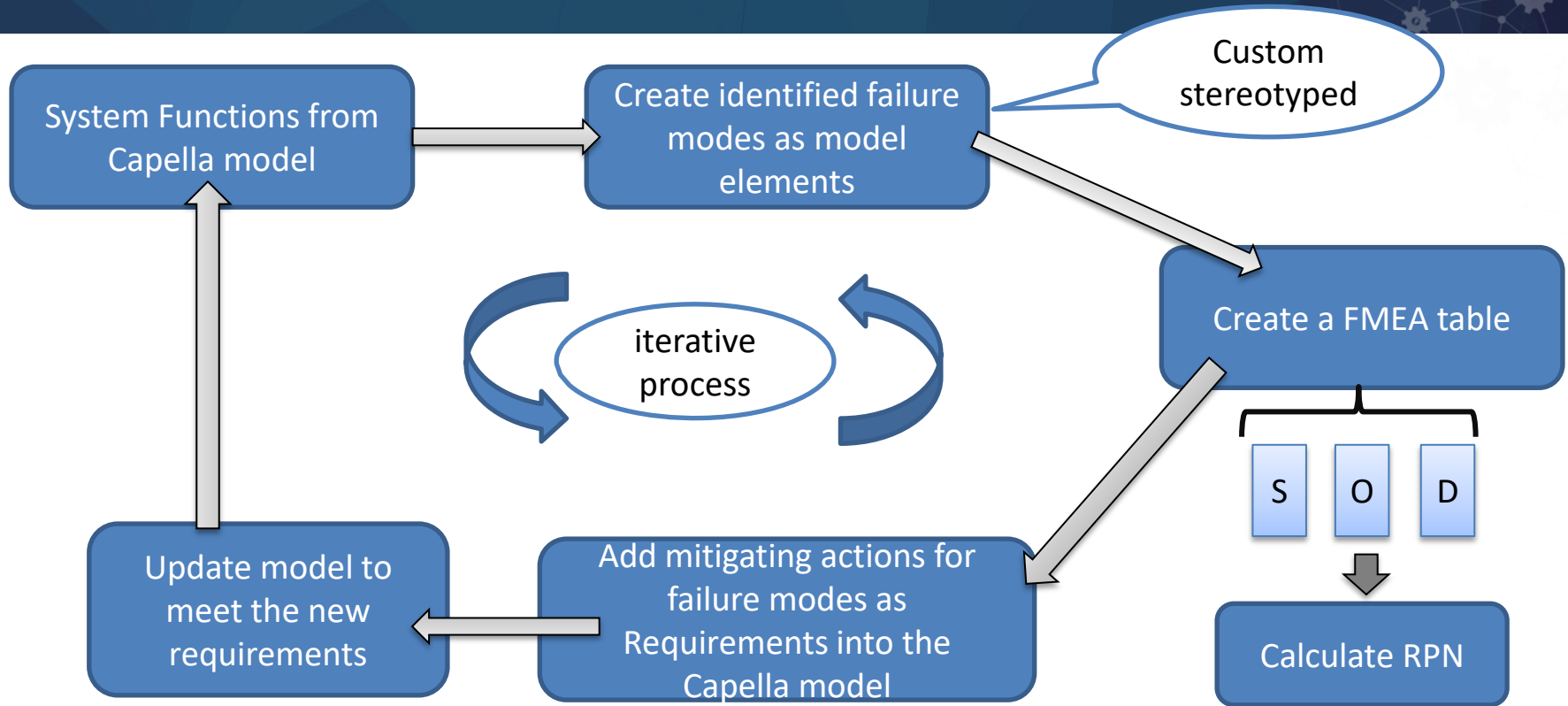
ID	Failure Mode	Effect	Cause	Detection
1	Functional/Behavior	Manual order of gear shift	Function to select gear by drivers manual operation	
2	Functional/Safety	Stop gear shift	Function to temporarily keep the current gear whenever it requires any legal instructions or detects wrong condition	
3	Functional/Behavior	Reduce the impact at gear shift	The DCT properly adjusts the time to engage the clutch. Activate the DCT when the clutch is released. The DCT properly adjusts the time to disengage the clutch. Activate the DCT when the clutch is released.	
4	Functional/Behavior	Creep Function	Creep Function	

