



International Council on Systems Engineering
A better world through a systems approach



THE REUSE
COMPANY

Interoperability as an enabler for System Lifecycle digitalization

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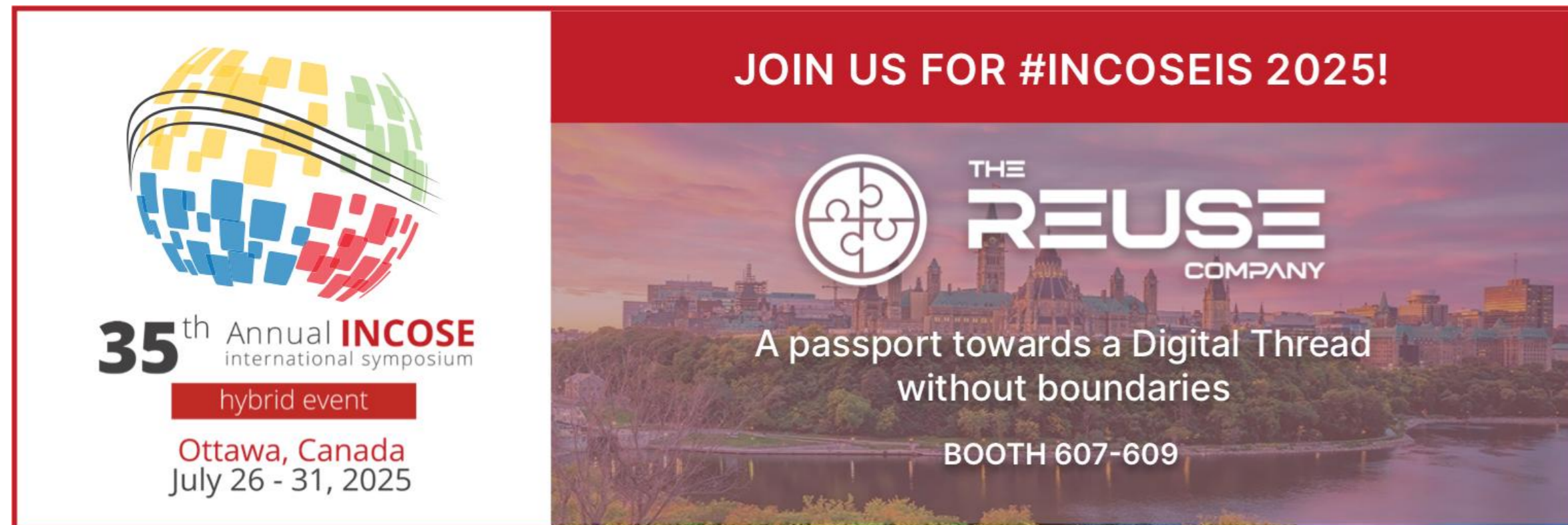
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Presenters




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 **THE REUSE COMPANY**

A passport towards a Digital Thread without boundaries

BOOTH 607-609


35th Annual INCOSE
international symposium
hybrid event
Ottawa, Canada
July 26 - 31, 2025



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ASEP Certified

Major contributor of the RWG's *INCOSE Guide to Writing Requirements (GtWR)*

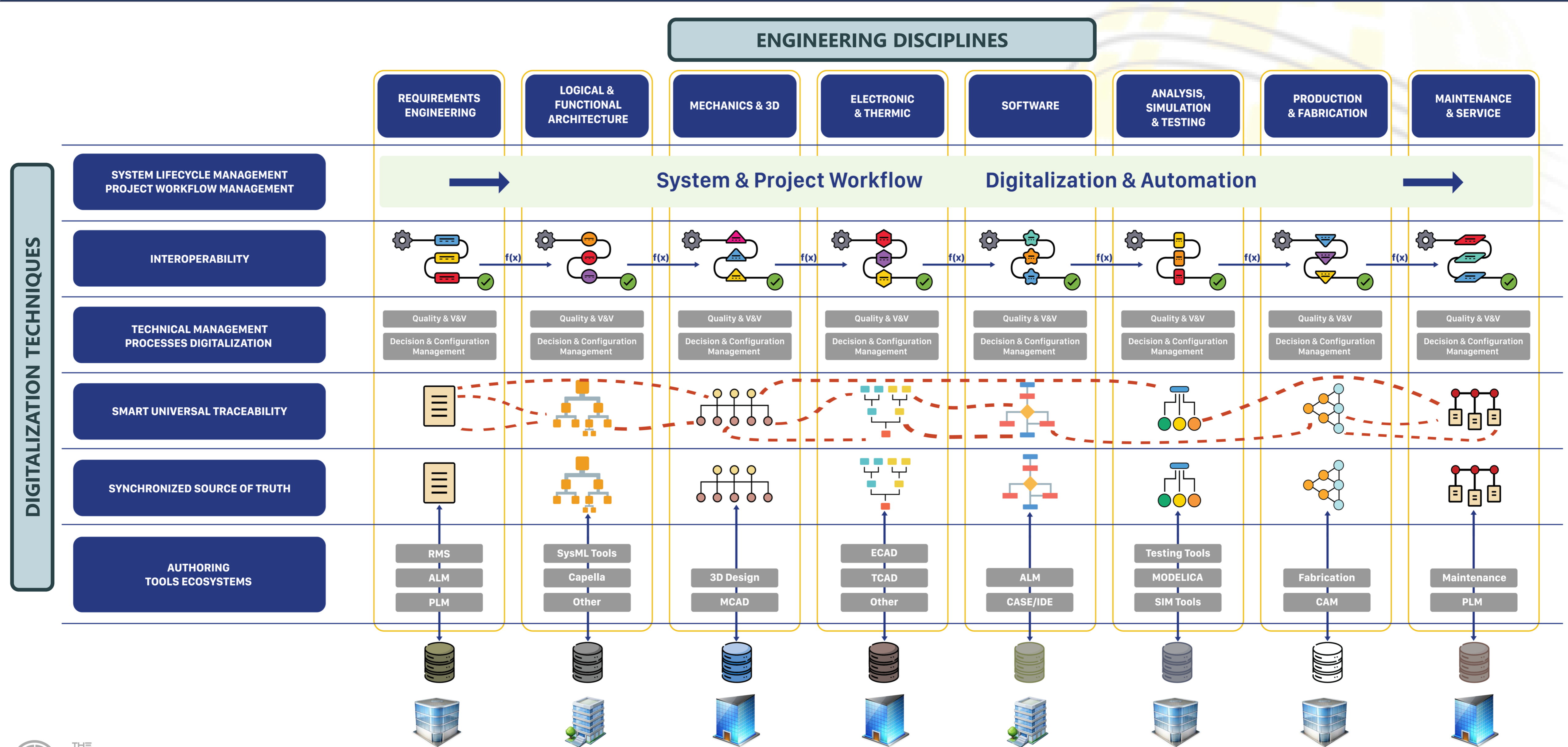
ilyes.yousfi@reusecompany.com

<https://www.linkedin.com/in/ilyesyousfi/en>



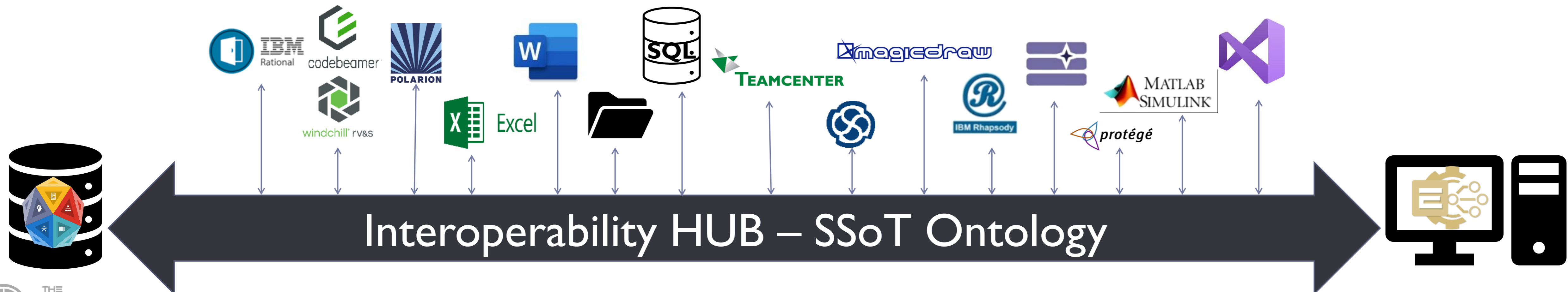
“The REUSE Company is a solutions provider specialized in the application of **SEMANTIC TECHNOLOGIES** and **ARTIFICIAL INTELLIGENCE** to improve the **DIGITALIZATION** of the **SYSTEM** life cycle following the principles of **KNOWLEDGE REUSE**.”





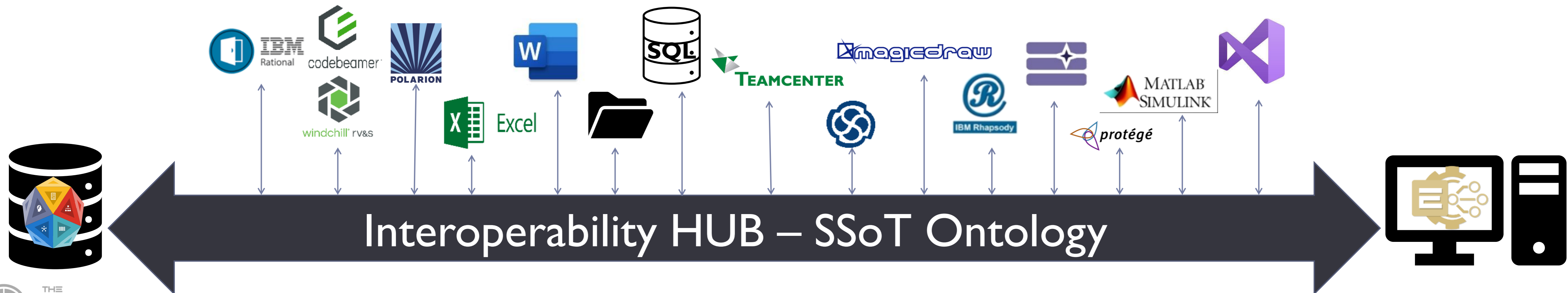


- ▶ SES ENGINEERING Studio has implemented the notion of **Interoperability HUB (SSoT – Synchronized Source of Truth)**:
 - ▶ **No one-to-one connector**: every tool connects to the hub
 - ▶ **Bidirectional** transformation from every source to the HUB upper ontology
 - ▶ Source tools from many different disciplines: RMS, MBSE, PLM, ALM, MS Office, PDFs, DBMS
 - ▶ **No wipe-out** approach at all, those sources remain as the *Authoritative Source of Truth (ASoT)*





- ▶ SES ENGINEERING Studio has implemented the notion of **Interoperability HUB (SSoT – Synchronized Source of Truth)**:
 - ▶ Changes in the source are notified in the SES ENGINEERING Studio and raise the notion of suspect links
 - ▶ Changes in the SES ENGINEERING Studio are persisted in the corresponding source tool (ASoT)
 - ▶ Empowered with:
 - ▶ additional **Technical & Management Processes**: Automatic Quality Assessment, KM, V&V...
 - ▶ a global **Semantic Search Engine**





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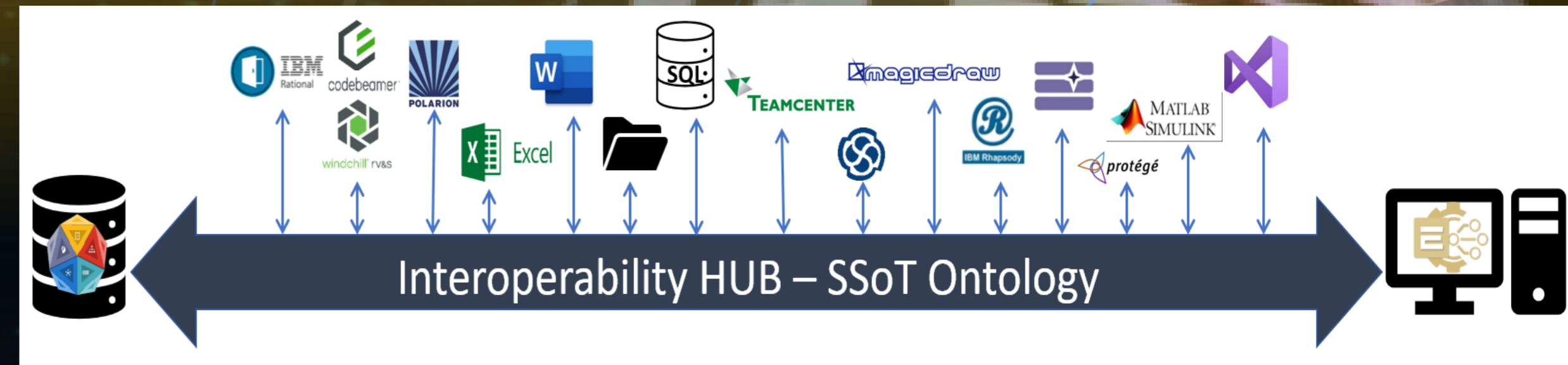
The pillars of

Interoperability HUB

Digital thread
without frontiers

Connectivity

+50 tools: RMS, MBSE, ALM, PLM tools, PDF, MS Office...
Semantic parsing of unstructured sources



1

Connectivity

+50 tools: RMS, MBSE, ALM, PLM tools, PDF, MS Office...
Semantic parsing of unstructured sources

2

End-to-End Semantic traceability

Traces into a heterogeneous environment
Automatic detection/suggestion of traces based on AI

3

The pillars of

4

Interoperability HUB

5

Digital thread without frontiers

6

The screenshot displays the TRACEABILITY Studio interface. On the left, a table lists traceability modules with columns for ID, Name, Description, Trace types, Security, Traces, and Evaluated on. On the right, a 'Module Map' diagram shows a network of interconnected nodes representing different modules and their relationships.

