WEBINAR RULES

- You'll be **muted** all along the Webinar
- There's a '***Question'* section** to ask your questions whenever you want, you don't need to wait until the end. All questions will be addressed at the **end of the webinar**.
- If you have any **technical issues** please use this chatting box, or mail us at: support@reusecompany.com
- You will receive a survey either after the webinar or by mail. Your **opinion** is **EXTREMELY VALUABLE**!
- The Webinar **will be recorded**. A link to the recording will be **sent to you** in few days.

STARTING SOON

05:00

CEST

SEMANTIC TRACEABILITY:

A PASSPORT TOWARDS A DIGITAL THREAD WITHOUT BOUNDARIES

- José M. Fuentes
- Sales Manager

THE REUSE COMPANY

01

What we DO

The REUSE Company is a solution provider specialized in the application of **semantic technologies** and **artificial intelligence** to improve the **digitalization of the Systems Engineering life cycle.**

José Fuentes

- **Current Position:** Chief Sales Manager of The REUSE Company
- Former Product Manager of RQA and the Systems Engineering Suite
- INCOSE CSEP Certified
- Graduated in the INCOSE Institute for Technical Leadership
- Member of the board of AEIS – The Spanish chapter of INCOSE
- Active contributor to the INCOSE Guide to Writing Requirements
- Other certifications: ITIL
- Other interests: Project Management, Business Analysis, Risk Management

CONTENTS

01

- Traceability: basic concepts

02

- Traceability and the Systems Engineering Suite

03

- And now what: the Interop HUB

04

- Practical demonstration

05

- Q&A and your thoughts

TRACEABILITY: BASIC CONCEPTS

WHAT IS TRACEABILITY?

- The capacity to find where a product was made
- What raw material and added components were used
- How it was produced
- Where it was stored
- How it has been released
- All along the logistic chain
- …
- From beginning to end

BASIC TRACEABILITY: WITHIN A SOFTWARE ENVIRONMENT

- *"A software requirements specification is traceable if (i) the origin of each of its requirements is clear and if (ii) it facilitates the referencing of each requirement in future development or enhancement documentation"*

Source: ANSI/IEEE Standard 830-1984

- *" A requirement is verifiable if, and only if, there exists some finite cost-effective process with which a person or machine can check that the software product meets the requirement"*

Source: ANSI/IEEE Standard 830-1984

BASIC TRACEABILITY: TRACEABILITY MATRIX

Sample traceability matrix

Requirement Identifiers	Reqs Tested	REQ1 UC 1.1	REQ1 UC 1.2	REQ1 UC 1.3	REQ1 UC 2.1	REQ1 UC 2.2	REQ1 UC 2.3.1	REQ1 UC 2.3.2	REQ1 UC 2.3.3	REQ1 UC 2.4	REQ1 UC 3.1	REQ1 UC 3.2	REQ1 TECH 1.1	REQ1 TECH 1.2	REQ1 TECH 1.3
Test Cases	321	3	2	3	1	1	1	1	1	1	2	3	1	1	1
Tested Implicitly	77														
1.1.1	1	x													
1.1.2	2		x	x											
1.1.3	2	x											x		
1.1.4	1			x											
1.1.5	2	x												x	
1.1.6	1		x												
1.1.7	1			x											
1.2.1	2				x		x								
1.2.2	2					x		x							
1.2.3	2								x	x					
1.3.1	1										x				
1.3.2	1										x				
1.3.3	1											x			
1.3.4	1											x			
1.3.5	1											x			
etc....															
5.6.2	1														x

- ✓ Might be good as a first step
- ✓ Allows to check where every requirement comes from
- ✓ Allows you to check completeness of tests
- ✓ Ensures that implementation meets specification
- ✓ Enough for some projects (e.g. SW)
- ✗ Not enough in complex projects
- ✗ No support to req. decomposition or design
- ✗ Doesn't satisfy standards like: ARP4754, DO-174, DO-254, ISO26262…

TRACEABILITY IN COMPLEX PROJECTS: ARP4754

> Listed below are the processes the supplier should provide to show they are meeting the **ARP4754A** objectives:

- Requirements management process, including traceability and allocation processes
- Requirements validation process
- Requirements verification process
- Safety analysis process
- Configuration control processes (for DA data)
- Change management process (covering change impact and regression analysis)
- Problem reporting process
- PA (audit/assessment process to verify adherence to the processes)

Source: DOT/FAA/TC-16/39
Safety Issues and Shortcomings With Requirements Definition, Validation, and Verification Processes Final Report

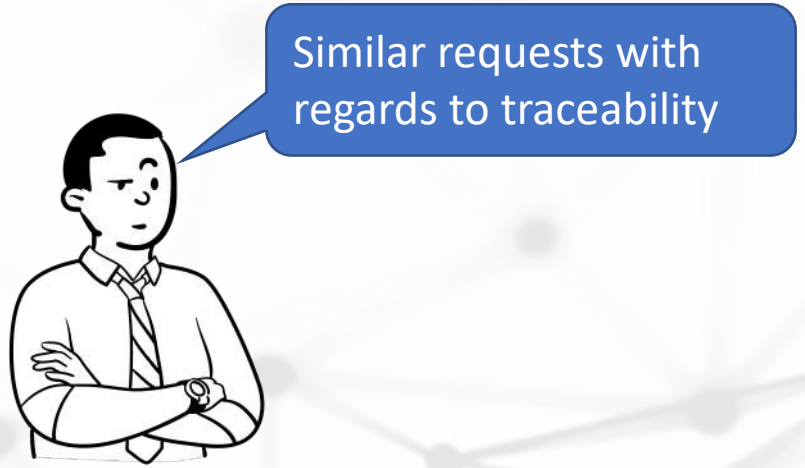
TRACEABILITY IN COMPLEX PROJECTS: ARP4754

"The following objective statement is from ARP4754A, Section 5.3.1.1, Safety Requirements:

