Requirements Quality with Logical&Physical models and Ontologies



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WEBINARS 2018

Requirements Quality with Logical & Physical Models (Rhapsody & Simulink) and Ontologies (Protégé)

Friday, 16 March 2018



Presenters' profile

- Borja López
 - Rich Authoring Tool Architect



Borja López borja.lopez@reusecompany.com



- Description of The Reuse Company
- Requirements Management and Modelling
- > An ecosystem full of tools
- Knowledge Interfaces
- Quality Assessment based on External Knowledge
- > Demo
- > Q&A



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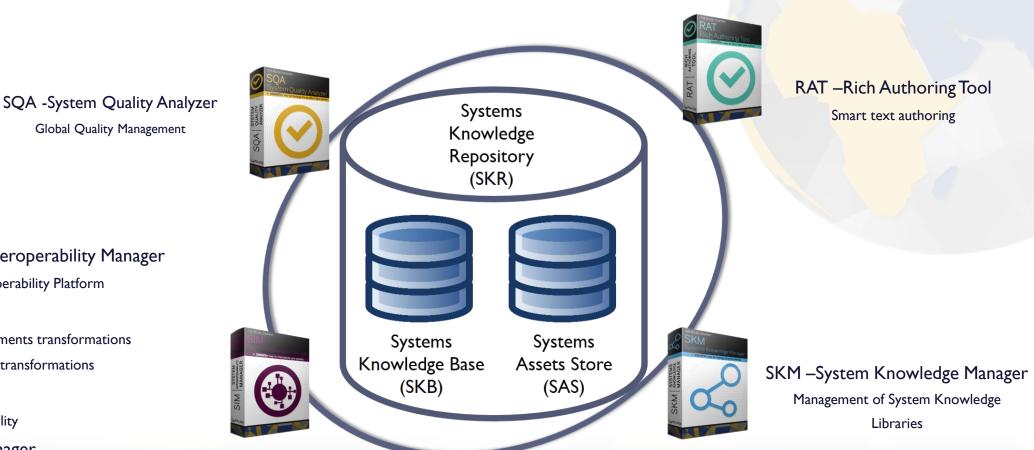




By means of a: Knowledge Centric Approach



KCSE Suite v18



Global Quality Management

SIM –System Interoperability Manager

Tailorable Interoperability Platform

- R+ Manager

Managing requirements transformations Managing models transformations

- T+ Manager

Managing traceability

- Reasoning Manager
 - Task based environment

The REUSE Company in the World





Selected set of Customers

Aerospace and Defense

AIRBUS AIRBUS HELICOPTERS	EADS INNOVATION WORKS		SAFRAN Snecma SAFRAN Sagem
Automotive	Energy	Consulting	
	FUSION FOR ENERGY	iter by to new energy Indra	
Banking		Health care	
Banco de Costa Rico	ð Santander		Health Net
Other industries			
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Requirements Management

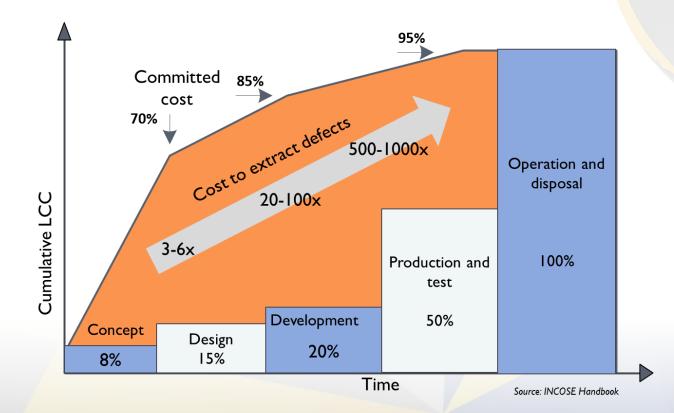
- > The development process is affected by a fast-changing environment:
 - > Technology issues
 - > Changing needs
 - > Unidentified risks
- > **Requirements Engineering** becomes central for organizations
 - > Reducing the development cycle (time to deploy the technology)
 - > Time to Market ...
 - > Time to Market with the right Product
- Requirements become the base