Ident.	Name	Description	Trace types	Security	Traces	Evaluated on
107962	Stakeholder requirements derives into Syst.	Stakeholder	Derives		0	Loaded
108027	TW System requirements derives into Contr.		Derives		0	Loaded
108028	TW System Requirements Threatens by Ri...		Threatens		5	Loaded
108029	TW System Requirements Realized in Cap...		Realizes		1	Loaded
108055	Goals derive into Stakeholder Requirements		Traceability		0	Loaded



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The pillars of

Interoperability HUB

Digital thread without frontiers

Connectivity

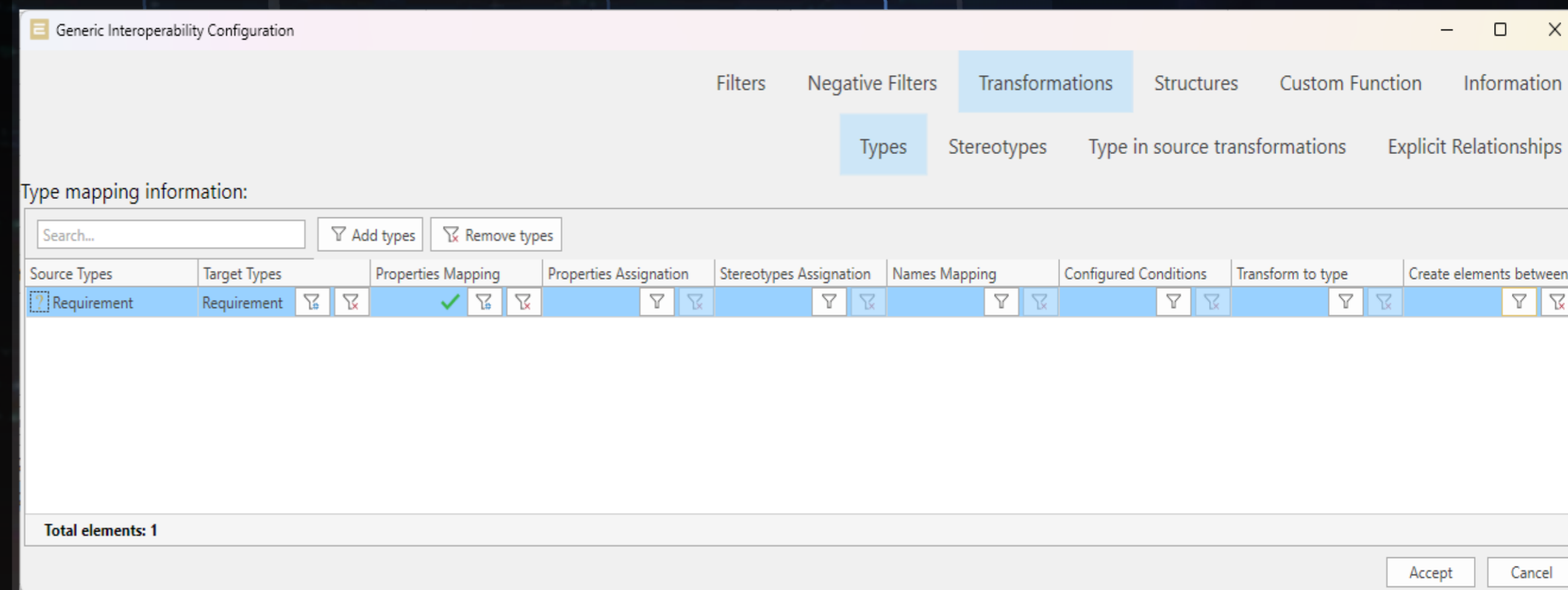
+50 tools: RMS, MBSE, ALM, PLM tools, PDF, MS Office...
Semantic parsing of unstructured sources

End-to-End Semantic traceability

Traces into a heterogeneous environment
Automatic detection/suggestion of traces based on AI

Copying/Moving/Synchronizing Work products

No change of metamodel between source and target
Just moving among different tools



Generic Interoperability Configuration

Filters Negative Filters Transformations Structures Custom Function Information

Types Stereotypes Type in source transformations Explicit Relationships

Type mapping information:

Search... Add types Remove types

Source Types	Target Types	Properties Mapping	Properties Assignment	Stereotypes Assignment	Names Mapping	Configured Conditions	Transform to type	Create elements between
Requirement	Requirement	✓						

Total elements: 1

Accept Cancel

1

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Connectivity

+50 tools: RMS, MBSE, ALM, PLM tools, PDF, MS Office...
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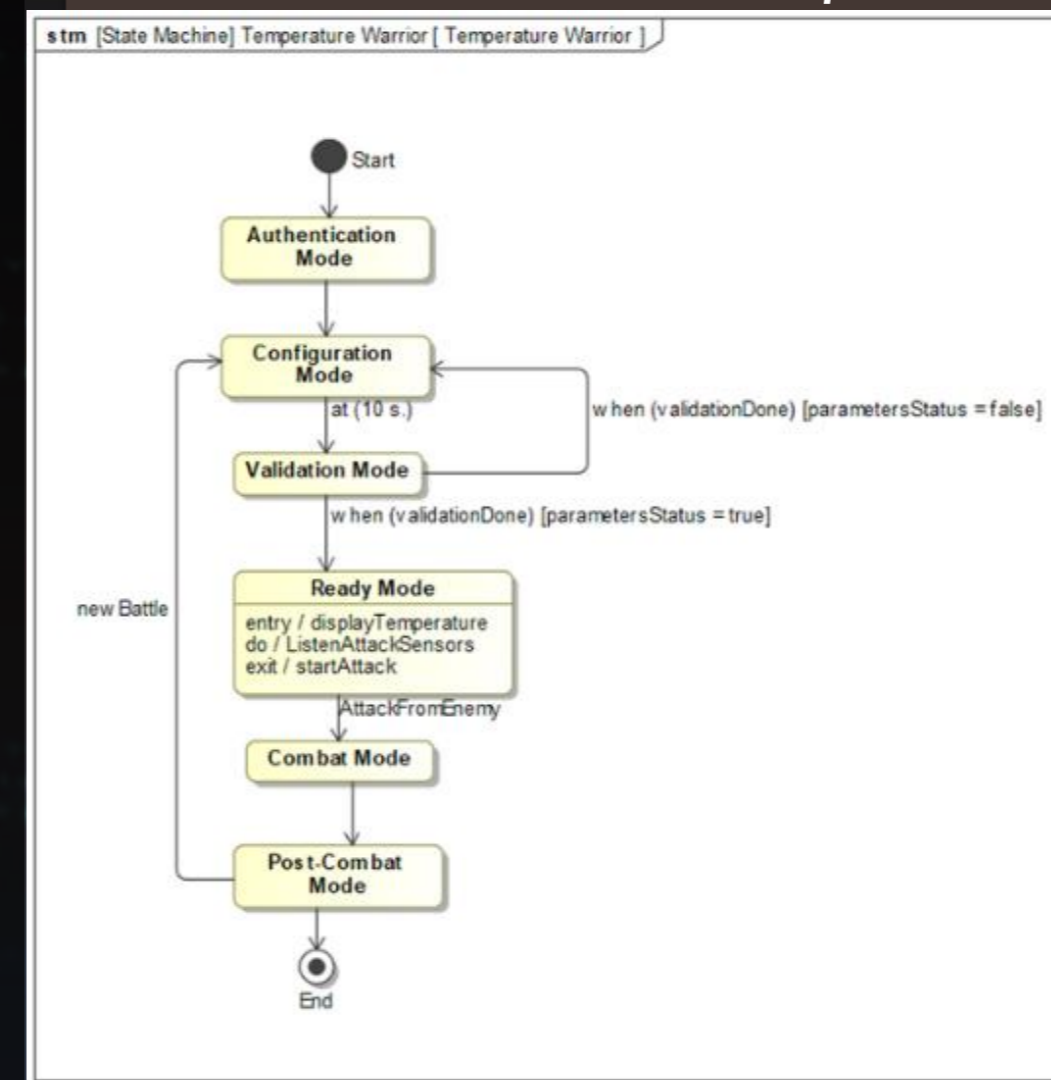
Transforming work products

Change of metamodel between source and target work products
Textual requirements to models, SysML to Capella...

The pillars of

Interoperability HUB

Digital thread without frontiers



ID	Quality	Quality Date	Quality Summary	Quality
1 State				
SysR-1	High	15/05/2024 18:41:26		
SysR-2	High	15/05/2024 18:41:26		
SysR-3	High	15/05/2024 18:41:26		
SysR-4	High	15/05/2024 18:41:26		
SysR-5	High	15/05/2024 18:41:26		
SysR-6	High	15/05/2024 18:41:26		
SysR-7	High	15/05/2024 18:41:26		
2 Transitions				
SysR-8	High	15/05/2024 18:41:26		
SysR-9	High	15/05/2024 18:41:26		
SysR-10	High	15/05/2024 18:41:27		
3 Activities				
SysR-11	Medium	15/05/2024 18:41:26	Avoid misspelling: "displayTemperature".	
SysR-13	Medium	15/05/2024 18:41:26	Avoid misspelling: "startAttack".	
SysR-12	Medium	15/05/2024 18:41:26	Avoid misspelling: "ListenAttackSensors".	
4 Triggers				
SysR-15	Low	15/05/2024 18:41:26	Use a separate clause for each condition: "when", "while". Avoid misspelling: "parametersStatus". Avoid abbreviation of the condition: "true", "false".	



1

Connectivity

+50 tools: RMS, MBSE, ALM, PLM tools, PDF, MS Office...
Semantic parsing of unstructured sources.

2

End-to-End Semantic traceability

Traces into a heterogeneous environment
Automatic detection/suggestion of traces based on AI

3

Copying/Moving/Synchronizing Work products

No change of metamodel between source and target
Just moving among different tools.

4

Transforming work products

Change of metamodel between source and target work products
Textual requirements to models, SysML to Capella...

5

Binding work products

Changes in one work product triggering changes to target work products.

6

Remote connectivity

Collaborative access to the content of a repository even from an external infrastructure.

