- Webinar rules:
  - You'll be muted all along the Webinar
  - There's a *Questions* section to ask your questions whenever you want
  - All questions will be answered at the end of the webinar
  - If you have any technical issue please use the chatting box, or mail us at: support@reusecompany.com
  - The Webinar will be recorded. A link to the recording will be sent to you in few days

Taming the System Engineering Life cycle using Connectivity and Interoperability:

The SES ENGINEERING Studio

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Marketing & Communication
The REUSE Company
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THE REUSE COMPANY

- Introduction to The REUSE Company and the presenter
- About the System Lifecycle Management
- Introduction to the SES ENGINEERING Studio
- Connectivity within SES
- Interoperability between connections
- Technical Management processes Digitalization
- Lifecycle Management Digitalization
- Q&A

The REUSE Company is a tool vendor specialized in the application of reuse methods, semantic technologies and artificial intelligence to improve the 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, and providing full support to technical management as in ISO 15288

We are known in the market for Quality, Traceability, V&V and Knowledge Management Software tools (RQA, RAT, Traceability Studio, V&V Studio and Knowledge Manager)

SES ENGINEERING
Studio

- SE Professor at Universidad Carlos III de Madrid (Spain)
- CTO at The REUSE Company
- Board member of INCOSE Spain
  - Member of INCOSE R-WG / PLE-WG / KM-WG
  - CSEP / ESEP

Juan Llorens

Juan.llorens@reusecompany.com

Systems Engineering Life Cycle Management (SELM)

SES ENGINEERING Studio (SES)

CONNECTIVITY

INTEROPERABILITY between connections

TECHNICAL MANAGEMENT Processes Digitalization

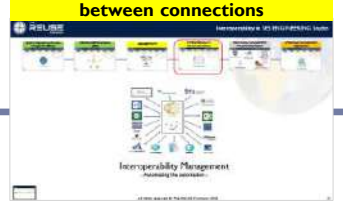
LIFECYCLE MANAGEMENT Digitalization

Systems Engineering Life Cycle Management (SELM)

SES ENGINEERING Studio (SES)

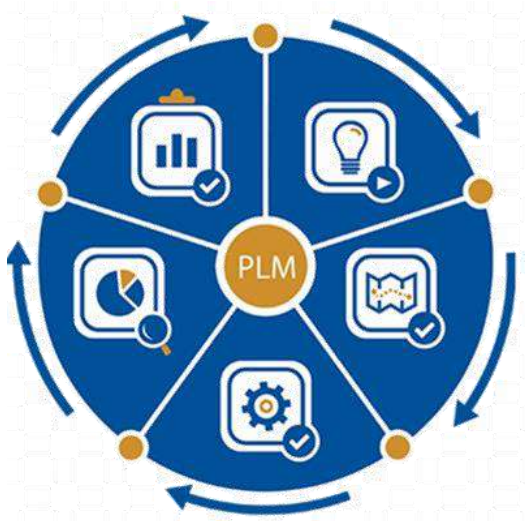
CONNECTIVITY

INTEROPERABILITY between connections



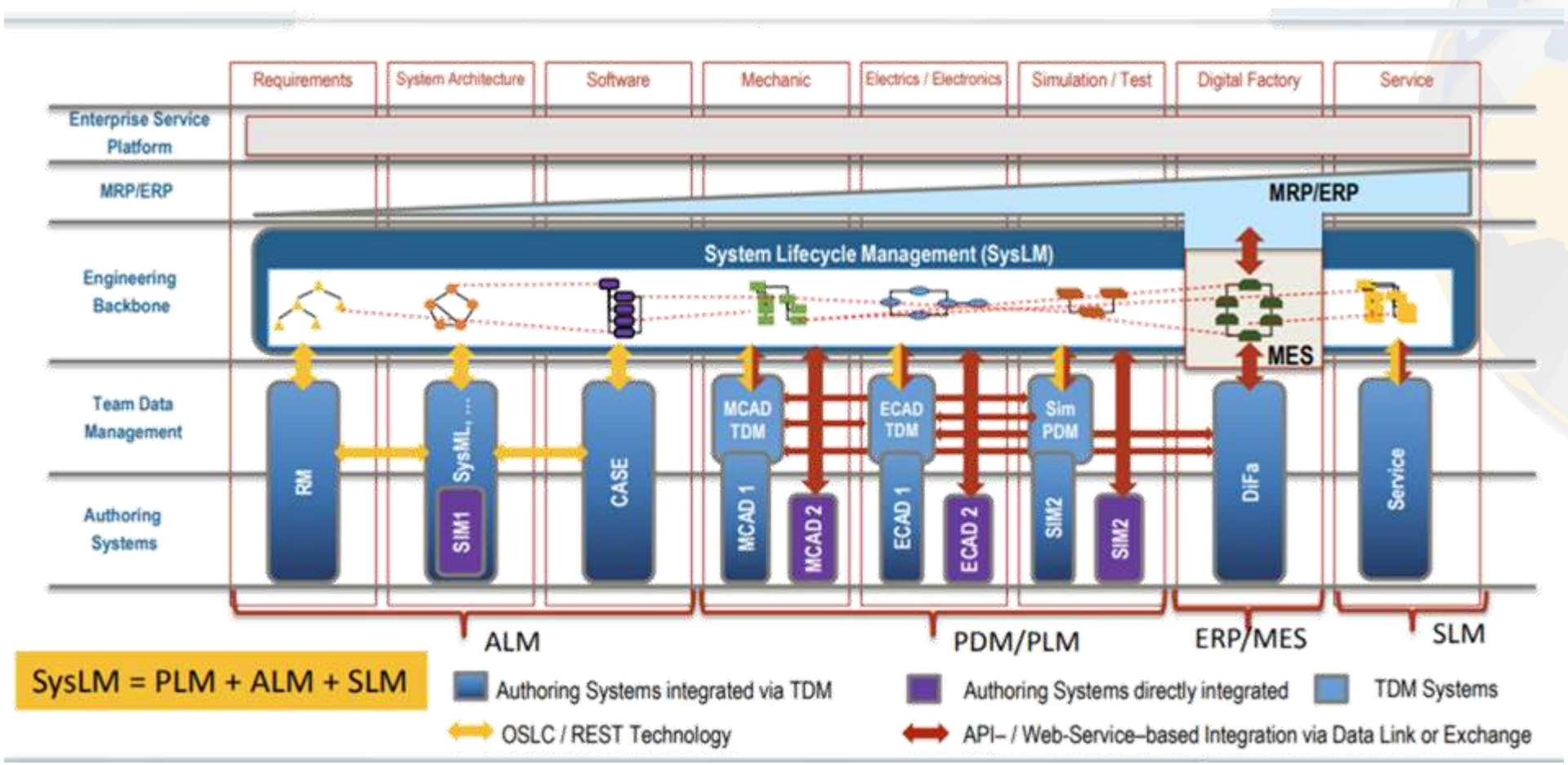
TECHNICAL MANAGEMENT Processes Digitalization

LIFECYCLE MANAGEMENT Digitalization



PLM-SELM Domain

X Lifecycle Management (XLM) soup… how digested in 2017



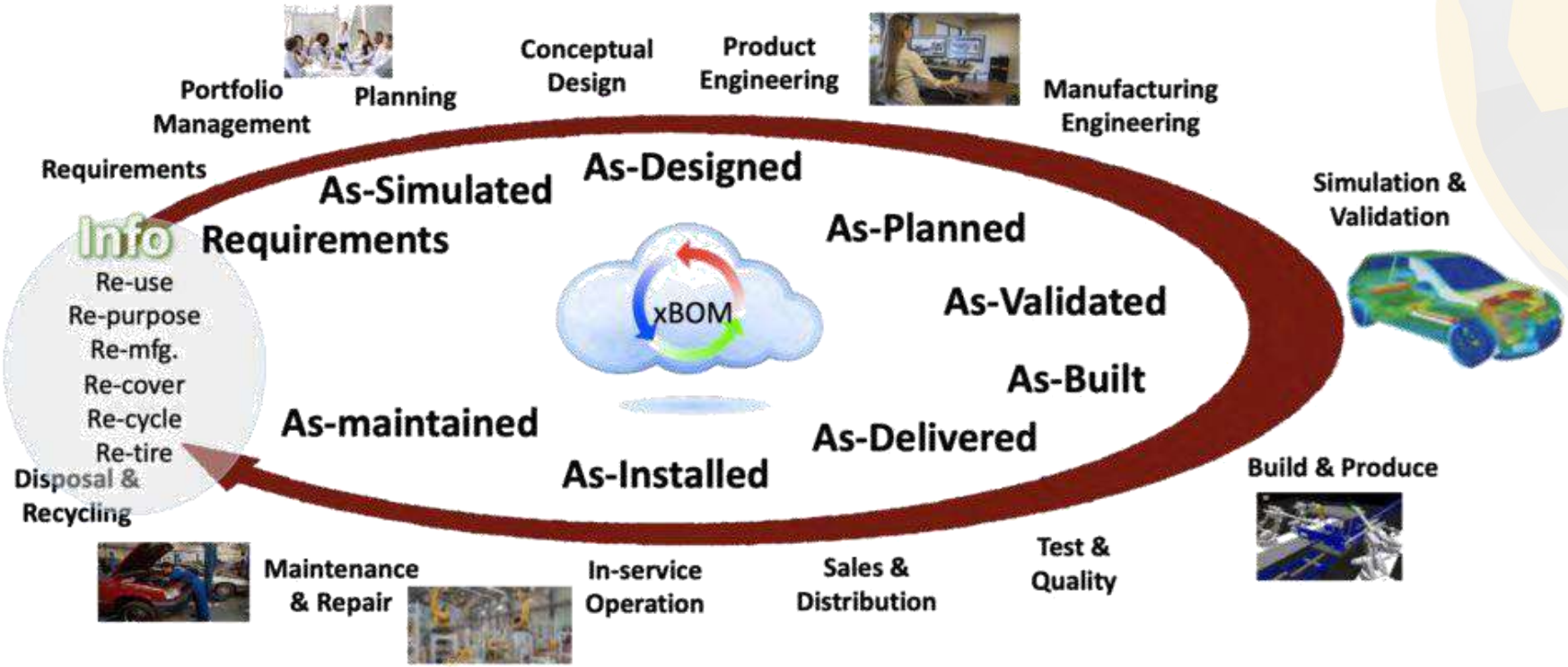
TDM = Team Data Management // PDM = Product Data Management

(2017) Martin Eigner – Eigner Engineering Consult
https://pdteurope.com/wp-content/uploads/2017/10/9-Systems-Life-Cycle-Management-as-a-Bimodal-IT-Approach-1-1.pdf

- **PLM** seems to cover only the "close to physics" part to the complete life cycle
- **ALM** intends to cover Software Lifecycle Management
- Hundreds of **Authoring** Systems!
- Need to **connectivity** (Standards needed)
- Need to **traceability**
- A fully integrated Engineering Backbone **does not exist. It is a wish!**
- **Trend in Tool Vendors** to "bigger vision of platforms with increased vertical integration" leading to "to even bigger challenges in cross-system integration and interoperability"
- Old (2017) vision. ALM and PLM do not share Technical Processes and compete within Authoring Systems.

