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# Configuration Management in SES ENGINEERING Studio: "From a tool-centric to a life cycle-wide approach"



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**Cecilia Karlsson** Marketing & Communication The REUSE Company *cecilia.karlsson@reusecompany.com* 







- Introduction to The REUSE Company and the speaker
- Introduction and context of Configuration Management (CM)
- Holistic CM for complex systems
- Configuration management in SES ENGINEERING Studio
- > Live demo
- > Q&A

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# The REUSE Company:

- specialized in the application of reuse methods,
- semantic technologies and artificial intelligence,
- digitalization of the Systems Engineering lifecycle.

#### "

We promote lifecycle management methodologies guided by REUSE, based on a knowledge-centric approach, supporting the notion of authoritative source of truth, offering connectivity to everything, unlimited interoperability, **n** and providing full support to technical management as in ISO 15288





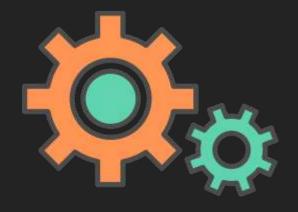
- RQA QUALITY Studio
- RAT AUTHORING Tool
- > TRACEABILITY Studio
- > V&V Studio
- KM Knowledge Manager
- SES ENGINEERING Studio





llyes Yousfi

- Current position: Senior Key Account Manager at The REUSE Company
- Master's degree from the University of Montreal (Canada) and the IMT Atlantique School of Engineering (France).
- 7 years of experience in sales, technical background in energy and mechanical engineering
- Involved in a research project around the environmental impacts of end-of-life management of aircrafts (2014)
- Consulting services to help industry actors leverage and digitalize Systems Engineering activities.
- Passionate about international projects and learning languages, Ilyes speaks 4 languages fluently: English, French, German and Spanish.

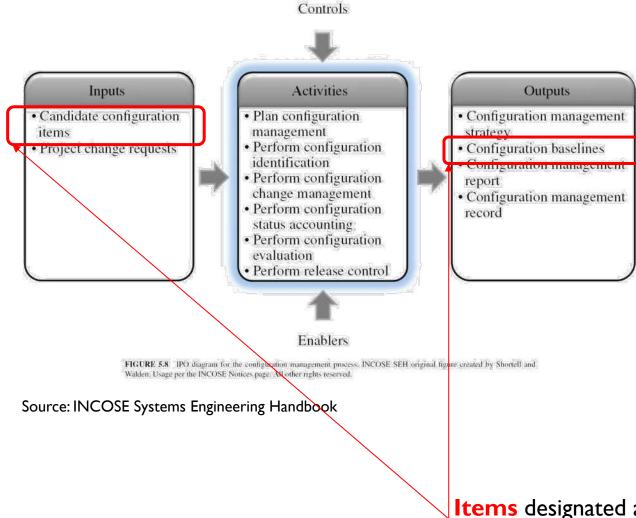


# Introduction to

Configuration Management







#### (ISO 15288)

"The purpose of Configuration Management is to manage and control system elements and configurations **over the life cycle.** CM also manages **consistency** between a product and its associated configuration definition".

#### (EIA-649)

Process that establishes and maintains **consistency** of a product's attributes with its requirements and product configuration information **throughout the product's life cycle** 

**Items** designated at any stage of the life cycle to produce **baselines** of the system configurations





> Change is a factor we cannot avoid!

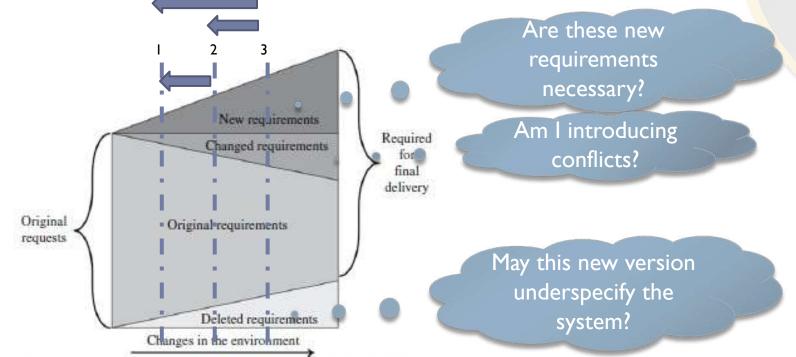
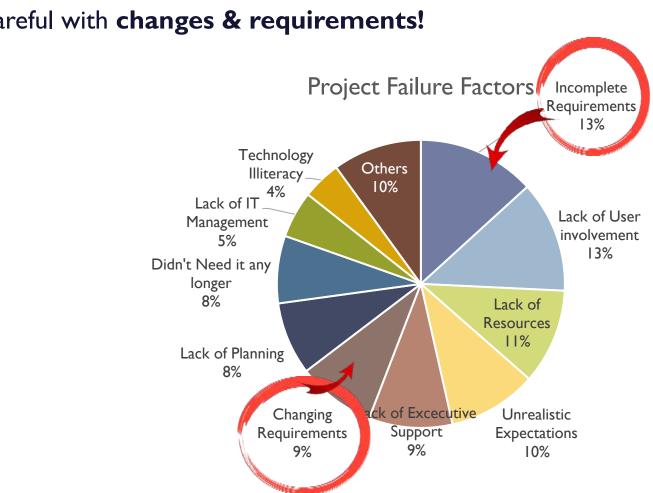




FIGURE 5.9 Requirements changes are inevitable. Derived from (Forsberg et al., 2005) Figure 9.3. Reprinted with permission from Kevin Forsberg. All other rights reserved.

