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  - The Webinar will be recorded. A link to the recording will be sent to you in few days

Requirements Authoring Tool **RAT** for **Capella**

- The perfect way for working with both Models and Textual Requirements

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The REUSE Company
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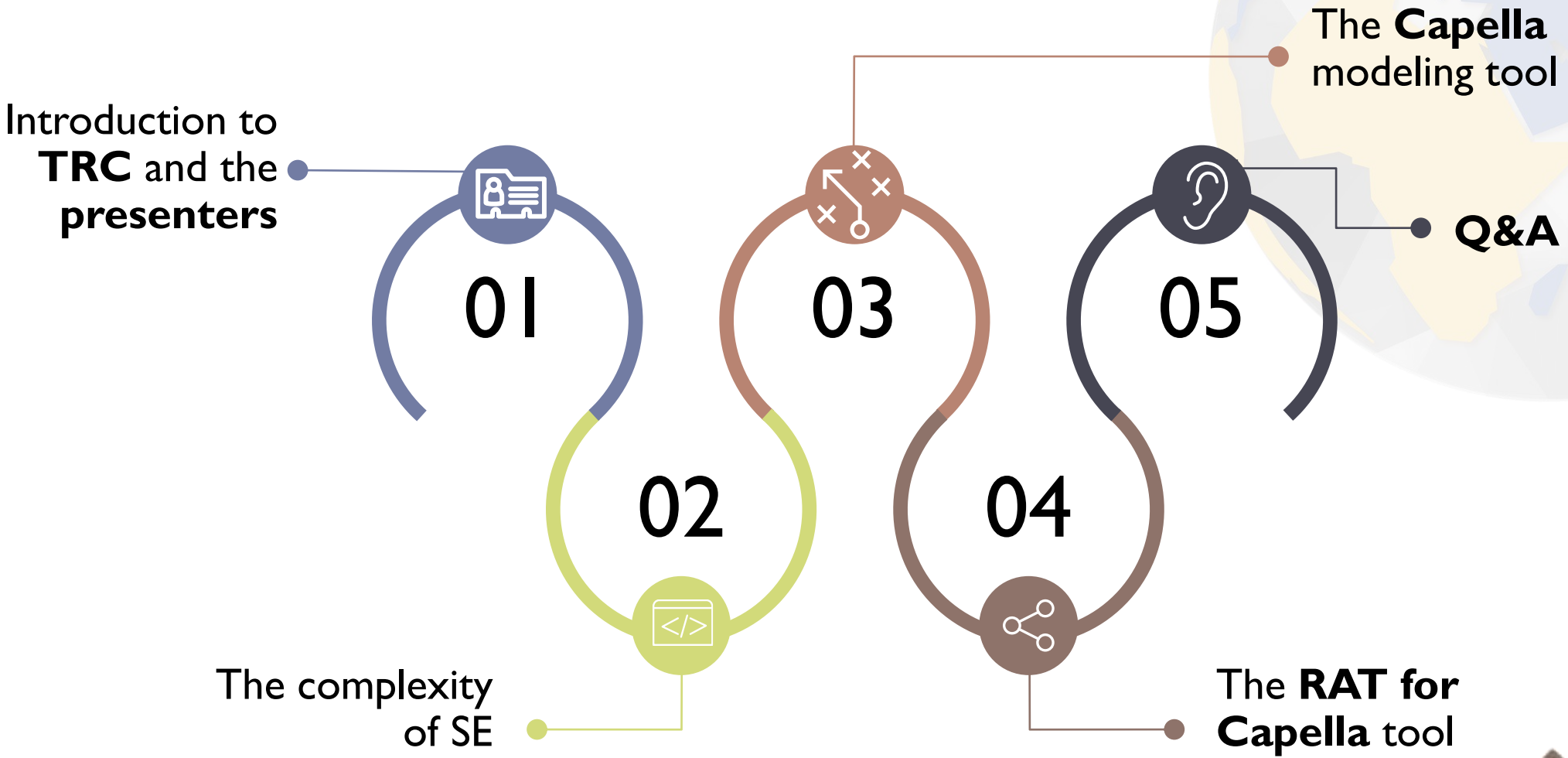
THE REUSE COMPANY

Contents



Introduction to

TRC and the presenters

Introduction to The REUSE Company

01 The company was established in **1999**

As a spin-off of a University in Madrid

02 **System + Software Engineers**

Smart combination between Company staff and R&D from Academia

03 **Headquarters:**
Madrid (Spain)

International offices:
Stockholm (Sweden)
Tokyo (Japan) Delegation

2021:
USA
Chicago/Detroit/Miami

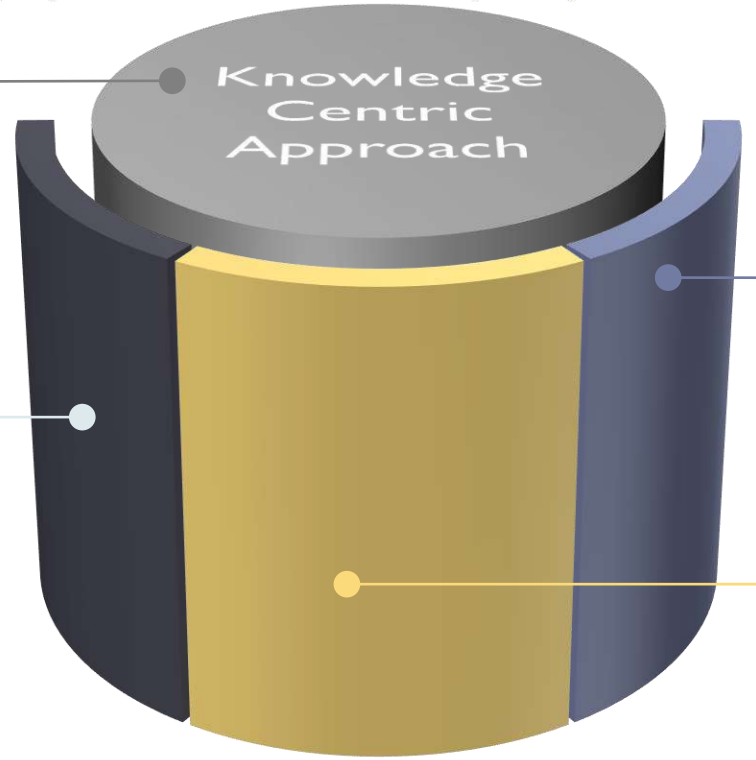
04 To promote a **reusable**, **scalable** and global solution to a **smart** and **interoperable** Systems Engineering environment, by offering a **semantic knowledge centric** approach.

THE REUSE COMPANY

T(he) R(euse) Q(company)(company)

Knowledge Centric Systems Engineering (KCSE)

Global Repositories –
Archiving –
Configuration Management –



TRACEABILITY

Interoperability and links –
Change impact –
SMART identification of missing traces –
Flexible reporting –

QUALITY (ies)

- Quality Management
- Automatic static quality assessments
- Verification & Validation management
- Risks Management
- Smart Authoring

REUSABILITY

- Interoperability
- Retrieval & Archiving
- Adaptability to Existing Toolsets

The Presenter

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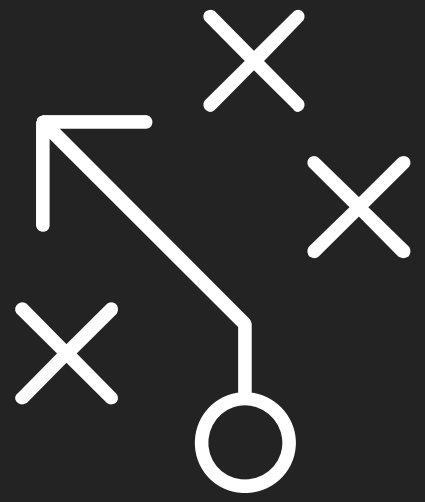
https://www.linkedin.com/in/christerfroling/

Christer Fröling is a Swedish citizen acting in the role of the **CEO for Reuse Company Scandinavia**. He has over **two decade of experience in** successful implementation of **Systems Engineering (SE)** and its sub-disciplines in a variety of roles and technical domains.

He has **experience** from both **developing advanced technical systems** as well as **helping public organizations** in the specification and **procurement** of complex infrastructure projects.

Christer specializes as a **principal consultant in applying SE and "design thinking"** into organizations willing to adopt change and implement a **knowledge driven** and **Lean SE approach** focusing on information quality, knowledge buildup and reuse with a passion of coaching others.

He is an **appreciated lecturer**, **teacher** and a strong **believer in knowledge sharing** and networking.



Complexity of Systems Engineering

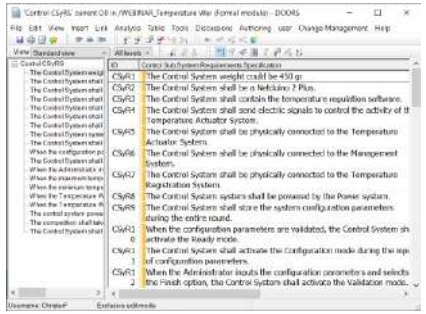
Why matching text with models?

*"It's hard to imagine a world without **text**. A picture may well be worth a thousand words, but it's likely a different thousand words for each of us. Text gives our ideas a precision that we can rarely approach with images alone."*

Need model

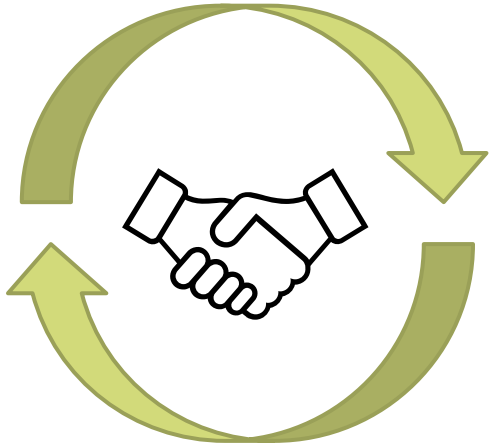
helps formalize and consolidate customer and system requirements

*"Our brain is hard-wired to process the world in a **visual form**. It's part of our 'native OS'. For at least 40,000 years, humans have been transferring information from one person to another with the help of images, pictograms and graphic symbols."*



Textual requirements

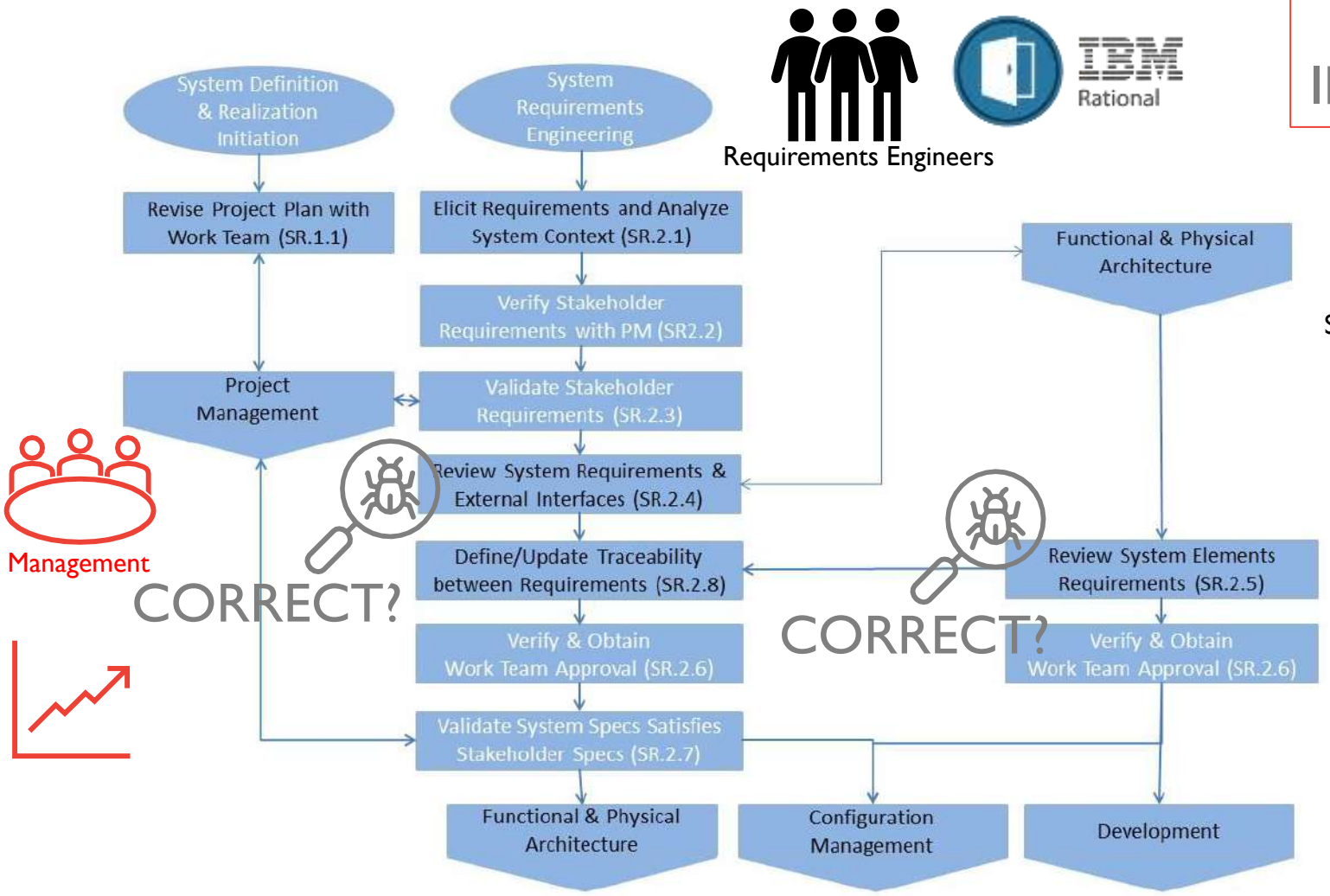
are at the heart of the current engineering practices