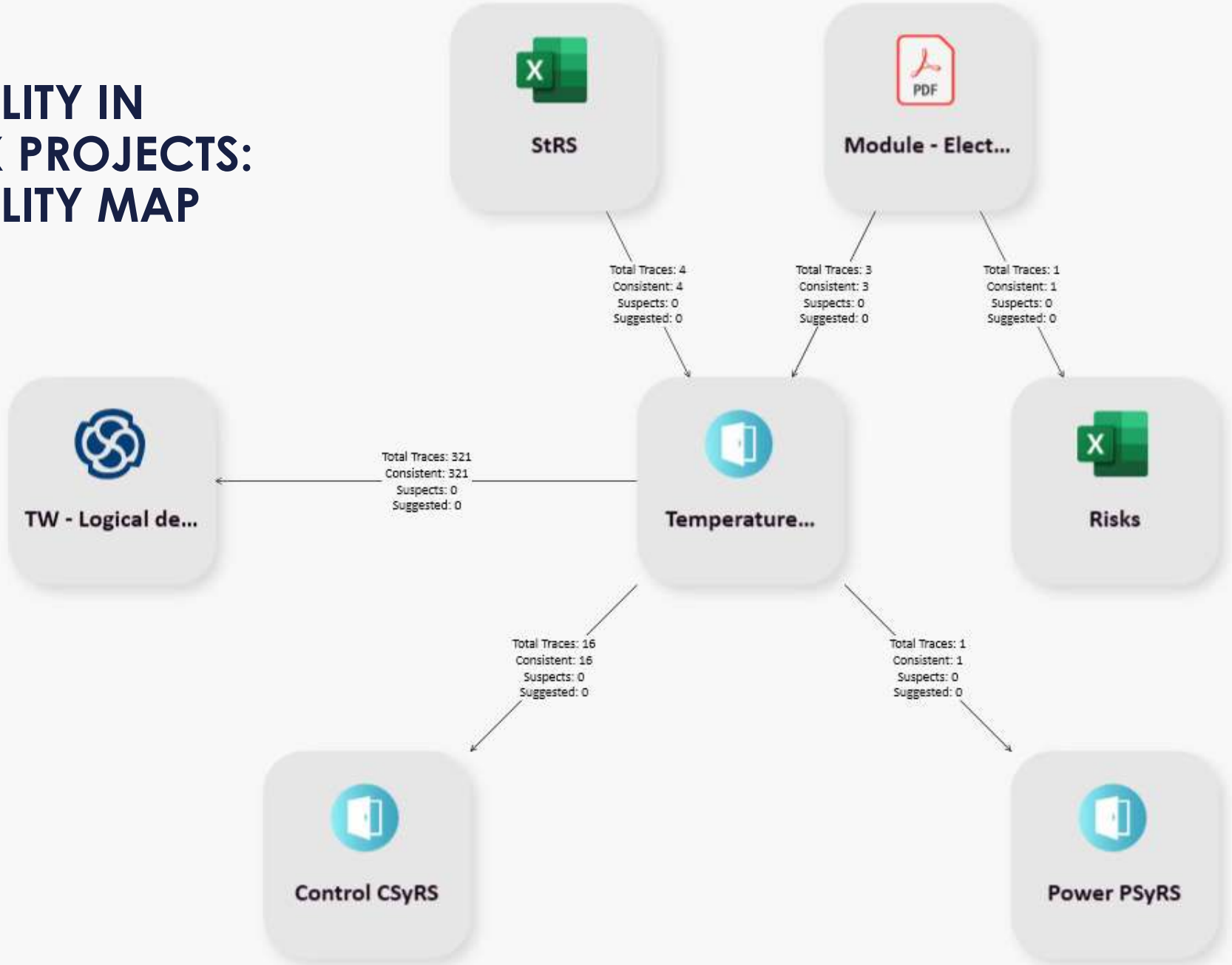
"Requirements that are defined to prevent failure conditions or to provide safety related functions should be uniquely identified and traceable through the levels of development. This will ensure visibility of the safety requirements at the software and electronic hardware design level."

Requires to **prove** that requirements' sets are sufficiently **correct** and **complete** so that the final product will **meet the customer' needs**.

Functional Safety: IEC 61508
- EN 50128 Railway
- IEC 60601 Medial Equipment
- IEC 61511 Process Industry
- IEC 62061 Machinery
- EN 60880 Nuclear
- ISO 26262 Automotive



TRACEABILITY IN COMPLEX PROJECTS: TRACEABILITY MAP



TRACEABILITY IN COMPLEX PROJECTS: TRACEABILITY MAP

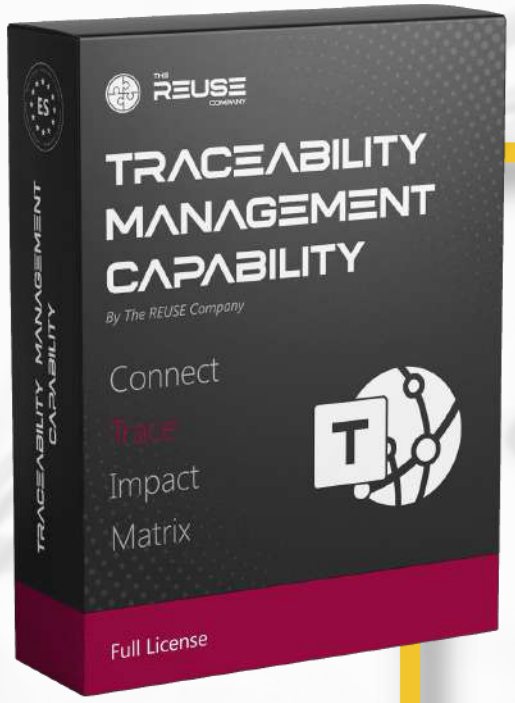
Traceability in complex projects

Pros

It's a **must** in complex and safety critical projects
Requested by **standards** and **good practices**: ISO26262, ARP4754…
Provides **visibility** in complex projects

Cons

It's normally a **tedious** and **manual** task
Involves **connection** of tools that are not easy to connect
It has to be aware of **changes** and the evolution of the project