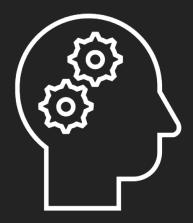
### I. Introduction to Configuration Management











# Configuration Management at Life Cycle level



**RISK**??

- If CM is applied by identifying the relevant items throughout the life cycle...
  - Impacts of change are appropriately controlled
  - Threat -> Opportunity (change out of surprise -> anticipated change)

## BUT...

- Complex System Development = Complex monitoring of change impact
- Interaction with Decision & Risk Management:



- Change in I activity impacts several decisions over the life cycle
- I decision might impact several activities over the life cycle

## Need for a holistic approach of Configuration Management



Solution/Eystem Realization

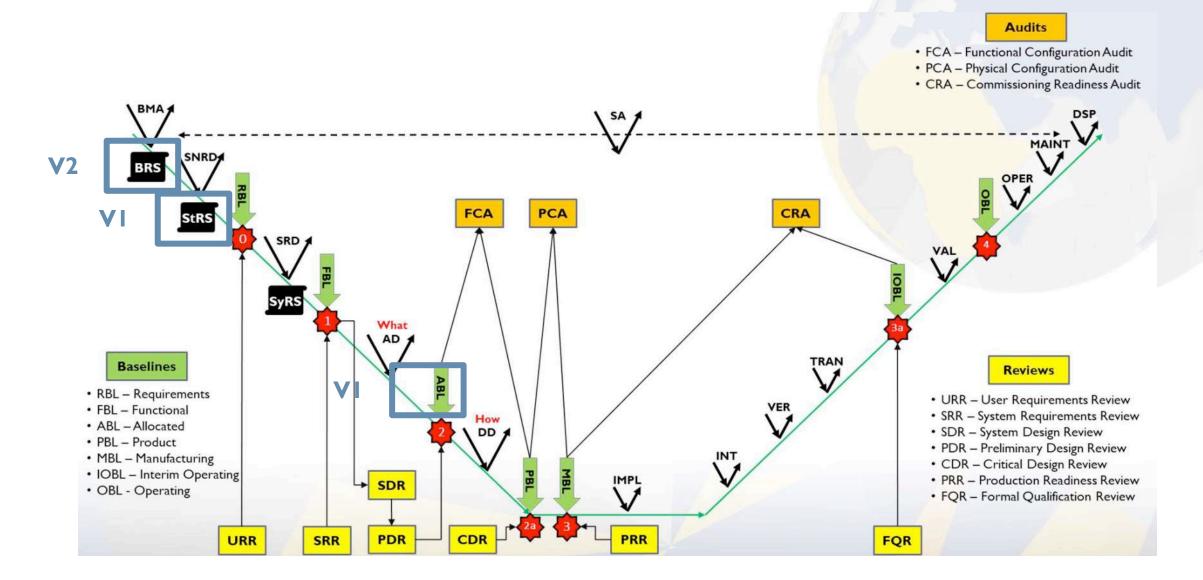
System Developmen



		20 Carlie	
Life cycle level?	?		
<b>Objects set</b> level	<ul><li> Objects</li><li> Attributes</li></ul>		
<b>Object</b> level	• Attributes		



#### 2. Configuration Management at Life Cycle level





URR

SRR

PDR

FQR

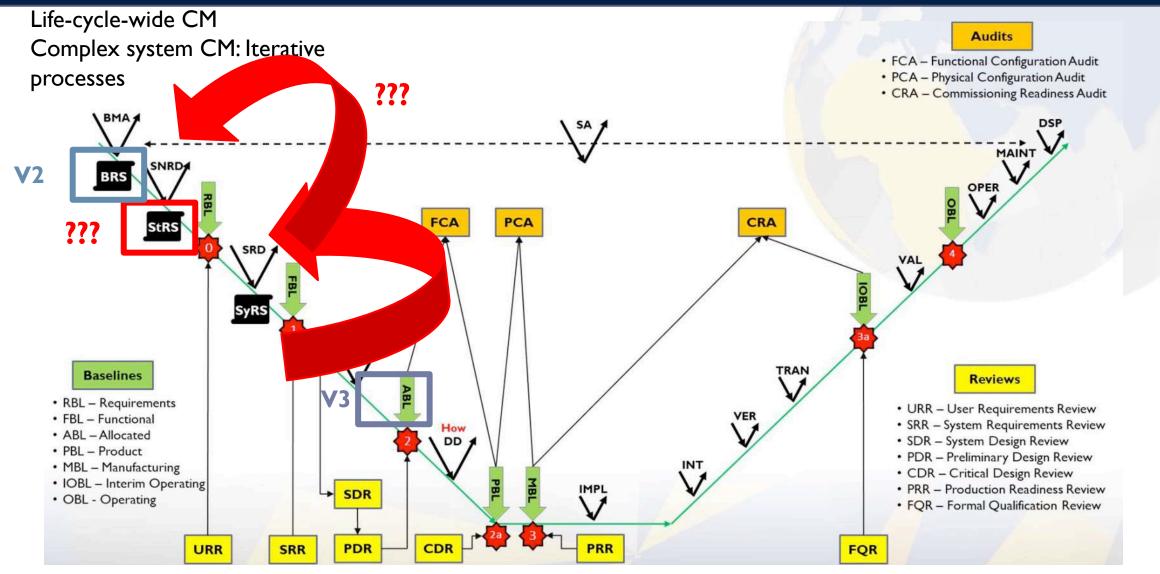
#### Document-level CM Audits • FCA - Functional Configuration Audit • PCA - Physical Configuration Audit CRA – Commissioning Readiness Audit BMA 1 DSP SA 1 MAINT SNRD **V2** OPER B PCA CRA FCA **V2** StRS VAL IOB SyRS What AD TRAN **Baselines** Reviews V • RBL - Requirements • URR - User Requirements Review VER FBL – Functional SRR – System Requirements Review How ABL – Allocated • SDR - System Design Review DD • PBL - Product • PDR - Preliminary Design Review INT MBL – Manufacturing CDR – Critical Design Review IOBL – Interim Operating IMPL • PRR - Production Readiness Review SDR . • OBL - Operating • FQR - Formal Qualification Review