Solution model

helps validate feasibility, elicit/justify new requirements for the system/subsystems

The need for recursive engineering: TEAM COMMUNICATION



Requirements Engineers

IBM Rational

INCOMPLETE !?
INCONSISTENT !?

System Architects

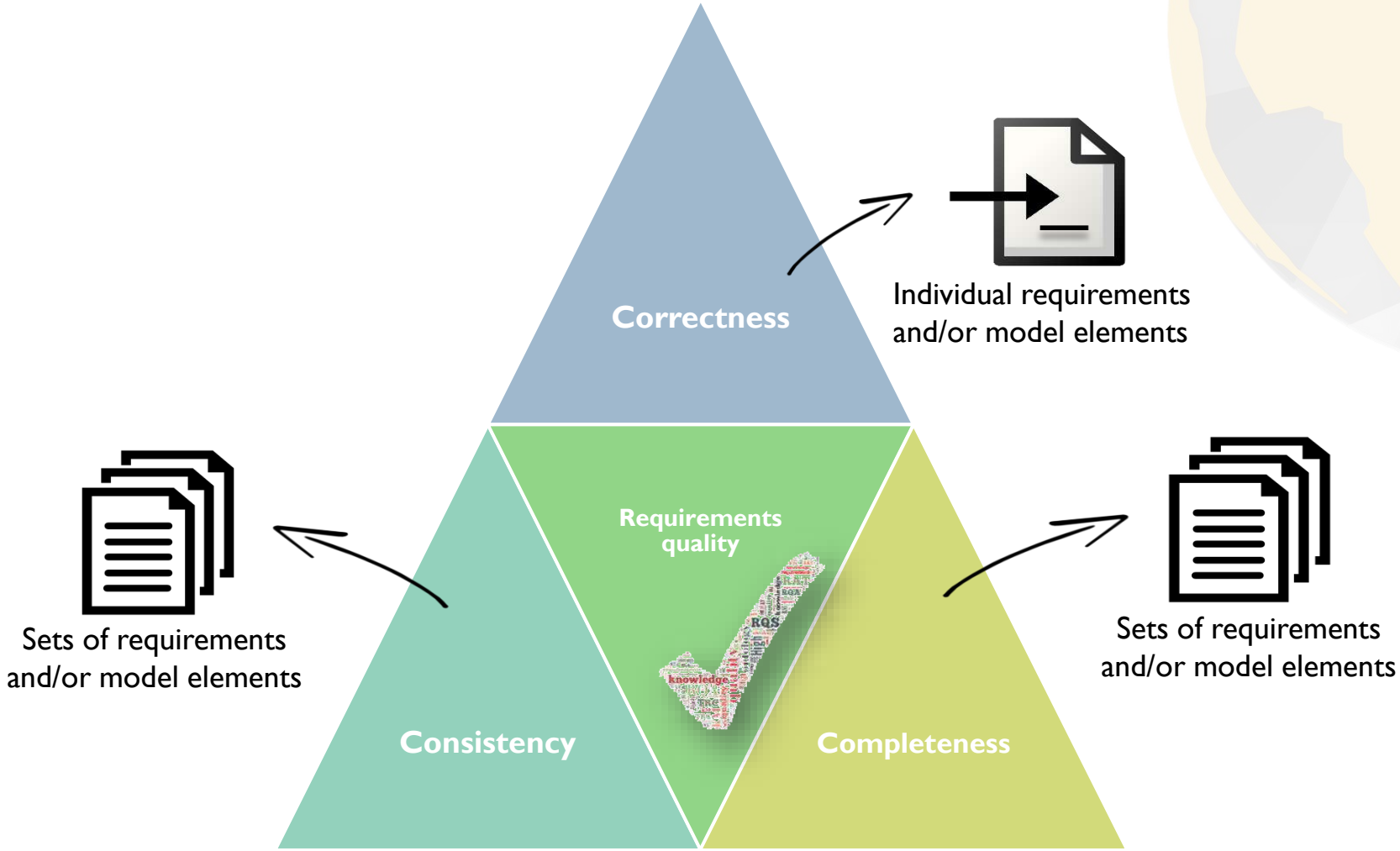
Capella

Developers

Money and schedule overrun!!

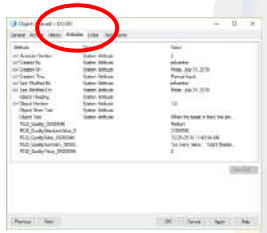
Source: ISO/IEC 29110 Systems and software engineering -- Lifecycle profiles for Very Small Entities (VSEs)

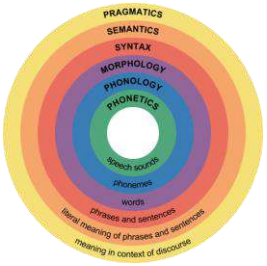
CCC – Correctness, Consistency and Completeness

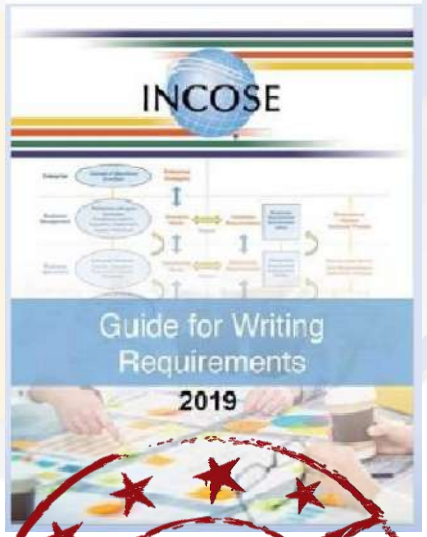


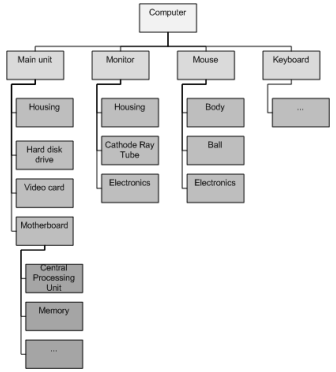
Real-time quality analysis: **Correctness**

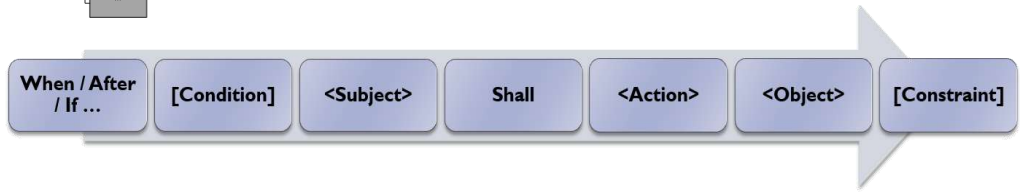
- **Metrics based on information coming from the RMS:**
  - Attributes, links, versions…
- **Metrics based on lists of terms:**
  - Forbidden: ambiguous, pronouns…
  - Restricted: negations…
  - Mandatory: 'shall', 'will', 'should'…
- **Metrics based on linguistic algorithms:**
  - Text length, misspelling, readability….
  - Detection of passive voice, imperative tense…
- **Metrics based on the conformance with models:**
  - Concepts in your requirements coming from PBS, FBS…
- **Metrics based on patterns:**
  - Compliance with different types of requirements patterns
  - Detection of specific structures within the requirements



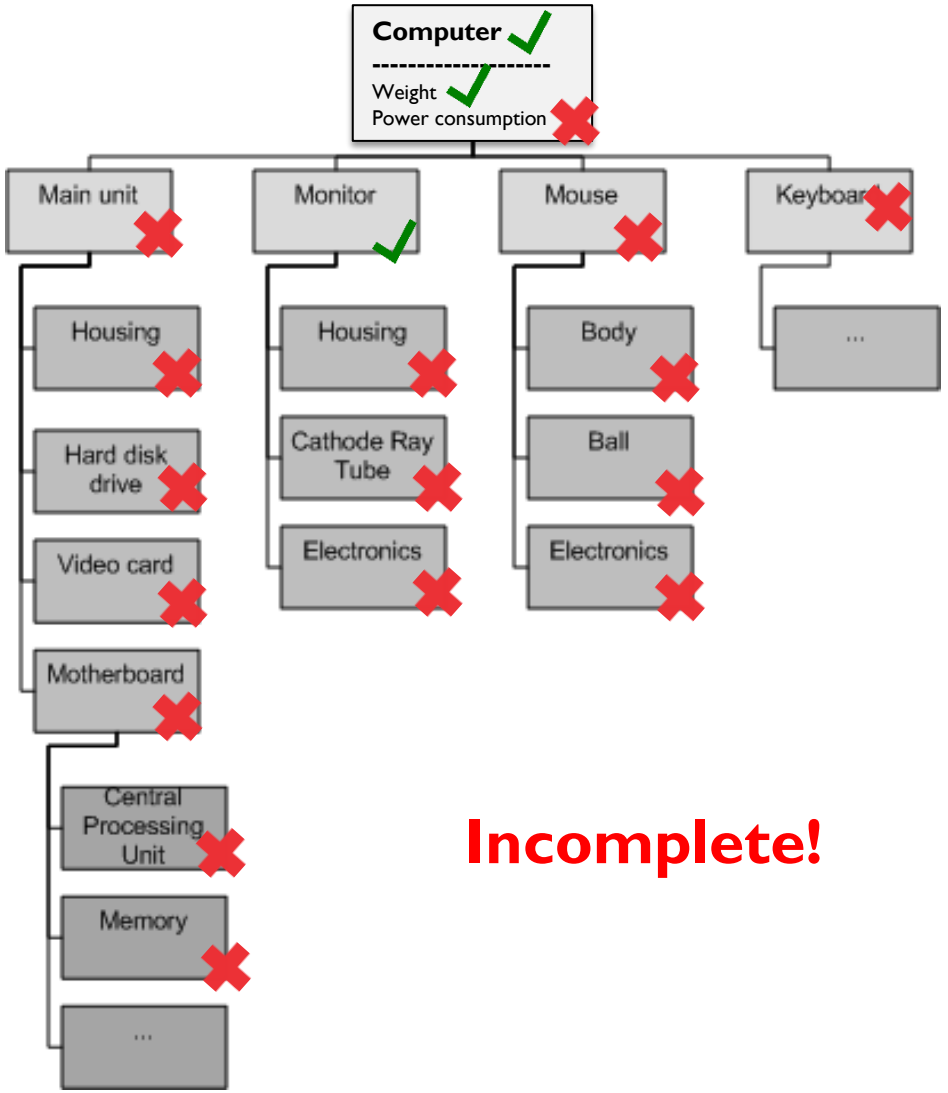




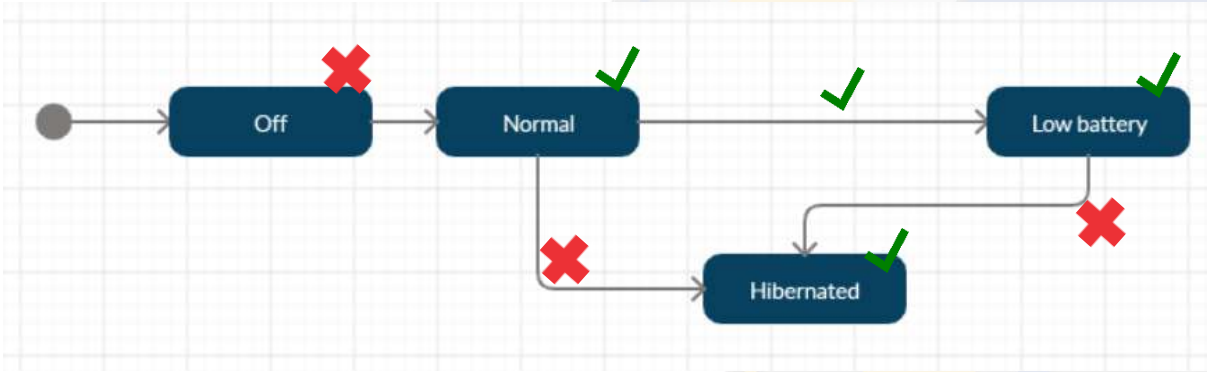




Real-time quality analysis: **Completeness**



Incomplete!