The pillars of

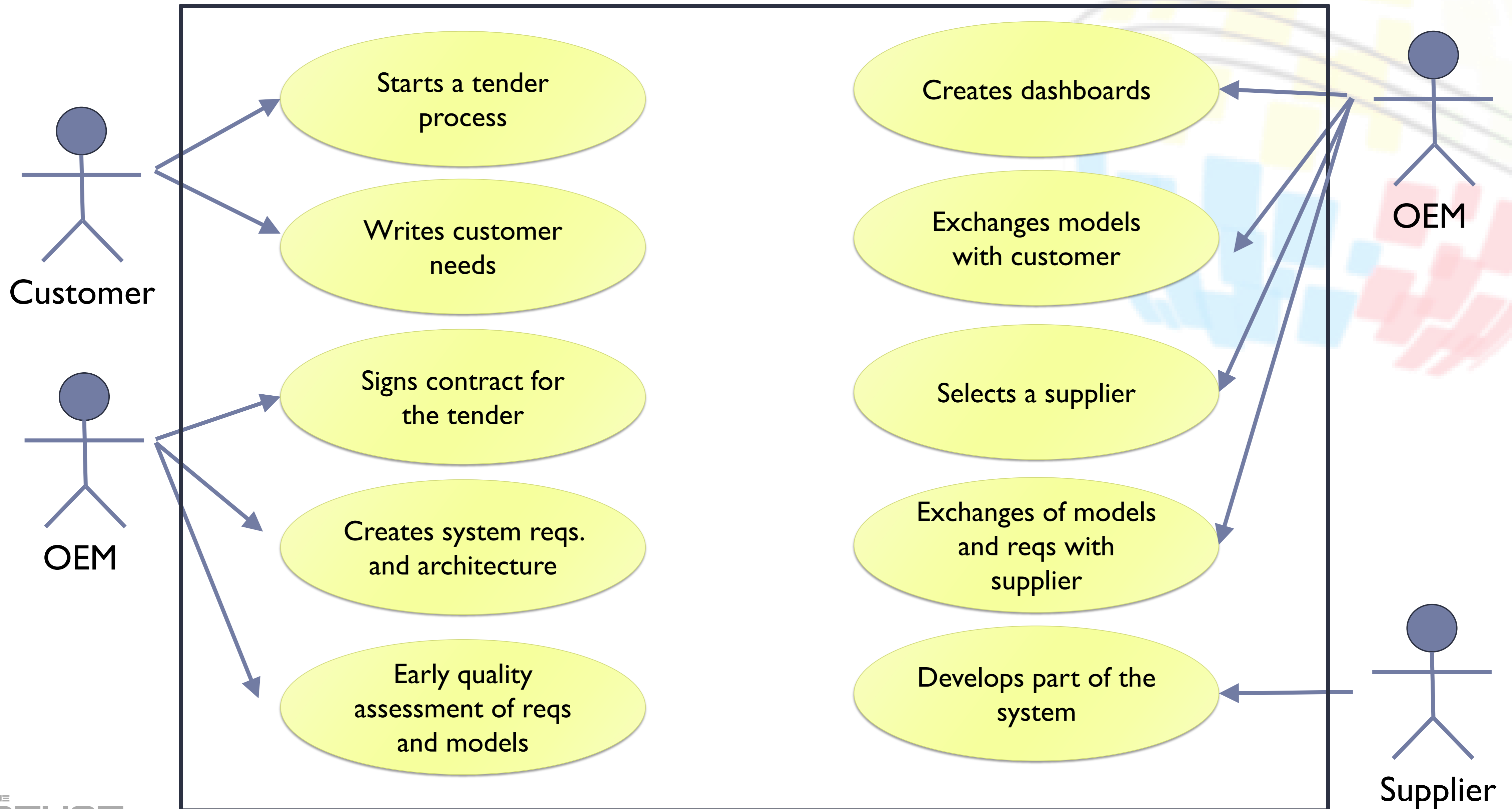
Interoperability HUB

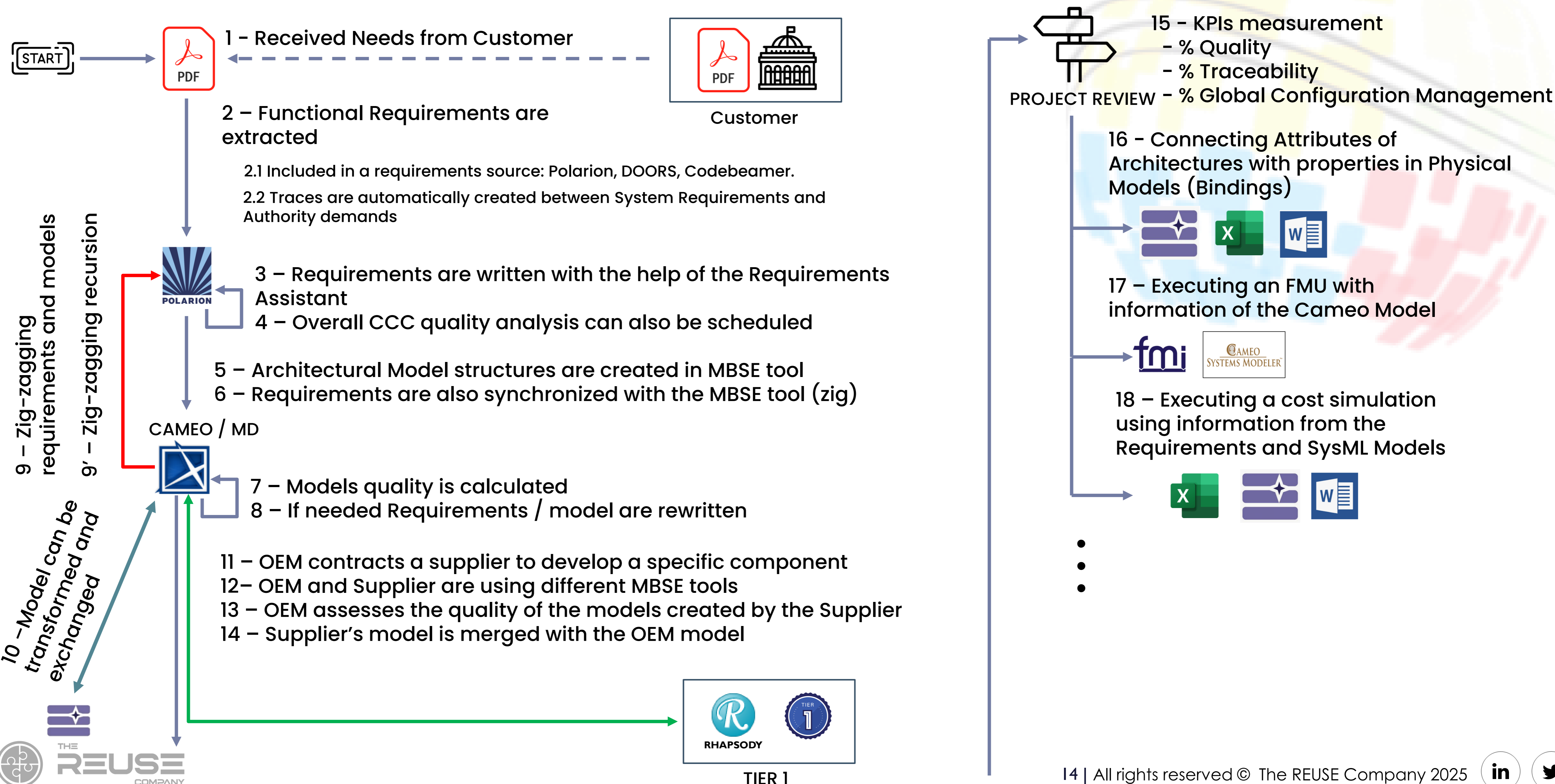
Digital thread without frontiers

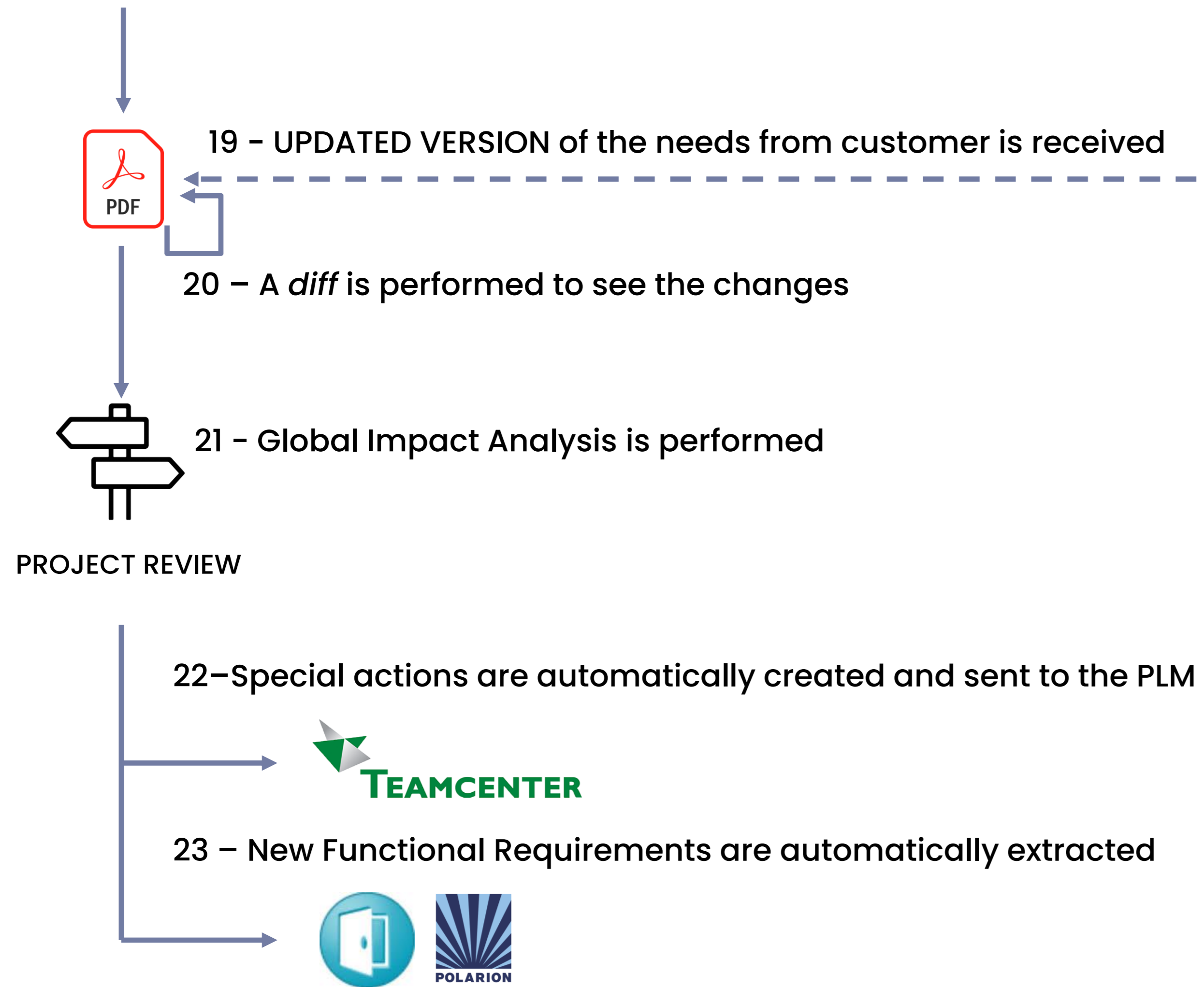
The REUSE Company - Digital Thread without Frontiers

A practical case

The background features a pair of hands holding a glowing, textured globe. A network of white lines connects various glowing nodes across the scene, creating a sense of interconnectedness and digital technology.