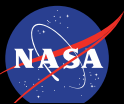
Excel

MapleMBSE

Capella Model

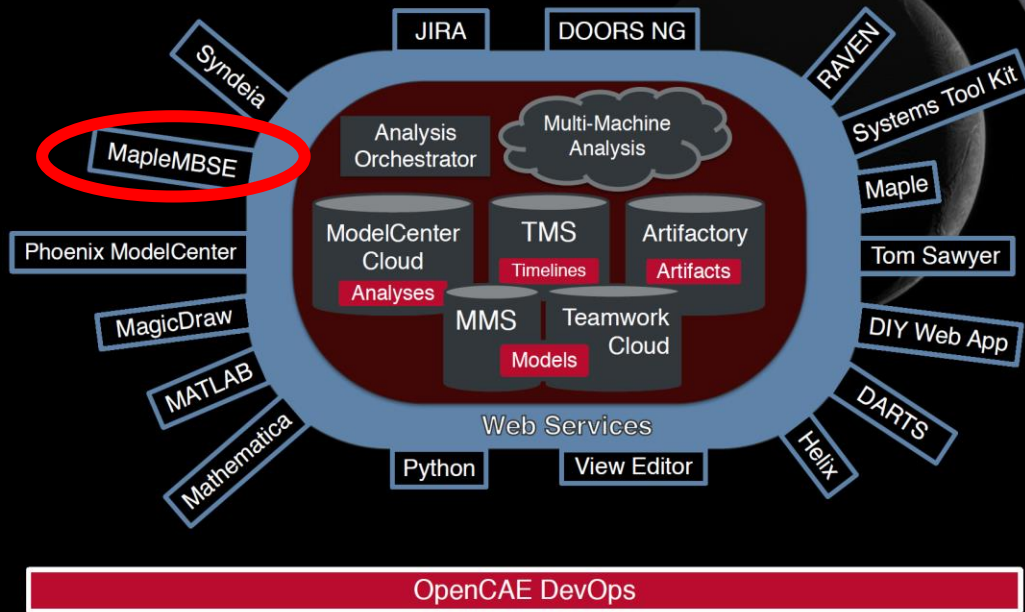
Demonstration work-flow: FMEA





Jet Propulsion Laboratory
California Institute of Technology

CAE Systems Environment: Overview

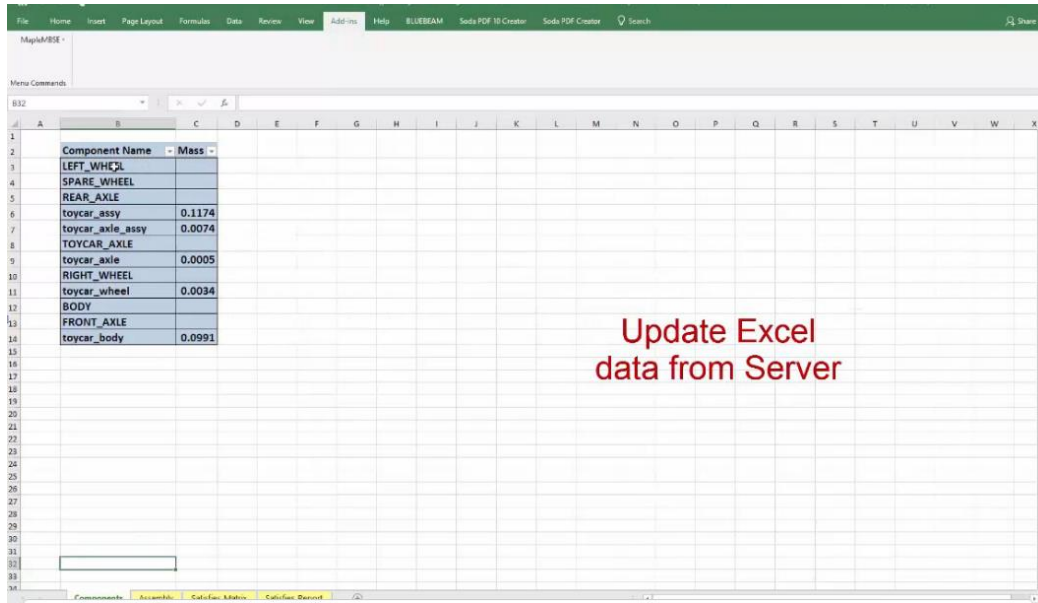


“MapleMBSE is one of the key enablers for effectively viewing and editing systems models”