The computer shall have 2 monitors.

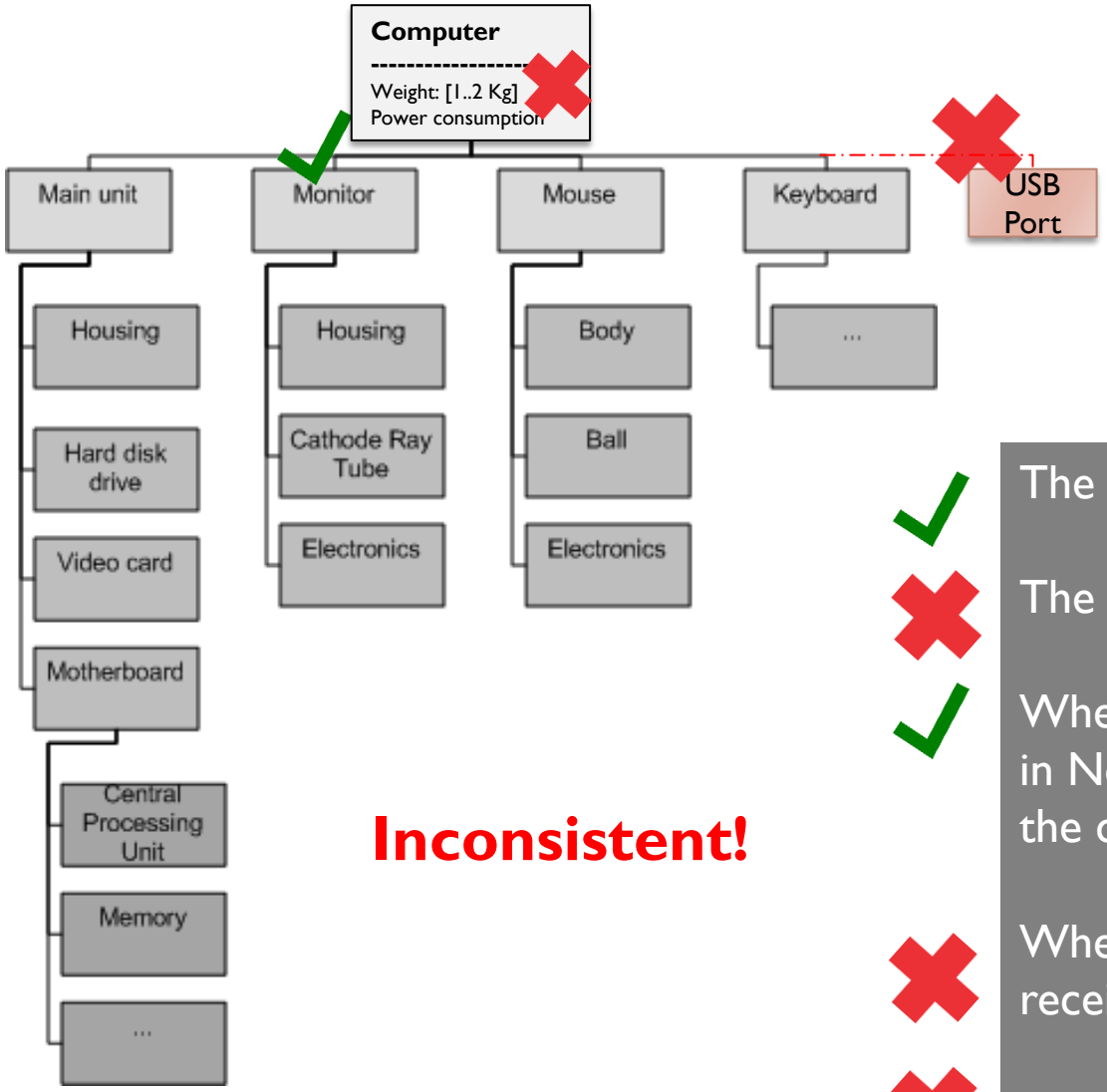
The computer shall have 2 USB ports.

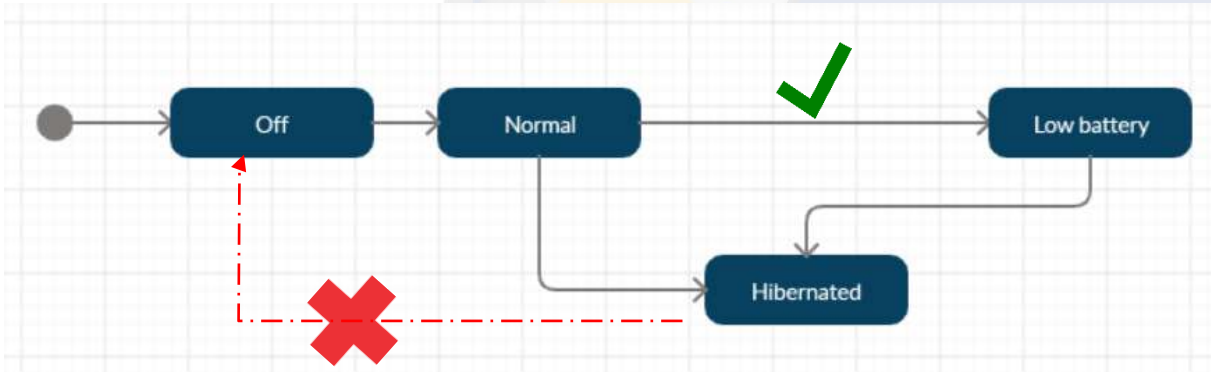
When the Computer is not plugged in, and the computer is in Normal mode and the level of battery drops below 10%, the computer shall transit to Low battery state.

When the Computer is in Hibernated state, the monitor shall turn black.

The weight of the computer shall be 1.2 kg +- 10%

Real-time quality analysis: **Consistency**





Inconsistent!

The computer shall have 2 monitors

The computer shall have 2 USB ports

When the Computer is not plugged in, and the computer is in Normal mode and the level of battery drops below 10%, the computer shall transit to Low battery state

When the Computer is in Hibernated state and EventX is received, the computer shall transit to Off mode

The weight of the computer shall be 3.5 kg +- 10%

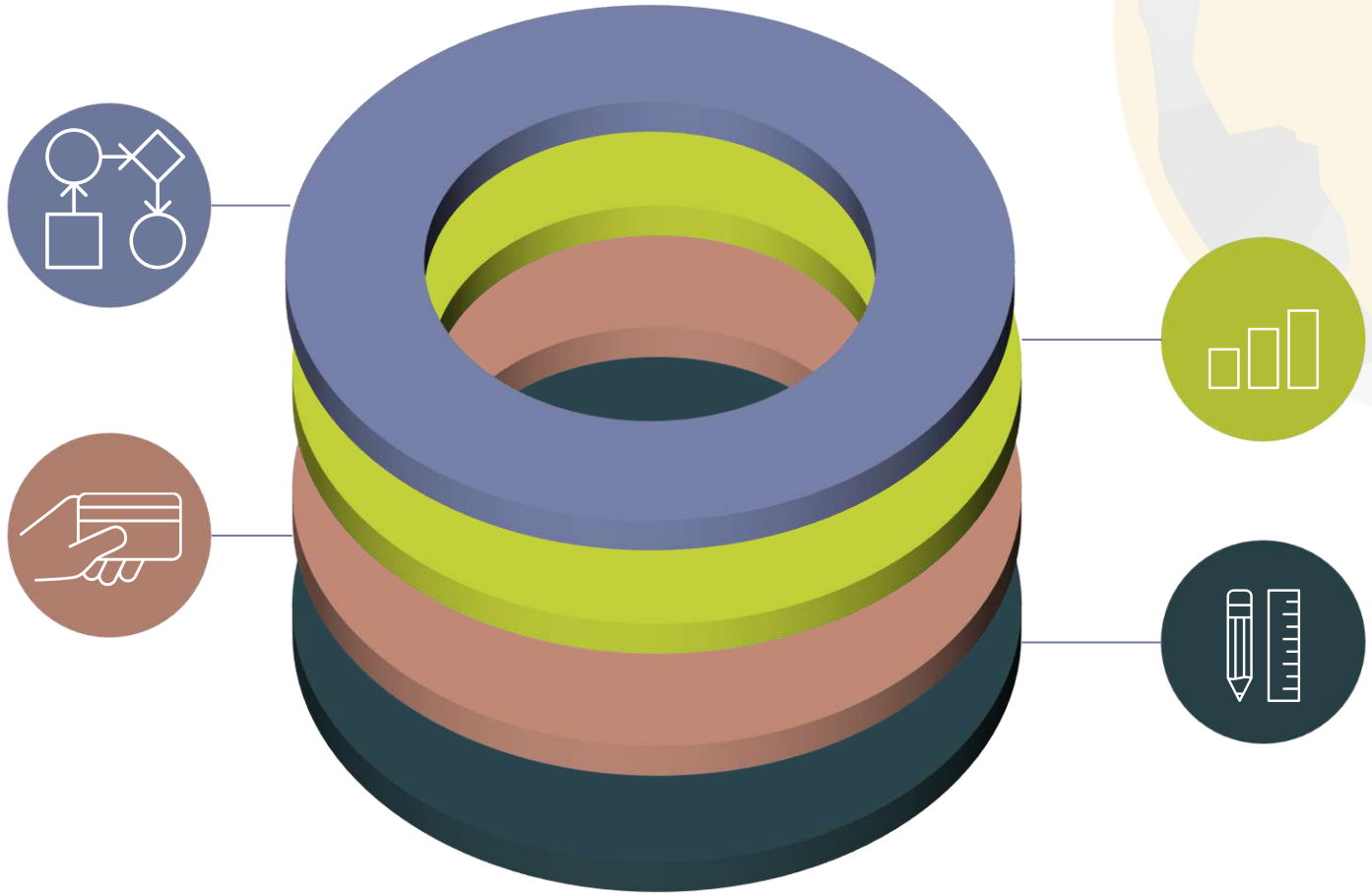
Real-time quality analysis: **Consistency**