Lifecycle Information is Represented by Structures

Managing relationships between structures throughout the lifecycle—they must be managed throughout



PLM Solutions—Information Management across Media, Process, Time, Geography & Enterprise

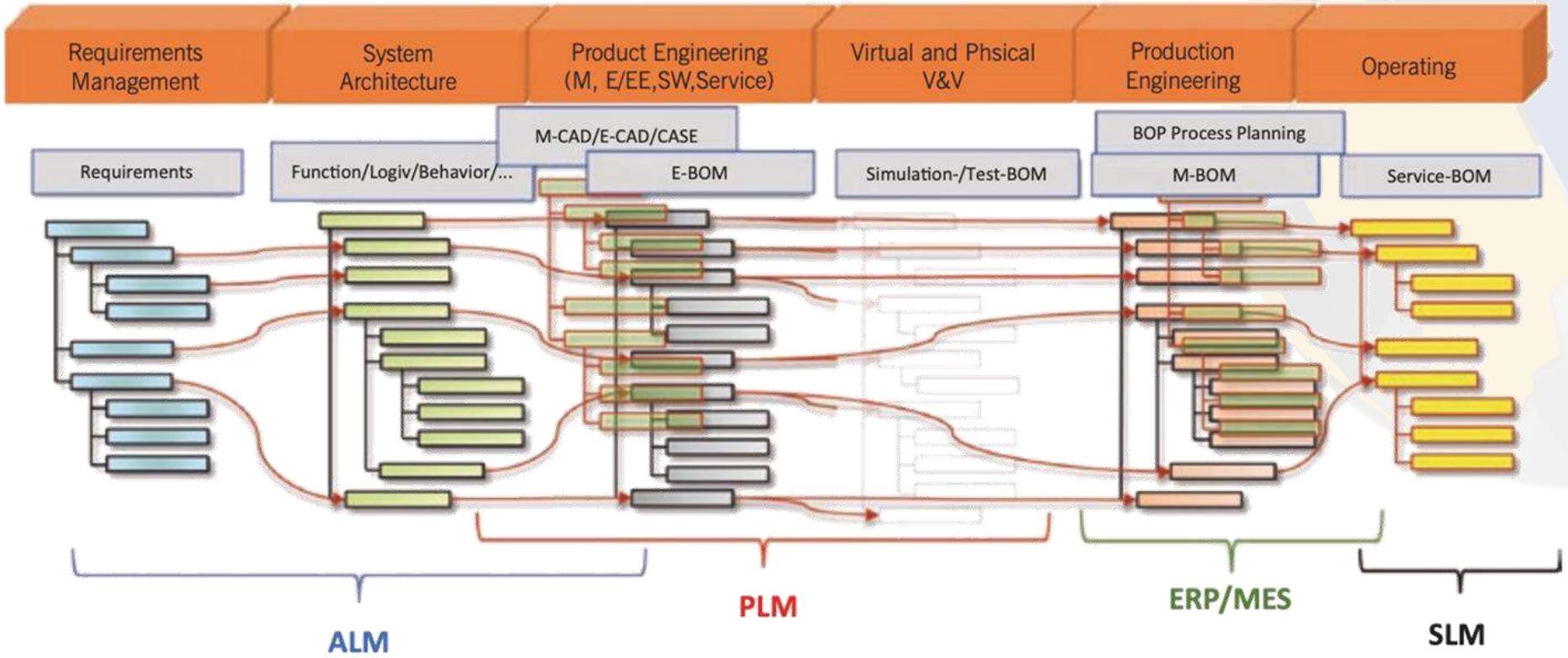
CIMdata

8

- **CIMdata** proposes a neutral model to Engineering Backbone
  - Evolution of the BOM to a Bill of Information (BOI)

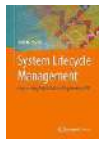
CIMdata virtual event 2020 PDT and PLM Roadmap

X Lifecycle Management (XLM) soup… how digested in 2021



BOM Bill of Material **BOP** Bill of Processes **ALM** Application Lifecycle Mgmt. **PLM** Product Lifecycle Mgmt.
ERP Enterprise Resource Planning **MES** Manufacturing Execution System **SLM** Service Lifecycle Mgmt.

System Lifecycle Management. Martin Eigner



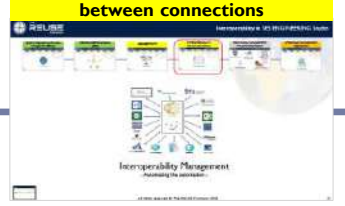
SES ENGINEERING Studio: Core Position

Systems Engineering Life Cycle Management (SELM)

SES ENGINEERING Studio (SES)

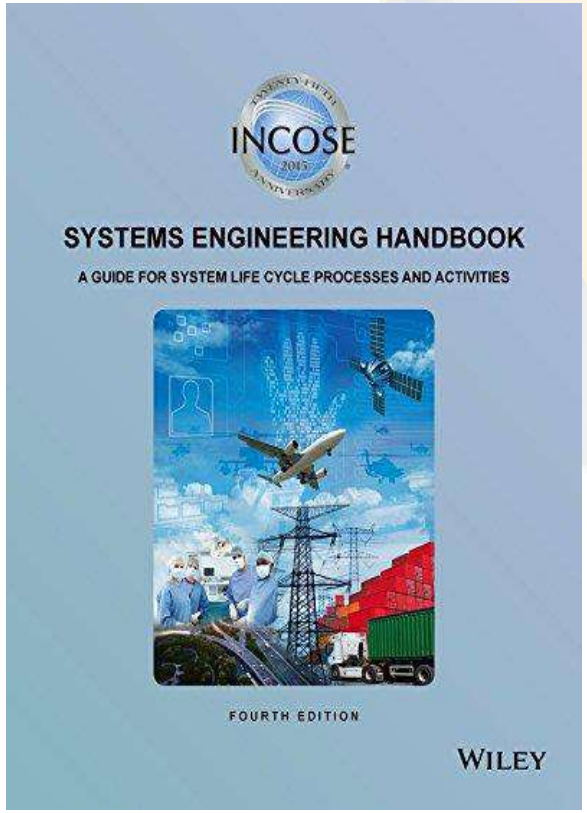
CONNECTIVITY

INTEROPERABILITY between connections

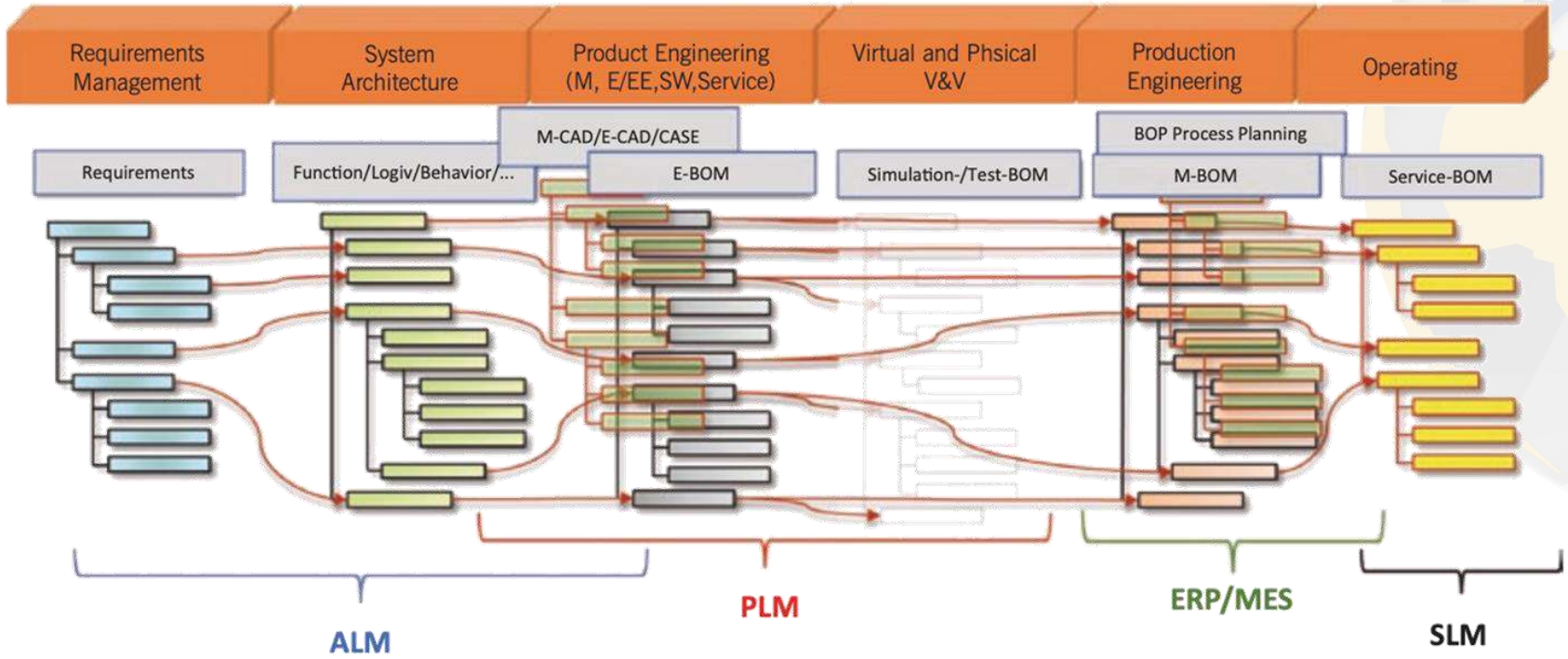


TECHNICAL MANAGEMENT Processes Digitalization

LIFECYCLE MANAGEMENT Digitalization



SES ENGINEERING Studio is the SW solution of The REUSE Company to improve the digitalization, processes + authoring tools integration, and automation of the system lifecycle, by following the ISO 15288 Guidelines



