# **RAT for** Capella : Writing the perfect textual requirement



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# TRC WEBINARS 2020 RAT for Capella:Writing the perfect textual requirements

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- > Brief introduction to the presenters
- > Why textual requirements?
- > Main features of RAT for Capella
- > Live demo
- Q&A







#### Introduction

#### Introduction to The REUSE Company





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# TRC WEBINARS 2020 RAT for Capella:Writing the perfect textual requirements

#### Introduction to The REUSE Company

> Customers all over the world: +20 countries



Customers within different industries:







Introduction

#### The presenters



José M. Fuentes

- **Current position:** Chief Operating Officer at The REUSE Company >
- Product manager of the Systems Engineering Suite tools during the last 5 years >
- **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 for Writing Requirements











# Why Textual requirements

in Capella

Why textual requirements in Capella?

#### 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/



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Why textual requirements in Capella?

Textual requirements and model requirements

#### **Need model**

helps formalize and consolidate customer and system requirements

#### Solution model

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

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Textual requirements

are at the heart of the current engineering practices





Why textual requirements in Capella?

#### Textual requirements and model requirements

Models add rigor to need expression / solution description

Models enable automated processing

A model requirement can formalize a textual requirement and explicit its effects and ramifications





Why textual requirements in Capella?

#### Textual requirements and model requirements



Text is normally better for the first interactions with customers and suppliers

Legally binding documents are normally written in text

High-level needs and other expectations (environmental, regulations, etc) are easier to express with textual descriptions

Some expectations on a given element at a given engineering level do not require any formal modeling (which is left to subsystem design)

Text allows for a much earlier focus on quality (verification of textual requirements). Remember: "Quality is everyone's responsibility" by E. Deming

So, textual form of needs and requirements are not only useful, they are fully necessary



Why textual requirements in Capella?



## TRC WEBINARS 2020 So, what is a perfect requirement

Requirement: The agreed-upon need, desire, want, capability, capacity, or demand for personnel, equipment, facilities, or other resources or services by specified quantities for specific periods of time or at a specified time expressed as a "shall" statement. Acceptable form for a requirement statement is individually clear, correct, feasible to obtain, unambiguous in meaning, and can be validated at the level of the system structure at which it is stated. In pairs of requirement statements or as a set, collectively, they are not redundant, are adequately related with respect to terms used, and are not in conflict with one another.

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Why textual requirements in Capella?

# **4.2** Technical Requirements Definition

The Technical Requirements Definition Process transforms the stakeholder expectations into a definition of the problem and then into a complete set of validated technical requirements expressed as "shall" statements that can be used for defining a design solution for the Product Breakdown Structure (PBS) and related enabling products. The process of requirements definition is a recursive and iterative one that develops the stakeholders' requirements, product requirements, and lower level product/component requirements. The requirements should enable the description of all inputs, outputs, and required relationships between inputs and outputs, including constraints, and system interactions with operators, maintainers, and other systems. The requirements documents organize and communicate requirements to the customer and other stakeholders and the technical community.











# **RAT for Capella**

# Main capabilities

#### TRC WEBINARS 2020 Capella integration with RAT: the Authoring Tools Enhancing the Requirements and models collaboration Connection from text to model requirements is nice! But... > ... it has to be Patternconsistent and robust, Usability based > quality must be writing guaranteed at both sides, and shall be Accessib-Consistency ility checked as early as checking possible Requirements roundtrip

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#### Real-time quality analysis

### REQUIREMENTS are the reason for FAILURE







#### 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



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Capella integration with RAT: the Authoring Tools



#### Real-time quality analysis: Patterns



Capella integration with RAT: the Authoring Tools

#### Real-time quality analysis: Completeness





The computer shall have 2 monitors

The computer shall have 2 engines

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

When the Computer is in Hibernated mode, the monitor shall turn black

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



#### Capella integration with RAT: the Authoring Tools

Real-time quality analysis: Patterns



Capella integration with RAT: the Authoring Tools

#### Real-time quality analysis: Patterns

> Automatic identification of model elements from textual sources:

				2545ter RQA .RAT	Ur
	When	Trigger	System	Shall ···	<state></state>
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This document Will 2. Scope					main screen
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selected quality metrics. SyR-003 - While RQA is on the main screen , when the author presses the				197 - M	
report button, RQA shall generate a quality report including the current content of the main screen.	lf	Trigger	system	shall	
SyR-004 - While RQA is in real-time mode, the RQA shall analyze the structure			0.75		
selected pattern.					Trigger
keyboard, the RQA shall analyze the quality of the requirement.					· the user
syR-006 - When the user connects to a requirements repository, the RQA shall retrieve the requirements modules.	19 C 10 C 10			-	connects to
SyR-007 - When the user connects to a requirements module, the RQA shall retrieve the requirements of the module.	1				repuirements
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#### Real-time quality analysis: Patterns

#### Patterns to contextualize how correctness metrics are executed:

Example: Application of INCOSE R02 (Use Active Voice) to detect passive voice only outside conditions:

Authoring without patterns          < No pettern group >         Image: State of the st	q1 ■ = = = = + 1 • • • • • • • • • • • • • • • • • • •	o selected pattern group implies no writing assistance	0	Correctness metrics summary:     Low Quality     Metric     Accuracy R02 / TRC-M040: Avo	a id the use of Passive W	20.00 vide vide out of the condit	
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#### Capella integration with RAT: the Authoring Tools

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#### Real-time quality analysis: dictionaries





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#### Real-time quality analysis: traces

📃 runtime-EclipseApplication - platform:/resource/In-Flight%20Entertainment%20System/In-Flight%20Entertainment%20System.aird/[MCB] Capabilities Context - Capabla 0 -File Edit Diagram Navigate Search Project Run RAT Window Help □・□◎ Quick Access 🚆 "Capella Project Explorer 🕴 📊 🔄 🧐 🖓 🖓 🖓 🗖 🗋 😚 In-Flight Entertainment System 🛛 & [OAB] Coerational Context 🛛 💑 "(MCB) Capabilities Context 😒 - 0 Palette Select a name to find ? = any character, " = any string Dees-Yr. type filter text S Tools Provide Audio and Video Intercommunication Means Aircraft 👻 🔝 in-Flight Entertainment System Cabin Crew & Actor 0 C 🔒 In-Flight Entertainment System.afm c (FD Mission ✓ In Flight Entertainment System.aird Capability ✓ ▲ In-Flight Entertainment System ---> Capability Exploitation > 🕞 Catalog ming Services > 🗄 Operational Analysis > Involved Actor 0 ✓ 
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 A> Extends ✓ ℝ System Requirements 1.> Includes ① [] The Aircraft shall Provide Video Gaming S @ [] The actor shall perform the interaction -> Capability Generalization ) 告 System Functions - Actor Generalization B Requirements Actors ) 🔁 Capabilities 🔁 Interfaces New - Requirements Authoring Tool × > 🗁 Data > \* System Context File Suggestions View Log > IFE System > 2> Actors **RAT Plugin for Capella** ~ > 🔁 Missions D System Functions - Operational Activities By The REUSE Company > 
 Logical Architecture Authoring with pattern 'Stakeholder Functional Requirement' O Correctness metrics summary: > 
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Hibernated

Low battery

#### Real-time quality analysis: Consistency





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#### Requirements roundtrip



#### ... and more

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#### Capella integration with RAT: the Authoring Tools