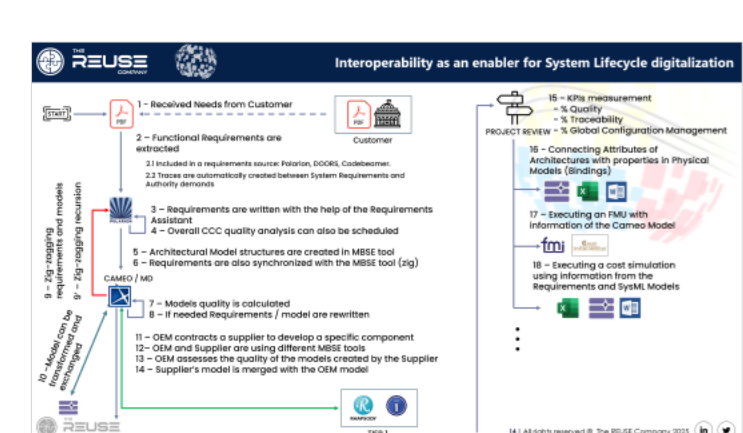
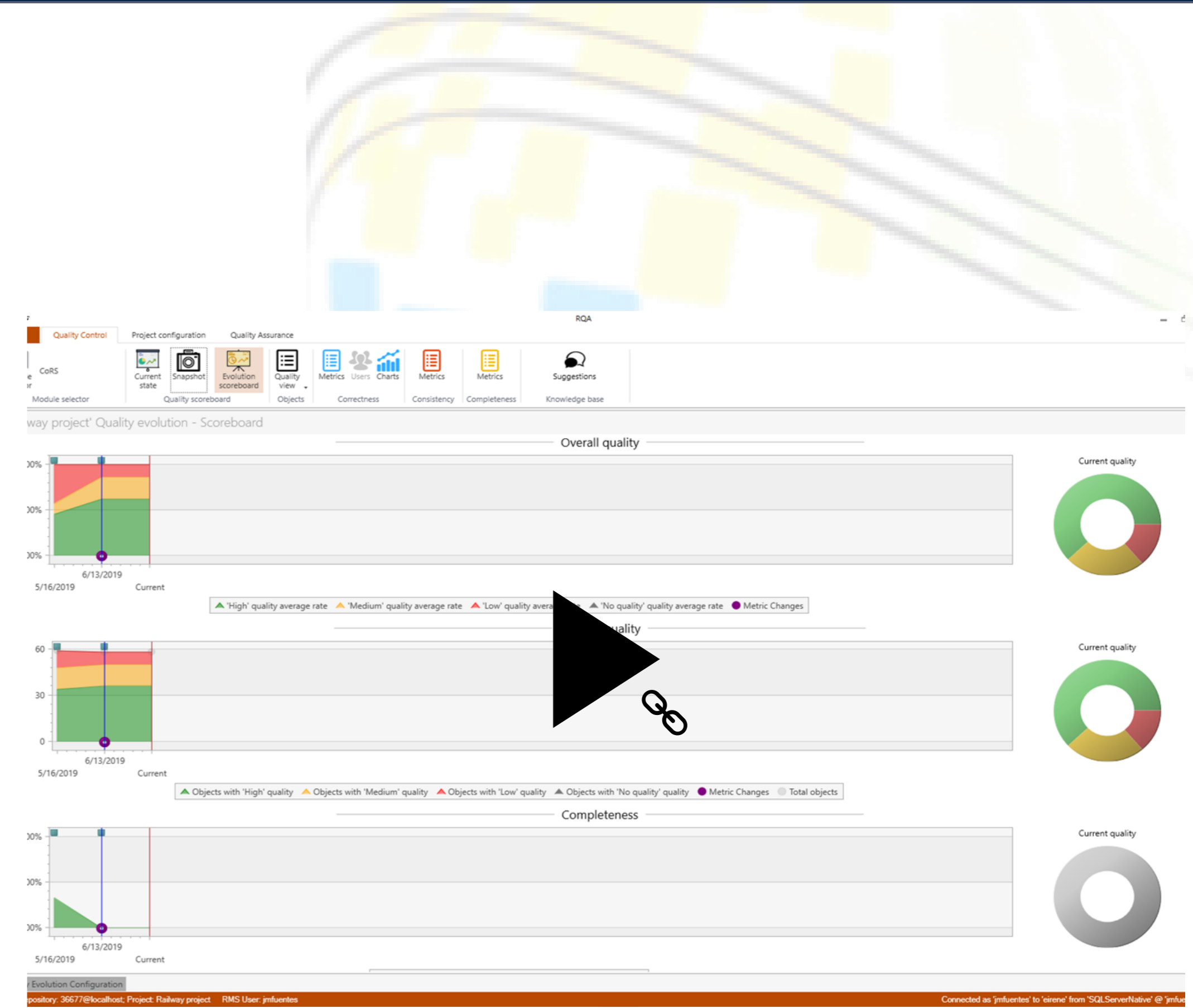






- 
- 3 – Requirements are written with the help of the Requirements Assistant
 - 4 – Overall CCC quality analysis can also be scheduled

1. Your quality rules for requirements (GtWR or other) are configured in RQA – QUALITY Studio and assigned to a System Requirements document
2. A set of suitable requirements patterns (EARS) is also assigned to the document
3. RAT – Requirements Assistant is the perfect way to write requirements *right the first time*: **real-time** quality check, **pattern** assistance, **domain-specific** vocabulary, **semantic** search for similar requirements in your document...
4. Complete CCC quality dashboards & reports created in RQA



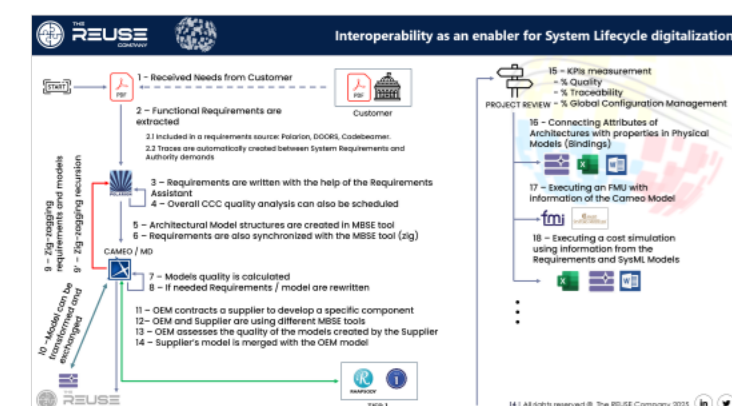
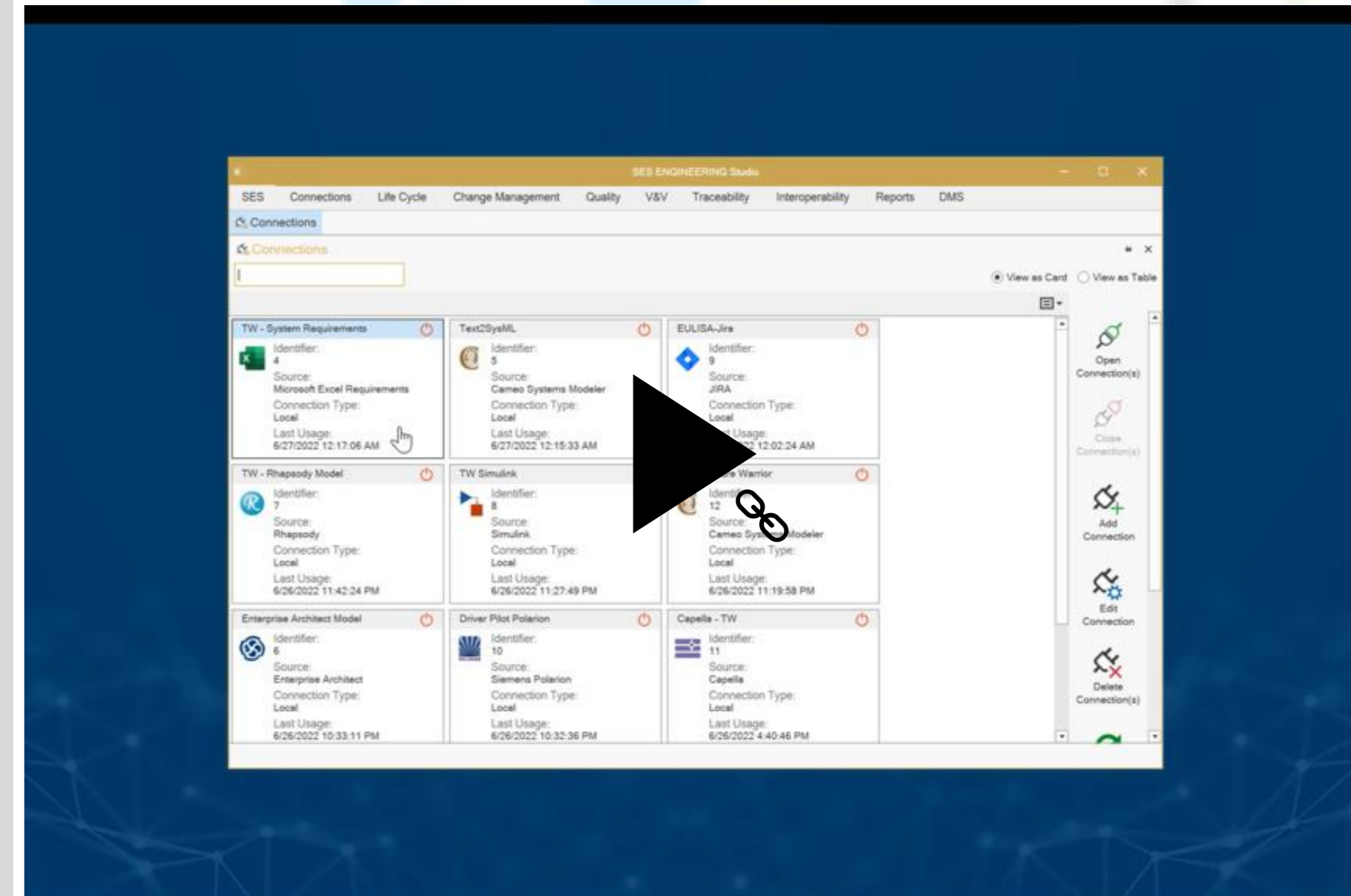


- 5 – Architectural Model structures are created in MBSE tool
- 6 – Requirements are also synchronized with the MBSE tool (zig)

CAMEO / MD



1. An MBSE tool is selected to develop the conceptual architecture of our system
2. Pieces of the model can be created automatically from your textual requirements
3. Zig: A “copy” of the system requirements is created (from Polarion) in our MBSE tool
4. Traces and allocation relationships among requirements and model elements are created in Cameo
5. Derived requirements are also created
6. Modifications are injected into our requirements



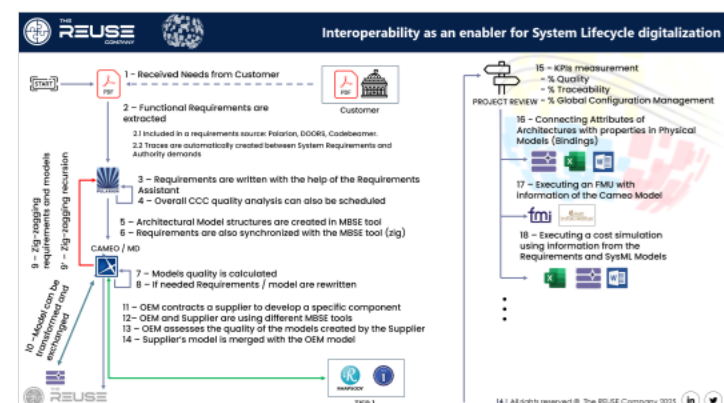
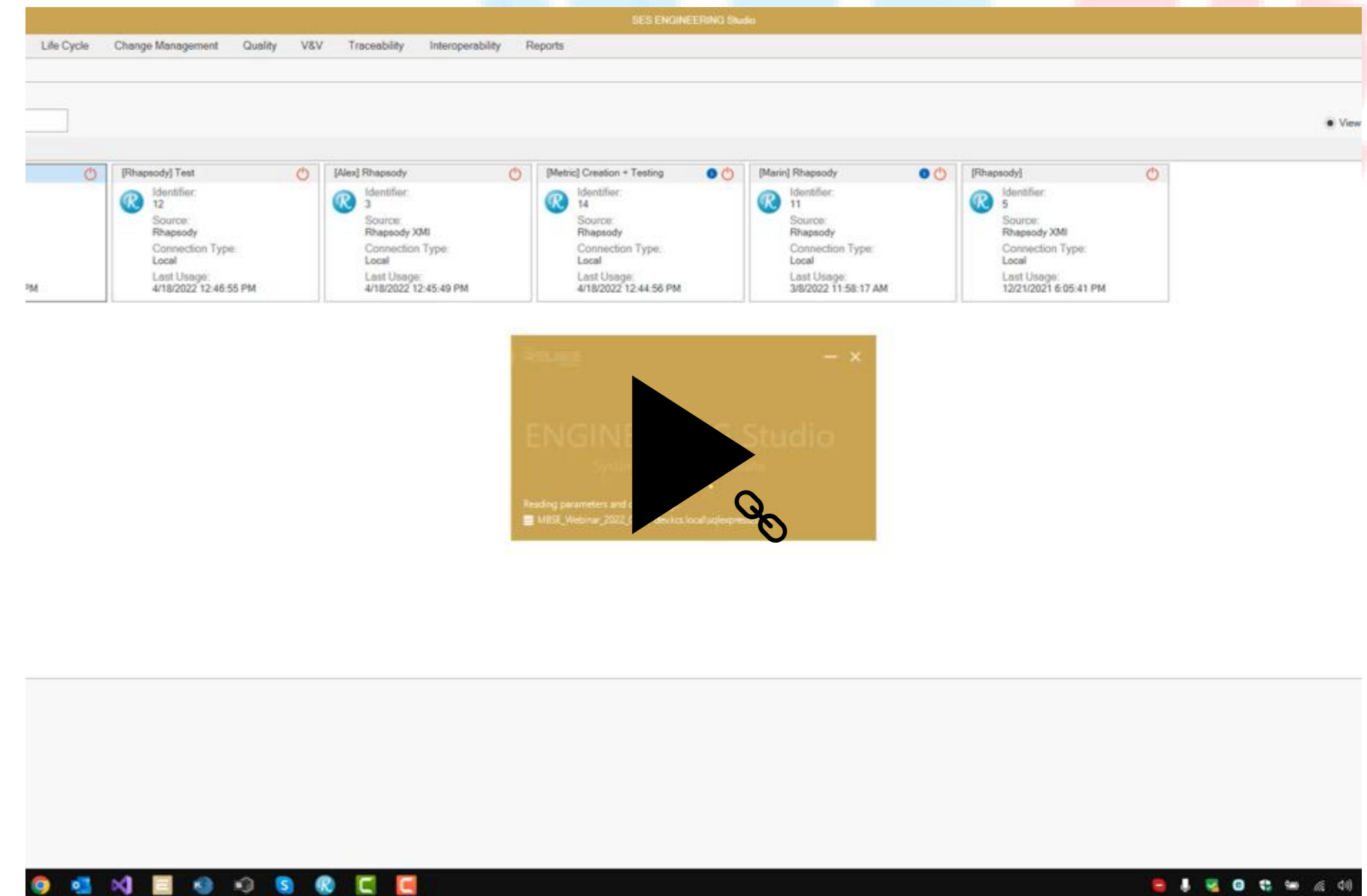