Requirements Management

> Importance of writing **High Quality Requirements**

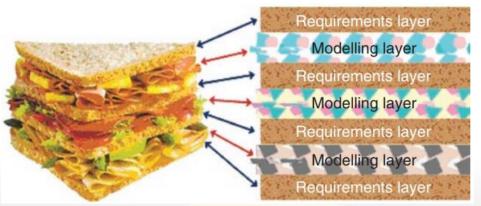


Requirements Management and Modelling

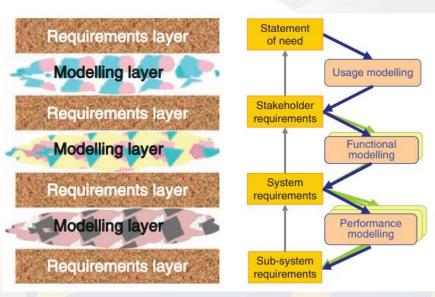
Requirements and Modelling

Relationship between Requirements Management and System Modelling

- > Modelling supports the design activity
- > Modelling helps decompose the requirements into the next level down
- > Models never say everything about a system
 - > Requirements can cover not modelled aspects



Source: Requirements Engineering, Third Edition



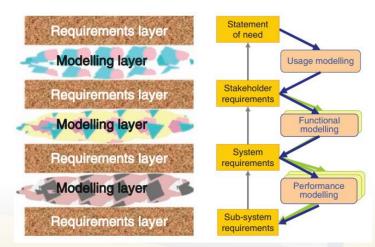
Source: Requirements Engineering, Third Edition

Requirements and Modelling

- > Models assist the requirements engineers in analyzing the requirements
 - > Improve understanding of the system

14

- > Presence of desired emergent properties (and absence of undesirable ones)
- > Help determine how to satisfy requirements among different layers

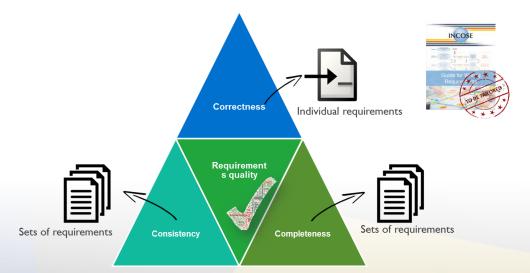


Source: Requirements Engineering, Third Edition

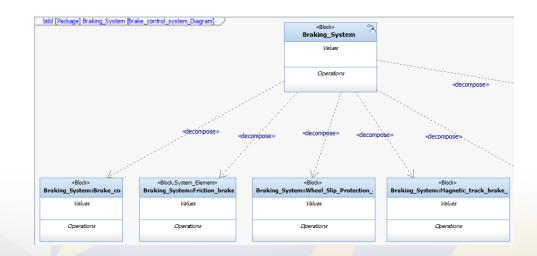
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Requirements and Modelling

- > Important to analyze the quality of the requirements
 - > Requirements are not isolated artifacts:
 - > Are they Correct?
 - > Are they **Consistent** with the models?
 - Are they **Complete** regarding the information stored in the models?



v Standard view 🗸	All levels	🗸 📲 茶 📲 🖓 🛹 圖 🗸 🥊 液 約
MyReqModule	ID	
1 1 Scope 2 2 Normative references	3	1 1 Scope
3 3 Tems and definition	4	This International Standard specifies the definition of the system, classification, functions,
 J S Gene Bit John and requireme J S Test method F S F Arnes: An éromative): Nation A T Bibliography 	1278	This international scanard specines the deminution of the system, classification, indicating, human-machine interface (HMI) and test methods for lane departure warning systems. These are in-vehicle systems that can warn the driver of a lane departure on highways and highway-like roads. The subject system, which may utilize optical, electromagnetic, GFS or other sensor technologies, issues a warning consistent with the visible lane markings. The issuance of warnings at roadway sections having temporary or irregular lane markings (such as roadwork zones) is not within the scope of this International Standard. This international Standard applies to passenger cars, commercial vehicles and buses. The system will not take any automatic action to prevent possible lane departures. Responsibility for the safe operation of the vehicle remains with the driver. The break system shall be deployed 10 miles before landing
	5	2 2 Normative references
	6	The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.
	7	ISO 15037-1, Road vehicles - Vehicle dynamics test methods - Part 1: General conditions for passenger cars
	8	IS0 15037-2, Road vehicles - Vehicle dynamics test methods - Part 2: General conditions for heavy vehicles and buses
	9	3 3 Terms and definition
	10	The system shall be able to fly
	11	3.1
	12	lane