Requirements-models Consistency

e.g. allocation of properties

Naming consistency

Among models elements and elements in textual requirements

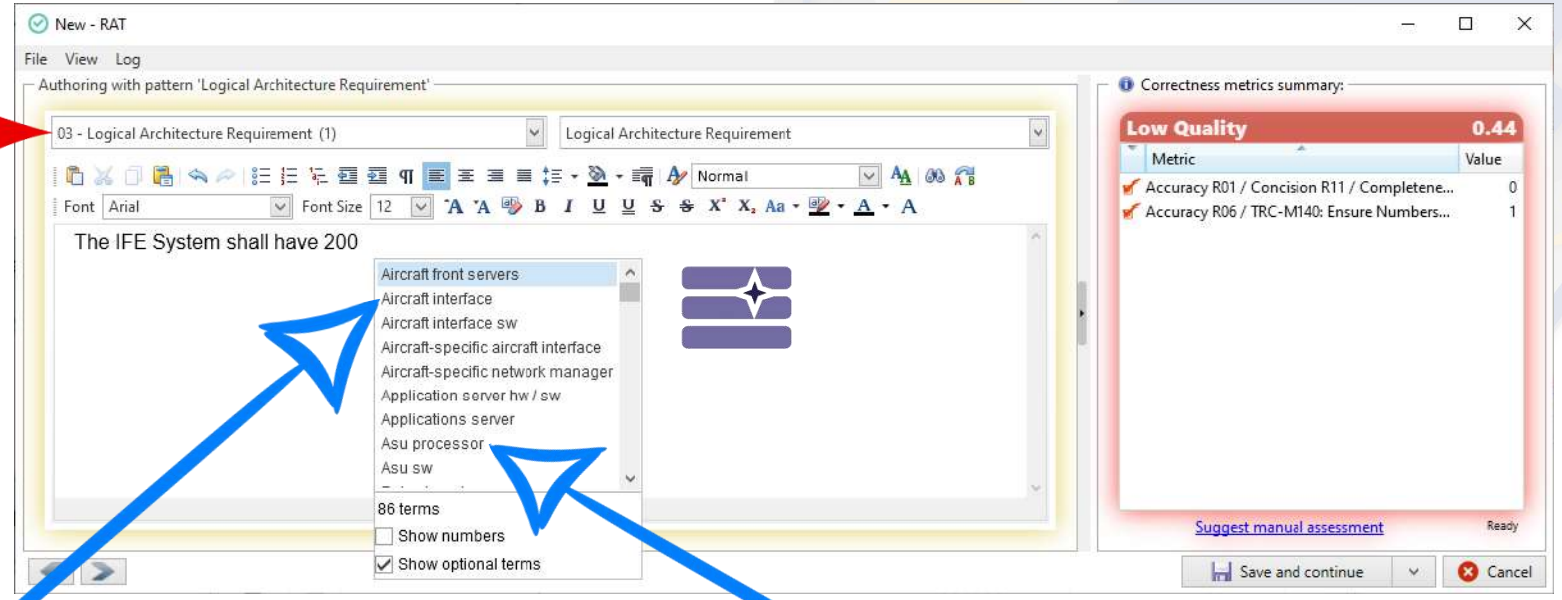


Consistency Among requirements:

e.g. overlapping

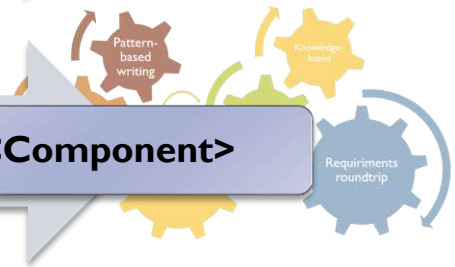
Pattern-based writing

Real-time quality analysis: **Patterns**

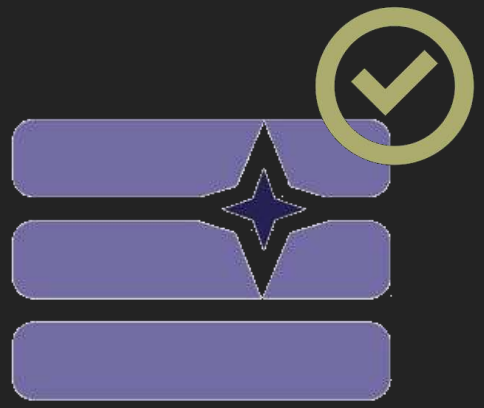


When / After / If …	[Condition]	<Component>	Shall	<Function>	<Component>	[Constraint]

<Component>	Shall	Have	a/NUMBER	<Component>



- OK, I understand. But…
- … the connection between requirements and models has to be consistent and robust
- Quality must be guaranteed at both sides, right?
- We need to know what and where the truth is kept.



The

Capella modeling tool

What is Capella

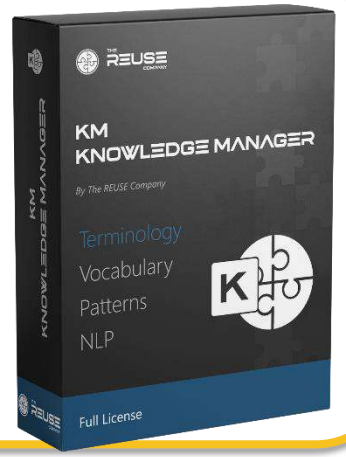
- Open-Source solution for Model-based Systems Engineering
- Comprehensive, extensible and field-proven MBSE tool and method to successfully design systems architecture
- Main characteristics:
  - Understand the customer need
  - Define and share the solution
  - Ensure engineering-wide collaboration
  - Early evaluate and justify architectural choices
  - Prepare and master V&V
- +info: https://www.eclipse.org/capella/

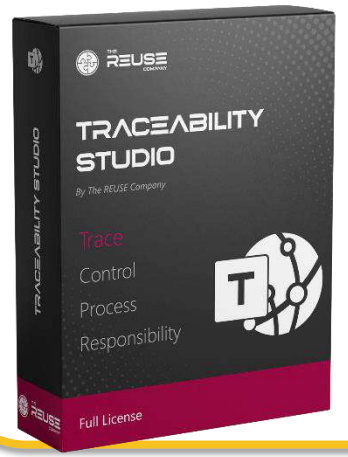
Main capabilities of

RAT for Capella

Knowledge Management

Capture, creation, **representation**, and **exchange of knowledge** across targeted groups of **stakeholders**





Traceability

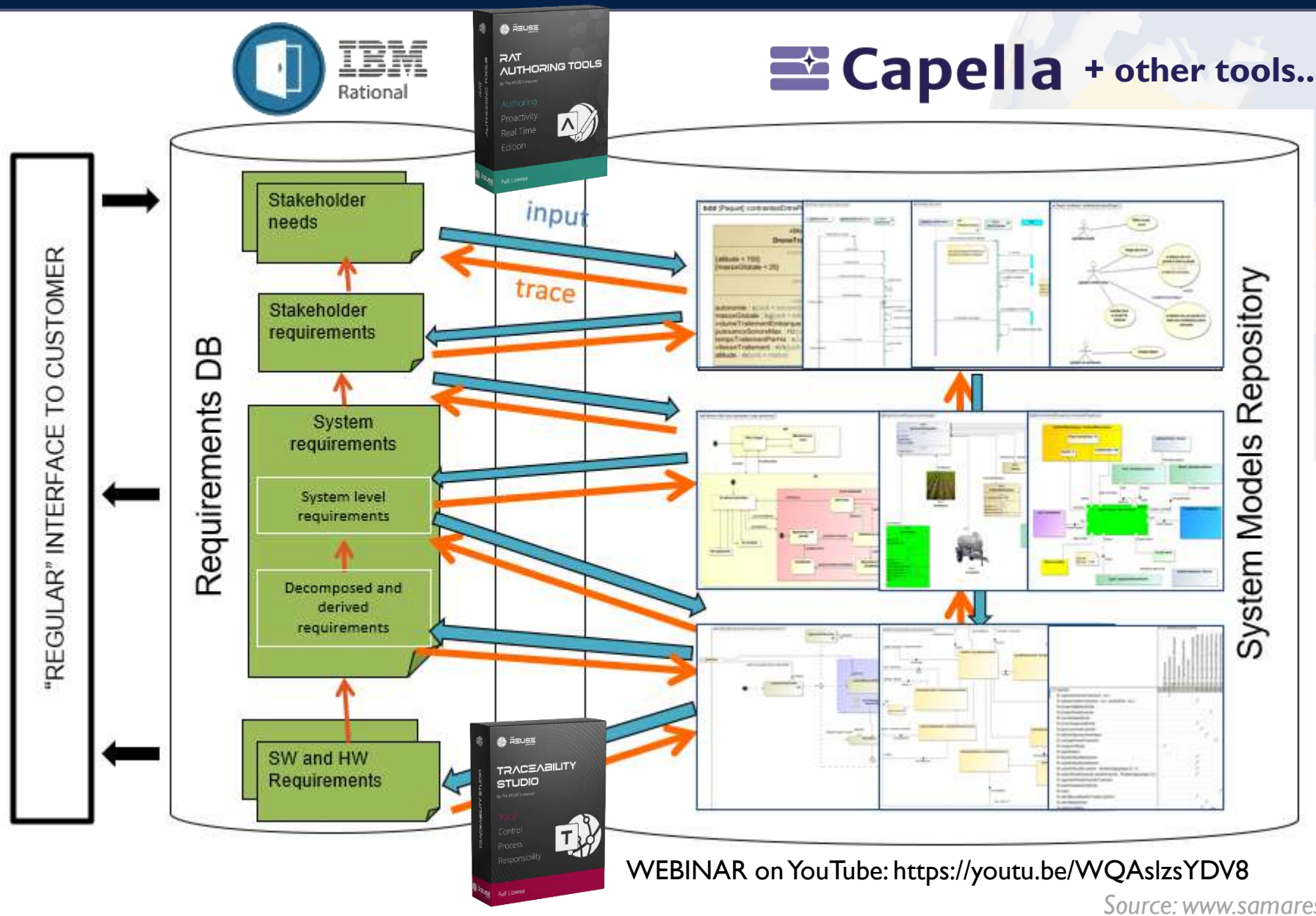
Support the **integration** among assets through semantic **interoperability** to discover and keep the **traces** among related elements

Authoring

Definition of requirements and other textual engineering assets based on **real-time analysis** (NLP), **writing assistance**, **data extraction**..

Quality Management

Define, implement and perform **measures** to meet the **quality priorities** that satisfy the **verification** of any engineering element



WEBINAR on YouTube: https://youtu.be/WQAslzsYDV8

Source: www.samares-engineering.com

RAT for Capella : Main Features

Connections

Connection to data sources

- Connection to multiple types of MBSE and RM tool sources
- Extract's information to be imported to the Ontology (KM)

Click Here

Editing

Requirements Editing

- In line writing assistance
- Pattern based for correct and complete requirements syntax
- Easy to adapt a personal window setting

Click Here

Quality

Knowledge Based

- Uses an Ontology (KM)
- SMART quality rules for Correctness, Completeness and Consistency checking.
- Ensure naming consistency between the model elements and the textual requirements

Click Here

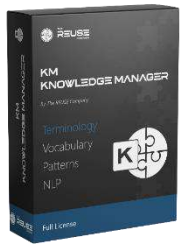
Synchronization

Data management

- Provide a complete round-trip between textual requirements in Requirement Management Systems and models
- Enables synchronization of different data sources

Click Here

The Knowledge manager (KM)



01 Vocabulary

Controlled Organizational and Project Vocabulary for a common understanding among stakeholders

02 SCM/Architectures

Recreate and capture the system architectures represented in views and models. Stablish relationships among system and system elements

03 Patterns

Represent requirements similarities and enable formal representation, automatic recognition and aid authors

04 Formalization

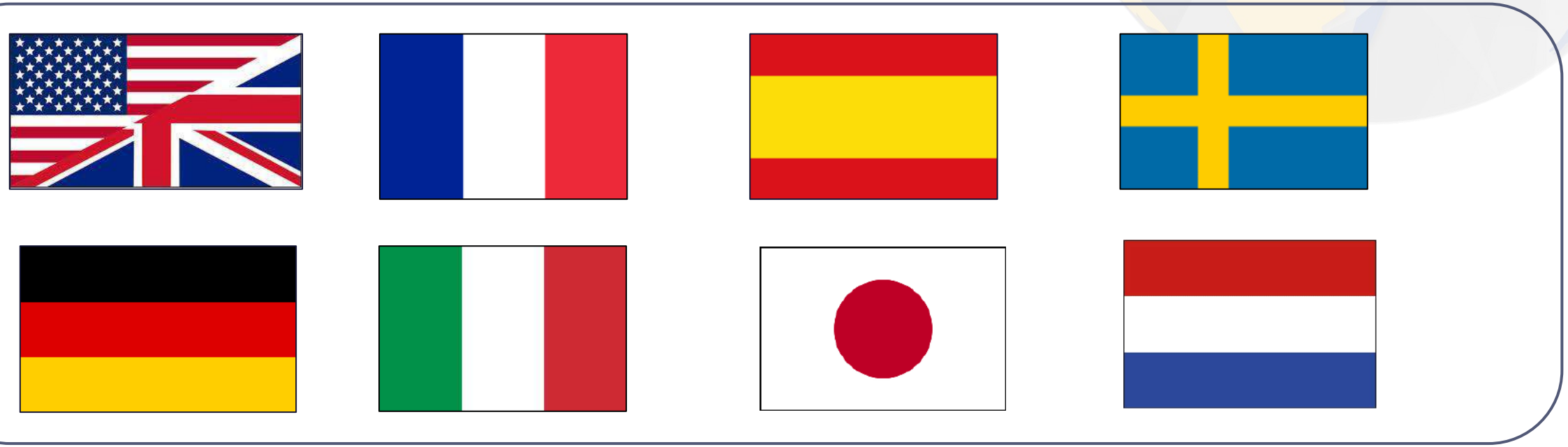
Representation of assets semantic through SRL – System Representation Language