CAMEO / MD



- 7 – Models quality is calculated
- 8 – If needed Requirements / model are rewritten

1. RQA is used to analyze the quality of models based on a set of predefined model-related rules
2. New requirements written in Cameo can be assessed with the help of the Requirements Assistant





POLARION

9 – Zig-zagging requirements and models

CAMEO / MD



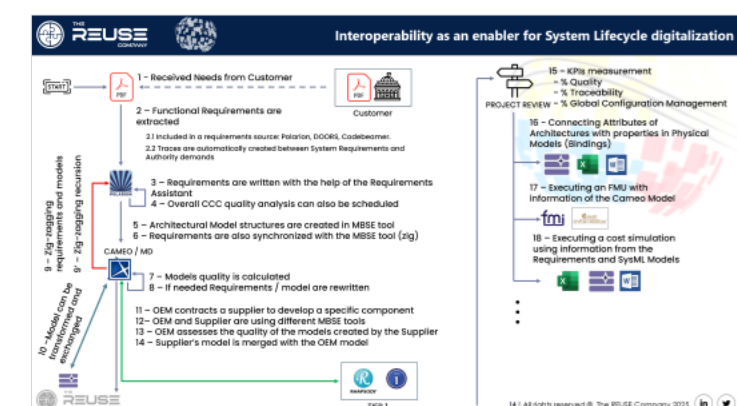
1. Updated requirements consolidate a new baseline in the requirements source of truth (Polarion)
2. Relationships created in Cameo are transformed into actual traces in the HUB between the actual requirements in Polarion and the model element

Requirements' current 0.0 in /Temperature Warrior (Formal module) - DOORS

View Insert Link Analysis Table Tools Discussions Rich Authoring user Change Management Help

g View All levels Fast scroll

ID	Type	Created By	Risk Level
SySR-30	Header	iker.gonzalez	NA
0			
SySR-16	Requirement	iker.gonzalez	Medium
6			
SySR-21	Requirement	iker.gonzalez	High
9			
SySR-17	Requirement	iker.gonzalez	High
4			
SySR-17	Requirement	iker.gonzalez	Low
6			
SySR-21	Requirement	iker.gonzalez	Low
7			
SySR-17	Requirement	iker.gonzalez	Low
7			
SySR-18	Requirement	iker.gonzalez	Medium
2			
SySR-18	Requirement	iker.gonzalez	Medium
3			
SySR-18	Requirement	iker.gonzalez	High
9			
SySR-18	Requirement	iker.gonzalez	Low
1			





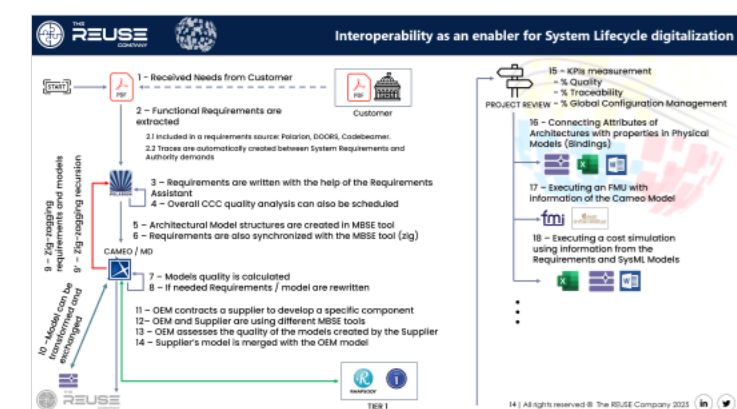
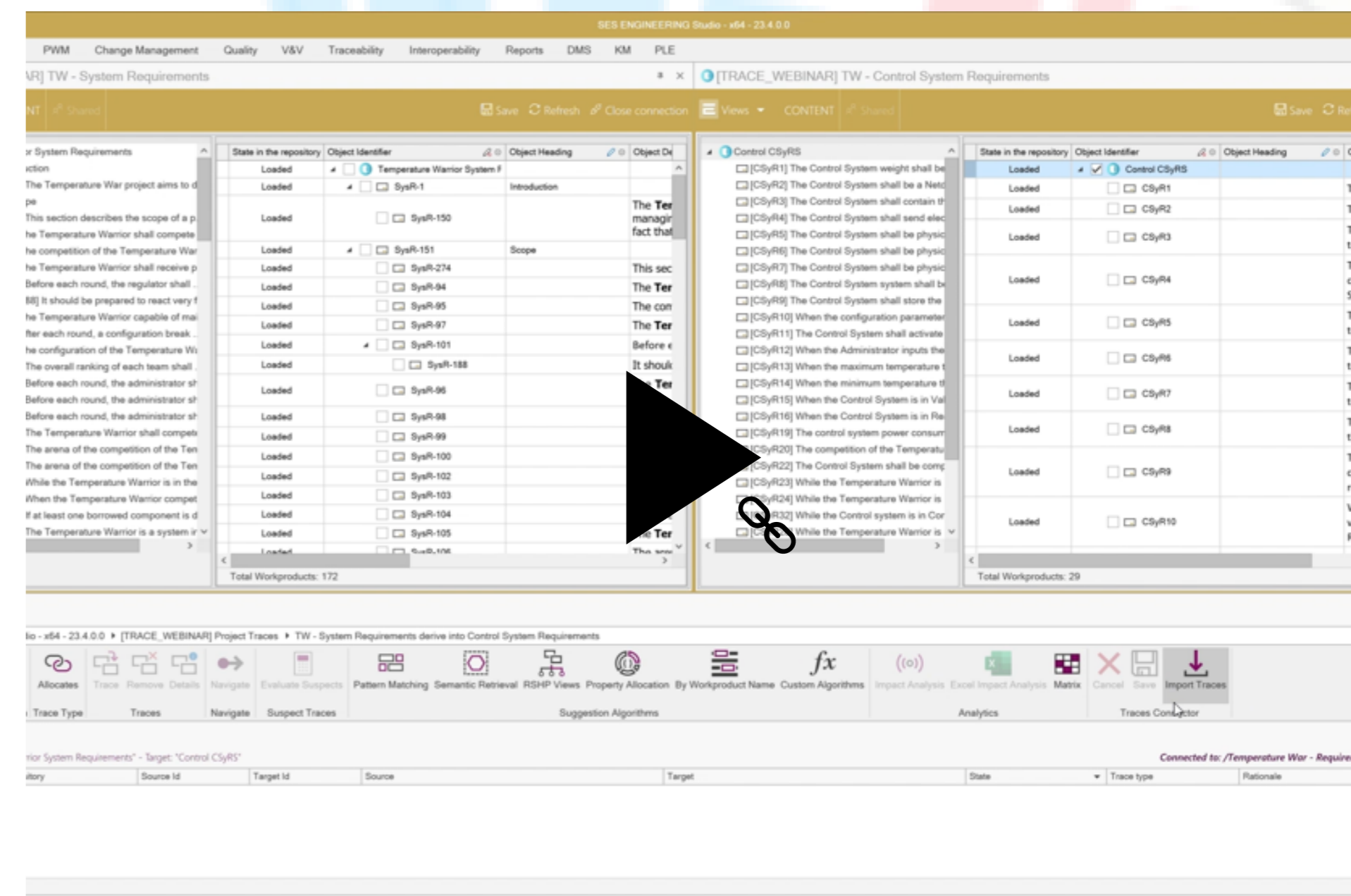
POLARION