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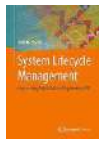
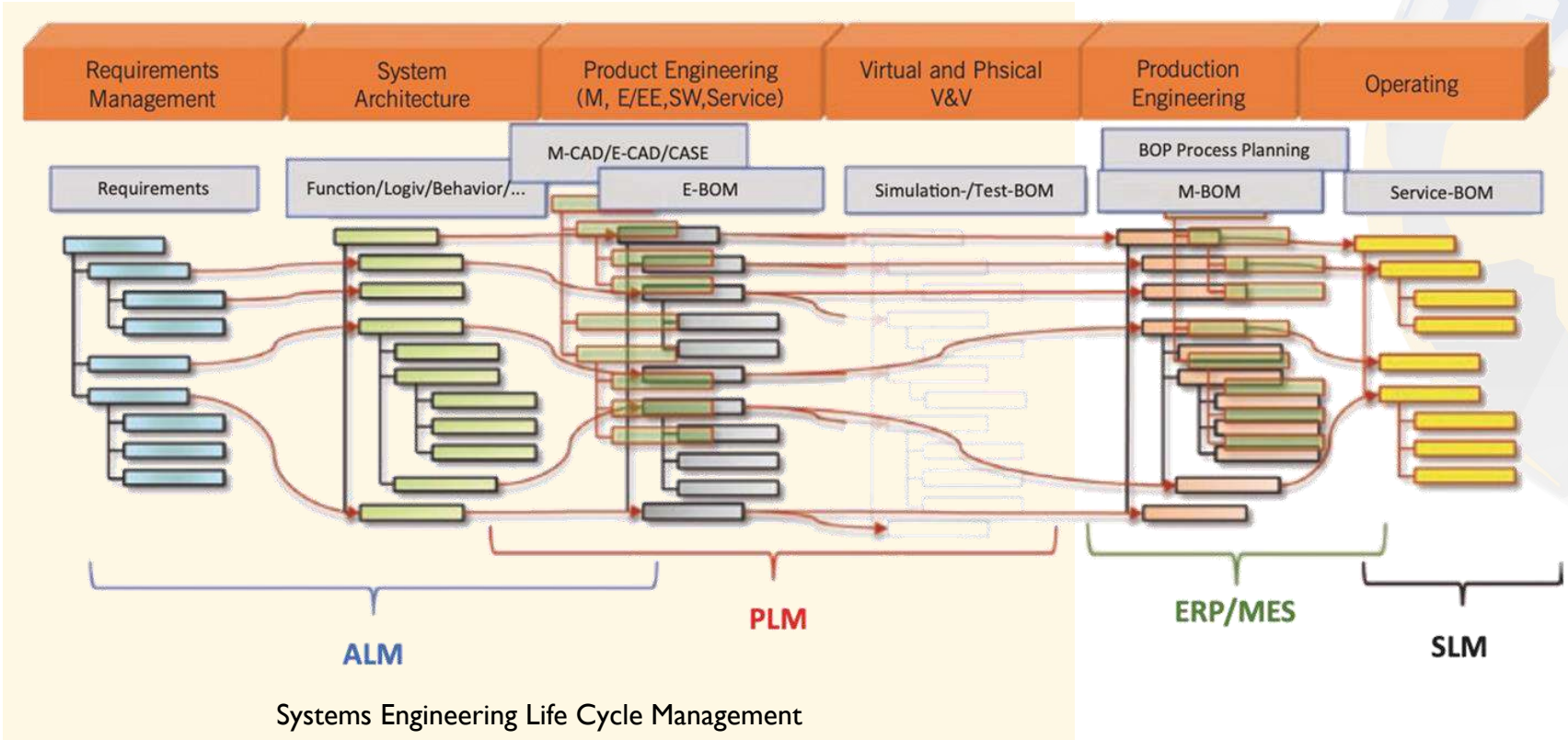
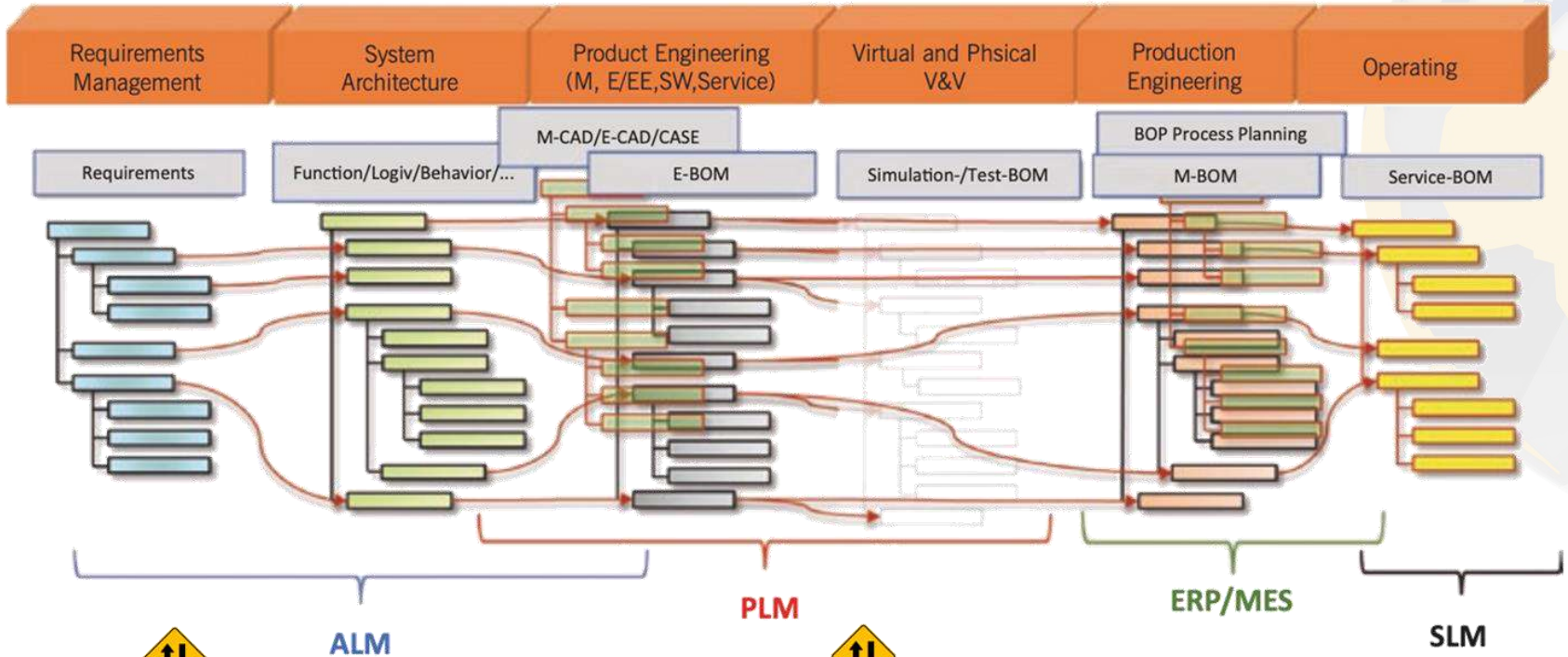


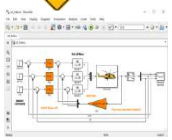


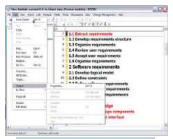
Systems Engineering Life Cycle Management




MS WORD


MS EXCEL


SIMULINK


DOORS

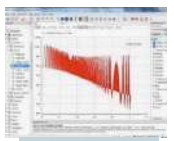

WINDCHILL


RHAPSODY


CATIA


EA


ALTIUM DES


OM EDIT


CAMEO


OWN TOOL

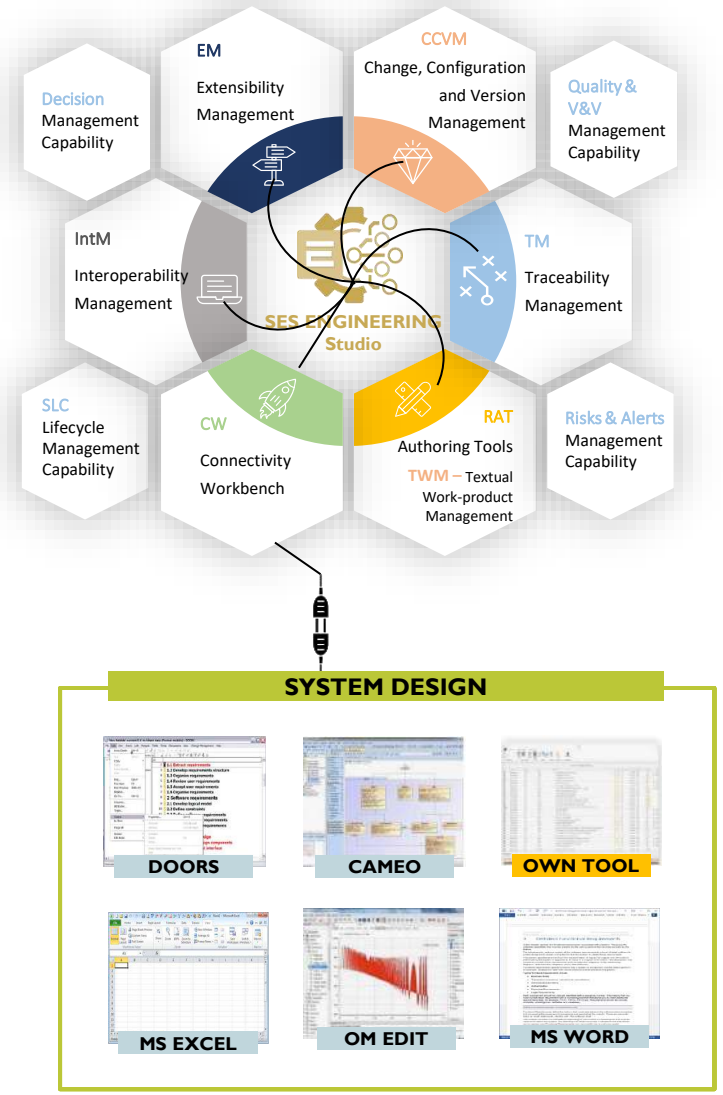

AUTOCAD

Ecosystem of Authoring Systems

- **System Engineering Life-cycle management (SELM) Digitalization.**
- **MBSE** Integration by **Connectivity** technology
- **Semantic Analysis Technologies**, Natural Language Processing and Ontologies applied to Systems Engineering.
- **Text authoring and assistance** for technical writers: requirements, risks, FMEA, tests cases, manuals…
- Semantic **interoperability** to digitalize the different activities that conform a complex project.
- **Complete Technical Management Support**: SMART **quality** analysis, **IV&V**, **traceability**, **configuration** management, **decision** management, **knowledge** management, lifecycle management:
  - Empowered by AI techniques and knowledge repositories.
- **MBRE**: Fully integration of Requirements and NL texts in the MBSE wave. Requirements Management, Requirements to models and vice-versa.
- **Digitalization of the system engineering Life-cycle** managing **workflows**.
- Complete orientation to **REUSE**. Authoritative source of truth, Data Hub support, Repository, Smart Archiving, etc.

What is the SES ENGINEERING Studio in an overview

- Continuity with previous products
  - Still enjoying
    - Quality
    - Traceability
    - Verification and Validation
    - RAT (Smart Authoring tool)
    - Knowledge Management
- By extending the concept of Connectivity
  - To requirements, models, designs, 3D, etc.
- By also extending the full support to all Technical Management processes of the ISO-15288

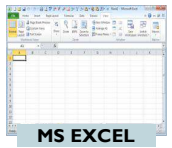


SES ENGINEERING Studio is new SW solution of The REUSE Company to improve the digitalization, processes integration and automation of the system lifecycle, by following the ISO 15288 Guidelines

Usual situation within organizations (I)

STRATEGIC LEVEL

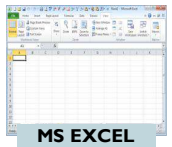

MS WORD


MS EXCEL


SAP

BUSINESS DEPT


HUBSPOT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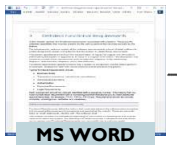
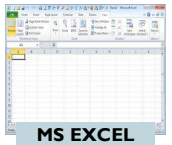

MS WORD

PROJECT OFFICE


MS PROJECT


MS WORD

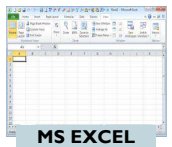

MS EXCEL


JIRA

PRODUCT/PROGRAM OFFICE


TEAMCENTER


MS WORD


MS EXCEL

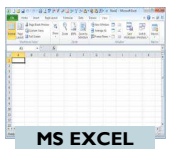

MS PPOINT

SYSTEM DESIGN


DOORS


CAMEO


OWN TOOL

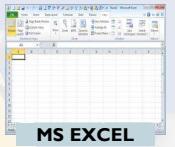

MS EXCEL


OM EDIT


MS WORD

CUSTOMER / PUBLIC ADMIN


MS VISIO


MS EXCEL

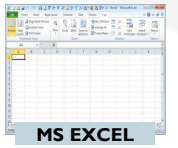

MS WORD

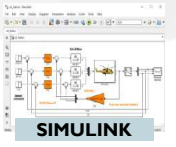
COMPONENT I DESIGN (Supplier 1)

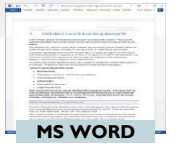

WINDCHILL


RHAPSODY

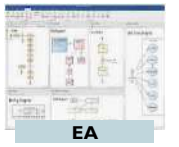

CATIA


MS EXCEL

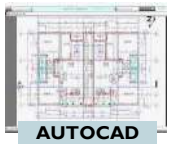

SIMULINK

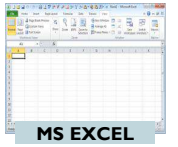

MS WORD

COMPONENT I DESIGN (Supplier 2)