CDR

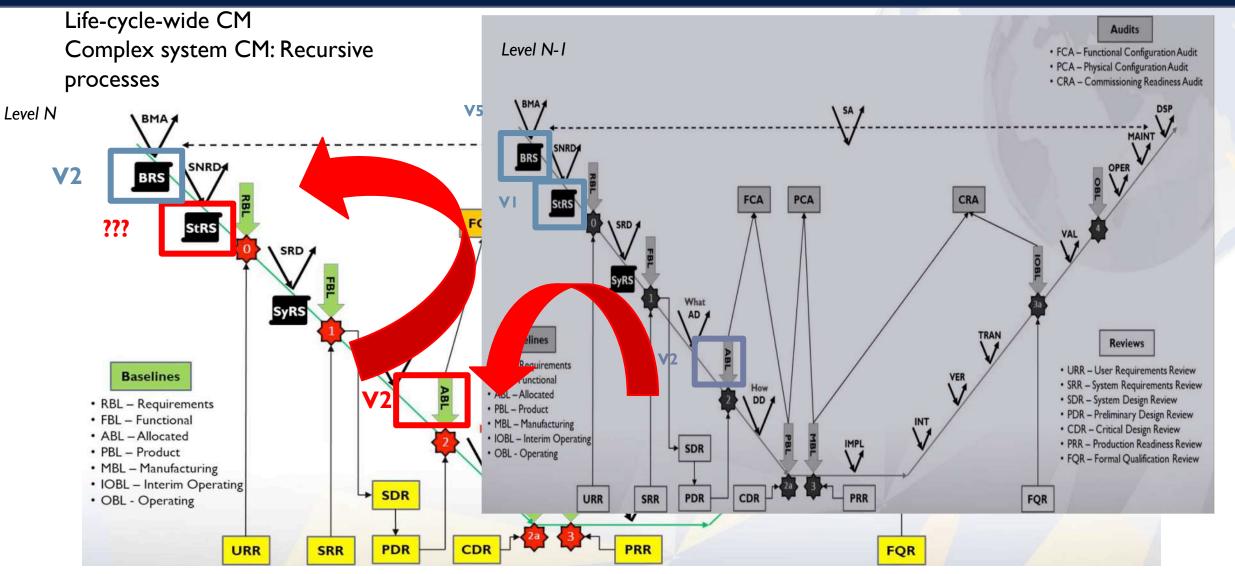
PRR



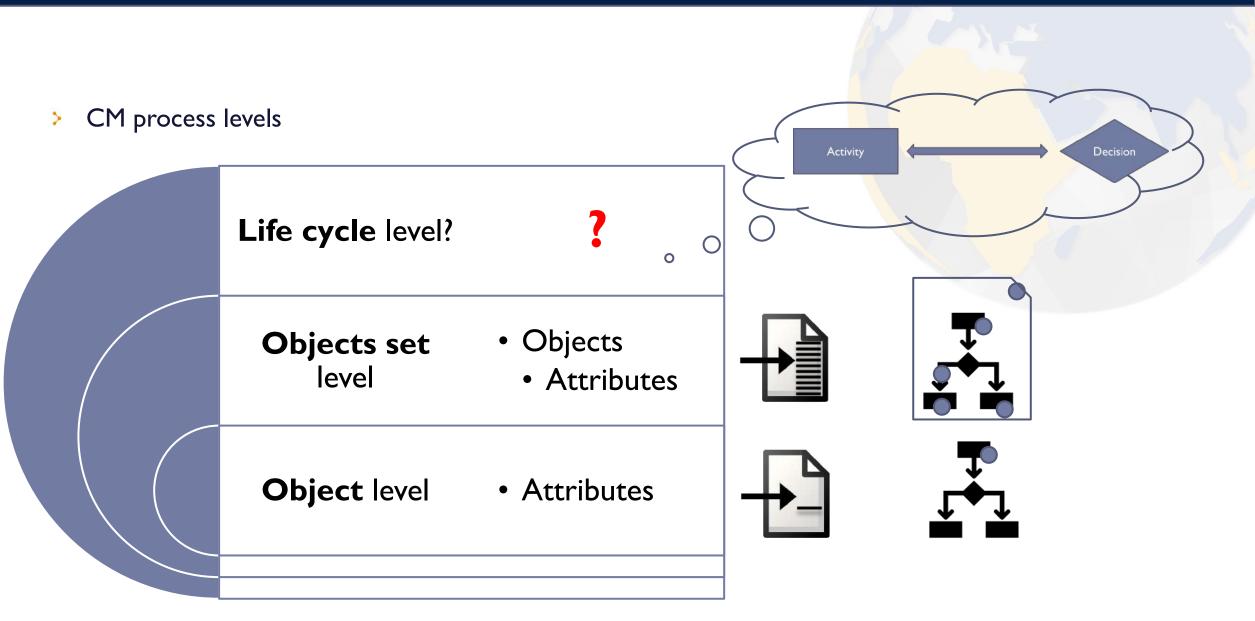
## 2. Configuration Management at Life Cycle level