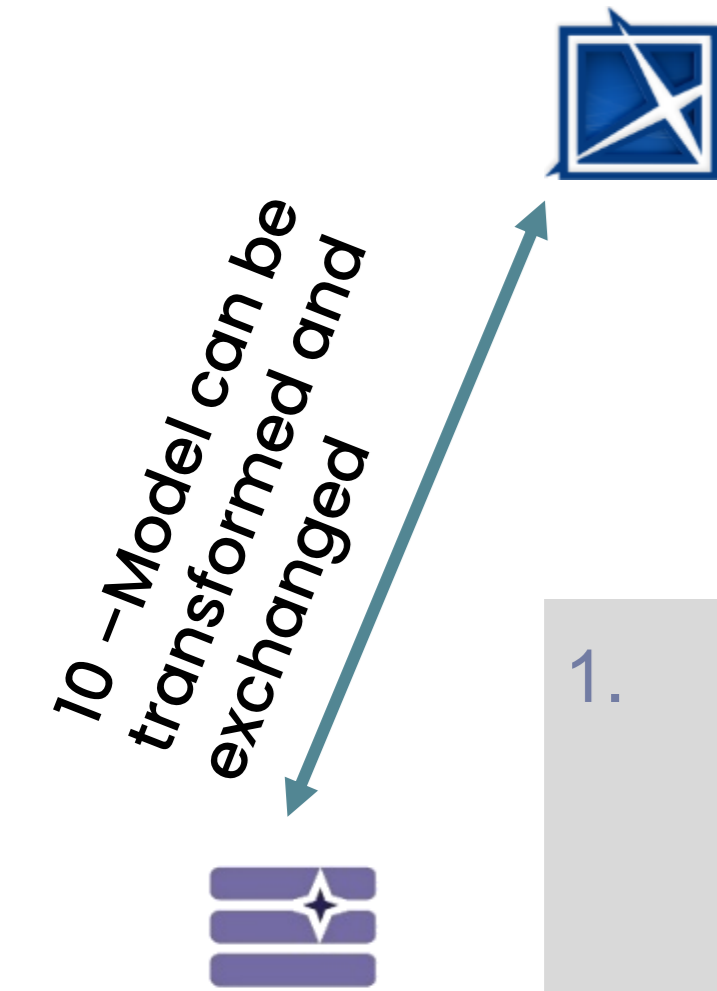
9' – Zig-zagging recursion

CAMEO / MD

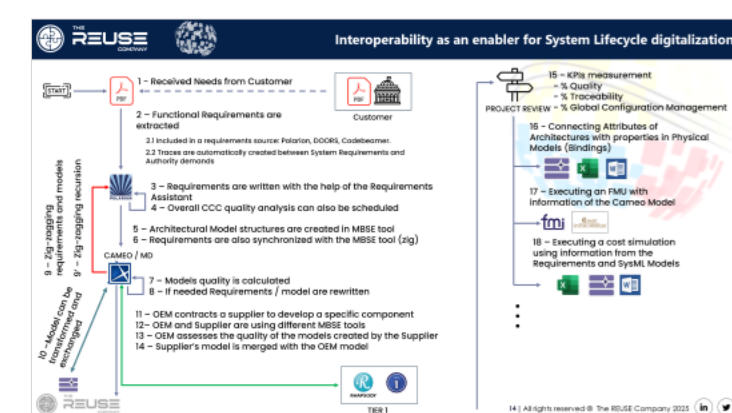
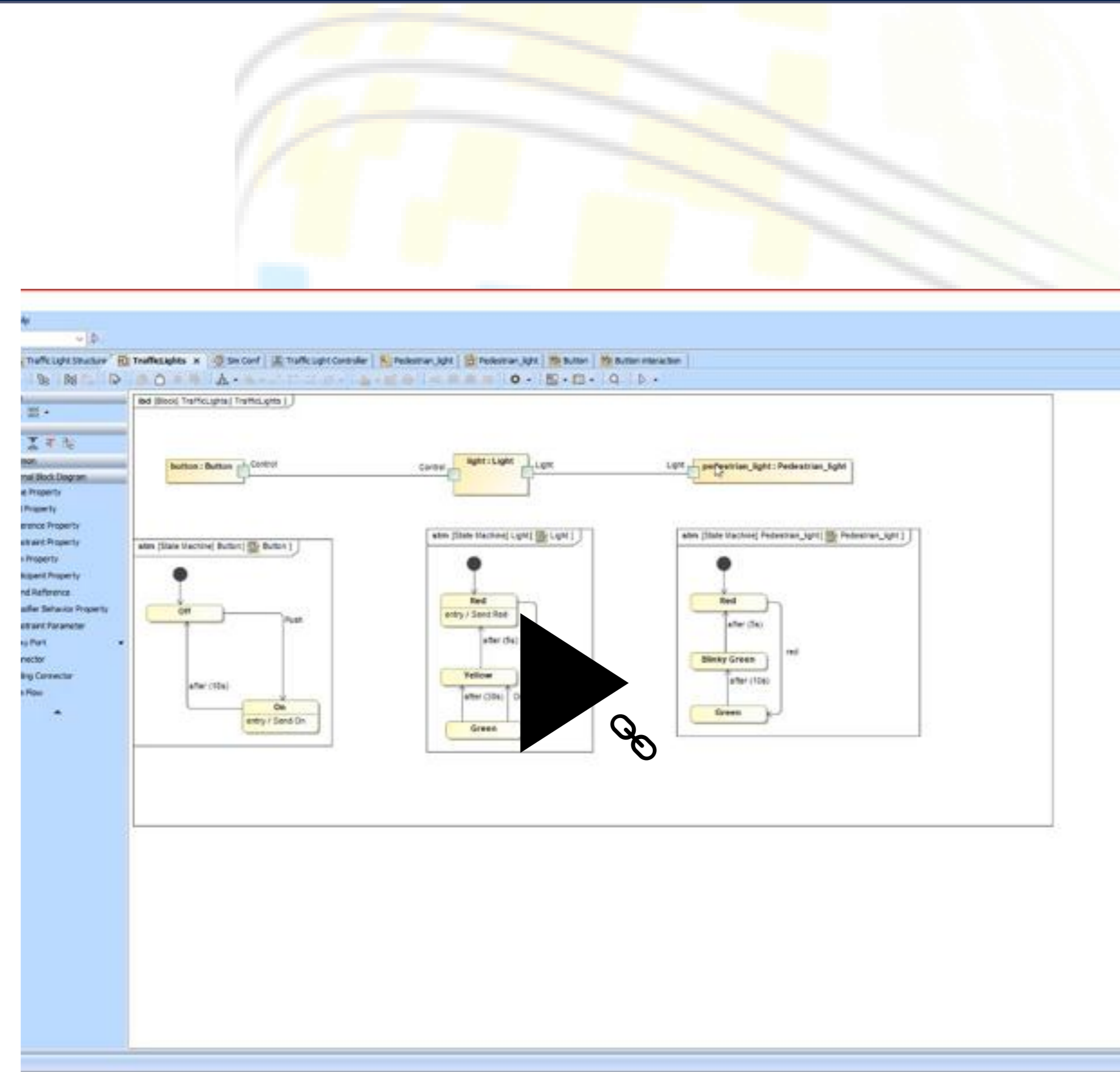


1. This zig-zagging between the RM and the MBSE tool can continue at different layers of decomposition
2. Traces between the different layers of documents can be created in the RMS or in the ontology (can be synchronized)
3. Traces between the different documents can also be suggested with semantic algorithms and AI





1. Our model in Cameo can be transformed into Capella (or other tools and frameworks) to be exchanged with the customer
2. Default transformation rules are included OOTB
3. Custom transformation rules can be created by the end-user for a more accurate and semantic transformation
4. Transformations might be bi-directional when needed

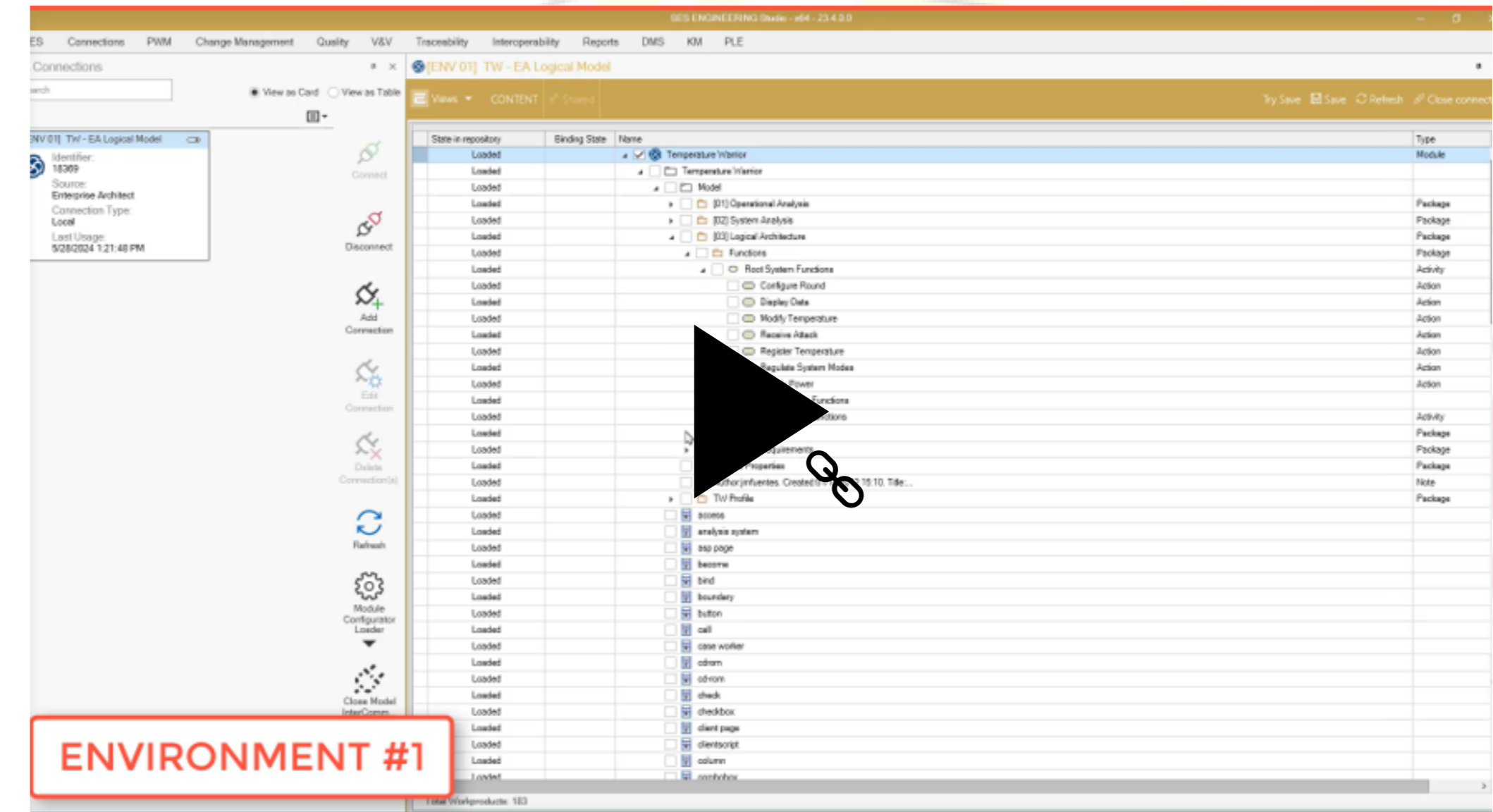




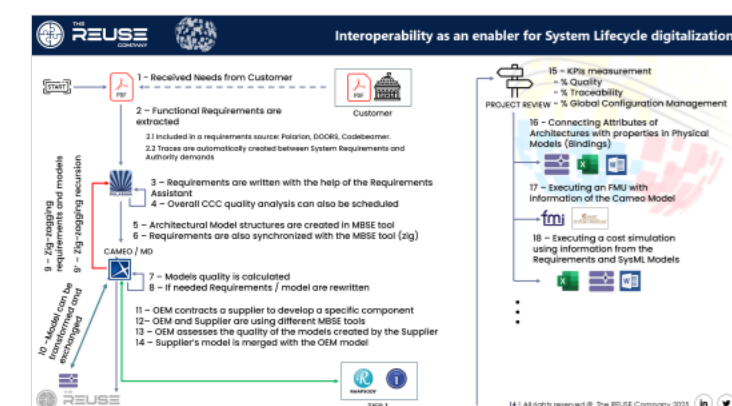
- 11 – OEM contracts a supplier to develop a specific component
- 12– OEM and Supplier are using different MBSE tools
- 13 – OEM assesses the quality of the models created by the Supplier
- 14 – Supplier’s model is merged with the OEM model



TIER 1



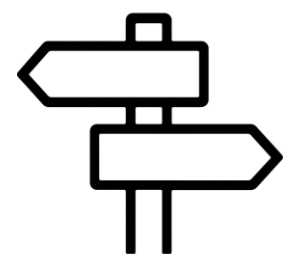
1. OEM allows a remote connection to its public model in Cameo
2. Supplier creates a new model in Rhapsody to develop a specific branch of the model
3. Supplier accesses the public model in the OEM’s remote connection, then Supplier synchronizes this package with its own Rhapsody model
4. Changes made in Rhapsody are synchronized with the content from the remote connection
5. OEM can visualize changes in the public model in Cameo, even if they were injected with Rhapsody
6. A quality assessment of the contents provide by the supplier can be executed by OEM





15 - KPIs measurement

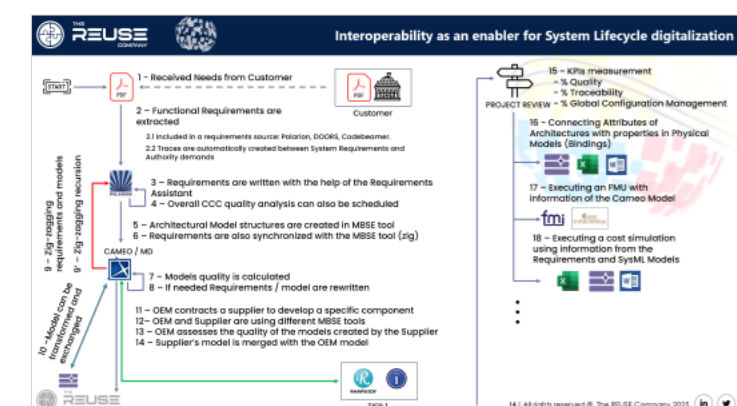
- % Quality
- % Traceability
- % Global Configuration Management

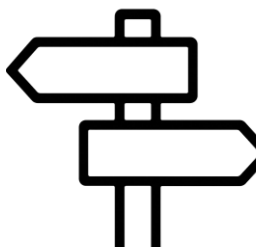


PROJECT REVIEW

1. Information about the level of assessed quality (CCC) of requirements and models, the level of completeness for traceability, as well as the status of verification, is collected all throughout the thread
2. This info can be shown within a complete set of dashboards and matrices
3. And exported into customizable reports

Name	Version	State	Progress	Activity Verification Action	Correctness	Consistency	Completeness	Verification	Validation	Suspect traces	Traced elements
TW System Development	1	Not Completed	84%	Not Calculated							
TW - Statement of Work	1	Done	100%	Not Defined							
TW - Stakeholder Requirements - After "TW - Statement of Work"	2	Done	100%	Not Defined							
TW - System Requirements - After "TW - Stakeholder Requirements"	3	Done	100%	Not Defined							
Requirements Verification against INCOSE Guidelines - After "TW - System Req"	4	used With Rema	70%	Not Defined							
TW - Capella Model - After "Requ"	5	In Progress	50%	Not Defined							