EA


HP QUALITY


AUTOCAD

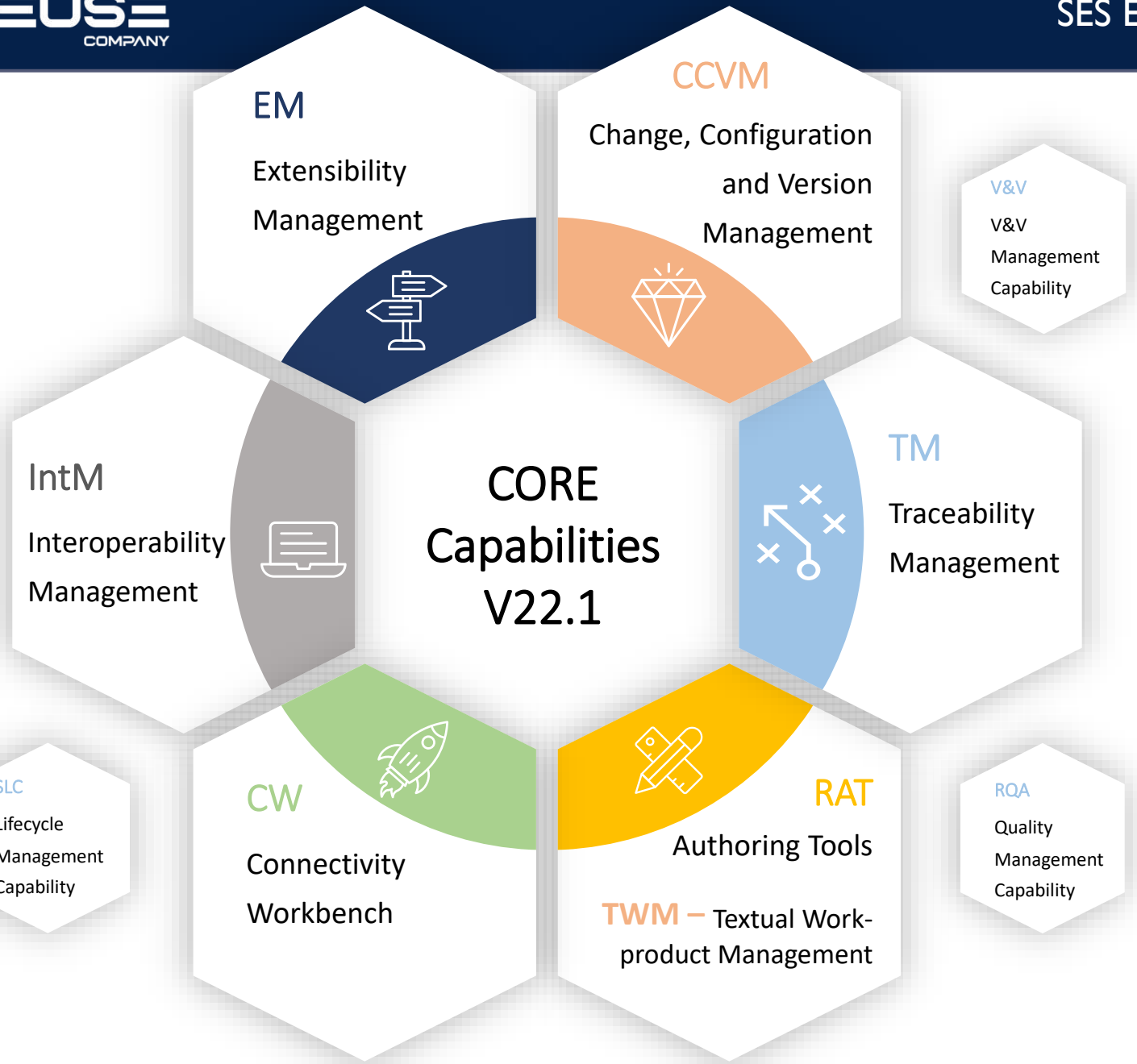

MS EXCEL


SIM CENTER


ALTIUM DES

SES ENGINEERING Studio Architecture

SES ENGINEERING Studio: Functional Architecture



V&V
V&V Management Capability

SLC
Lifecycle Management Capability

RQA
Quality Management Capability

Additional Capabilities V22.2 Q2 2022 (updated)

R&A
Risks and Alerts Management Capability

ASM
Acquisition/Supply Management Capability

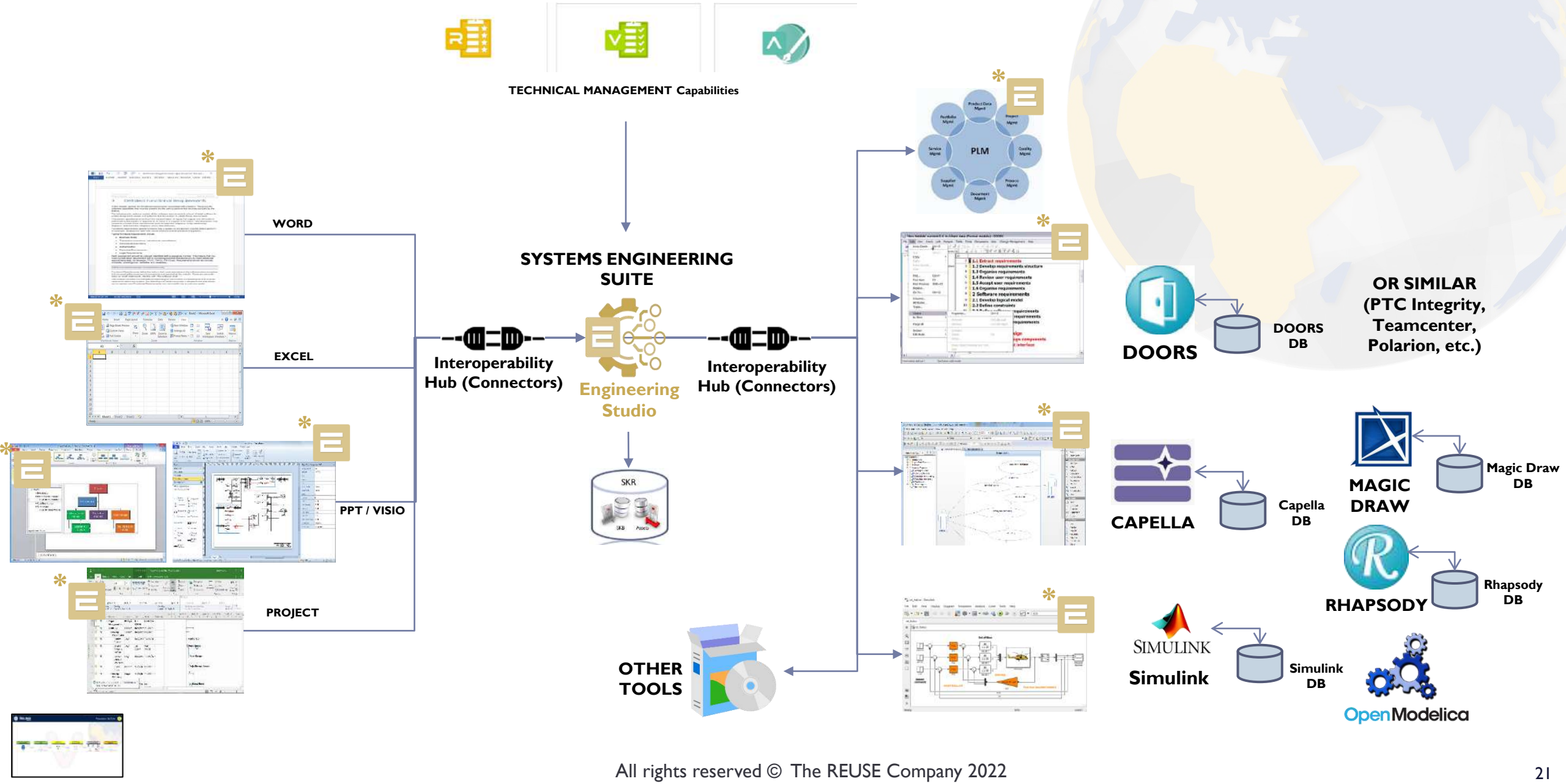
Additional Capabilities V22.3 Q1 2023 (updated)

DM
Decision Management Capability

SM
Software Management Capability

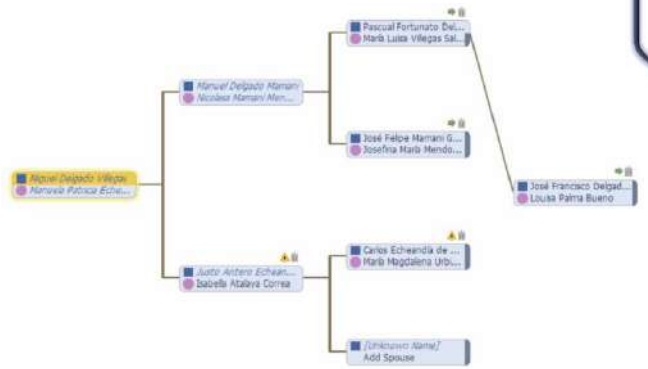
IM
Information Management Capability

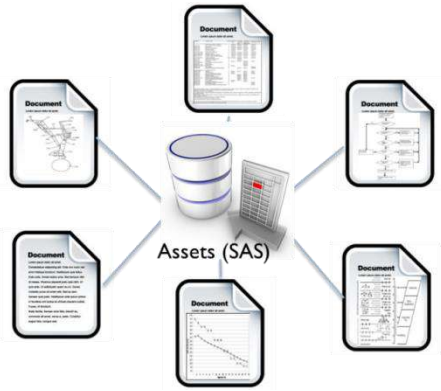
SES ENGINEERING Studio: Applications Architecture



- System Knowledge Repository (SKR)
  - Allows representing, storing, managing and retrieving
    - Relevant knowledge around the System and its domain (including the SE Process)
    - Digital content (Assets) regarding a particular System

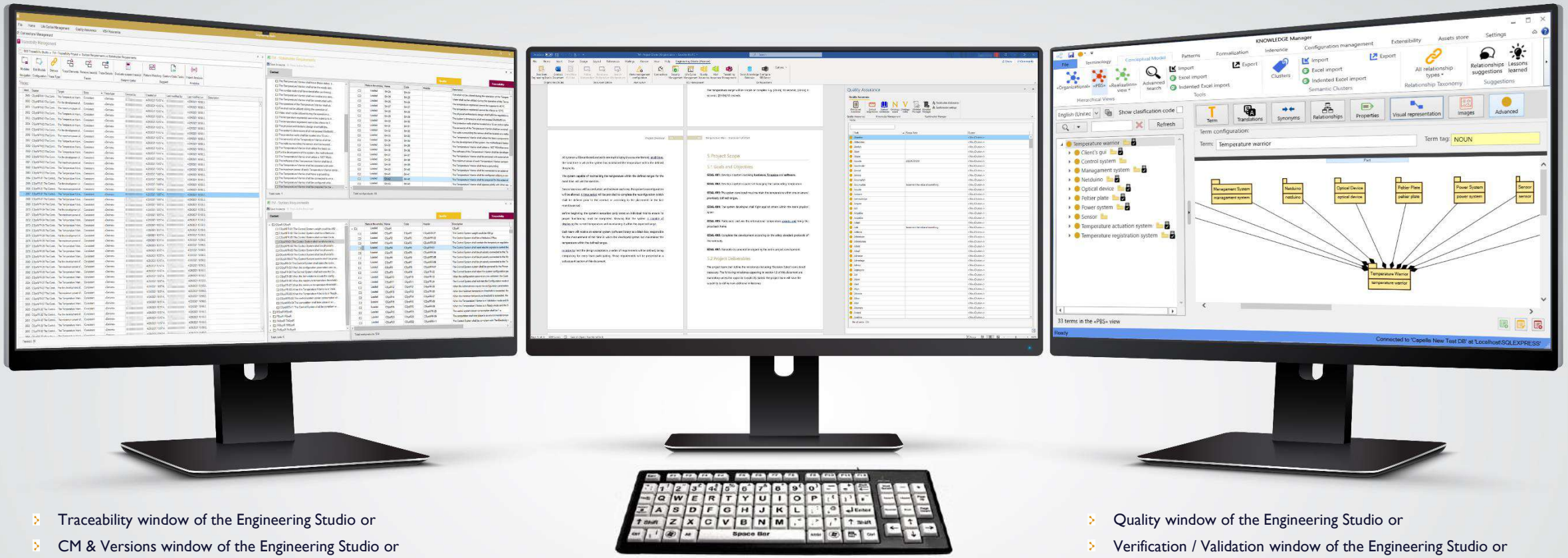
- The SKR is formed by
  - SKB – System Knowledge Base (Ontology)
  - SAS – System Assets Store





System Conceptual Model (SCM)

Requirements / Models Engineer



- Traceability window of the Engineering Studio or
- CM & Versions window of the Engineering Studio or
- Lifecycle Management window of the Engineering Studio or
- Interoperability window of the Engineering Studio or
- Other connection to a Source tool (for example IBM DOORS) or
- Whatever other window

- Engineering Studio inside Microsoft Word

  or
- Engineering Studio stand alone

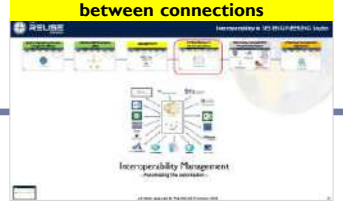
- Quality window of the Engineering Studio or
- Verification / Validation window of the Engineering Studio or
- Knowledge Manager
- Other connection to a Source tool (for example IBM DOORS) or
- Whatever other window

Systems Engineering Life Cycle Management (SELM)

SES ENGINEERING Studio (SES)

CONNECTIVITY

INTEROPERABILITY between connections



TECHNICAL MANAGEMENT Processes Digitalization

LIFECYCLE MANAGEMENT Digitalization

Connectivity

- How to connect with everything -

Types of Connections: to Content and to Functions

Connection to Information Content

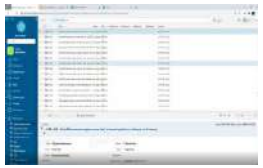
- Examples:
  - Connect to POLARION for accessing Requirements, or
  - Connect to CAPELLA for Models / or Simulink for Models / etc.