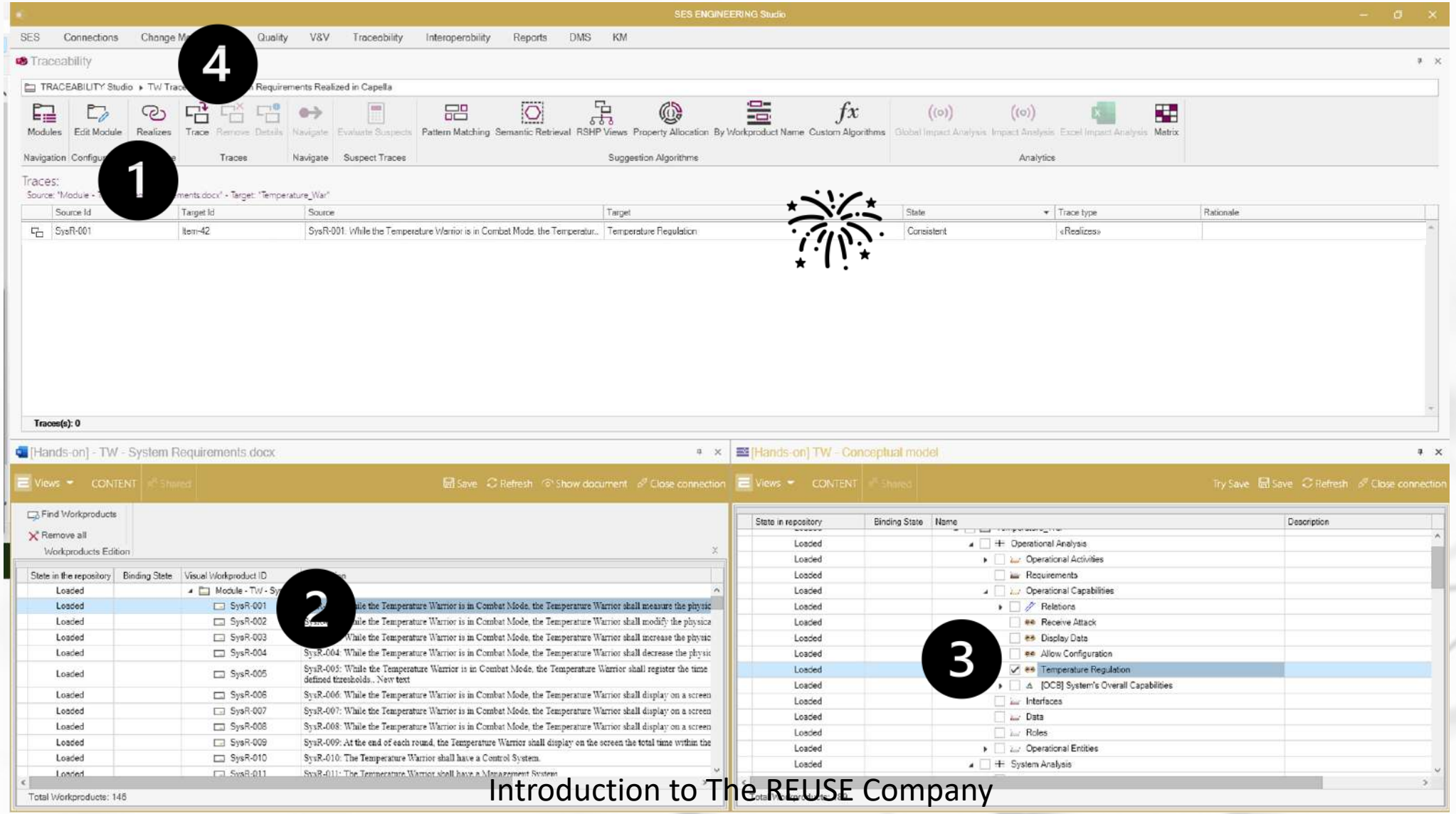


TRACEABILITY: AND THE SYSTEMS ENGINEERING SUITE

SEMANTIC TRACEABILITY: ENGINEERING STUDIO

- SES can open several documents at once
- Traces rely on the HUB
- Traces can be synced with the ASoT: RMS, MBSE
- Other traceability features:
  - Cross-platform traceability management
  - Dynamic traceability matrices
  - Semantic Impact analysis
  - Flexible reporting
  - Semantic suggestion of traces