PROJECT REVIEW

SES ENGINEERING Studio

SES Connections Life Cycle Change Management Quality V&V Traceability Interoperability Reports

TW System Development TW System Development Life Cycle Template

Overview

Save Project started Hide Performance View Show Gantt Show Dashboard

+ Add Activity View log Assess selected Update technical management for selected

X Delete Refresh Assess all Update technical management for all

Define group Update configuration

General Options Views Tree Management Verification Action Technical Management Configuration Management

Performance View TW System Development

Name	State	Progress	Activity Verification Action	Correctness	Consistency	Completeness	Verification	Validation	Suspect traces	Traced elements
TW System Development	Not Completed	84%	Not Calculated	[Green/Red]	[Grey]	[Green/Red]	[Green/Red]	[Green/Red]	[Green]	[Green]
TW - Statement of Work	Done	100%	Not Defined	[Green]	[Grey]	[Green]	[Green]	[Green]	[Green]	[Green]
TW - Stakeholder Requirements - After "TW - Statement of Work"	Done	100%	Not Defined	[Green]	[Grey]	[Green]	[Green]	[Green]	[Green]	[Green]
TW - System Requirements - After "TW - Stakeholder Requirements"	Done	100%	Not Defined	[Green]	[Grey]	[Green]	[Green]	[Green]	[Green]	[Green]
Requirements Verification against INCOSE Guidelines - After "TW - System Req	Assessed With Rema	70%	Not Defined	[Green/Red]	[Grey]	[Green/Red]	[Green/Red]	[Green/Red]	[Green]	[Green]
TW - Capella Model - After "Requ	In Progress	50%	Not Defined	[Green/Red]	[Grey]	[Green/Red]	[Green/Red]	[Green/Red]	[Green]	[Green]

Differences

#1 Configuration 'Initial Version', by 'SESAdministrator' on [11/28/2022 19:00:32]

Name	Version	State	Progress	Activity Verification Action	Correctness	Consistency	Completeness	Verification	Validation	Suspect traces	Traced elements
TW System Develop	2	Not Completed	84%	Not Calculated	[Green/Red]	[Grey]	[Green/Red]	[Green/Red]	[Green/Red]	[Green]	[Green]
TW - Statement of Work	2	Done	100%	Not Defined	[Green]	[Grey]	[Green]	[Green]	[Green]	[Green]	[Green]
TW - Stakeholder Requirements - After "TW - Statement of Work"	2	Done	100%	Not Defined	[Green]	[Grey]	[Green]	[Green]	[Green]	[Green]	[Green]
TW - System Requirements - After "TW - Stakeholder Requirements"	2	Done	100%	Not Defined	[Green]	[Grey]	[Green]	[Green]	[Green]	[Green]	[Green]
Requirements Verification against INCOSE Guidelines - After "TW - System Req	2	Assessed With Remark	70%	Not Defined	[Green/Red]	[Grey]	[Green/Red]	[Green/Red]	[Green/Red]	[Green]	[Green]
TW - Capella Model - After "Requirements Verification against INCOSE Guidelines - After "TW - System Req	2	In Progress	50%	Not Defined	[Green/Red]	[Grey]	[Green/Red]	[Green/Red]	[Green/Red]	[Green]	[Green]

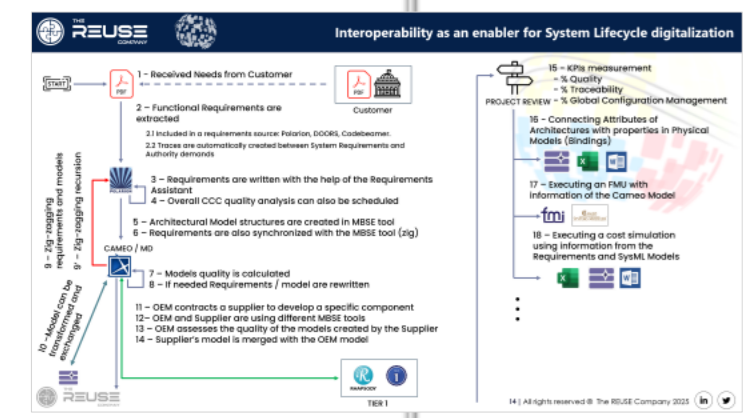
6 Activities

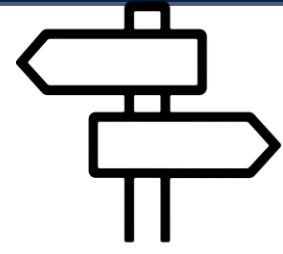
#1 Configuration 'Initial Version', by 'SESAdministrator' on [11/28/2022 19:00:32]

Name	Version	State	Progress	Activity Verification Action	Correctness	Consistency	Completeness	Verification	Validation	Suspect traces	Traced elements
TW System Develop	1	Not Completed	0%	Not Calculated	[Green/Red]	[Grey]	[Green/Red]	[Green/Red]	[Green/Red]	[Green]	[Green]
TW - Statement of Work	1	Not Started	0%	Not Defined	[Green]	[Grey]	[Green]	[Green]	[Green]	[Green]	[Green]
TW - Stakeholder Requirements - After "TW - Statement of Work"	1	Not Started	0%	Not Defined	[Green]	[Grey]	[Green]	[Green]	[Green]	[Green]	[Green]
TW - System Requirements - After "TW - Stakeholder Requirements"	1	Not Started	0%	Not Defined	[Green]	[Grey]	[Green]	[Green]	[Green]	[Green]	[Green]
Requirements Verification against INCOSE Guidelines - After "TW - System Req	1	Not Assigned	0%	Not Defined	[Green]	[Grey]	[Green]	[Green]	[Green]	[Green]	[Green]
TW - Capella Model - After "Requirements Verification against INCOSE Guidelines - After "TW - System Req	1	Not Started	0%	Not Defined	[Green]	[Grey]	[Green]	[Green]	[Green]	[Green]	[Green]

6 Activities

Show differences Close



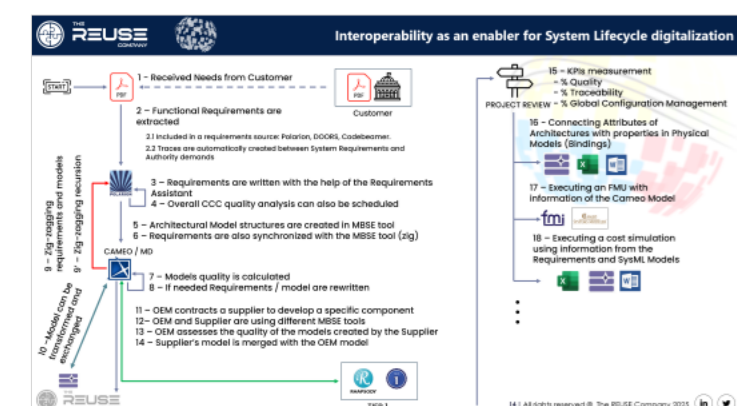
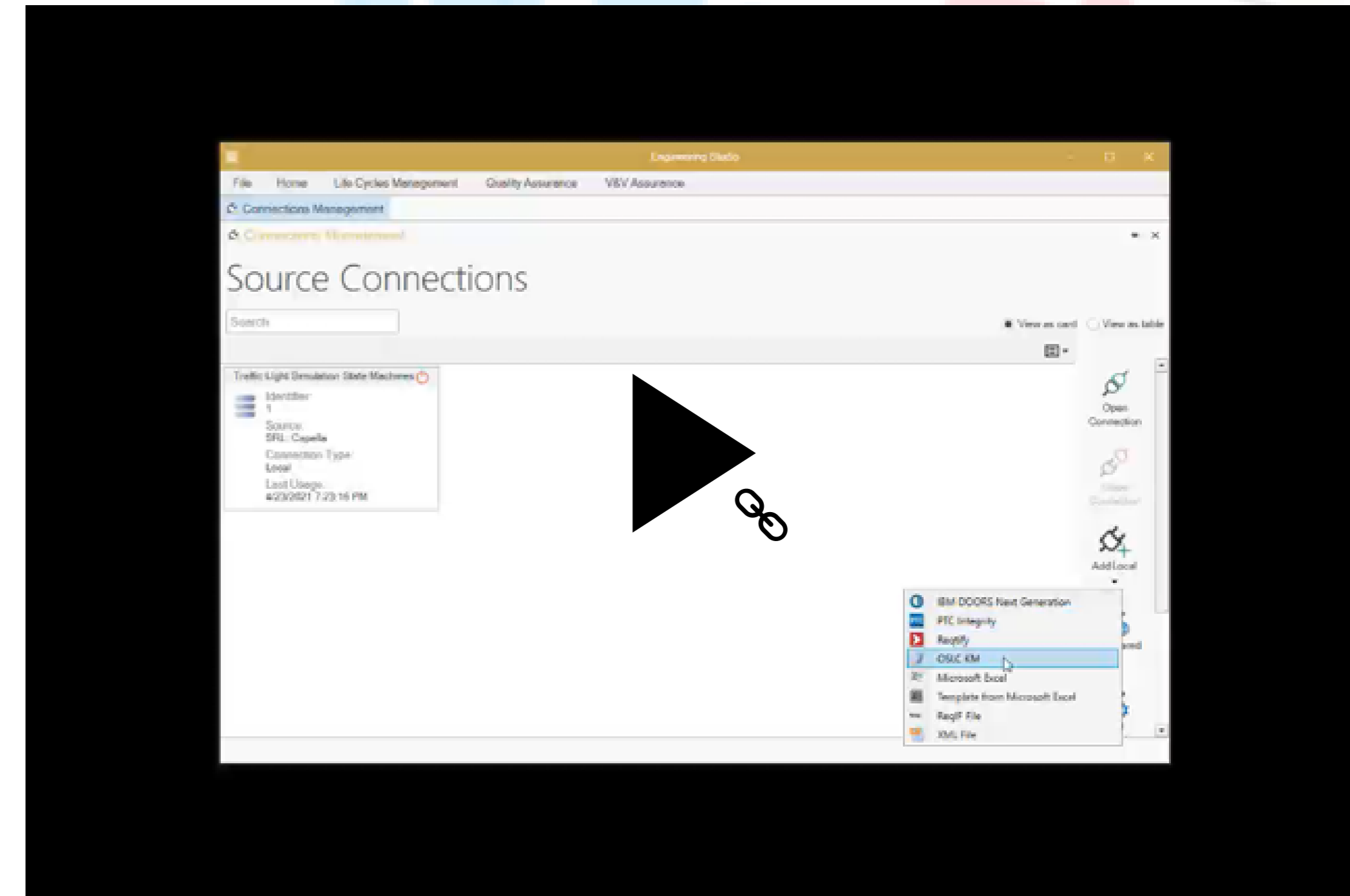


PROJECT REVIEW

16 - Connecting Attributes of Architectures with properties in Physical Models (Bindings)



1. Connect to the Logical Model in Capella
2. Connect to the simulation model (in MS Excel for example)
3. Connect to the results document in MS Word
4. Perform the bindings from Capella to the simulation model
5. Perform the bindings from the simulation model to MS Word
6. Execute the model and get the results in MS Word





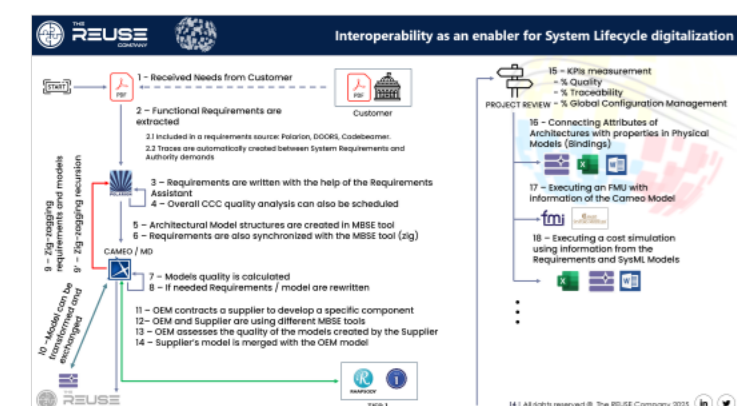
17 – Executing an FMU with information of the Cameo Model



1. Open the Architecture model (Cameo, Rhapsody, etc.)
2. Configure the binding between the attributes of the logical model (or even requirement) and the parameters of the FMU
3. Execute the FMU to verify the model or the requirement
4. Receive the result with OK or KO