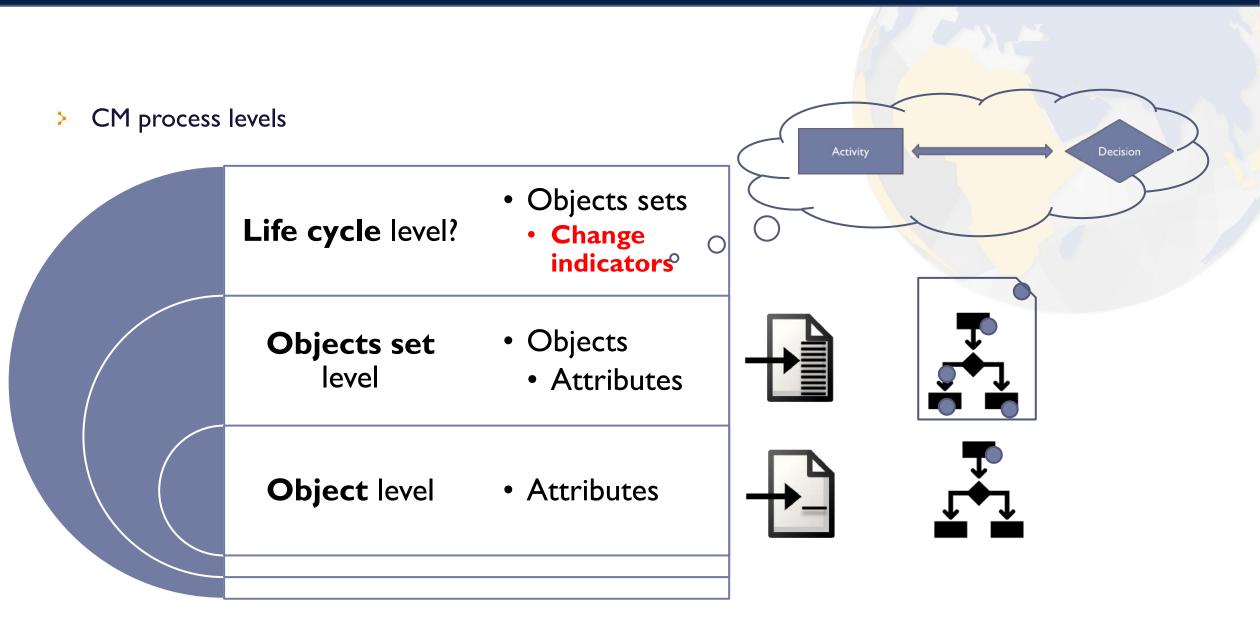














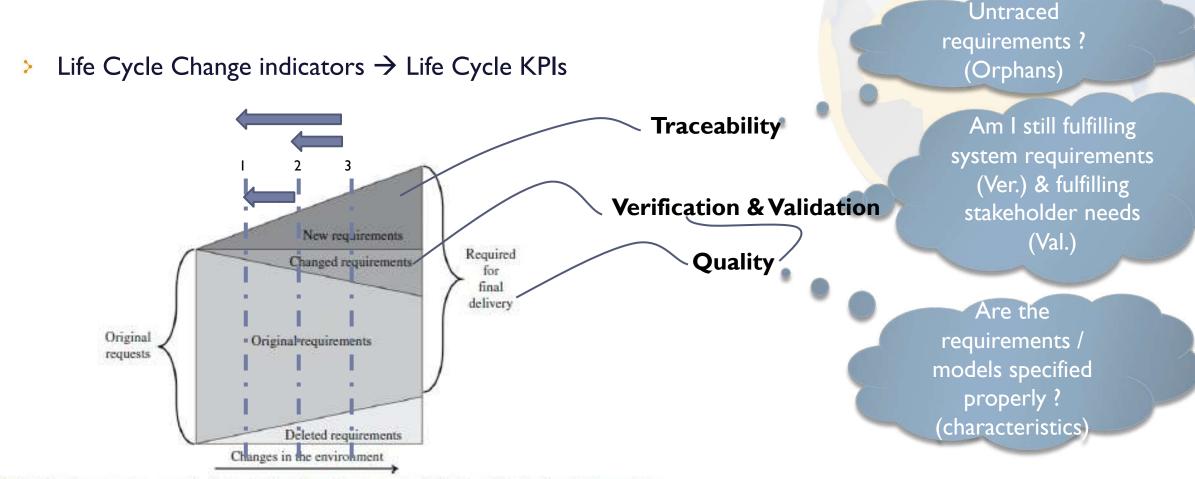


FIGURE 5.9 Requirements changes are inevitable. Derived from (Forsberg et al., 2005) Figure 9.3. Reprinted with permission from Kevin Forsberg. All other rights reserved.

## 2. Configuration Management at Life Cycle level



## > Quality Indicators

- % high/medium/low-quality rated work products
- > % attributes specified
- > % properties defined
- > Traceability Indicators
  - > % missing traces (by trace type)
  - > % suspect links
  - > Automated / manual traceability ratio
  - > Traceability Matrix

## > V&V Indicators

- % Verified/Not verified (Validated/Not validated) elements
- > # verification (validation) actions performed
- Source elements coverage

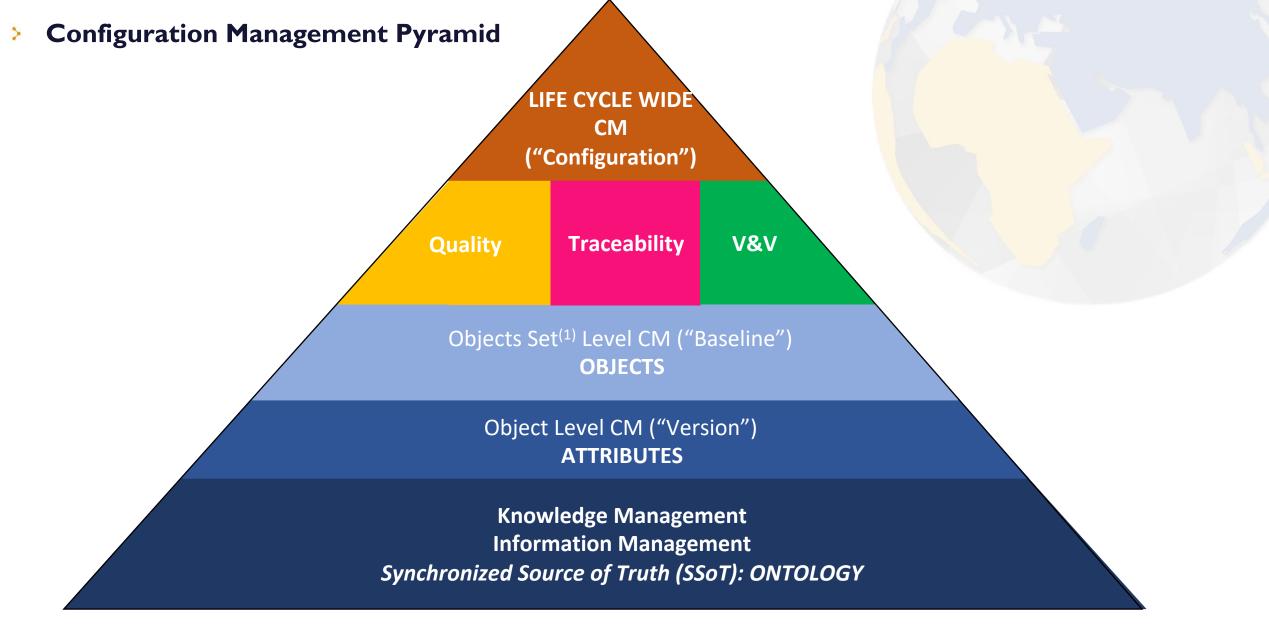
#### > ...