05 Reasoning

A combination of rules, tasks and groups to infer information from valuable assets

The TRC Quality Suite: supported languages

- The TRC SES Suite is highly dependent of the language of the requirements
- Languages supported so far:



Main features: semantic approach

Domain specific ⟵ ⟶ Generic English

Vocabulary

Hit | Target | Radar

System | Operate | Minimum | Environment | Pressure | Temperature

shall | The | of | at | Lower

SCM

<Entity> | Hit | Target

System | Elect. device

Display | Receiver | Transmitter | Radar | Sonar

<Action> | Emit | Receive | Connect | <Detect> | Detect | Identify

<Entity>

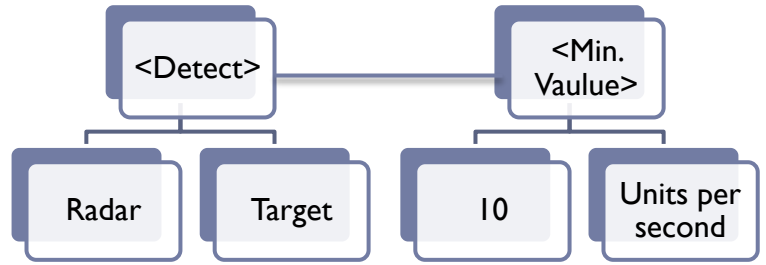
"Equivalence ="

Patterns

The | System (*) | Shall | <Detect> | <Entity> | At | Minimum | rate | Of | NUMBER | MEASUREMENT UNIT

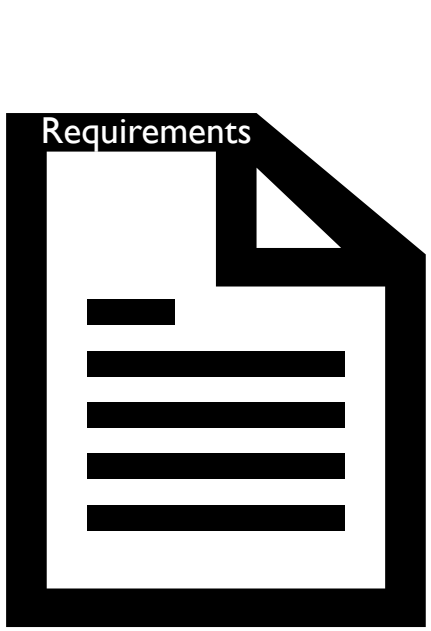
Formalization

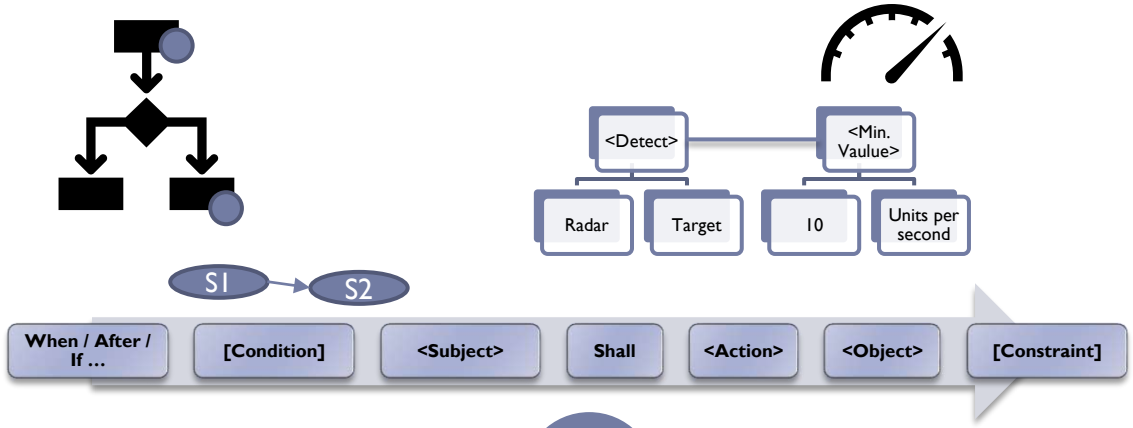
The Radar shall identify hits at a minimum rate of 10 units per second

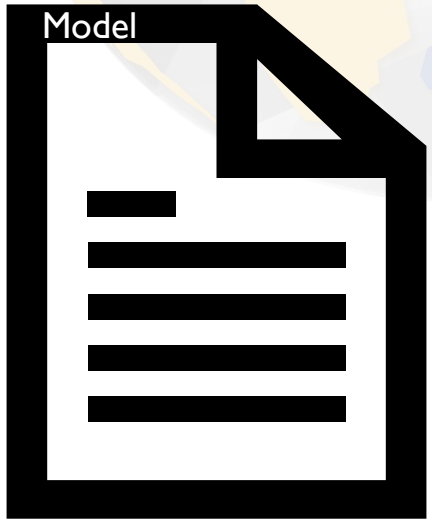


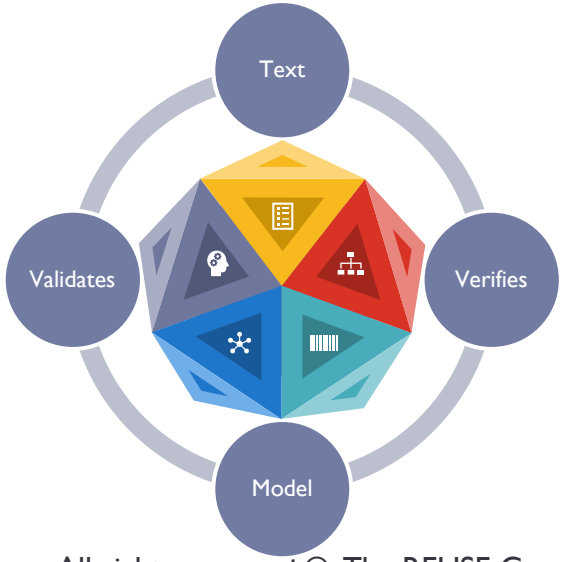
Main features: semantic approach

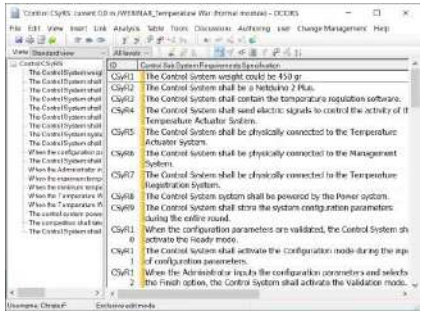
Reasoning layer: Ensure **CONSISTENCY** & **COMPLETENESS**