Connection to Functionality

- Example:
  - Connect to Simulink for accessing the functionality of Simulating / Generating documentation / etc.

Types of Connections: to Content and to Functions

POLARION

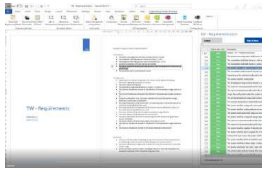


Connector to Polarion Requirements + RAT (1.18 min)

DOORS

Connector to IBM DOORS v9 (4.48 min)

MS WORD



RMS inside MS Word – Creating the Connection and editing requirements (5.50 min)

CAMEO / MD

Managing Cameo from the Engineering Studio (5.35 min)

CAPELLA

Managing Capella from the Engineering Studio (5.48 min)

RHAPSODY

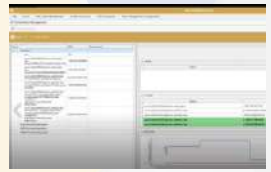
Managing Rhapsody from the Engineering Studio (3.15 min)

SIMULINK

Managing Simulink Models and Requirements (2.14 min)

Simulate()
Document()
Execute()
Etc..

SIMULINK



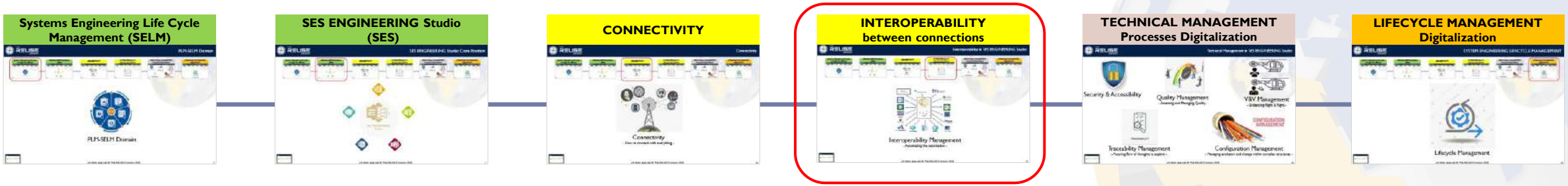
Connecting to Simulation Functionality (54 Sec.)

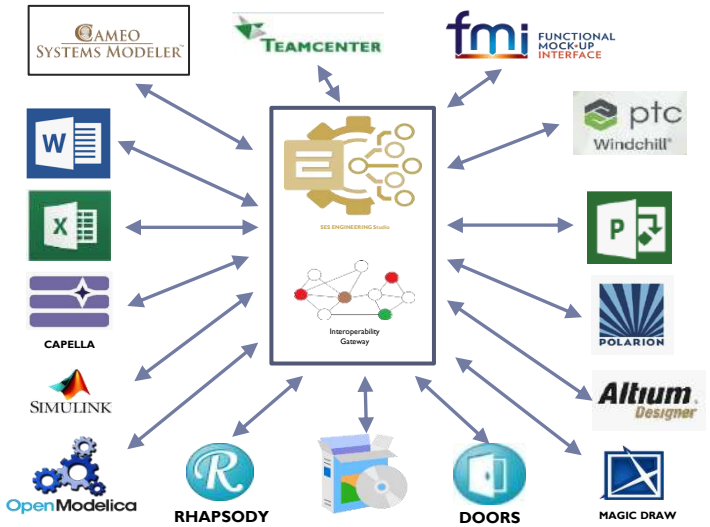
MS EXCEL

Connecting to Excel Functions (3.25 min)

SIMULINK

Connecting to the Documenting Capability (1.30 min)

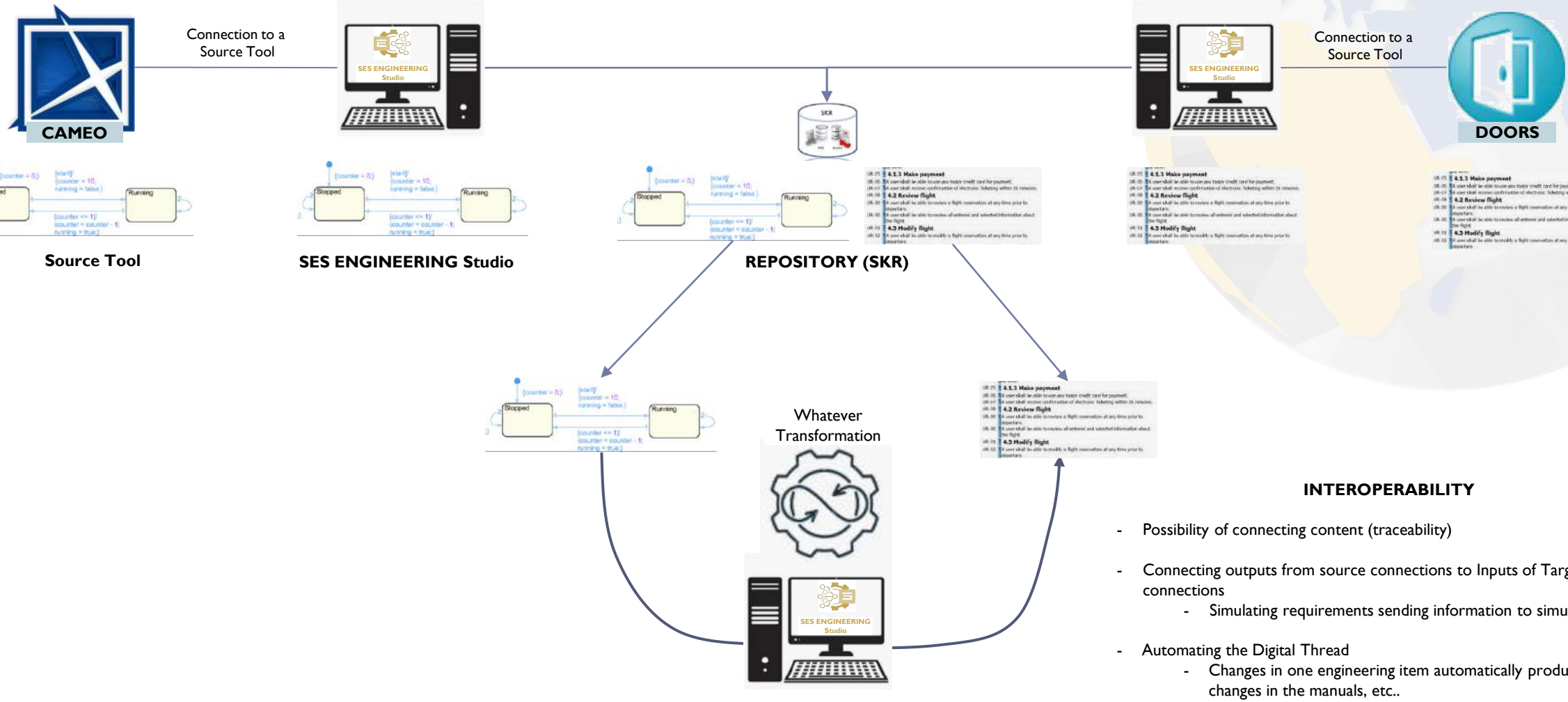




Interoperability Management

- Automating the automation -

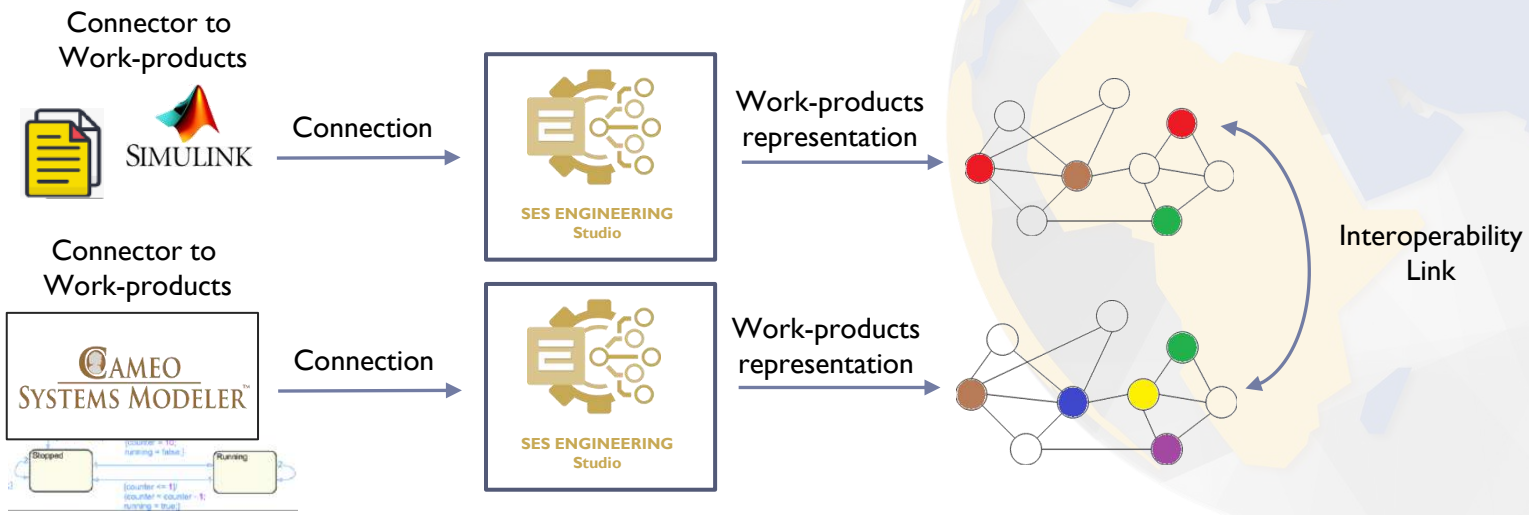
The philosophy of the Interoperability capability