## **Activity Progress Indicators**



2. Configuration Management at Life Cycle level



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## > Configuration Management Pyramid



Change in internal procedures or standards/regulations might affect quality assessment results and therefore impact decisions at life cycle.

Traceability

Ensures it maintains a 100% traceability between the work products to avoid orphan work products



Change in system requirements & stakeholder needs must be applied to the previously defined verification / validation actions. Work product verification / validation to be updated.



## > Examples

I. Change in I work product (object level) of the Life Cycle



Quality

Traceability V&V

Objects Set<sup>(1)</sup> Level CM ("Baseline") **OBJECTS** 

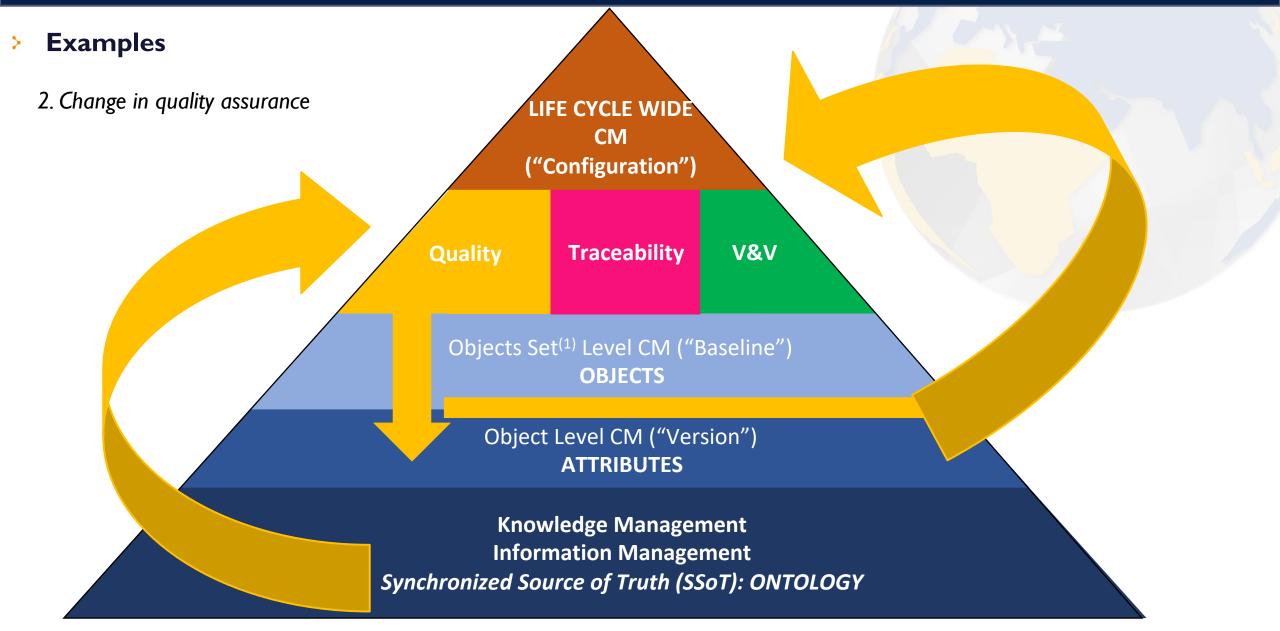
Object Level CM ("Version") ATTRIBUTES

Knowledge Management Information Management Synchronized Source of Truth (SSoT): ONTOLOGY

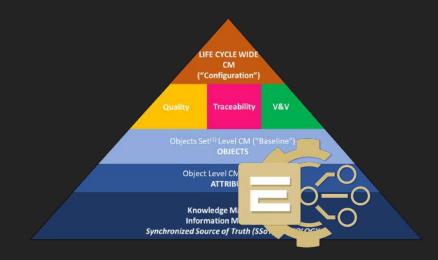
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#### 2. Configuration Management at Life Cycle level