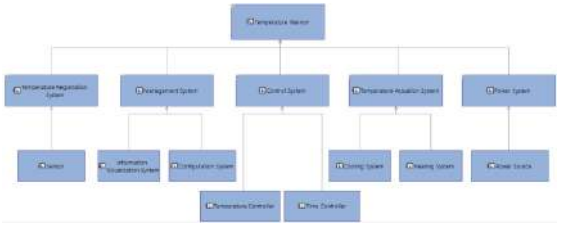




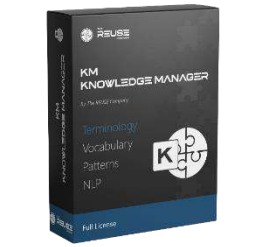


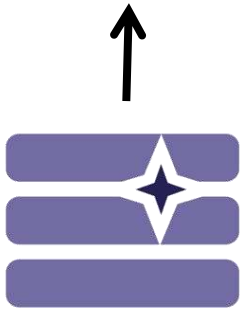


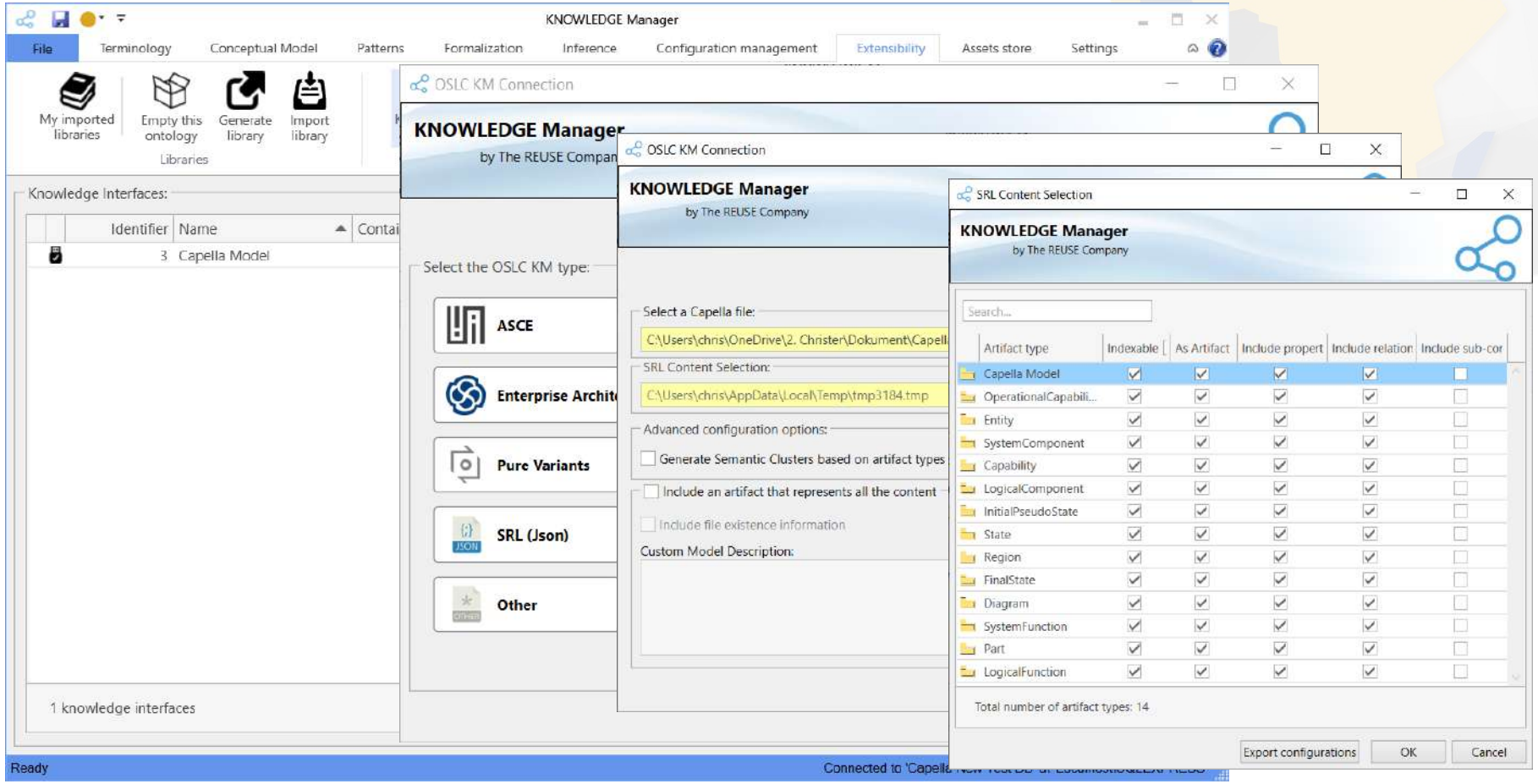




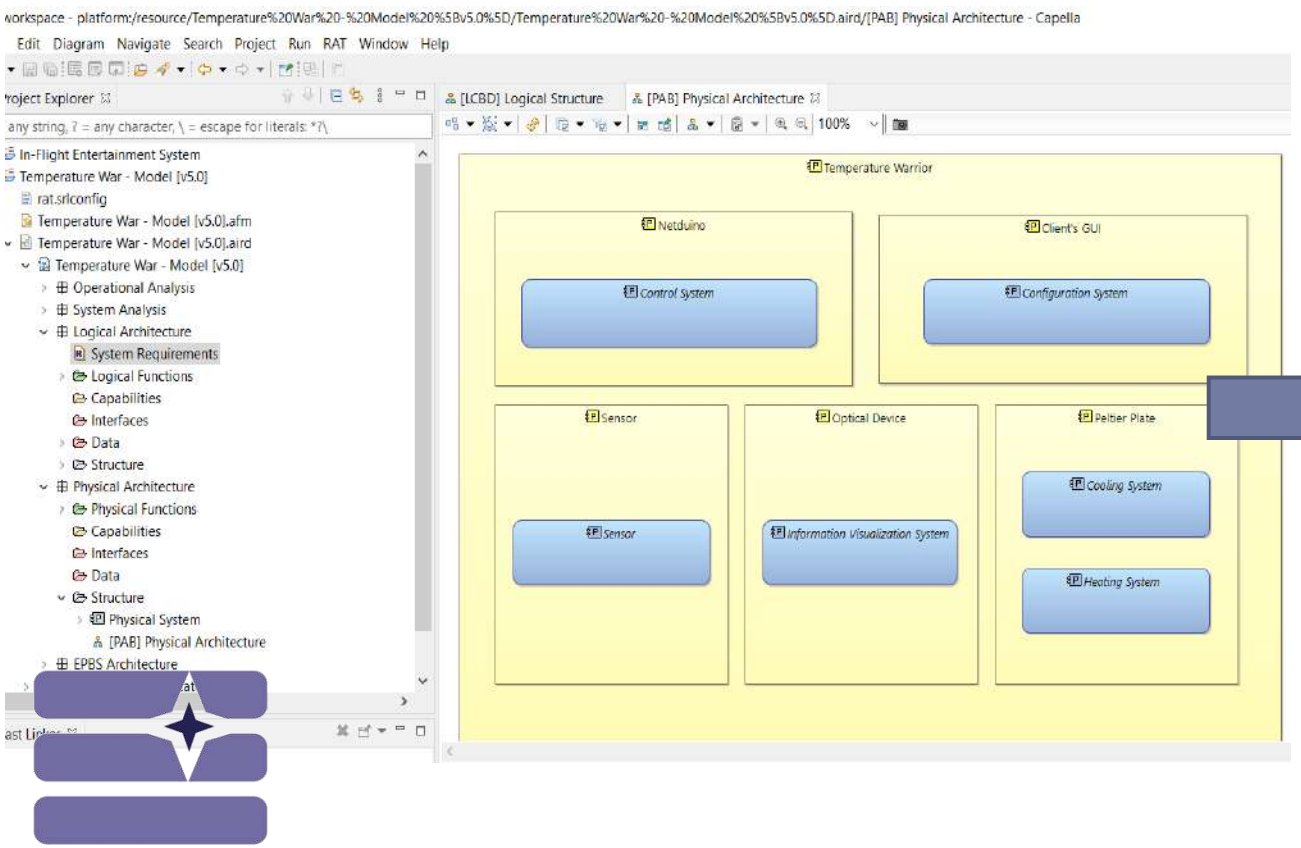
- Setting up the knowledge interface to Capella

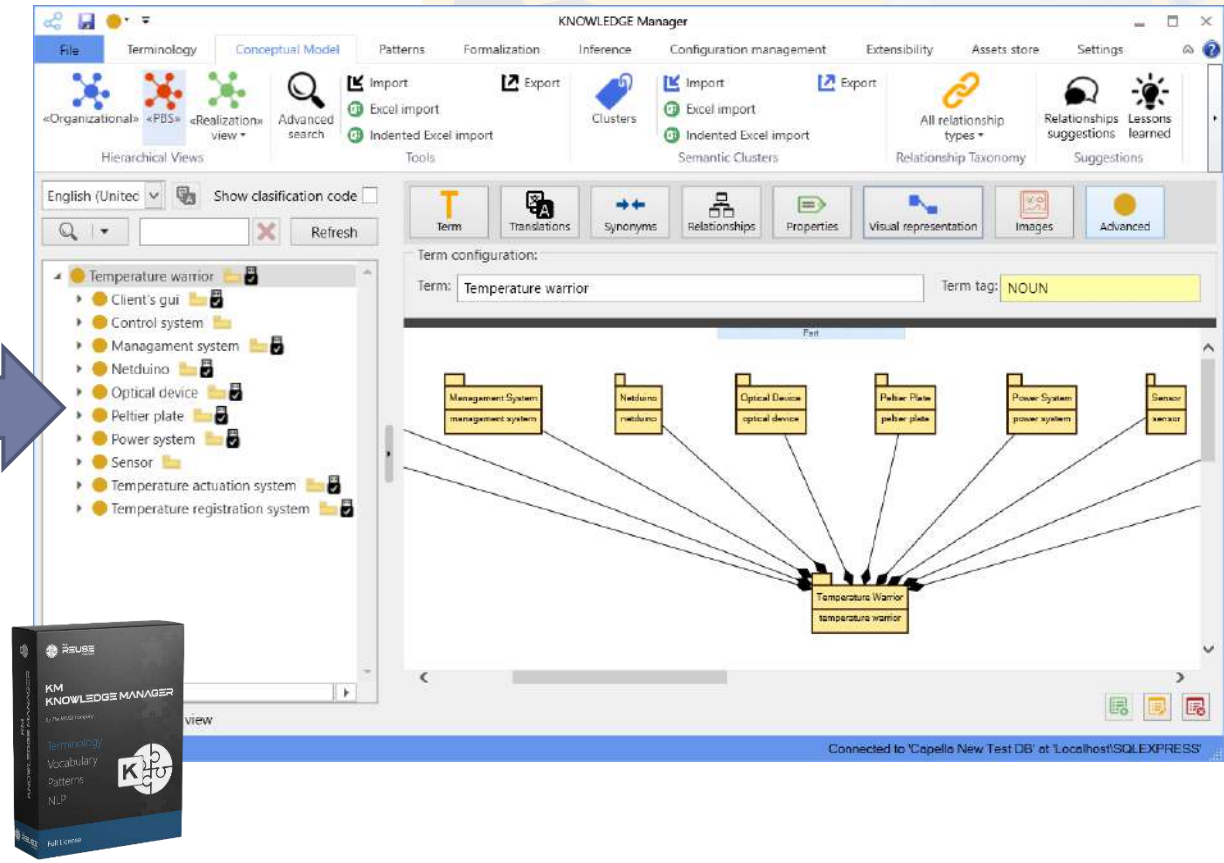




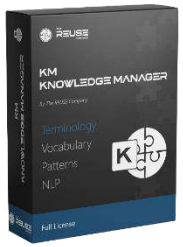


- **Master** in Capella
  - Stores the PBS/FBS/BDD, Actors, Subjects, Modes/States…
- **"Slave"** in Knowledge Manager
  - Updated every time you reload KM





Knowledge Centric Systems Engineering



Business or Mission Analysis

Stakeholder needs and requirements

System requirements

Architecture

Design

System Analysis

Implementation

Operation

Maintenance

Disposal

Validation

Transition

Verification

Integration

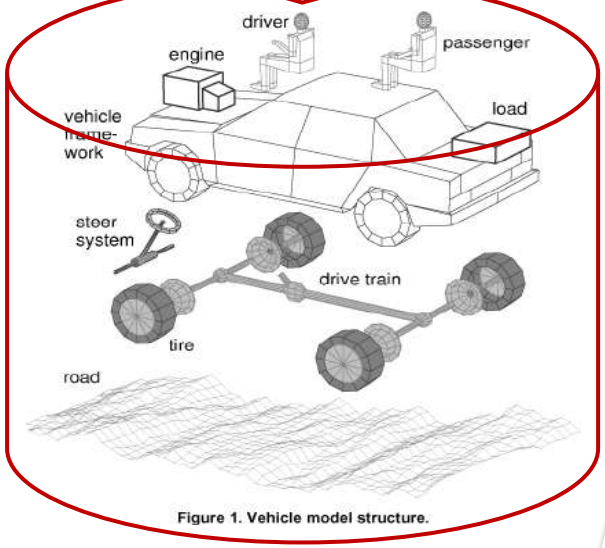


Figure 1. Vehicle model structure.

Knowledge Base - Ontology

PDF, W, X, integrity, ReqIF, IBM Rational, pure::variants, Capella, UML, ORACLE, Microsoft SQL Server, MySQL, RDF, XML, ADELARD, MODELICA, fmi FUNCTIONAL MOCK-UP INTERFACE, MATLAB & SIMULINK, protégé