Model-Based Systems Engineering Products in the OpenCAE Model-Based Engineering Environment with Europa Lander as a Case Study, Eric W Brower

Case Study: NASA-JPL

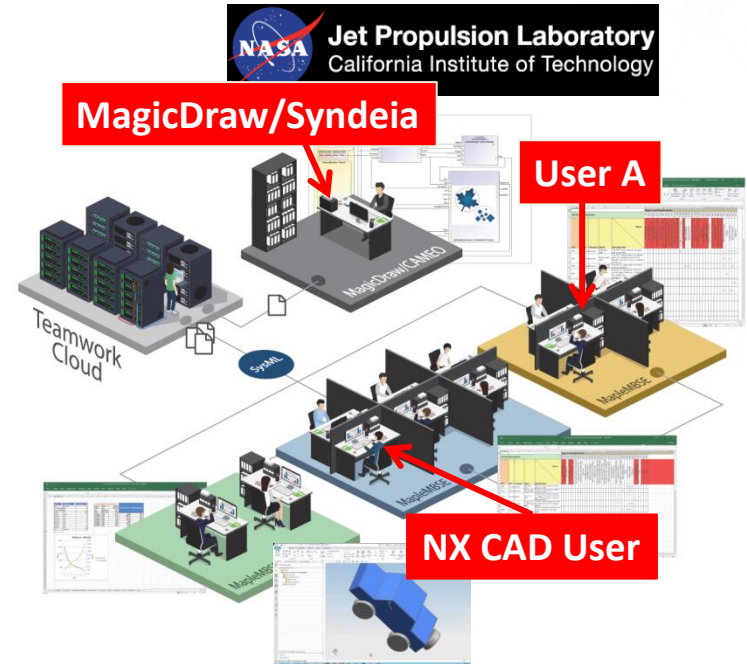
MapleMBSE-Syndeia-Excel-NX-integration



The screenshot shows the MapleMBSE application window with a menu bar (File, Home, Insert, Page Layout, Formulas, Data, Review, View, Add-ins, Help, BLUEBEAM, Soda PDF 10 Creator, Soda PDF Creator, Search) and a ribbon. The main workspace displays an Excel spreadsheet with the following data:

Component Name	Mass
LEFT_WHEEL	
SPARE_WHEEL	
REAR_AXLE	
toyCar_assy	0.1174
toyCar_axle_assy	0.0074
TOYCAR_AXLE	
toyCar_axle	0.0005
RIGHT_WHEEL	
toyCar_wheel	0.0034
BODY	
FRONT_AXLE	
toyCar_body	0.0991

Update Excel data from Server



Summary

- MapleMBSE provides easy-to-use Excel-based Systems Engineering modeling environment for system definition throughout the design cycle
- Offers the power to “democratize” the Systems Engineering process by allowing a broader range of stakeholders to engage with the systems model without learning other MBSE tools
- Proven to reduce risk in the system design process by simplifying the systems-model development, thus reducing errors and costs
- Currently supports Rhapsody and MagicDraw/TWC. We are building the business case for Capella

Questions?

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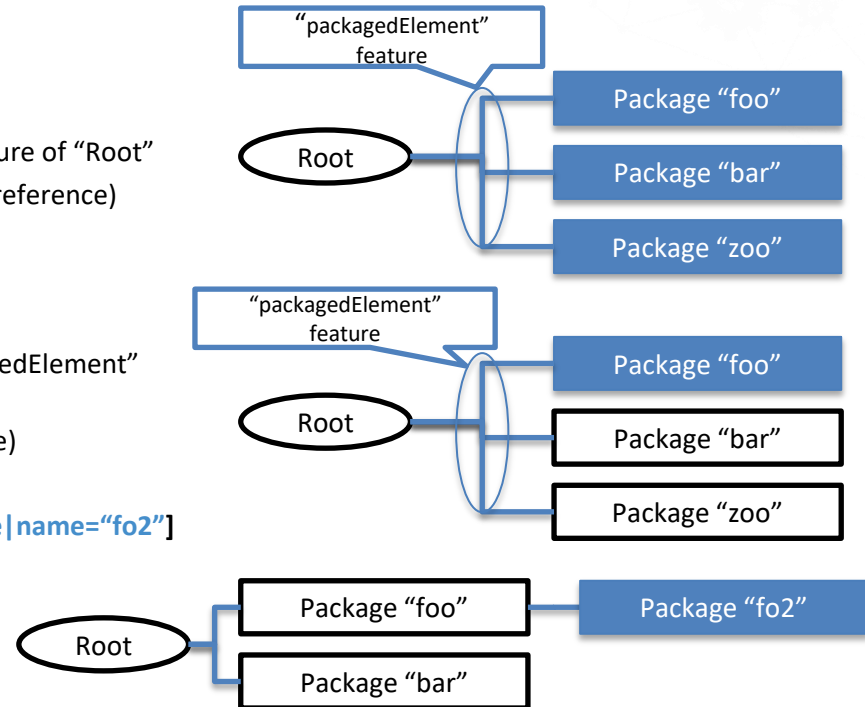
QPE: Query Path Expression