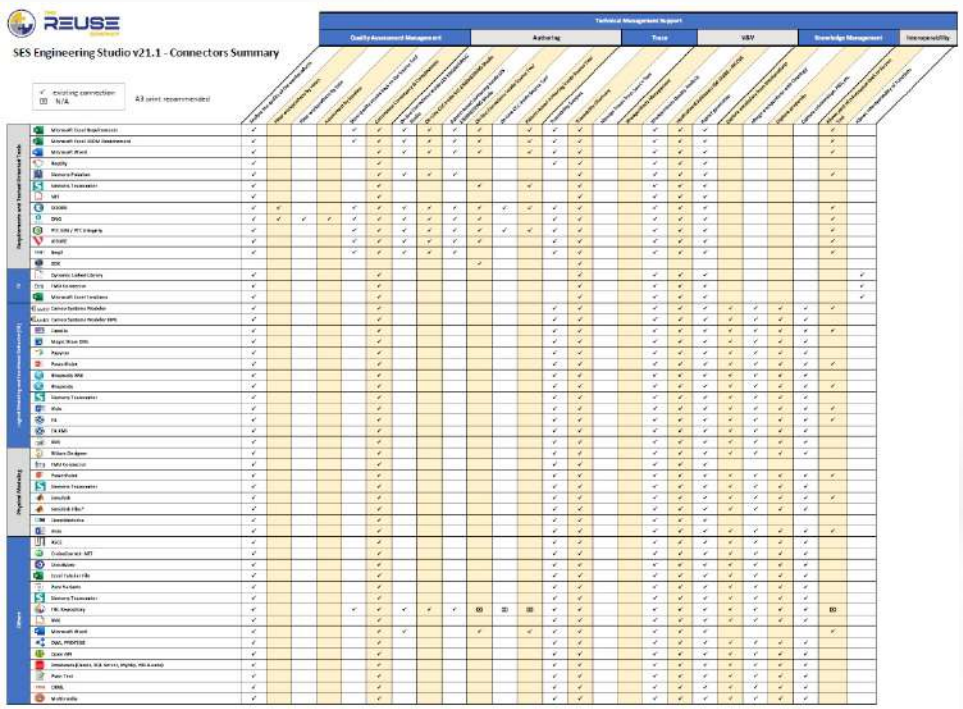
SEMANTIC TRACEABILITY: ENGINEERING STUDIO

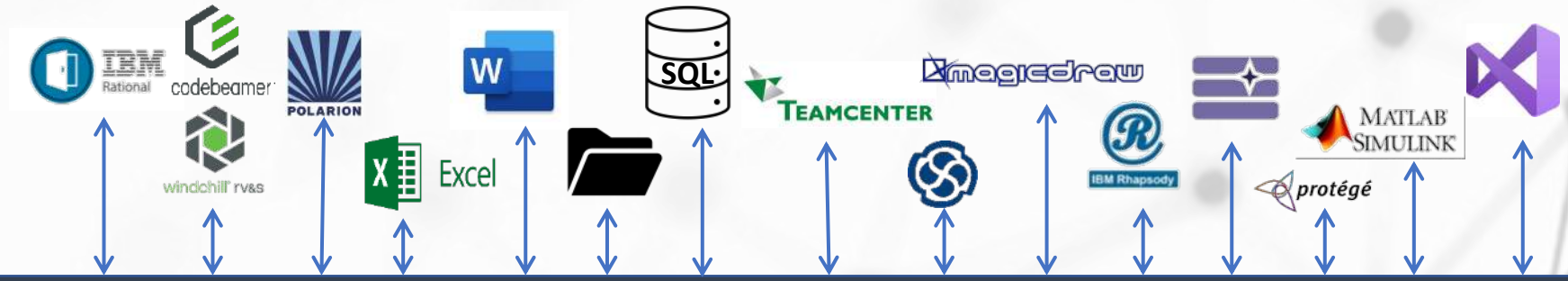


Introduction to The REUSE Company

SEMANTIC TRACEABILITY: CONNECTORS

- List of +50 connectors



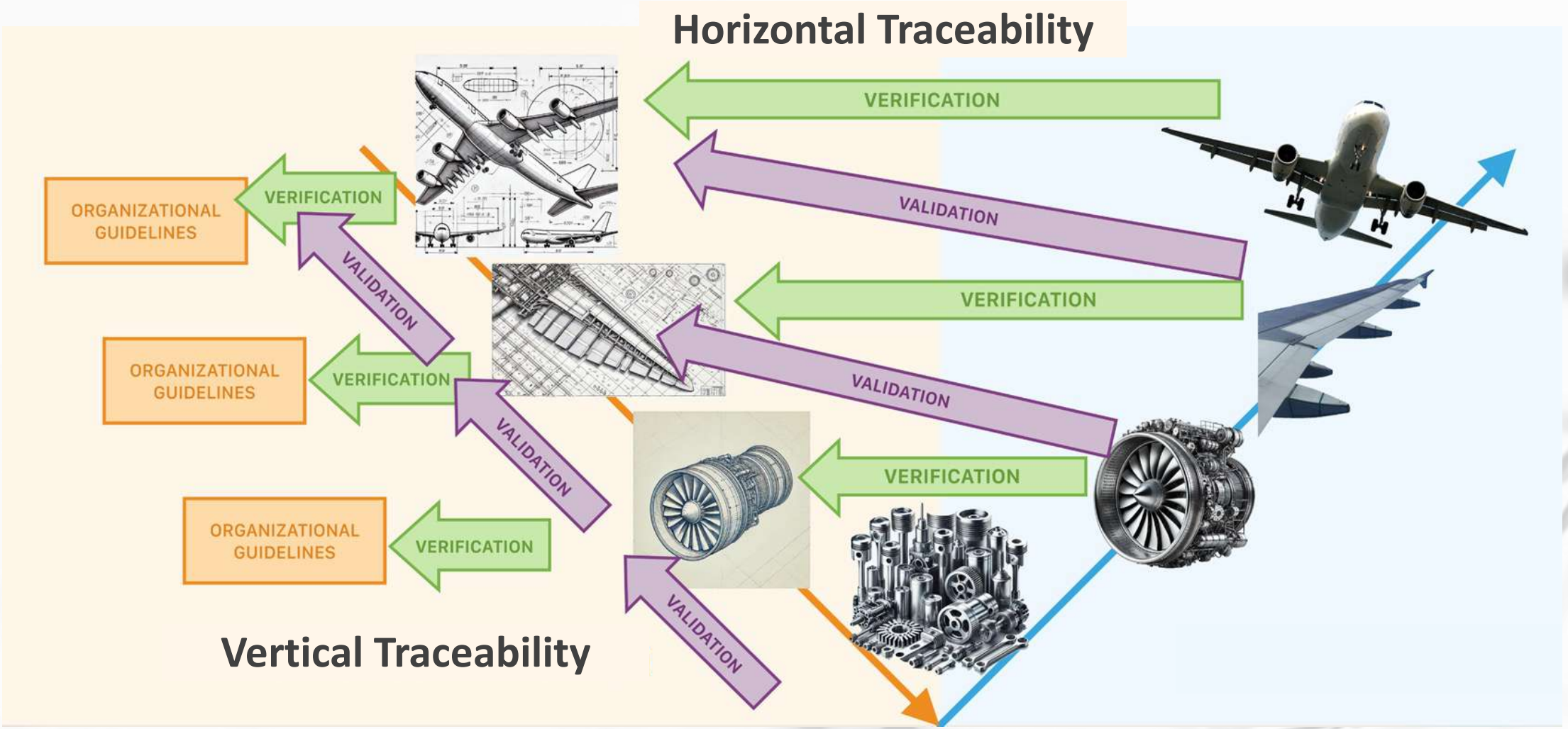


Interoperability HUB – SSoT Ontology

SEMANTIC TRACEABILITY: GRANULARITY

- Granularity in RMT, ALM, PLM
  - Every configuration item shall become a CI in the HUB
- Granularity for models: at different levels for traceability purposes
  - model,
  - diagram,
  - model element
- Granularity for non-structured sources: PDF, Word
  - Advanced parsing mechanisms to identify the meaningful blocks
  - Every of those identified items shall become a CI in the HUB