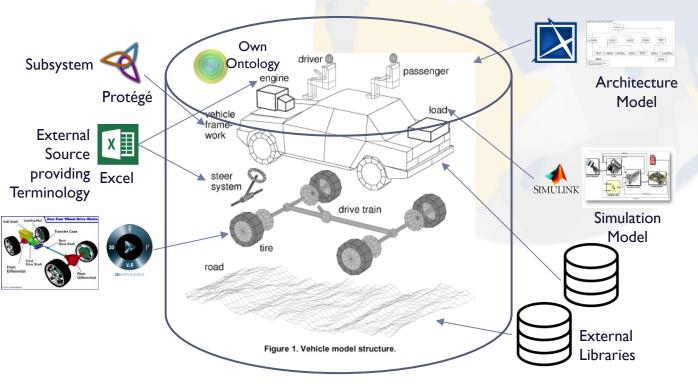


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TRC WEBINARS 2018 MBSE: An ecosystem full of tools

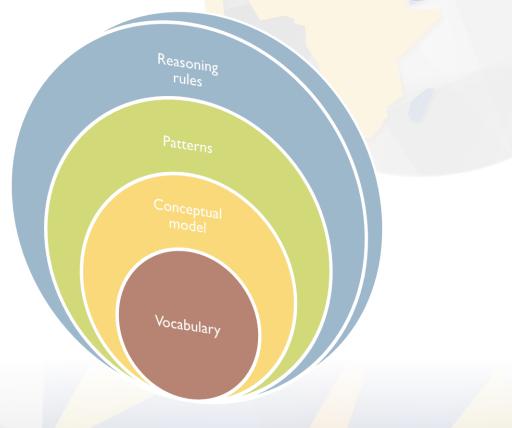
- > Different tools for different purposes:
 - > Requirements Management
 - > Modelling
 - > Traceability
 - Simulation
 - > Quality Management
 - > ...
- > KCSE Suite \rightarrow Interoperability
 - Key: Not to model everything in KM, but dynamically load the knowledge on real time
 - This way, SQA will perform quality assessment with all this knowledge