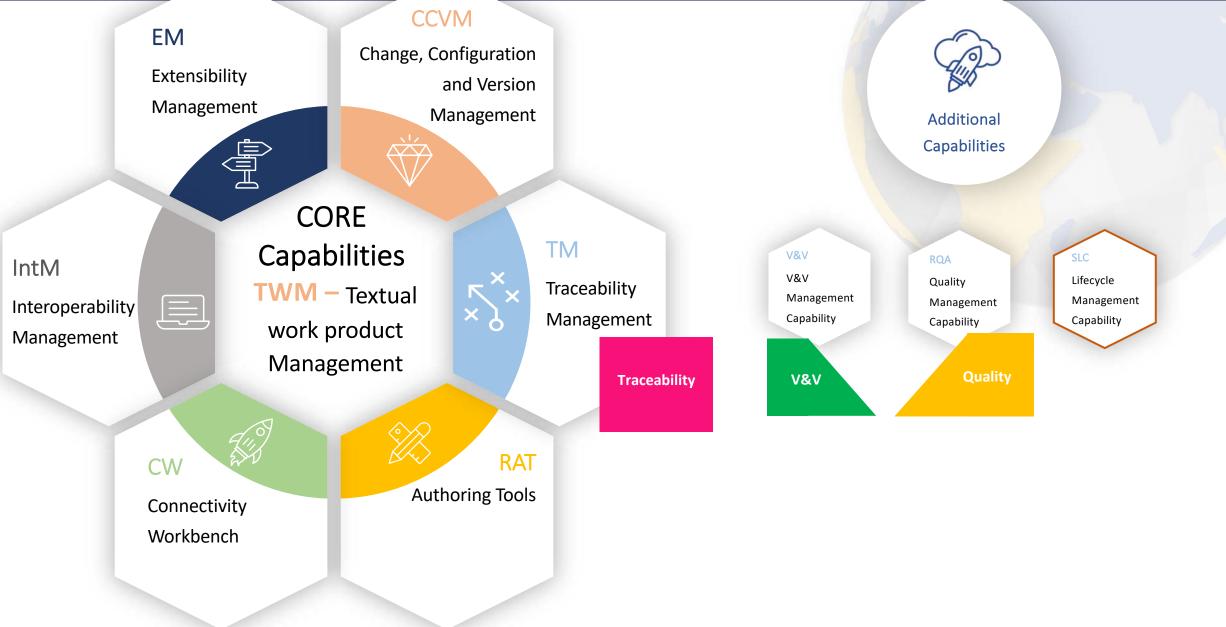
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# CM approach in SES ENGINEERING Studio

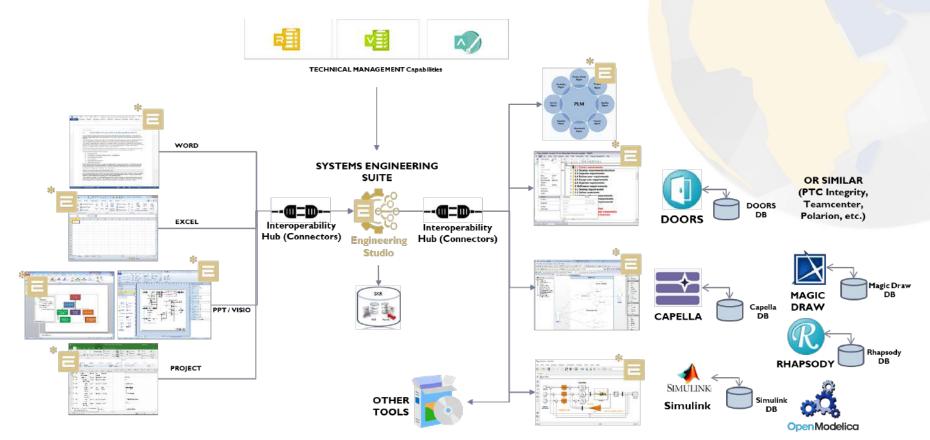


### 3. CM & SES ENGINEERING Studio





SES ENGINEERING Studio = Multi-capability platform to perform SE activities across the system life cycle



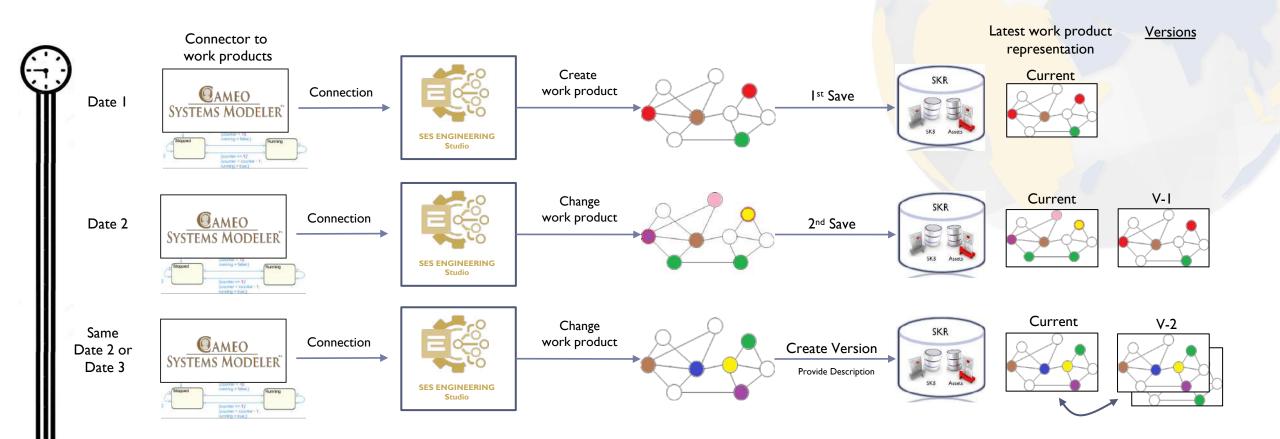
Main tool of the **Systems Engineering Suite (SES)**.



- Configuration Management Process (ISO I 5288, Project Processes)
- > Configuration Management at Workproduct Level
  - Scope: I workproduct (I req, I model, I test case, ...)
- > Cases where a new version is generated (automatic & manual):
  - > Automatic: Whenever there are unsaved changes, and the user decides to save them.
  - > Automatic: When including a workproduct within the Traceability system (creating a trace).
  - Manual: When a version is created by the user.
  - > Manual: In Lifecycle Management, when a configuration is created and the inner elements have changes, with regards to their last version.
- > Operations on top: Diff details, Revert to version.