SEMANTIC TRACEABILITY: TYPES OF TRACES



SEMANTIC TRACEABILITY: TYPES OF TRACES

Source: INCOSE Systems Engineering Handbook, Ed. 4

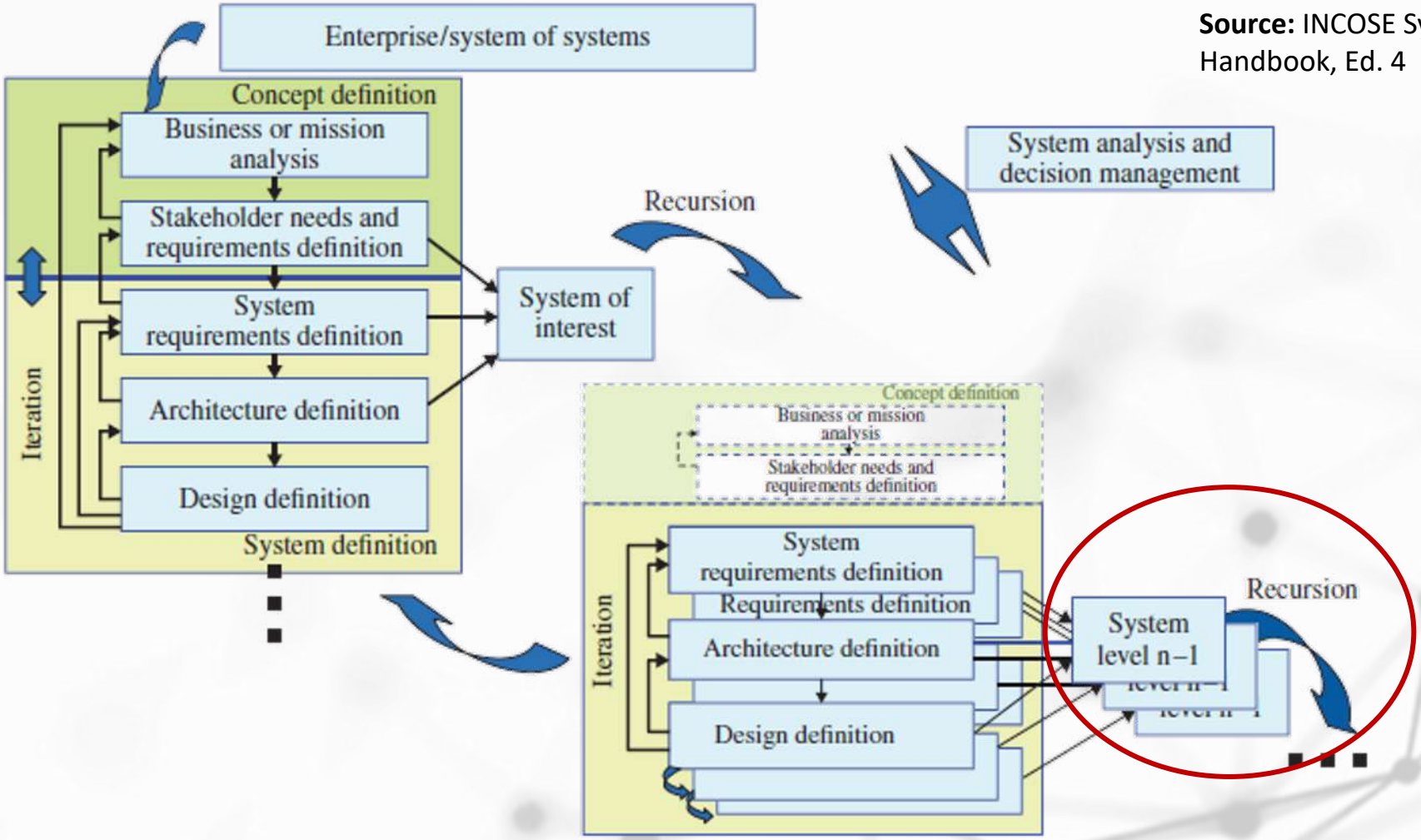
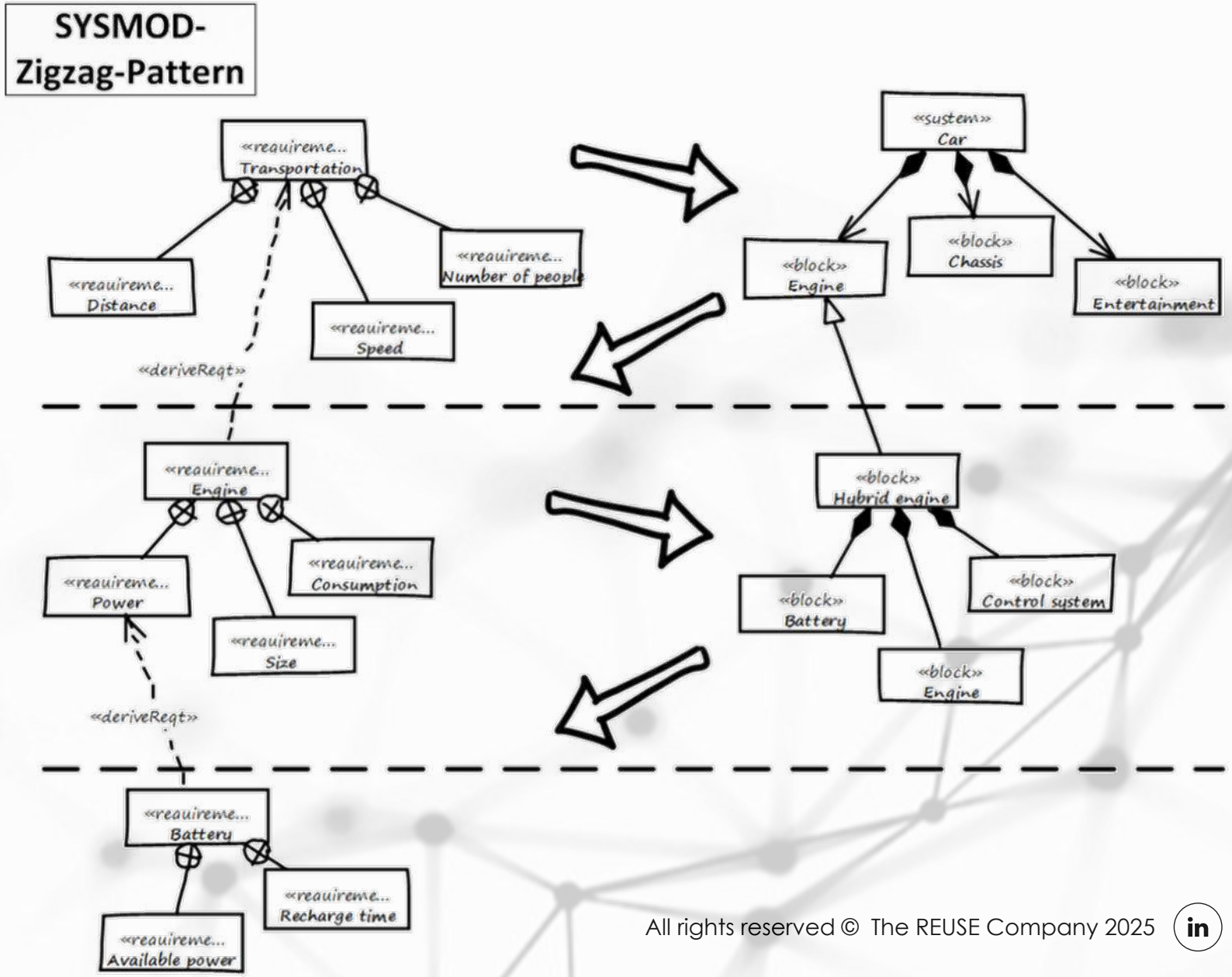


FIGURE 3.5 Iteration and recursion. Reprinted with permission from Garry Roedler. All other rights reserved.

SEMANTIC TRACEABILITY: ZIG-ZAG OF TRACES

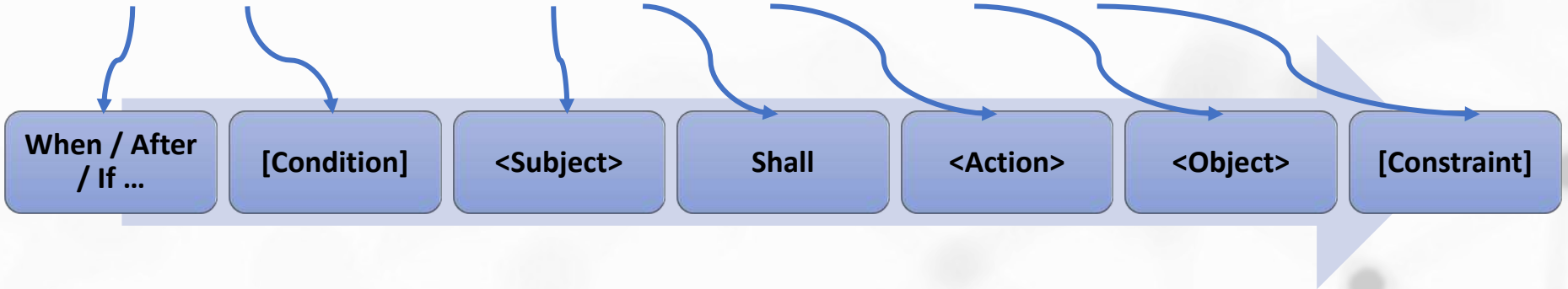
Source:
https://mbse4u.com/2012/03/26/the-sysmod-zigzag-pattern/