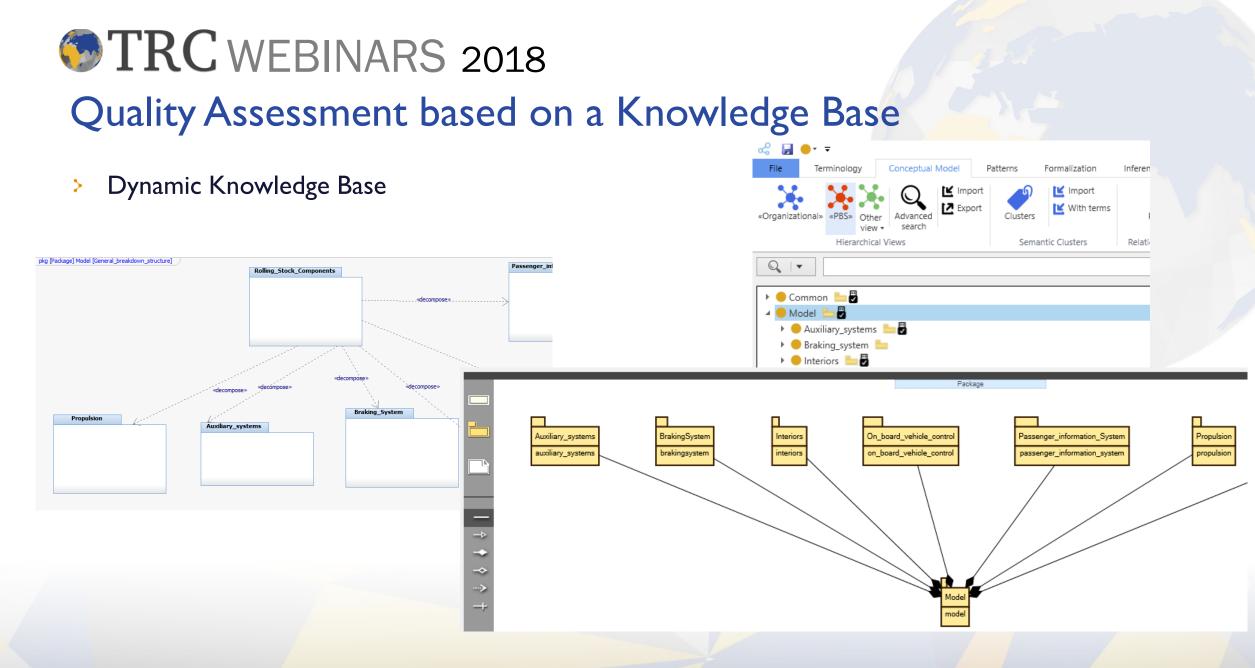


TRC WEBINARS 2018 Quality Assessment based on a Knowledge Base

- Knowledge is the Core
 - > Systems Knowledge Base (SKB) \rightarrow Ontology
 - > Terminology layer (Vocabulary)
 - > Thesaurus layer (System Conceptual Model)
 - > Patterns layer (Boilerplates)
 - > Reasoning layer (Decision Making)
- Knowledge Manager allows the user to model the domain (knowledge) into an ontology
 - Manual process + Semi-Automatic Import / Export.



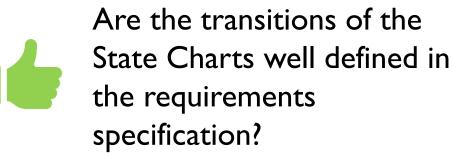


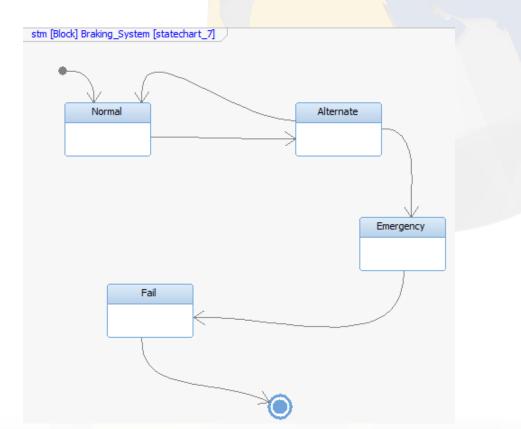




Requirements and Modelling

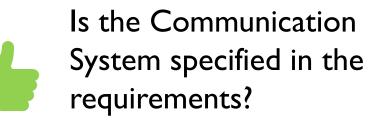
 Use Case: Completeness checking of a Rhapsody model





Requirements and Modelling

 Use Case: "Communication System" defined in Protégé



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nnotation properties Datatypes Individuals	System — http://www.semanticweb.org/jmfuentes/ontolc
asses Object properties Data properties	Class Annotations Class Usage
ass hierarchy: System 🛛 🗋 🗖 🖾	Usage: System
∔ 🔍 Asserted 🔻	Show: ♥ this♥ disjoints♥ named sub/superclasses
	Found 12 uses of System
Component System_Element System Stakeholder	Communication_system Communication_system Communication_system Stakeholder Stakeholder Stakeholder DisjointWith System Description: System General class axioms
	SubClass Of (Anonymous Ancestor) Instances Communication_system Train
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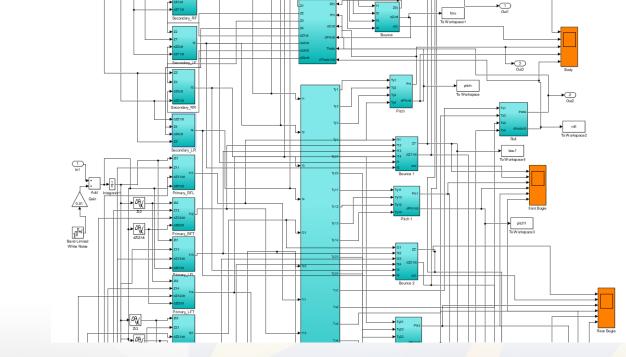
Requirements and Modelling

> Use Case: Components defined in Simulink

Are the requirements

specifying properly the

Simulink components?