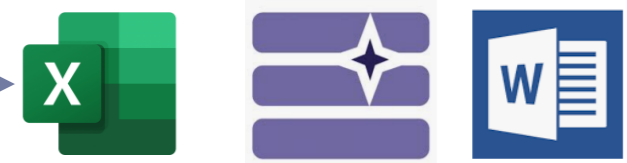
```

1 model Rocket1
2   constant Real g = 9.81;
3   //Real x(start = 1);
4   Real y(start = 1);
5   //Real v0_x;
6   Real v0_y;
7   String result;
8
9   parameter Real threshold = 200;
10  parameter Real v_module = 100;
11  parameter Real alpha = 45;
12  //parameter Real x0 = 0;
13  parameter Real y0 = 0;
14
15  equation
16  //v0_x = v_module * cos(alpha * 0.0174532925);
17  v0_y = v_module * sin(alpha * 0.0174532925);
18  //x = x0 + v0_x * time;
19  y = y0 + v0_y * time - 0.5 * g * time ^ 2;
20
21  //monitor
22  when y > threshold then
23    result = "success";
24  end when;
25
26 end Rocket1;
27
    
```

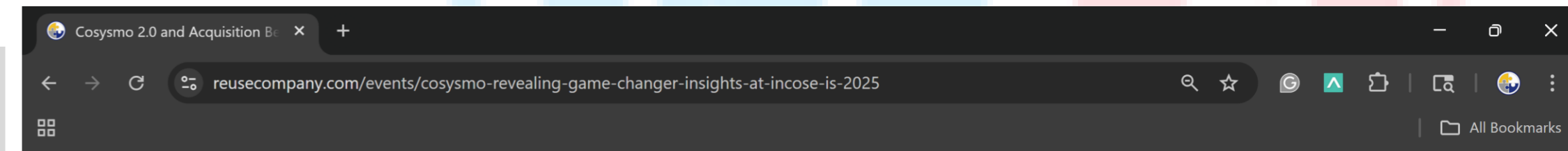




18 – Executing a cost simulation using information from the Requirements and SysML Models



1. Connect to the sources where the information to be linked with the Cost model is stored
2. Connect to the Cost Model (COSYSMO), for example in Microsoft EXCEL
3. Bind the inputs of the cost model with the outputs of the source connections
4. Execute the Cost simulation model in EXCEL
5. Bind the results with a MS Word Document



COSYSMO: Revealing Game-Changer Insights at INCOSE IS 2025

Christer Fröling to Present COSYSMO-Based Acquisition Paper at this year's edition

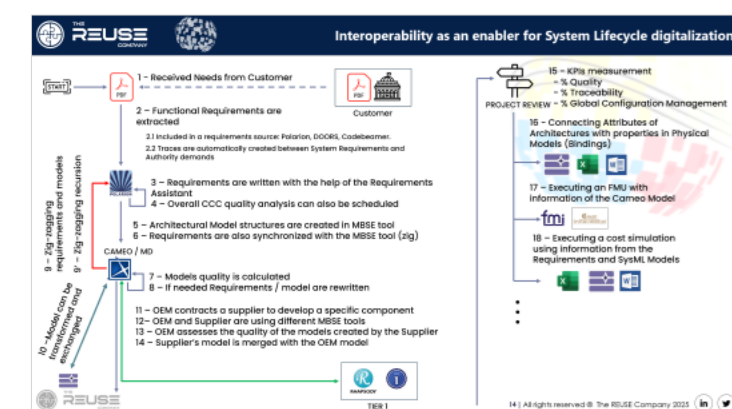
We're proud to announce that Christer Fröling, CEO of The REUSE Company Scandinavia, has been selected to present his paper at the upcoming **INCOSE International Symposium 2025**, held in Ottawa, Canada, from July 26 to 31, 2025.

His proposal was chosen among other submissions for its innovative perspective on acquisition modeling, leveraging the **COSYSMO 2.0 model** to build a decision-support tool tailored to the challenges of public procurement. The presentation will take place on **Wednesday, July 30**, from **10:45 to 11:25 EDT**.



Add to calendar!

A New Angle on Acquisition Modeling



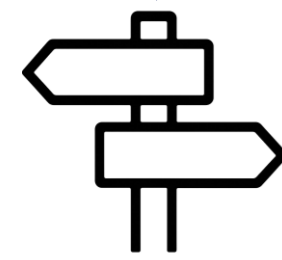


19 - UPDATED VERSION of the needs from customer is received

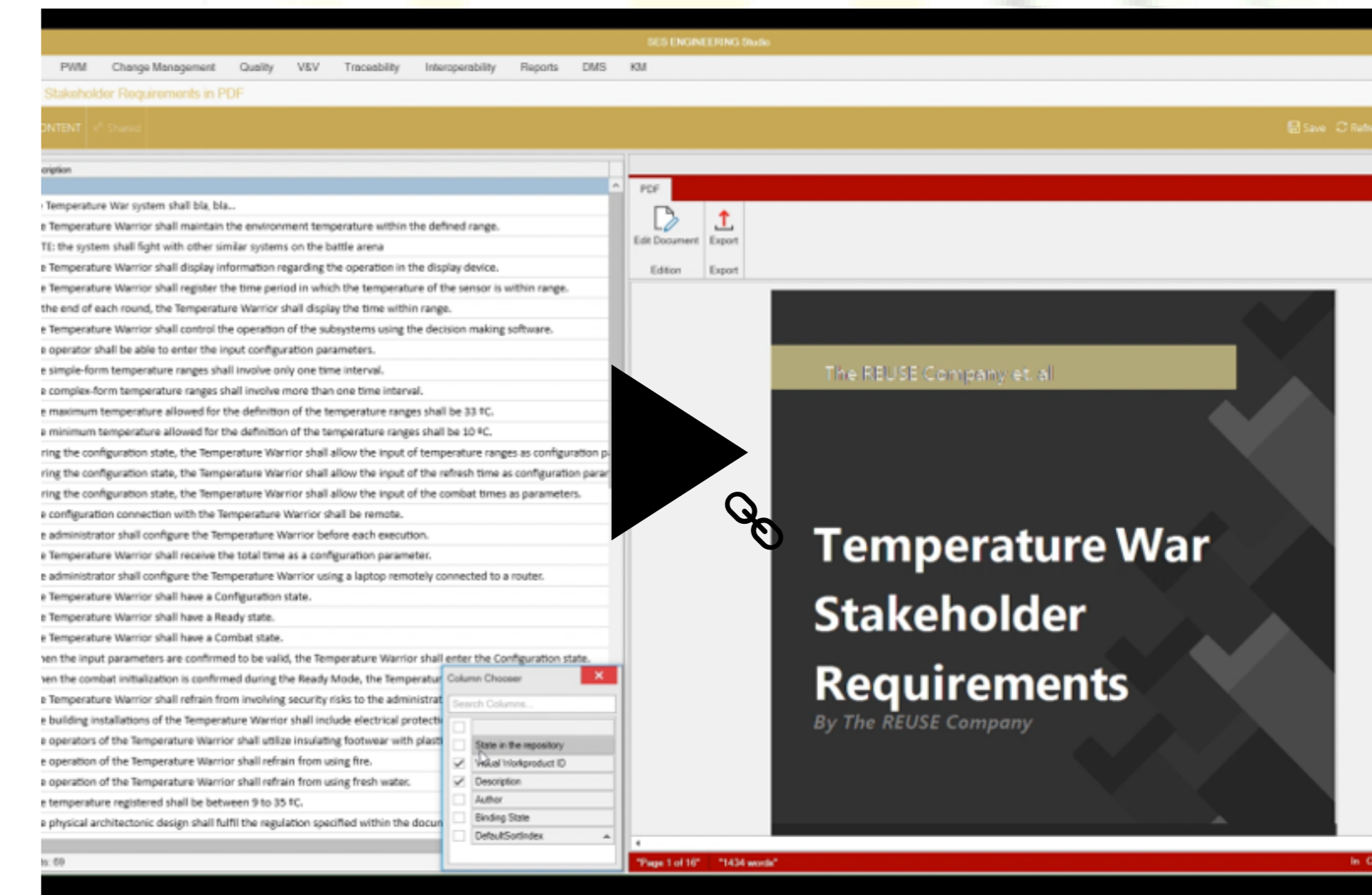


Customer

20 - A *diff* is performed to see the changes

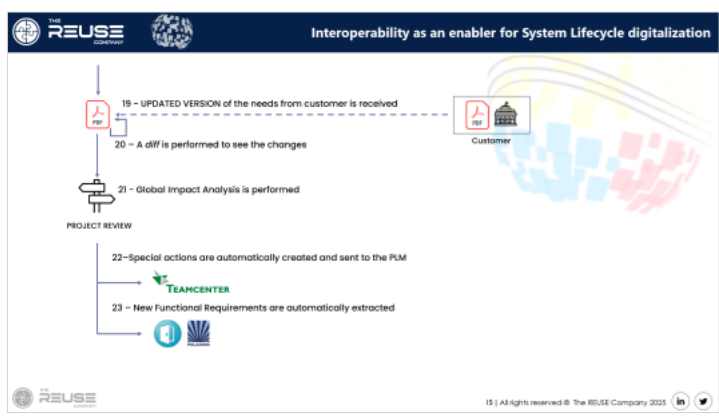


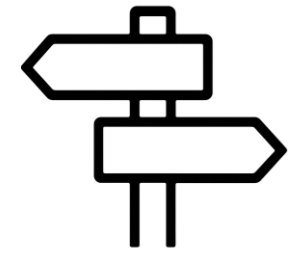
21-Global Impact Analysis is performed



1. Customer decides to issue a new version of the customer needs document
2. The updated version automatically generates a baseline
3. Changes provoke a *diff* process shown in the ENG Studio
4. Impact analysis for each change is also shown graphically or with a table or matrix
5. A Semantic Search Engine allows to look up for relevant information

PROJECT REVIEW



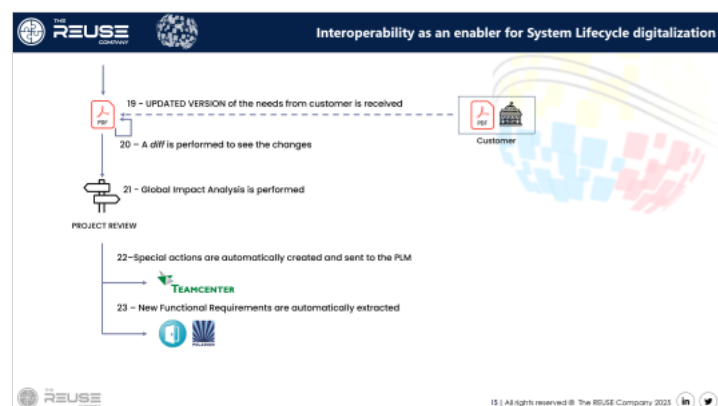


PROJECT REVIEW

22-Special actions are automatically created and sent to the PLM



1. The accepted new demands, once formally accepted, incur in new activities for the team
2. These new activities are generated automatically in Teamcenter

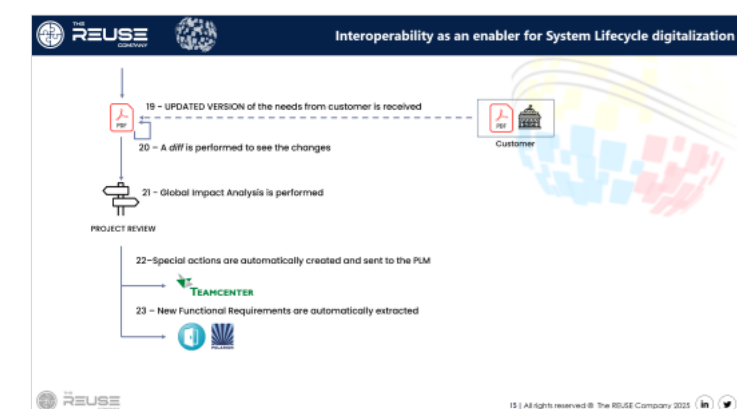




23 – New Functional Requirements are automatically extracted



1. New customer needs are transformed into new system requirements
2. The corresponding Interoperability operation needs to be executed
3. Traces between the need and the created requirements are automatically included into the system



Q&A

Providing a
knowledge-centric
approach to enable
SMART Systems
Engineering



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