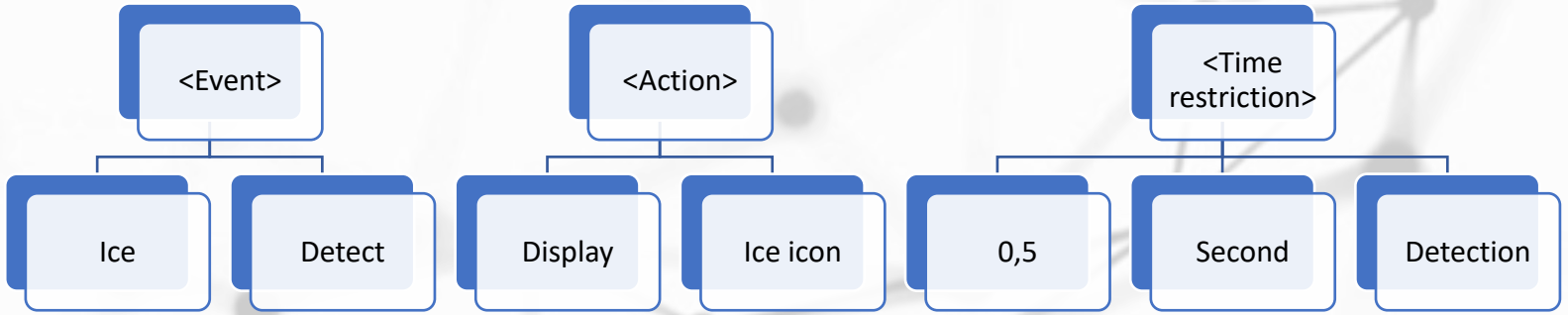
SEMANTIC TRACEABILITY: GRANULARITY

- Inputs and outputs:

SR0254: "When ice is detected, the car shall show an ice icon in less than 0,5 s from its detection"



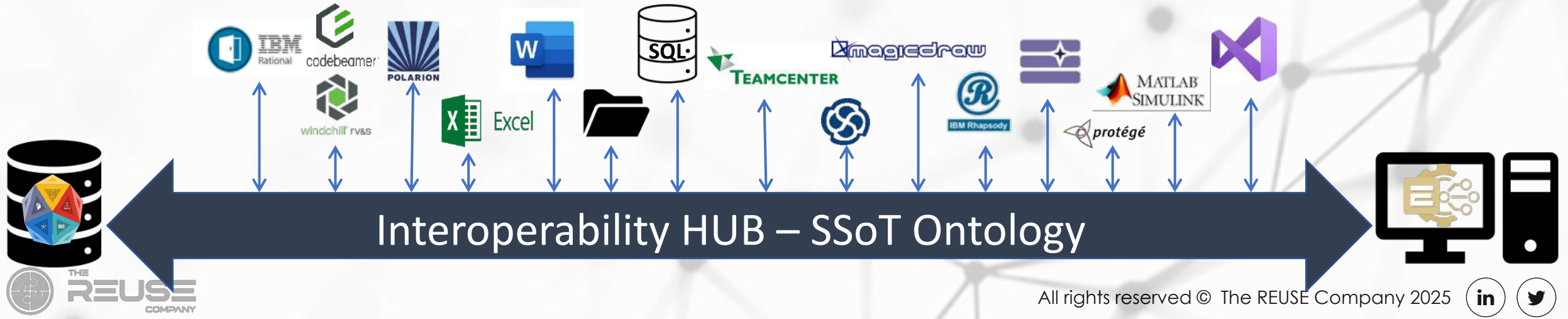
Semantic formalization (knowledge graph):



AND NOW WHAT:
THE INTEROPERABILITY HUB

SES ENGINEEERING STUDIO: INTEROPERABILITY HUB

- 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 source remain as the *Authoritative Source of Truth* (*ASoT*)
  - Changes in the source are notified in the SES ENGINEERING Studio and arise the notion of suspect links
  - Changes in the SES ENGINEERING Studio are persisted in the corresponding source tool (*ASoT*)



THE PILLARS OF

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Interoperability HUB

Digital thread without frontiers

CONNECTIVITY

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

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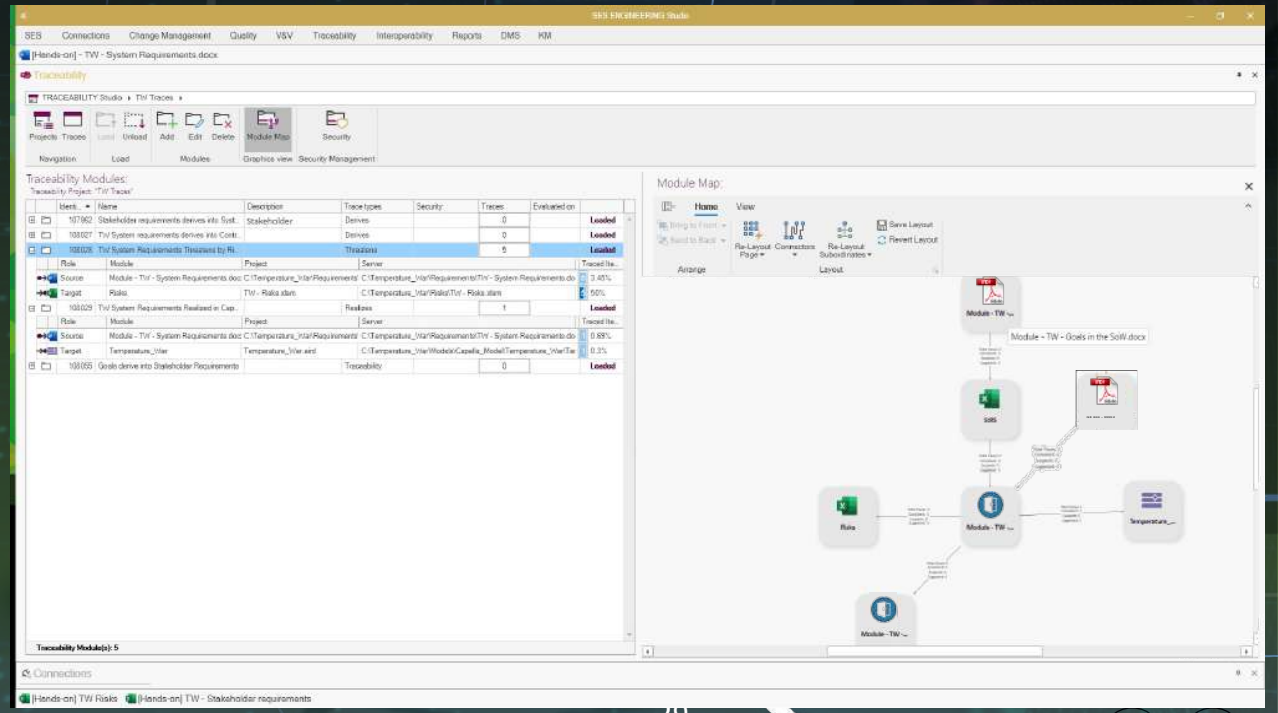
SEMANTIC TRACEABILITY