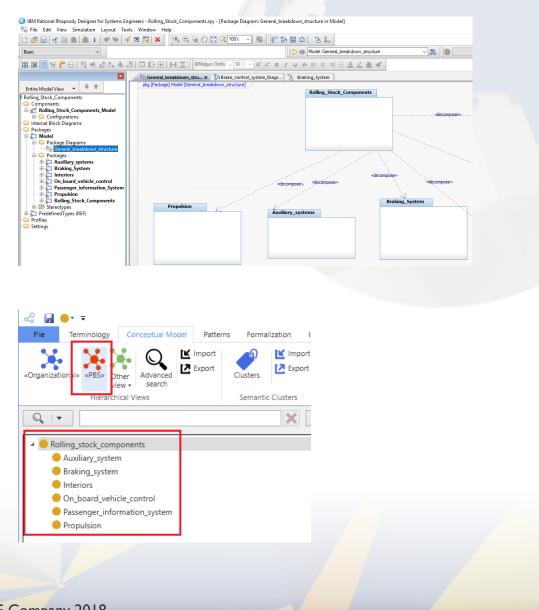


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TRC WEBINARS 2018 Modelling Knowledge into KM

- KM allows the user to model the information into the SKB (e.g. Rolling Stock Components of a Rhapsody model)
- A Product Breakdown Structure (PBS) can be modelled to represent the decomposition of the Rolling Stock Components
 - Different structures (relationship types) for the different elements of the model
- > Cons:
 - > Manual or Semi Automatic work is needed
 - Duplicated knowledge (Rhapsody & KM)



Knowledge Interfaces for SKB Extensibility

- What if ... the SKB (System Knowledge Base) was dynamically fulfilled?
 - No human effort in exporting / importing glossaries, taxonomies, etc.
 - No need to maintain / update the SKB.
- ► KCSE v18 Feature → Knowledge Interfaces
 - Connectors to external sources of knowledge (OSLC-KM).
- Changes on the source artifacts (e.g. SysML Rhapsody Model) \rightarrow The SKB gets updated.



Knowledge Interfaces for SKB Extensibility

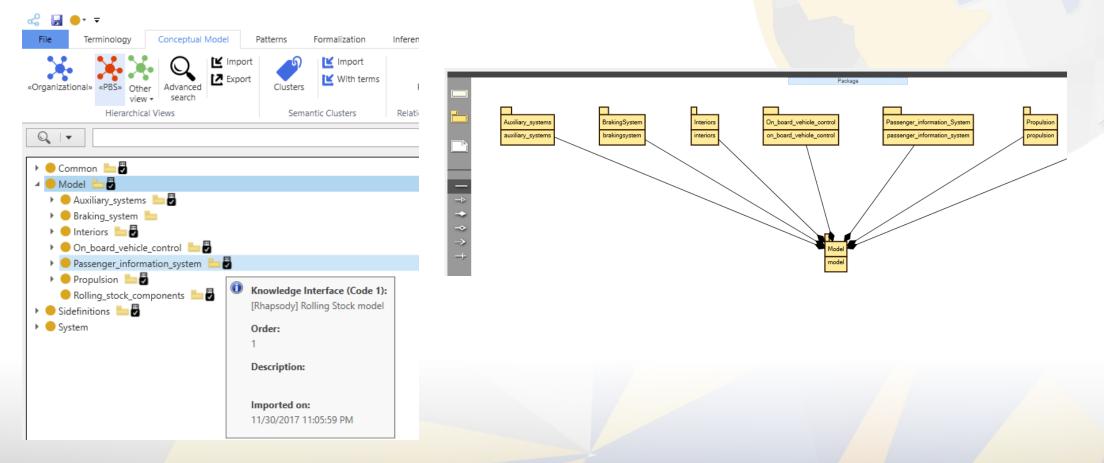
Managing connectors in Knowledge Manager

k la				
File Terminology Conceptual Model Patterns	Formalization Inference Conf	iguration management	Extensibility	y Assets store
My imported libraries Empty this ontology My configuration as library Libraries	Import library External Knowledge	edge ort +		Connection Information: Name: [Rhapsody] Rolling Stock model
Knowledge Interfaces:				Description:
Identifier Name	 Description 	Import date Langua	iage	
1 [Rhapsody] Rolling Stock model		11/30/2017 English	h (United Ki	
				OSLC KM Connection Parameters: RMS Location: OSLC Service O File SysML SubType: Rhapsody Project File: G:\rolling_stock_model.xmi