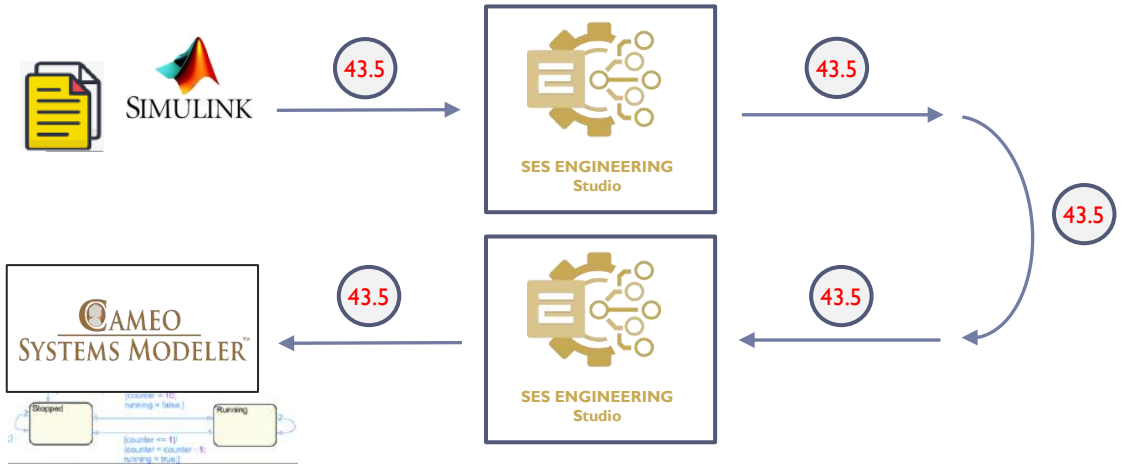
INTEROPERABILITY

- Possibility of connecting content (traceability)
- Connecting outputs from source connections to Inputs of Target connections
  - Simulating requirements sending information to simulations, etc.
- Automating the Digital Thread
  - Changes in one engineering item automatically produce the changes in the manuals, etc..
- Creation of content in one connection from content of other connection
  - Automatic generation of models, requirements, test cases etc.
- A Lifecycle Management Project can be created defining workflows of connections

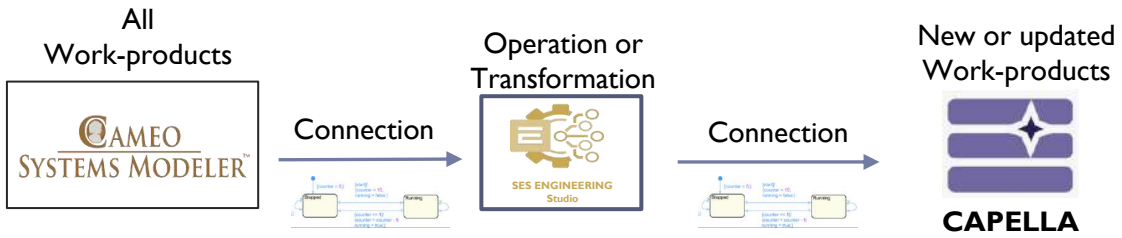
1- INTEROPERABILITY DEFINITION

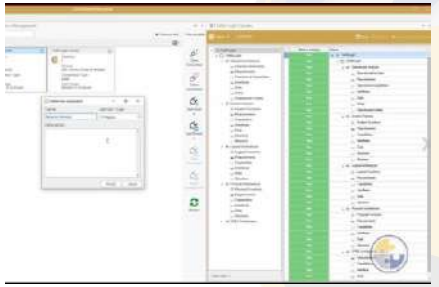


2- INTEROPERABILITY OPERATION

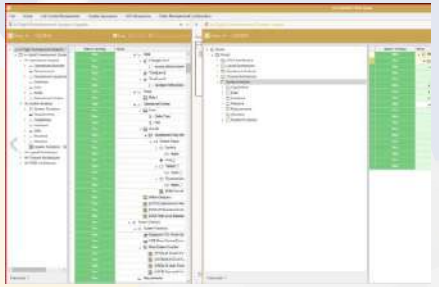


1- INTEROPERABILITY AT CONNECTION LEVEL



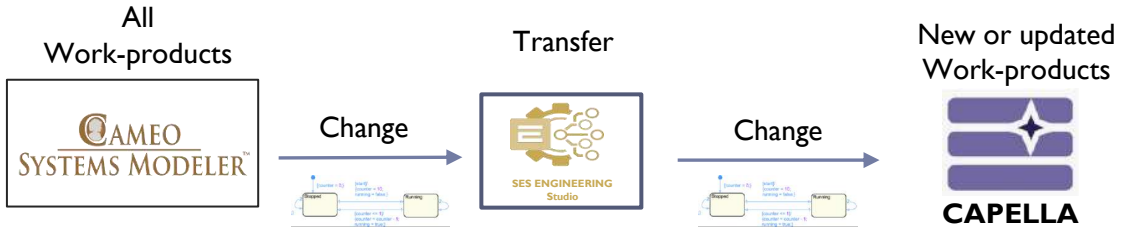


Interoperability:
Model's flow (Cameo->Capella) (5.55 min)

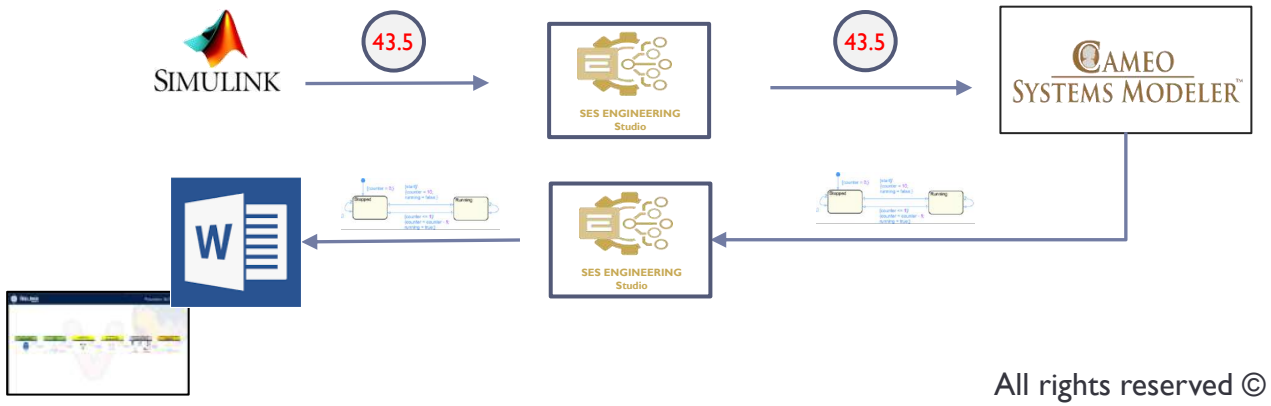


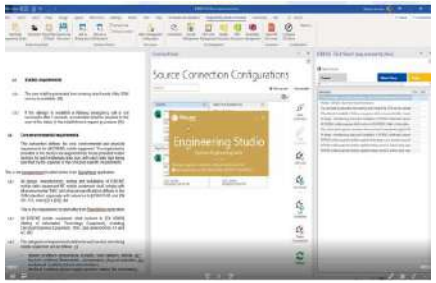
Interoperability:
Model's flow (Capella-Cameo) (3.45 min)

2- INTEROPERABILITY AT CONNECTION LEVEL: Synchronization



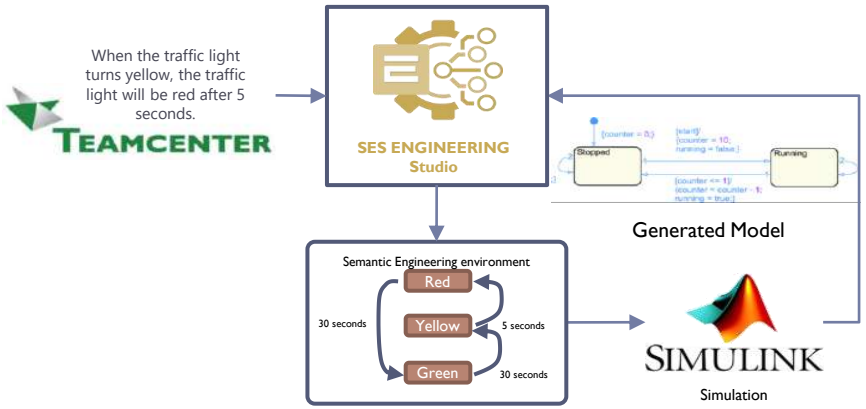
3- INTEROPERABILITY AT WORKPRODUCT LEVEL

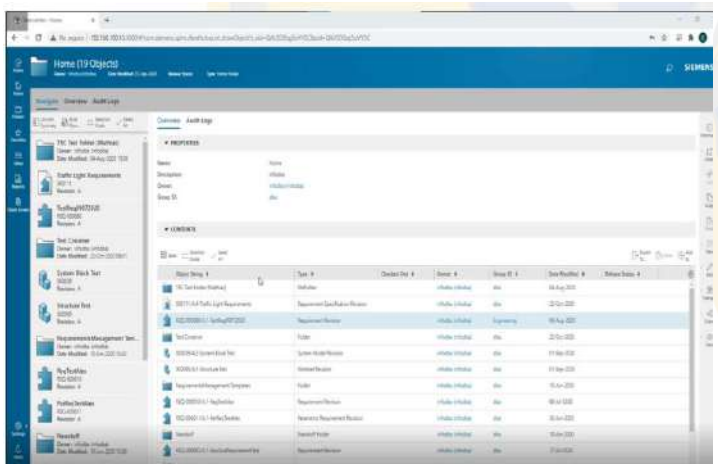




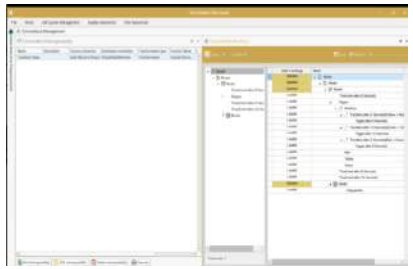
Interoperability:
Requirements Simulation (Word-Excel) (4.47 min)

Interoperability at Connection Level: Demos

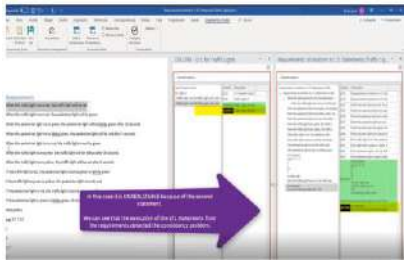




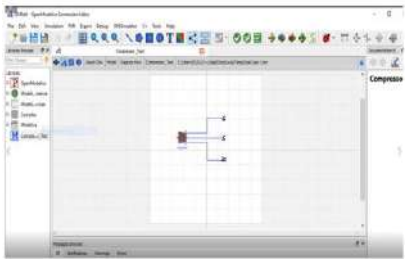
Automatic Generation of Simulink State Machines from Requirements (3.01 min)



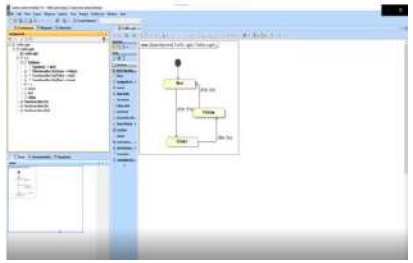
Automatic Generation of SysML from Requirements (4.03 min)



Automatic Generation of Linear Temporal Logic (LTL) from Requirements (3.23 min)