Main features: connection to data sources

Synchronisation

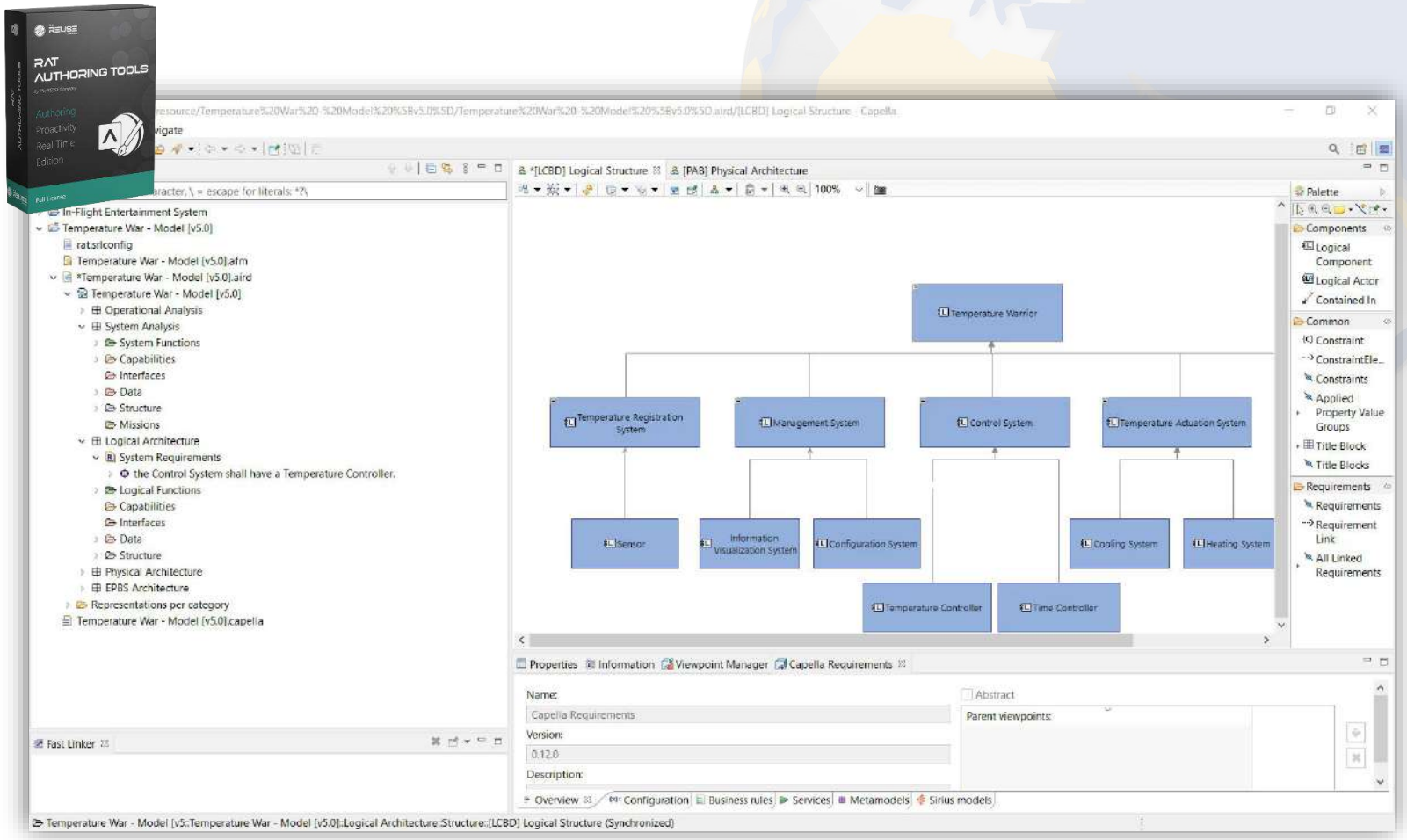
		Capabilities	Requirements Tools: DOORS	DNG	PTC ILM	VISUFLE	Teamcenter	Excel	Reqif	Reqtify	3DX	Modeling Tools: Capella	Rhapsody	Cameo	EA	Simulink	XMI	Papyrus	ASCE	FMI/FMU	Pure Variants	Others: OWL	Word	XML
Req. Analysis	Quality assessment	Analyze the quality of requirements (RQA)	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓		✓	✓	✓					✓
		Filter by views	✓	✓																				
		Filter by artifact type		✓																				
		Assessment by baseline		✓																				
		Store quality results back in the tool	✓	✓	✓	✓		✓																
		CCC with RQA	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓		✓	✓	✓					✓
	Requirements Authoring	RAT.exe. Correctness	✓	✓	✓	✓		✓	✓	✓			✓											
		RAT.exe. CCC	✓	✓	✓	✓		✓	✓	✓														
		RAT.exe. Pattern-based authoring	✓	✓	✓	✓		✓	✓	✓														
		RAT Plug-in. Correctness	✓	✓	✓	✓	✓	✓			✓	✓	✓										✓	
		RAT Plug-in. CCC	✓		✓							✓												
		RAT Plug-in. Pattern-based authoring	✓		✓			✓				✓	✓										✓	
Contents		Capture vocabulary						✓				✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		
	Logical Models	Extract info from class/block diagrams											✓	✓	✓		✓	✓						
		Classes and Interfaces										✓	✓	✓	✓		✓	✓						
		Extract properties						✓					✓	✓	✓		✓	✓						
		Extract relations: hierarchical, aggregation						✓				✓	✓	✓	✓	✓	✓	✓	✓			✓		
		Extract info from state machines											✓	✓	✓		✓	✓						
		Extract states										✓	✓	✓	✓		✓	✓						
		Extract transitions										✓	✓	✓	✓		✓	✓						
		Capella Operational Architecture										✓												
		Capella Capabilities										✓												
		Capella Dataflows										✓												
		Capella Architecture										✓												
		Capella Trees										✓												
		Extract info from sequence diagrams										✓	✓	✓	✓		✓	✓						
		Extract info from packages elements											✓	✓	✓		✓	✓						
		Extract info from use cases and actors											✓	✓	✓		✓	✓						
		Extract info from activities											✓	✓	✓		✓	✓						
	Physical models	Extract signals											✓	✓	✓		✓	✓						
		Signal values											✓	✓	✓		✓	✓						
		Simulink Blocks														✓								
		Simulink Common Block Properties														✓								
		Simulink Block-Specific Parameters														✓								
	Others	Safety case diagrams																	✓					
		Feature models vocabulary																			✓			
		Export future models																			✓			
		Ontological information																				✓		

RAT for Capella

Demo

Tool Demo: RAT for CAPELLA

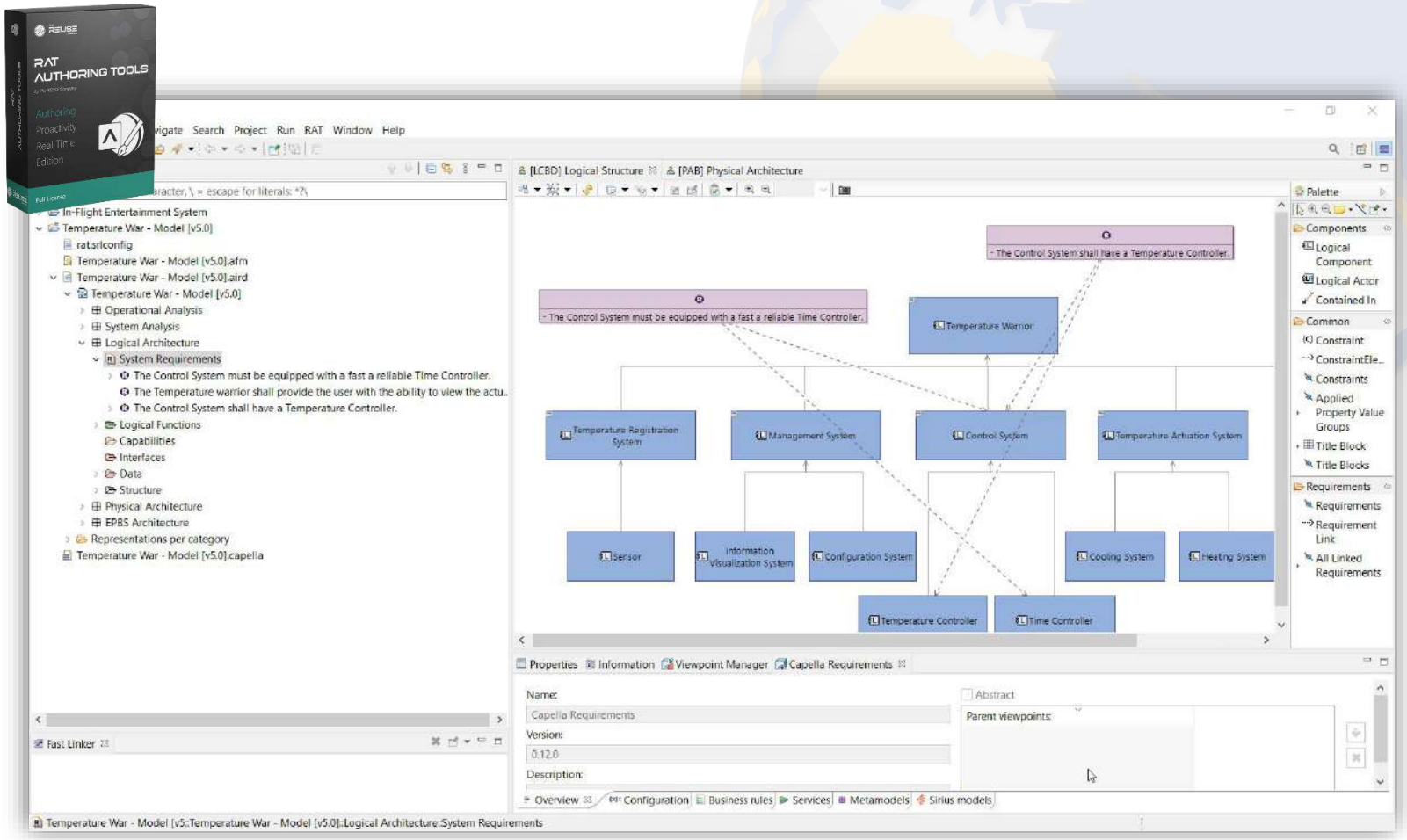
- **USE CASE #1** – Write a new requirement in Capella using RAT
- Sequence:
  1. Write a new requirement in Capella.
  2. Allocate requirement links.
  3. Open RAT. Edit and save the requirement.
  4. Write a new requirements in RAT using a pattern.



[6:04 min]

Tool Demo: RAT for CAPELLA

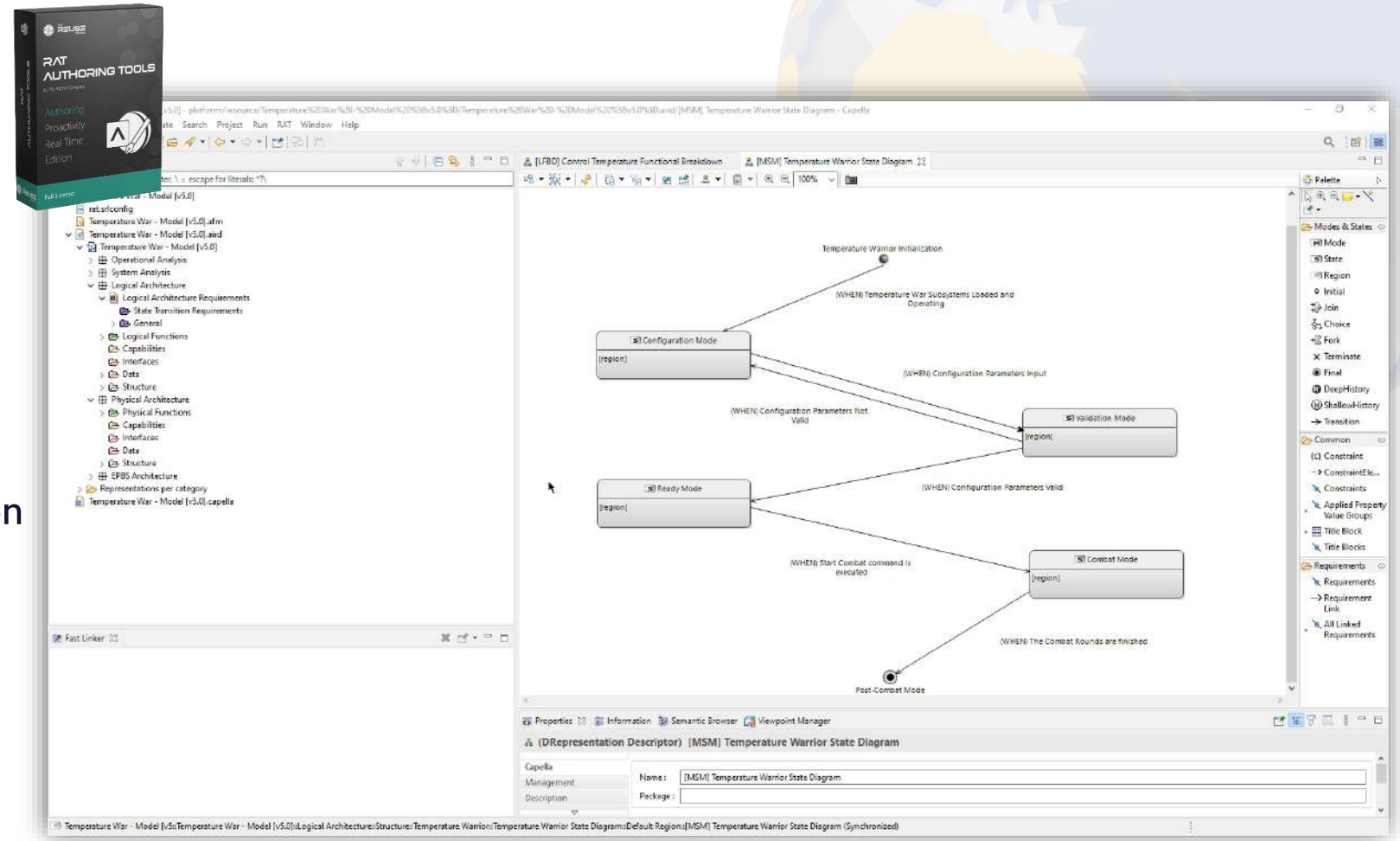
- **USE CASE #2** – Use the RAT grid to edit requirements
- Sequence:
  1. Open the RAT Grid
  2. View all requirements in a sequence. Do some editing.
  3. Find suspect similar requirements.
     - Overlapping?
     - Inconsistent?
  4. Save and view in Capella.