Traces into heterogeneous environment
Automatic detection/suggestion of traces



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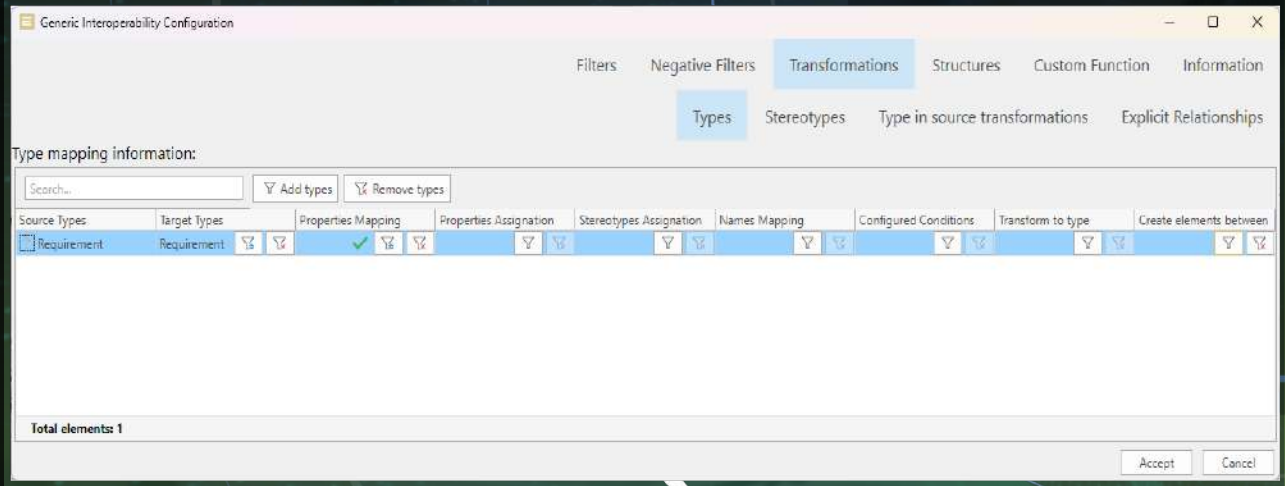
COPYING/MOVING/SYNCHRONIZING WORK PRODUCTS

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



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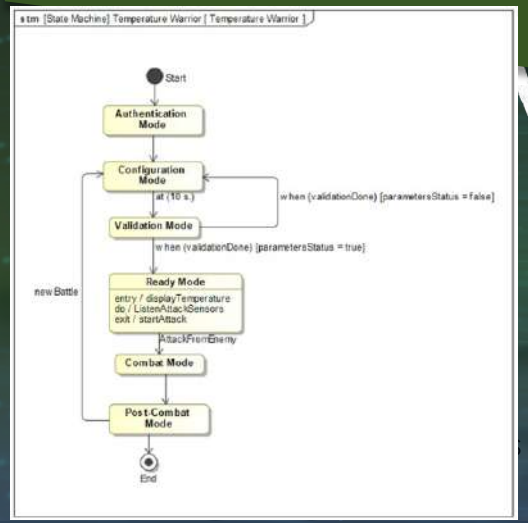
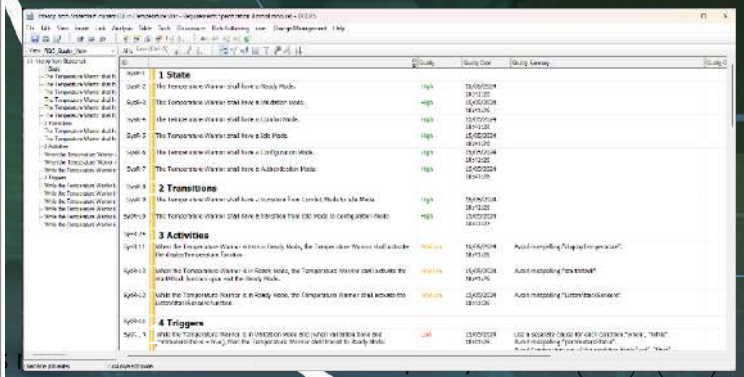
TRANSFORMING WORK PRODUCTS

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

Semantic Traceability

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CONNECTIVITY

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

SEMANTIC TRACEABILITY

Traces into heterogeneous environment
Automatic detection/suggestion of traces.

COPYING/MOVING/SYNCHRONIZING WORK PRODUCTS

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

TRANSFORMING WORK PRODUCTS

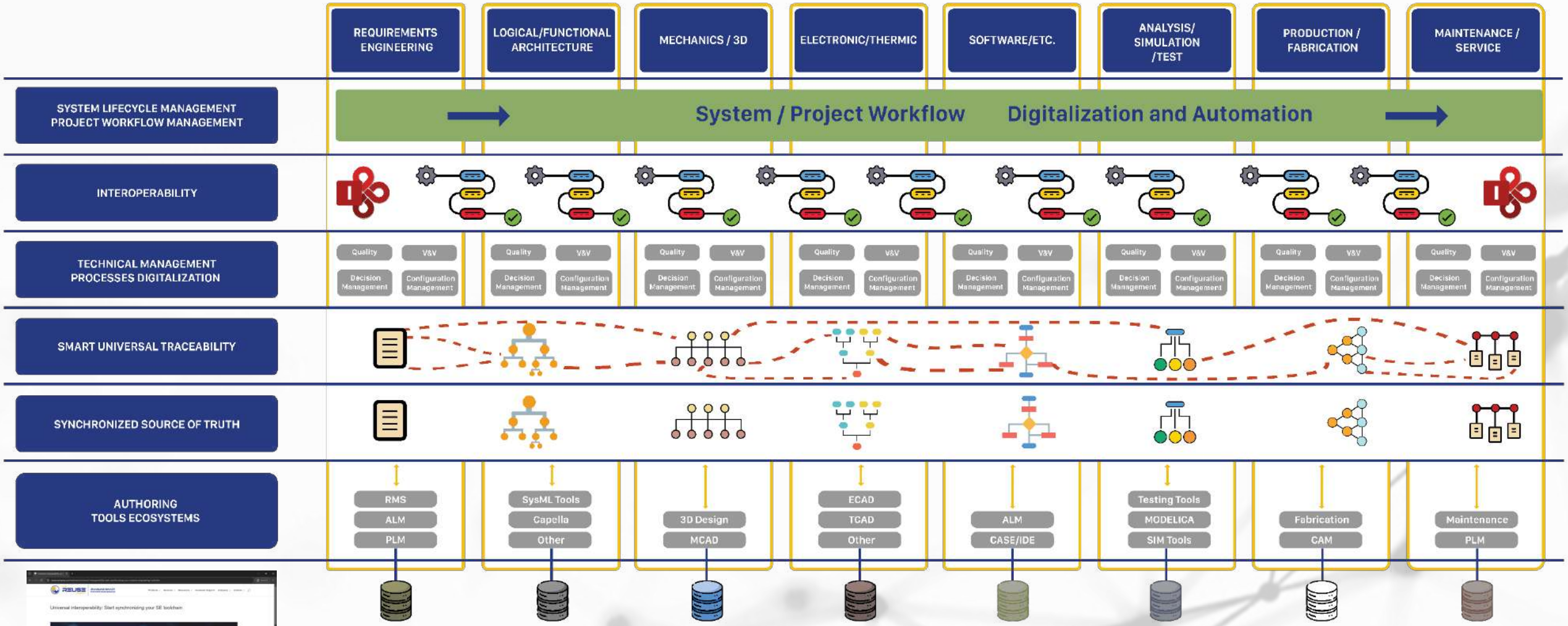
Change of metamodel between source and target work products
Textual requirements to models, SysML to Capella…