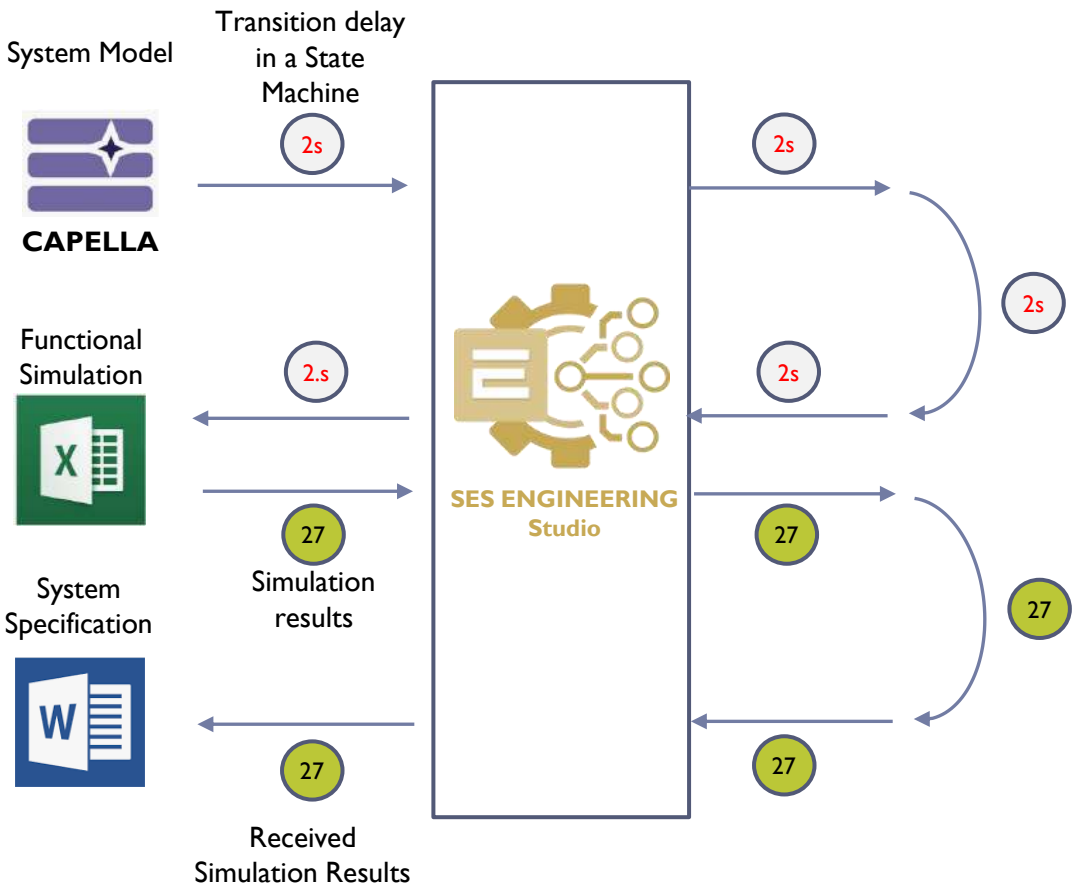


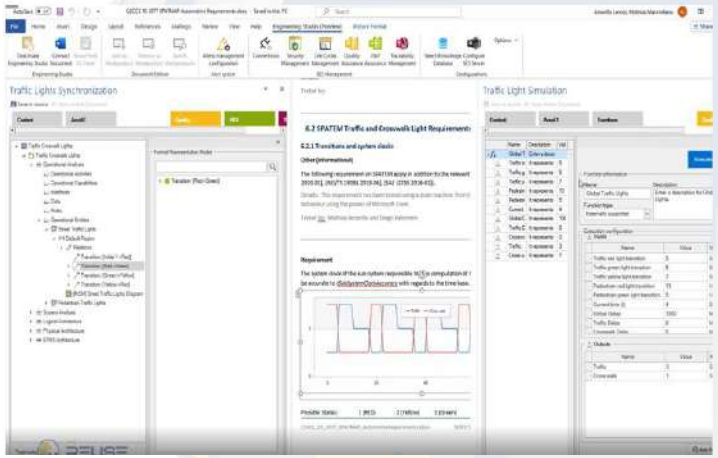
Automatic Generation of MODELICA Models from Requirements (3.52 min)



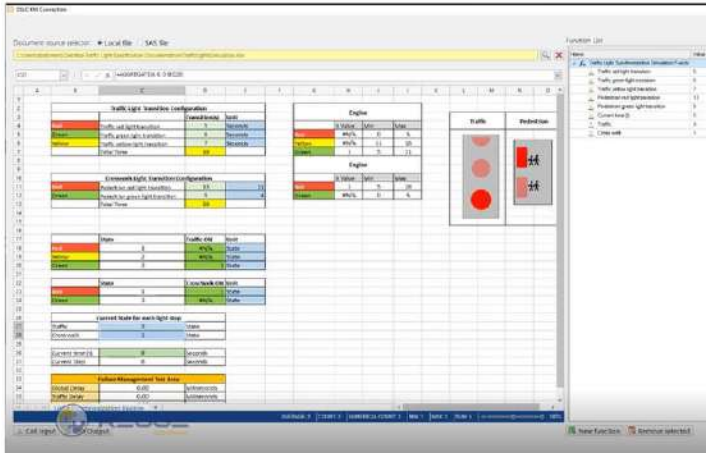
Interoperating Models: Magic Draw-Simulink (1.20 min)

Interoperability Models / Functions / Requirements Documents



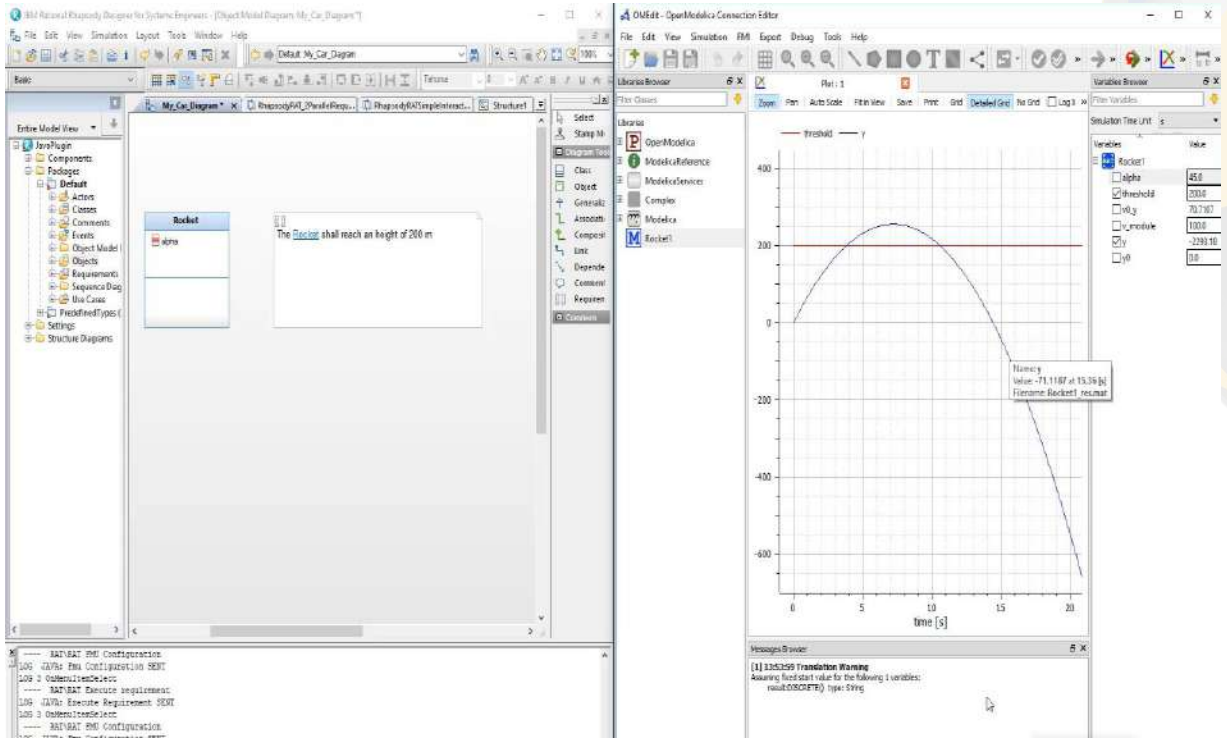


SES ENGINEERING Studio
Interoperability: Models Simulation (Capella – Excel - Word) (13.15 min)



SES ENGINEERING Studio
Capella – Word – Excel: Requirements Extraction and Management, Traceability, CRUD, Quality, Authoring, Simulation against Excel (24.45 min)

1.49

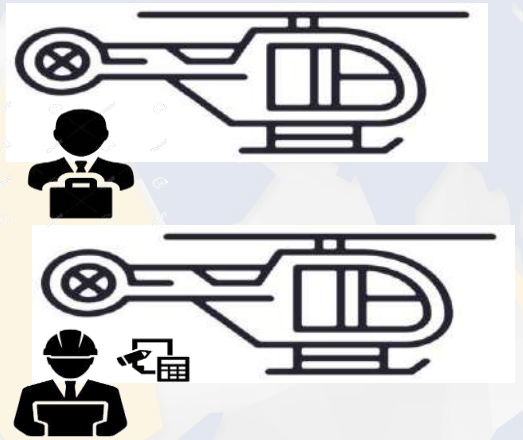


Executing Requirements using FMU and Rhapsody (4.27 min)

Security & Accessibility

Quality Management

- Assessing and Managing Quality-



V&V Management

- Evidencing Right & Right -

Traceability Management

- Assuring flow of thoughts is explicit -

Configuration Management

- Managing evolution and change within complex structures -

Technical Management support in SES ENGINEERING Studio

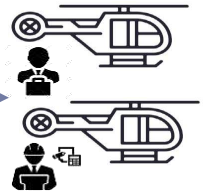
Connector to Work-products

Connection

More than 40 connectors

Traceability Management

Quality Management

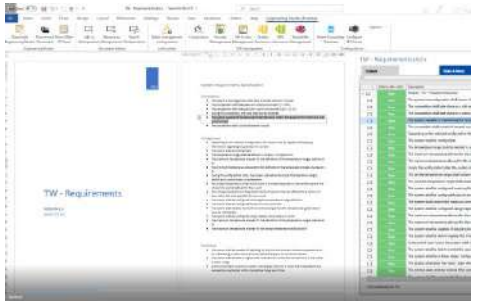


V&V Management

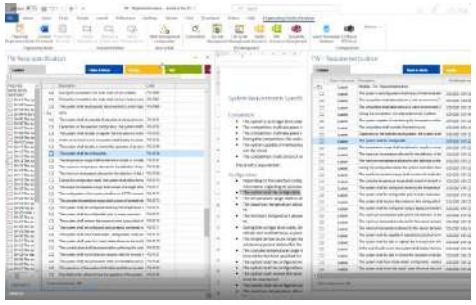
Security & Accessibility

TECHNICAL MANAGEMENT PROCESSES
Project planning process
Project assessment and control process
Decision management process
Risk management process
Configuration management process
Information management process
Measurement process
Quality assurance process

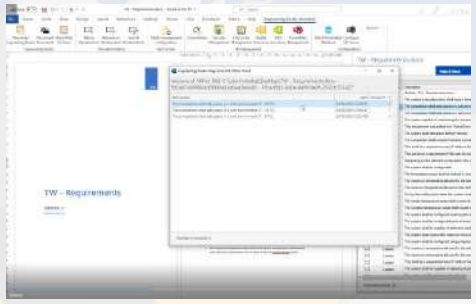
ORGANIZATIONAL PROJECT-ENABLING PROCESSES
Life cycle model management process
Infrastructure management process
Portfolio management process
Human resource management process
Quality management process
Knowledge management process



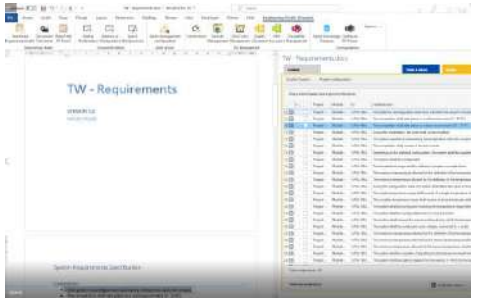
RMS inside MS Word – Creating the Connection and editing requirements (5.50 min)



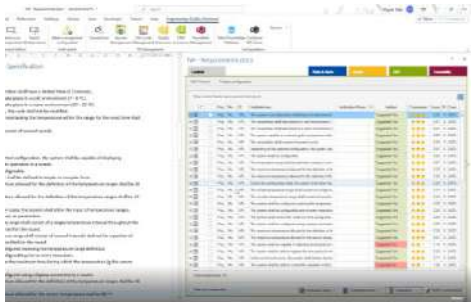
RMS inside MS Word – Managing Traceability (3.48 min)