Query Path Expression is a simplified XPath to query model elements

Examples:

- **Root/packagedElement[Package]**
 - Pick up all of “Package” elements under the “packagedElement” feature of “Root”
 - where “packagedElement” is a name of a feature (more specifically, reference)
 -
- **Root/packagedElement[Package | name=“foo”]**
 - Pick up a “Package” element of the name of “foo” under the “packagedElement” feature of “Root”,
 - where “name” is also a name of a feature (more specifically, attribute)
- **Root/packagedElement[Package | name=“foo”]/packagedElement[Package | name=“fo2”]**

[...] part is called a qualifier



MapleMBSE Demos on YouTube

[Introduction to MapleMBSE](#)

High-level overview of how MapleMBSE allows engagement with the systems engineering process by all project stake-holders across the enterprise

[Easy-to-use Excel-based UI for Systems Engineering](#)

MapleMBSE gives you an intuitive, Excel®-based interface for easily entering system definitions without having to be an expert in your company's MBSE tool.

[Allows all stakeholders to contribute to the Systems Engineering process](#)

With MapleMBSE, you don't need to be a systems engineering expert to contribute to the process. Task-specific views are excel-based and show each stakeholder only what they need to see.

[Simplifies information-entry, reducing risk of errors](#)

MapleMBSE allows you to use natural language and numerical inputs to reduce errors associated with the complex entry mechanisms of MBSE tools.

[Offers rapid customization of model views and data integration](#)

Because every systems engineering project is different, MapleMBSE allows you to provide customized model views that best suit the task at hand.

[MapleMBSE and No Magic Teamwork Cloud Workflow](#)

Detailed demonstration of how MapleMBSE users can interact with systems models on Teamwork Cloud for No Magic/Dassault Systemes

MapleMBSE Demos on YouTube

[MapleMBSE Demo with Rhapsody and MagicDraw](#)

This shows how MapleMBSE works with Rational Rhapsody and MagicDraw, both well-established diagramming tools used extensively by system engineers. Fundamentally, the spreadsheets are a “views” into the system model that can be edited by adding more detailed structures and requirements then submitted back into the system model.

[MapleSim ModelCenter Demo](#)

This shows how the data in a systems model can be integrated with other simulation and analysis tools (in this case, Maple and MapleSim) to perform functional verification of a proposed system design, using ModelCenter from Phoenix Integration. By simulating the system’s dynamic performance over a range of duty cycles, key properties can be tested to ensure compliance with the requirements very early in the design process.

[JPL/OpenMBEE Managed Excel](#)

This is a demo that was developed by one of our customers, JPL, that shows the workflow between different stakeholders who perform different tasks, but the results of these tasks have a direct impact on other. Both can work in MapleMBSE without needing to work in MagicDraw at all.

[JPL/OpenMBEE MultiBranch Excel](#)

This is a demo that was developed by one of our customers, JPL, that shows how different stakeholders can be working on different branches of the same system model. MapleMBSE automatically builds the view that is scoped by the branch of the model that is selected.

[JPL/Syndeia Excel NX Integration](#)

This is a demo that was developed by one of our customers, JPL, that shows the integration of MapleMBSE with Siemens NX through Syndeia from Intercax, and MagicDraw and CAMEO Systems Modeler from No Magic.