CM at Workproduct Level

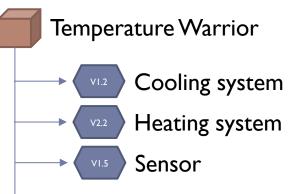


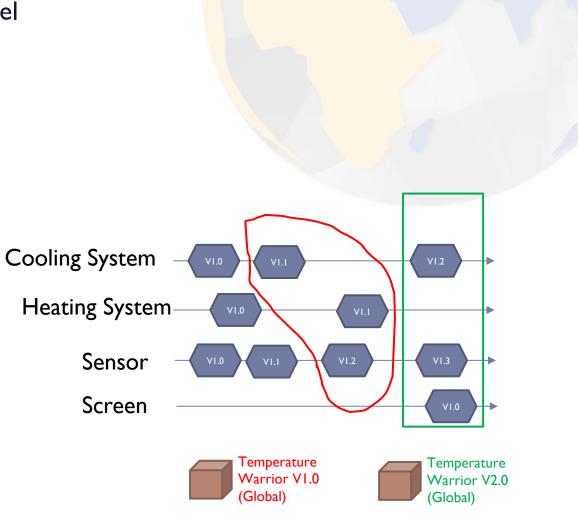






- Configuration Management Document / Project Level
- Baseline (Local)
   Temperature Warrior \_\_\_\_\_\_\_
- Global Configuration (Life Cycle)







## CM at Project Level

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Dverview																	
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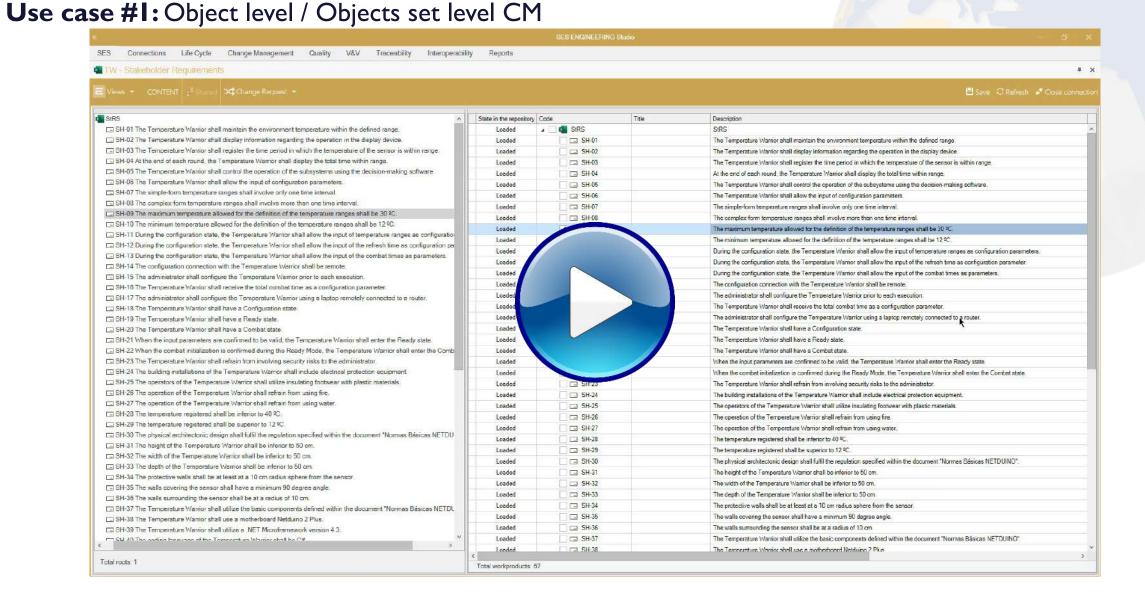
**Live Demo** Configuration Management



## Live Demo

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Devel	lop a system capable of managing the surrounding temp.	ford M. Fuertes	John Dose Mariann	
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## Live Demo: Use case #1