[2:53 min]

Tool Demo: RAT for CAPELLA

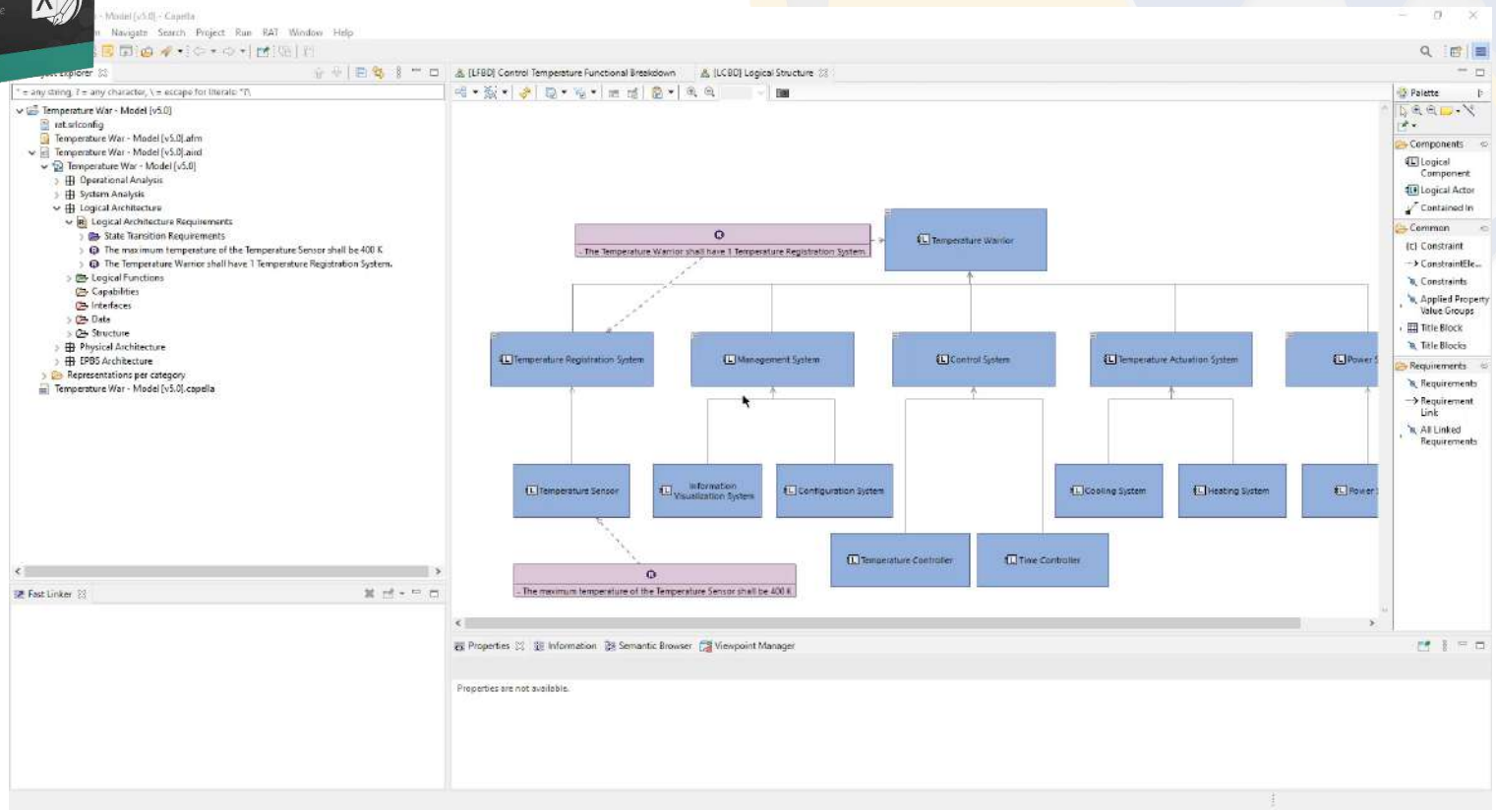
- **USE CASE #3** – Detecting wrong state transition
- Sequence:
  1. Author creates a new requirement with RAT.
  2. RAT quality window detects that the wrong state transition has been written.
  3. The author adds that state transition to the state chart.
  4. The knowledge interface is reloaded.
  5. The new requirement is now OK.



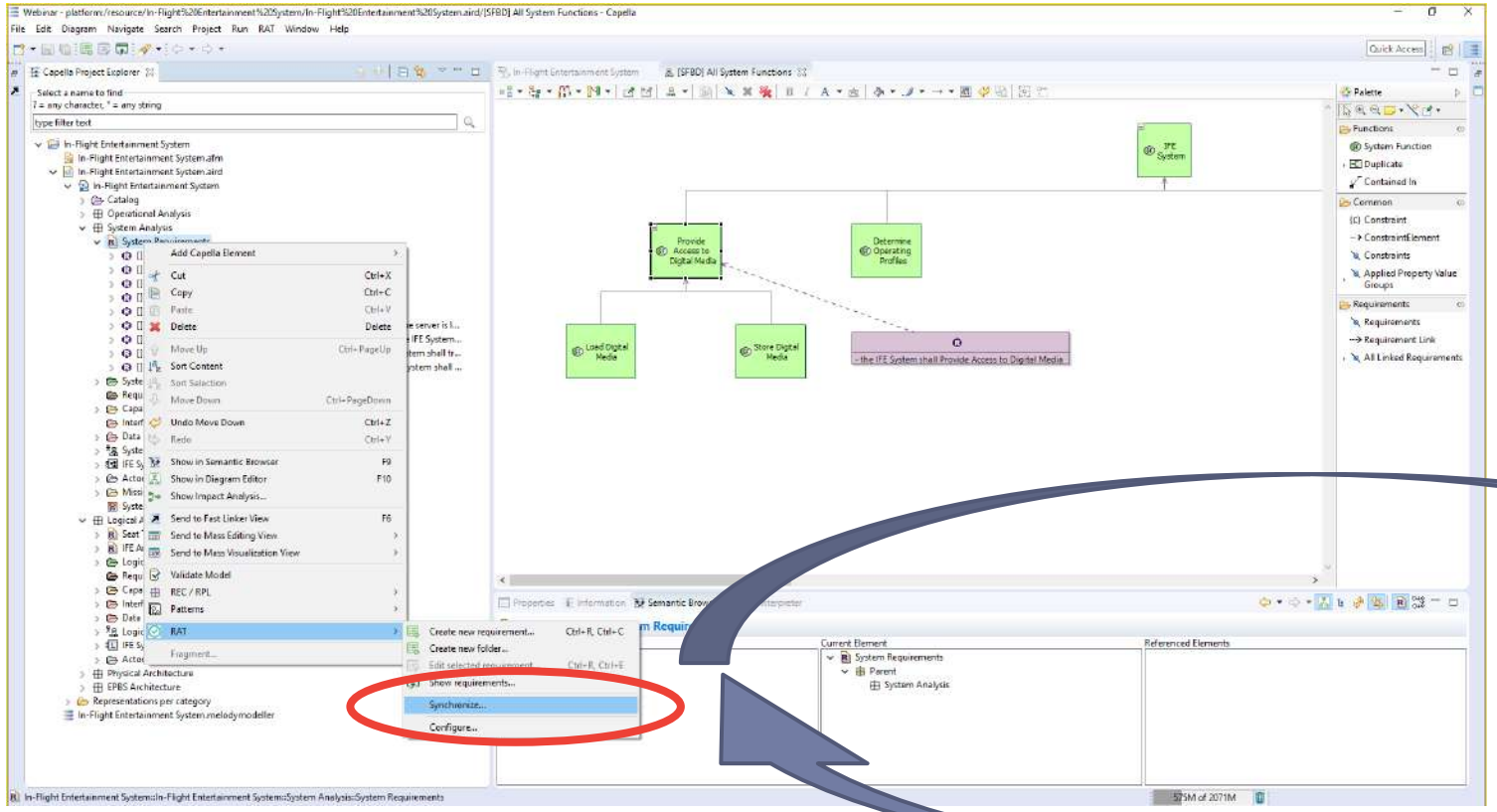
[2:13 min]

Tool Demo: RAT for CAPELLA

- **USE CASE #4** – Syntonise requirements between Capella and Doors
- Sequence:
  1. Start the RAT synchroniser
  2. Chose a:
     - Capella module, and;
     - DOORS module
  3. Chose to synchronisation requirements from DOORS to Capella.
  4. Edit a requirement and synchronise from Capella to DOORS.



[4:21 min]



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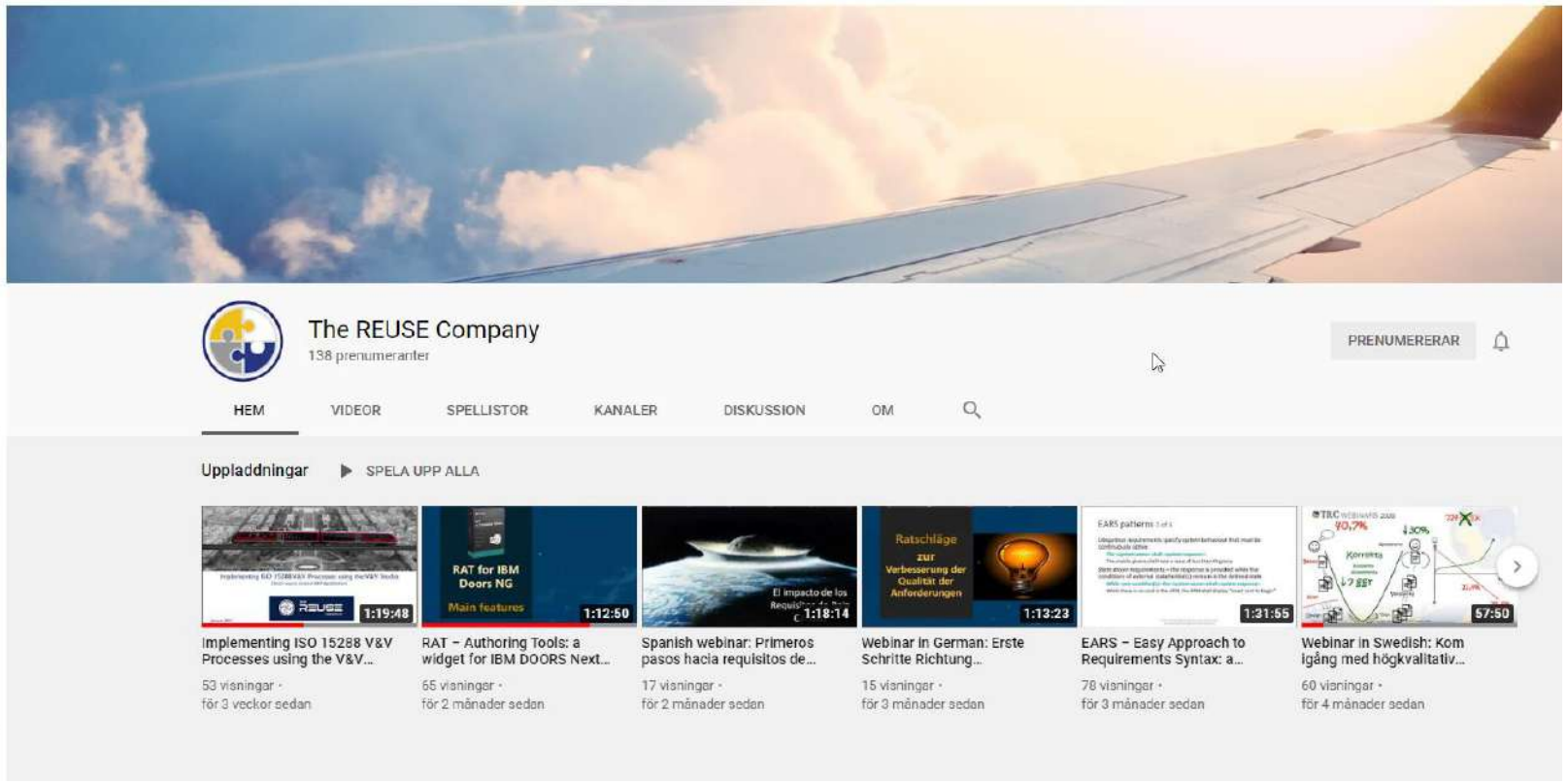
… and more

The End

- **Requirements Quality for Beginners**
- (Systems) Engineering projects, like buildings, require strong foundations to be successfully completed. However, instead of concrete or girders, as (systems) engineers, we have requirements. And if those specifications are poor in terms of quality, then our projects are most likely bound to fail.
- Throughout this webinar, you will be shown basic but important aspects to be considered when trying to improve any project requirements' quality. The RAT Authoring Tool and RQA Quality Studio will be the chosen software solutions, as they are capable of detecting prematurely defects or low-quality issues, as well as, providing consequent techniques to solve them

- **Dates:**
  - May 18, 2021
  - May 20, 2021



REUSE on YOUTUBE:

https://www.youtube.com/channel/UCHYV9teylpwC3FNGK_p8V6g


Q&A

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