BINDING WORK PRODUCTS

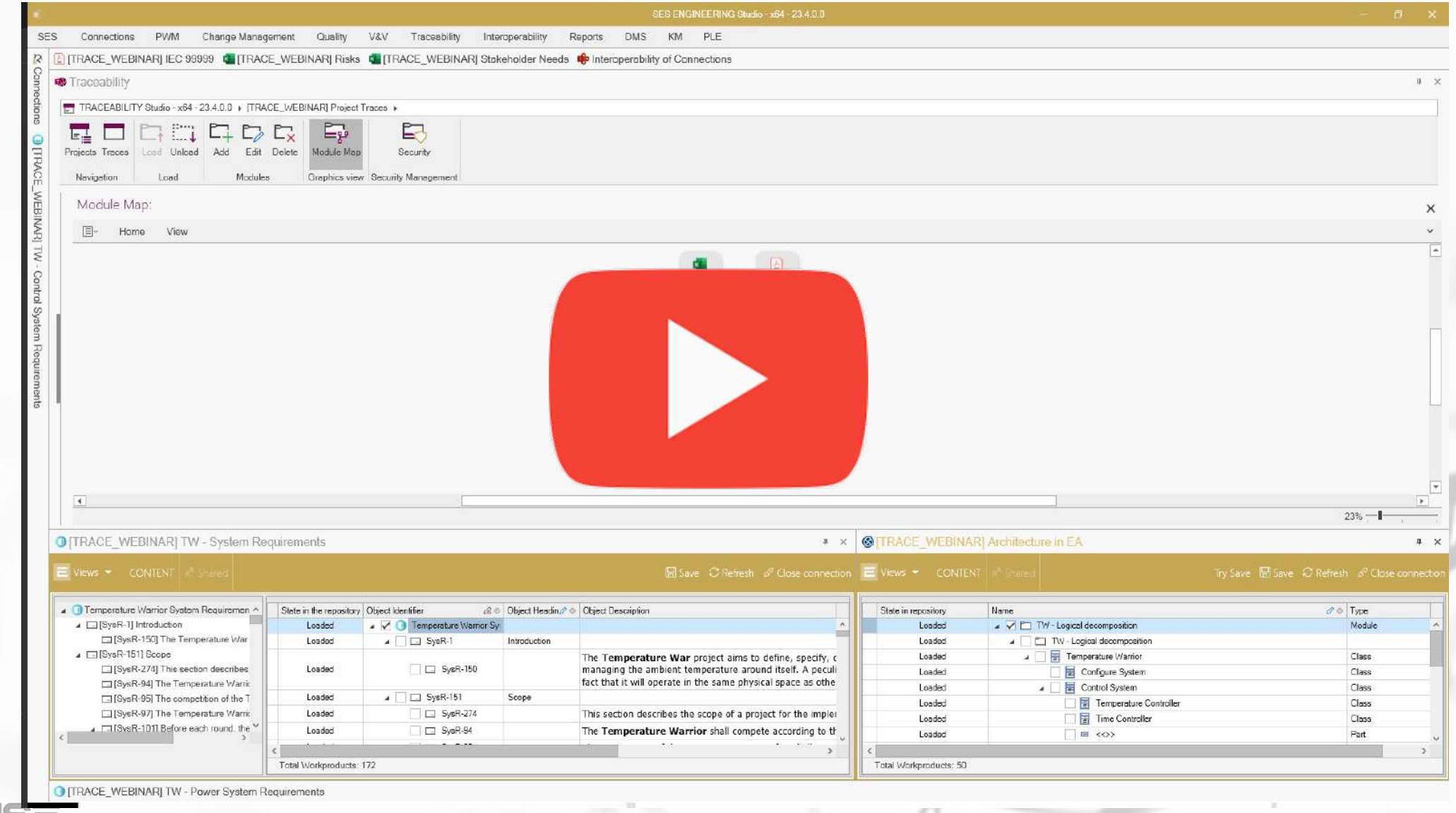
Changes in one work product triggering changes to target work products.

REMOTE CONNECTIVITY

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



SEMANTIC TRACEABILITY: DEMO



NEXT WEBINAR

Extended Interoperability :

Connecting Tools all over the System Life Cycle (even to other organizations)

Dates:

Tuesday, June 18, 2024, 5:00 PM CET (Madrid)/ 5:00 PM JST (Tokyo)/ 7:00 PM AEDT (Sydney)

Tuesday, June 18, 2024, 9:00 AM CET (Madrid)/ 8:00 AM PST (Los Angeles)/11:00 AM EST (Detroit)

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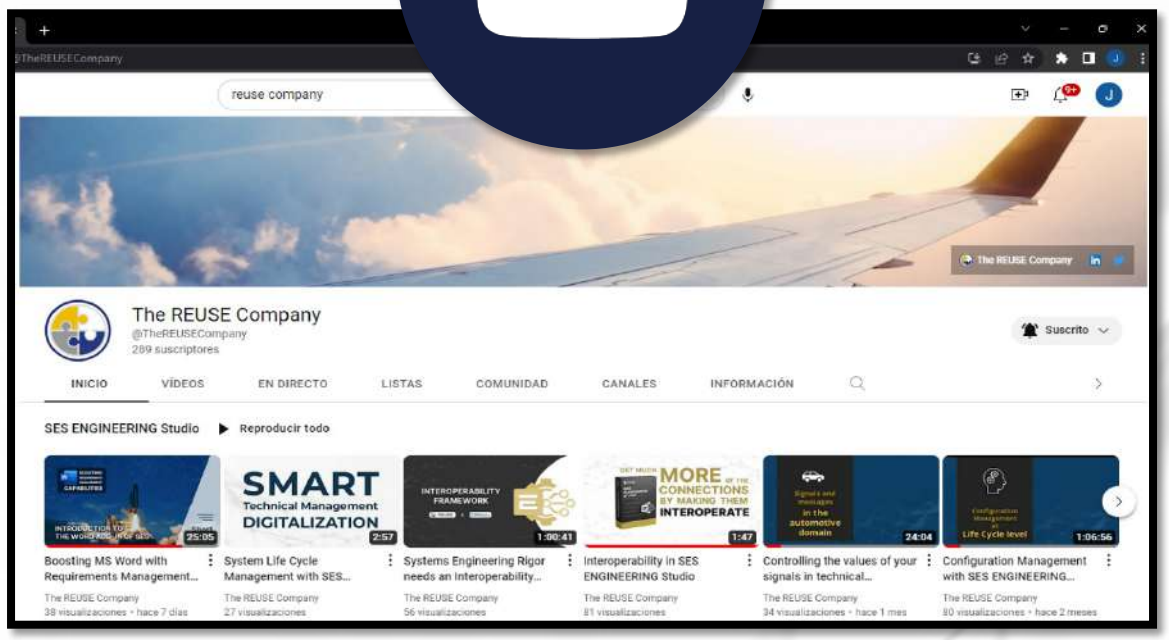

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