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#### Usability



### Accesibility

#### 😓 MBSE Tool - Team for Capella - 🔿 🗙 🚽 🕂 ☆) 📀 🔘 👍 🗷 → C 🔒 obeo.fr/en/team-for-capella J 🍪 E.O.I. DE LEGANES 📔 HubSpot | Inbound... 📕 Français 📕 DNG 📕 Renault 📕 ESA Other bookn Ð workspace - Test Team Project - Capella File Edit Navigate Search Project Run RAT Window Help 🖩 🔞 🞺 🖪 📴 🗔 🗀 🛷 - 🗘 -Quick Access 🔒 🔐 🕂 📄 😫 🗢 🗖 🔂 🗞 \*Test Team Project 💥 🔚 \*Capella Project Explorer 🛛 🕅 Select a name to find Workflow of Test Team Project ? = any character, \* = any string type filter text **Define Stakeholder Needs and Environment** In-Flight Entertainment System Tea Capture and consolidate operational needs from stakeholders Operational 📋 Test Team Project Define what the users of the system have to accomplish Analysis ✓ 🚰 Test Team Project.team.team Identify entities, actors, roles, activities, concepts rat.srlconfig A Test Team Project.team.team.a Formalize System Requirements 🗸 🗟 \*Test Team Project.team.team aird [use Identify the boundary of the system, consolidate requirements System Define what the system has to accomplish for the users > 🗁 RatForCapellaConfig Analysis Model functional dataflows and dynamic behaviour ✓ ⊕ Operational Analysis V 🚯 OA Requirements () The System administrator shall Manage operators and Manage **Develop System Logical Architecture** B he System administrator shall Configure module 2 See the system as a white box: define how the system will work so as to fulfill expectations Logical 😘 [] 📜 e system will have a System Perform a first trade-off analysis Add Capella Element Oper Jonal Activities > Operational Capabilities of Cut Ctrl+X Interfaces Сору Ctrl+C 🗁 Data **Develop System Physical Architecture** Paste Ctrl+V > <sup>余</sup>品 Operational Context How the system will be developed and built X Delete Software vs. hardware allocation, specification of interfaces. C Roles Delete deployment configurations, trade-off analysis > 🗁 Operational Entities A Move Up Ctrl+PageUp > 🗄 System Analysis a Sort Content > 🗄 Logical Architecture Formalize Component Requirements > 🗄 Physical Architecture ↓<sup>a</sup> Sort Selection Manage industrial criteria and integration strategy: what is > EPBS Architecture Hove Down Ctrl+PageDown expected from each designer/sub-contractor > 🧽 Representations per category Specify requirements and interfaces of all configuration items 4 Undo Model Edition Ctrl+Z 🖄 Redo Ctrl+Y Operational Analysis System Analysis Logical Architecture Physical Architecture EPBS Send to Mass Editing View 🐼 Send to Mass Visualization View 📑 🔍 🗖 ition 🛛 😿 Semantic Browser 🛛 🖓 Viewpoint Manager 🛛 👰 Error Log Validate Model e system will have a System administrato # REC / RPL Property Patterns RAT Create new requirement... Ctrl+R, Ctrl+C A Lock / Unlock... Create new folder. Show Commit History Edit selected requirement... Ctrl+R, Ctrl+E n administrato Show requirement Migration > 1 Edit a requirement using RAT Synchronize.. --- 🗙 Configure... 33 1

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Capella integration with RAT: the Authoring Tools



# Capella and Knowledge manager

# TRC WEBINARS 2020 Knowledge-based requirements writing

# 05 Reasoning

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

## 04 Formalization

Representation of assets semantic through SRL – System Representation Language Capella as a Knowledge Base

#### Vocabulary

Controlled Organizational and Project Vocabulary for a common understanding among stakeholders

### **02** <sup>3</sup>

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SCM/Architectures

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

#### Patterns

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



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#### Capella as a Knowledge Base

#### Capella models as Knowledge Base

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Capella as a Knowledge Base

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#### Capella models as Knowledge Base

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#### Capella as a Knowledge Base

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#### Using a RMS connected to Capella models

iFE System Requirements' current 0.0 in /RAT for Capella - IFE System (Formal module) - DOORS

<u>File Edit View Insert Link Analysis Table Tools Discussions Authoring user Change Management Help</u>

E System Requirements									
···· The IFE System shall Broadc			File Suggestions View Log						
The IFE System shall Comma	SyR82	The IFE System shall Retrieve vod movie data							
The IFE System shall Configu			RAT plugin for DOORS						
···· The IFE System shall Determ	SyR83	The IFE System shall Run airline channel service	By The REUSE Company						
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The IFE System shall Handle	SyR85	The IFE System shall Run cabin intercommunication service							
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···· The IFE System shall Manag	SyR88	The IFE System shall Run video-on-demand service	Read-only mode						
The IFE System shall Manag			Ready						
The IFE System shall Manag	SyR89	The IFE System shall Select passenger service	Real-time mode						
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The IFE System shall Provide			16:12:51						
The IFE System shall Provide	SyR95	The IFE System shall Play video games	Vew - Requirements Authoring Tool						
The IFE System shall Provide			File Suggestions View Log						
The IFE System shall Provide	SyR96	The IFE System shall Watch video on cabin screen	PAT plugin for DOORS						
···· The IFE System shall Run ar	SyR97	The IFE System shall Watch video on private screen	By The REUSE Company						
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Exclusive edit mode

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Live demo





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Contact information



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