Knowledge Interfaces for SKB Extensibility

Filling out the SKB in a dynamic way

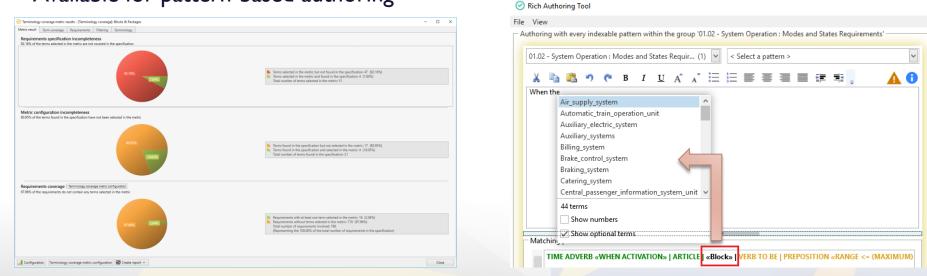


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TRC WEBINARS 2018 Using Knowledge Interfaces - Overview

- Knowledge Interfaces are fully integrated on SQA and RAT
 - Native support of UML/SysML (classes, blocks, actors, etc)
 - Available for quality assessment
 - Quality Metrics can be configured with the content of Knowledge Interfaces (e.g. state charts coverage)
 - > Available for pattern-based authoring



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Demo Summary

- Integrating a Rhapsody Model and a Simulink file to assess requirements quality
 - > KM to connect the Knowledge Base to the Rhapsody Model + the Simulink file
 - > SQA to define a set of quality metrics
 - > SQA to perform quality assessment
 - > RAT to create some missing requirements
- > Integrating a Protégé ontology for the Communication Subsystem assessment
 - > KM to connect the Knowledge Base to the Protégé Ontology
 - > SQA to define a set of quality metrics and perform quality assessment





Next webinar

Topic: Can script based languages, like DXL, hack Natural language Processing?

> Content:

A recent blog post by our esteemed college Christer Fröling has sparked a tidal wave of interest and his paper "NLP beats DXL (DOORS scripting) every day of the week" has been distributed widely. But can his claim be substantiated?

Dr. Simon Wright will investigate this claim during a webinar and examine the evidence. As someone who has been involved in improving requirements quality for over 20 years and as a DXL programmer for over 10 years he is ideally placed to referee this match, DXL verses NLP.

> Dates:

- Tuesday 10th APR 2018 at 5.00 pm CET
- > Thursday 12th APR 2018 at 9.00 am CET

WEBINAR			
ID	NAME	DATES	TIME
		16/01/2018	5.00 pm CET
TRCW-01	Requirements Quality along the supply chain	18/01/2018	9.00 am CET
		20/02/2018	5.00 pm CET
TRCW-02	Managing the quality ecosystem: DOORS, Rhapsody, Simulink and Modelica	22/02/2018	9.00 am CET
		13/03/2018	5.00 pm CET
TRCW-03	Ontologies Configuration Management	15/03/2018	9.00 am CET
		10/04/2018	5.00 pm CET
TRCW-04	Can script based languages, like DXL, hack Natural Language Processing?	12/04/2018	9.00 am CET
		08/05/2018	5.00 pm CET
TRCW-05	Procuring systems: PQS for SMARTer acquisition	10/05/2018	9.00 am CET
		05/06/2018	5.00 pm CET
TRCW-06	The SMARTER way to improve your requirement specifications	07/06/2018	9.00 am CET
		11/09/2018	5.00 pm CET
TRCW-07	Knowledge and Quality management milestones in a SE organization	13/09/2018	9.00 am CET
		16/10/2018	5.00 pm CET
TRCW-08	Automatic checking of quality metrics for logical and physical models	18/10/2018	9.00 am CET
	Following standards patterns in KCSE: An application to EARS patterns in	03/07/2018	5.00 pm CET
TRCW-09	RAT and SKM	05/07/2018	9.00 am CET
		06/11/2018	5.00 pm CET
TRCW-10	Tracing system work products: T+ Manager	08/11/2018	9.00 am CET
		11/12/2018	5.00 pm CET
TRCW-11	Defining your own quality rules in KCSE: A one-hour practical approach	13/12/2018	9.00 am CET
		15/01/2019	5.00 pm CET
TRCW-12	The KCSE approach in a nutshell	17/01/2019	9.00 am CET
		12/02/2019	5.00 pm CET
TRCW-13	Requirements Transformations	14/02/2019	9.00 am CET