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## Live Demo: Use case #2

## **Use case #2:** Object level / Objects set level CM with Change Control

Connections Life Cycle C	hange Manag	ement Quality V&V	Traceability Interoperability Reports	
Slakeholder Requirements				
	Change Req			💾 Save 🗢 Refresh 💉 Close conn
	11			
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SH-01 The Temperature Warrior st	Loaded	🔺 🔽 💶 StRS	SIRS	
SH-02 The Temperature Warrior st	Loeded	🗌 📼 SH-01	The Temperature Visition shall maintain the environment temperature within the defined range.	
SH-03 The Temperature Warrior st	Loaded	🗌 🗔 SH-02	The Temperature Warrior shall display information regarding the operation in the display device.	
SH-04 At the end of each round, th	Loaded	🗌 🗔 SH-03	The Temperature Warrior shall register the time period in which the temperature of the sensor is within range.	
SH-05 The Temperature Warrior st	Loaded	🗌 🗔 SH-04	At the end of each round, the Temperature Warrior shall display the total time within range.	
SH-06 The Temperature Warrior st	Loaded	🗌 🚍 SH-05	The Temperature Warrior shall control the operation of the subsystems using the decision-making software.	
SH-07 The simple-form temperatur	Loaded	🗌 📼 SH-06	The Temperature Warrior shall allow the input of configuration parameters.	
SH-08 The complex-form temperat	Londed	🗌 🗔 SH-07	The simple-form temperature ranges shall involve only one time interval.	
SH-09 The maximum temperature	Loaded	SH-08	The complex-form temperature ranges shall involve more than one time interval.	
SH-10 The minimum temperature a	Loaded	SH-09	The maximum temperature allowed for the ranges shall be 30 °C.	
SH-11 During the configuration star	Loaded	SH-10	The minimum temperature allow shall be 12 °C.	
SH-12 During the configuration stat	Loaded	SH-11	During the configuration state and a second state a	
SH-13 During the configuration stat	Loeded	SH-12	During the configuration set of the set of t	
SH-14 The configuration connectio	Loaded	SH-13	During the configuration mbst times as parameters.	
SH-15 The administrator shall conf	Loaded	SH-14	The configuration cond	
SH-16 The Temperature Warrior st	Loaded	SH-15	The administrator sha	
SH-17 The administrator shall conf	Loaded	SH-16	The Temperature Wa	
SH-18 The Temperature Warrior st	Loaded	SH-17	The administrator shall rected to a router.	
SH-19 The Temperature Warrior st		SH-18	The Temperature Man	
SH-20 The Temperature Warrier st	Loaded			
SH-21 When the input parameters	Loaded	SH-19	The Temperature Marrich	
SH-22 When the combat initializati	Loaded	C SH-20	The Temperature Warrior s	
SH-23 The Temperature Warrior st	Loaded	SH-21	When the input parameters are the shall enter the Ready state.	
SH-24 The building installations of	Loaded	🗌 🗔 SH-22	When the combat initialization is come for the comparature Warrior shall enter the Combat state.	
SH-25 The operators of the Tempe	Loaded	SH-23	The Temperature V/arrior shall refrain from investigation and the administrator.	
SH-26 The operation of the Tempe	Loaded	SH-24	The building installations of the Temperature Warrior shall include electrical protection equipment.	
SH-27 The operation of the Tempe	Losded	SH-25	The operators of the Temperature Warrior shall utilize insulating footwear with plastic materials.	
SH-28 The temperature registered	Loaded	SH-26	The operation of the Temperature Warricr shall refrain from using fire.	
SH-29 The temperature registered	Loeded	🗌 🗔 SH-27	The operation of the Temperature Warrior shall refrain from using water.	
SH-30 The physical architectonic d	Loaded	🗌 🗔 SH-28	The temperature registered shall be inferior to 40 °C.	
SH-31 The height of the Temperati	Loaded	🗌 📼 SH-29	The temperature registered shall be superior to 12 °C.	
SH-32 The width of the Temperatu	Loaded	🗌 🚍 SH-30	The physical architectonic design shall fulfil the regulation specified within the document "Normas Básicas NETDUINO".	
SH-33 The depth of the Temperatu	Loaded	🗌 🚍 SH-31	The height of the Temperature Warrior shall be inferior to 80 cm.	
SH-34 The protective walls shall be	Loaded	🖂 SH-32	The width of the Temperature Warrior shall be inferior to 80 cm.	
SH-35 The walls covering the sens	Loaded	🗌 🗔 SH-33	The depth of the Temperature Warrior shall be inferior to 80 cm.	
SH-36 The walls surrounding the s	Loaded	□ □ SH-34	The protective wells shall be at least at a 10 cm radius sphere from the sensor.	
SH-37 The Temperature Warrior st	Loaded	SH-35	The walls covering the sensor shall have a minimum 90 degree anole.	
SH-38 The Temperature Warrior st	Loaded	SH-36	The walls surrounding the sensor shall be at a radius of 10 cm.	
SH-39 The Temperature Warrior st	Loaded	SH-37	The Temperature Marrier shall utilize the basic components defined within the document "Normae Básicae NETDUINO".	
	Lorded	SH-38	The Temperature Vanice and state in source components control name the continent monitor based and the pointer .	
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## Live Demo: Use case #3

## **Use case #3:** Life Cycle Wide CM and baseline differences

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## CONTROLLING THE VALUES OF YOUR SIGNALS IN TECHNICAL SPECIFICATIONS - HOW TO CONNECT YOUR REQUIREMENTS MANAGEMENT TOOL TO A PROJECT DICTIONARY

- Have you ever dealt with low-level specifications involving signals and messages? How to know the exact name of the signals, and their possible values... requires a project dictionary that, in most cases, is far away from the Requirements Management tool.
- In this 15-minute webinar, you'll learn how the SES ENGINEERING Studio tackles this issue by connecting your preferred Requirements Management Tool (no matter which is your choice) to a project dictionary in real-time, suggesting the right names, checking the range of expected values, checking which signals can be sent or received by the components described in your textual requirements... and all this in a quick and simple manner.

## **Dates:** December 13 and 15, 2022<sub>All rights reserved © The REUSE Company 2022</sub>









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MBSE around the world. Spain with Juan Llorens

Requirements management through AllG Contracts

Connecting the Dots: Interoperability between your favourite Systems Engineering tools

Semantic traceability: how to keep the digital thread all along the SE lifecycle



is - Ep. 16 - V&V con Juan

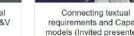




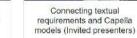
Requirements Management: Managing data over entire life cycles

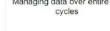
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How to kick off your KM -KNOWLEDGE Management project



Taming the System Engineering Life cycle using Connectivity and Interoperability: the SES ENGINEERING Studio



models is the only way forward

after high-quality requirements



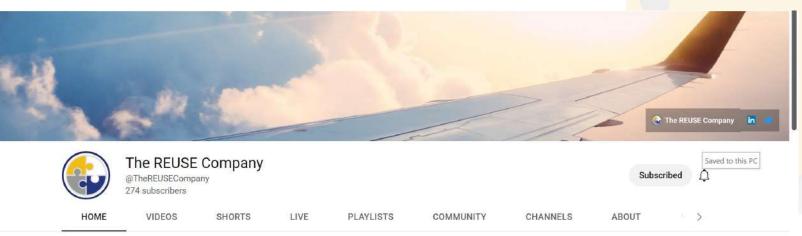
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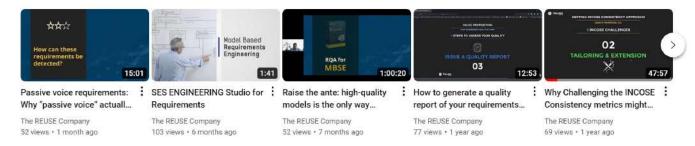
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