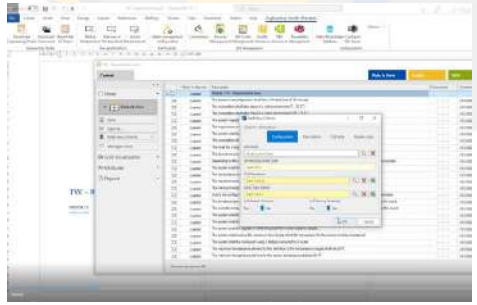
RMS inside MS Word – Managing Versions (3.03 min)



RMS inside MS Word – Managing Quality and Authoring with RAT (2.17 min)



RMS inside MS Word – Managing V&V (1.55 min)



RMS inside MS Word – Managing Attributes (4.30 min)

4.30

Change Management in MS Word (6.50 min)

Connector to Work-products

Connection

SES ENGINEERING Studio

Work-products representation

Connector to Work-products

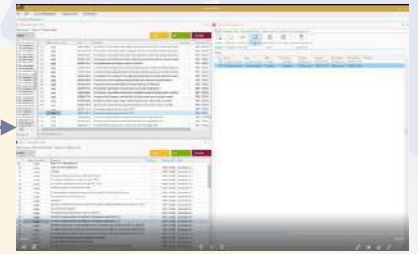
CAMEO SYSTEMS MODELER

Connection

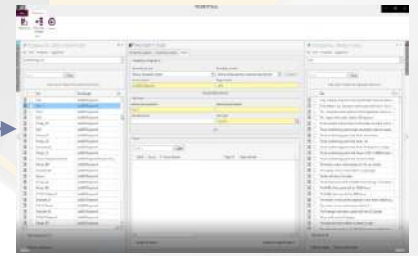
SES ENGINEERING Studio

Work-products representation

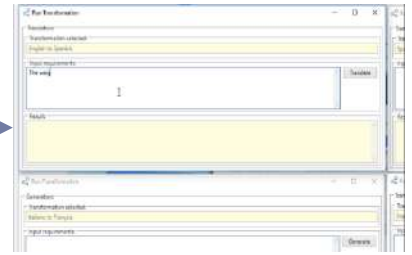
Manual or Automatic Mapping



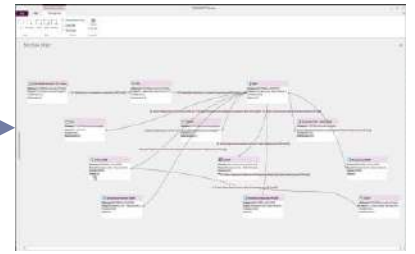
Managing Traces (6.22 min)



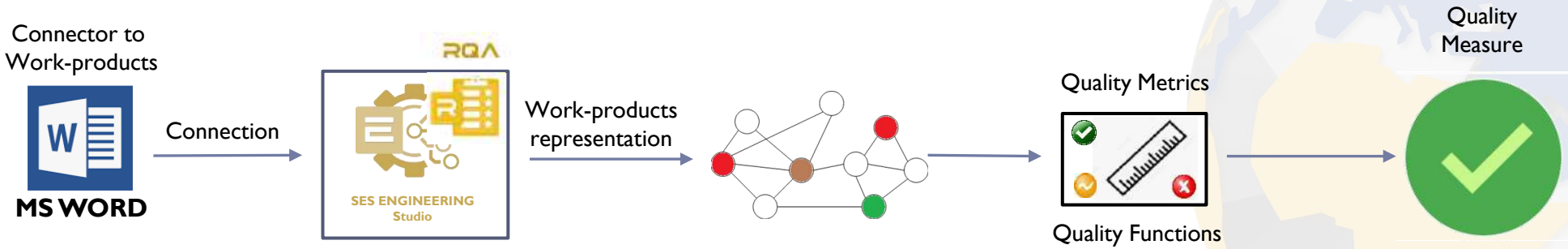
SMART Suspect Links (V18-V22)



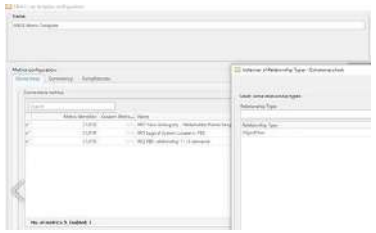
Discovering and Suggesting Traces (8.02 min)



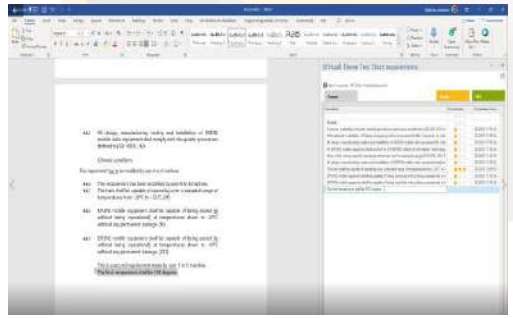
Traceability Studio V18 full Demo (44.28 min)



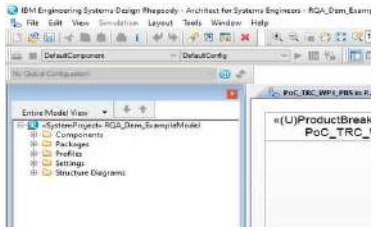
CCC Demo using a Railway example (28 min)



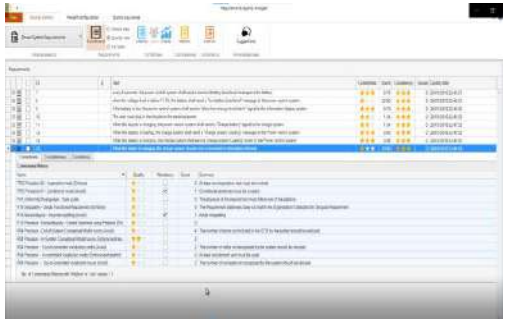
Models Quality Patterns (Rhapsody) (5.38 min)



Managing the Quality of MS Word Requirements (9.44 min)

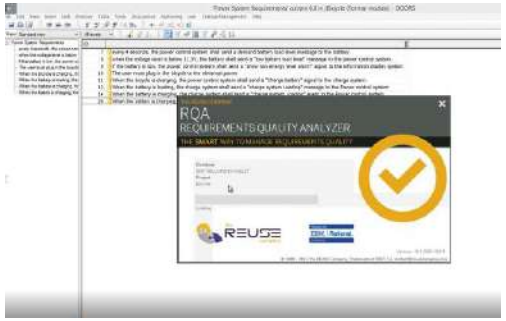


Models Quality Checking (Rhapsody) (9.58 min)



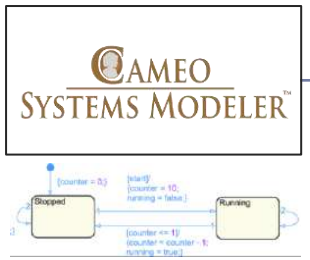
Requirements Quality Assessment and Management (4.42 min)

Models Quality Reporting (Rhapsody) (2.07 min)



RQA Quality Studio and RAT (V15) in IBM DOORS (4.42 min)

Items to be VERIFIED / VALIDATED

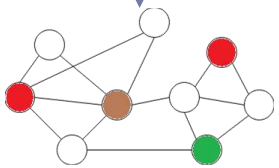


Connection

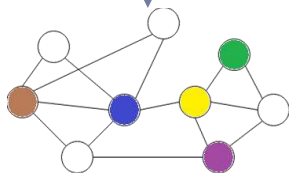
SES ENGINEERING Studio

Connection

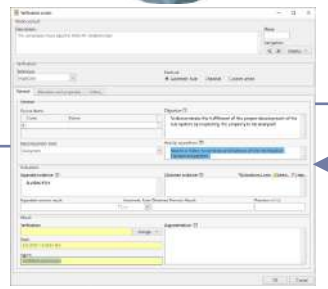
SOURCE Items



Items to be VERIFIED / VALIDATED



Source Items (Requirements, etc.)

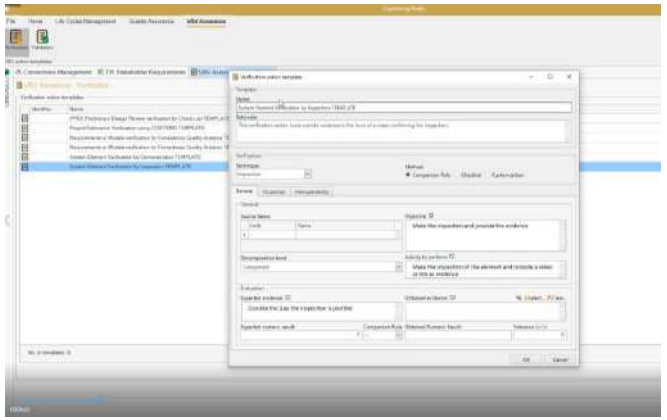


Evidences stored in a Verification Action (VA)

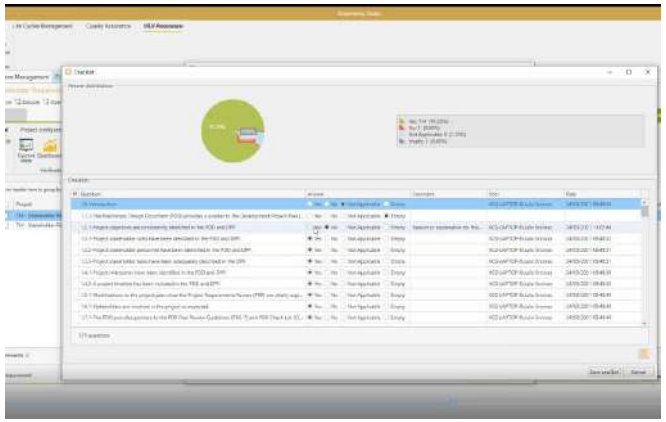
Connection

External Tools Support

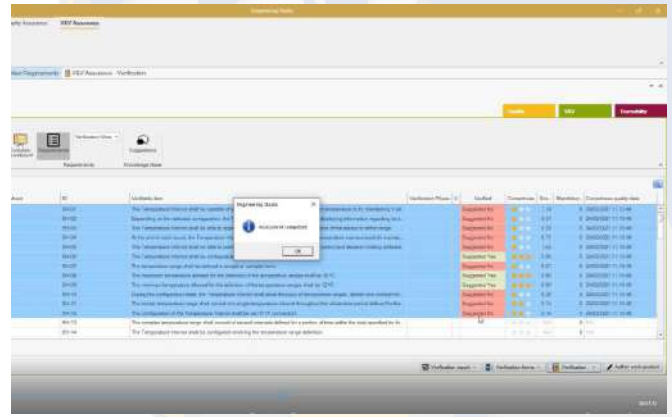
SES Engineering Studio - V&V Edition video snippets



V&V Studio (Manage VA Templates) (3.07 min)

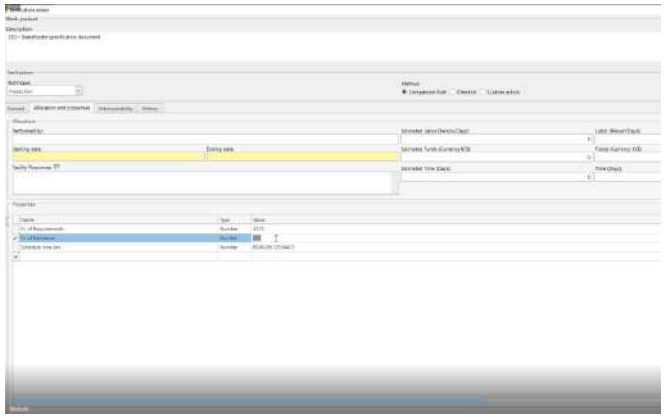


V&V Studio (VAs as Check Lists) (2.30 min)

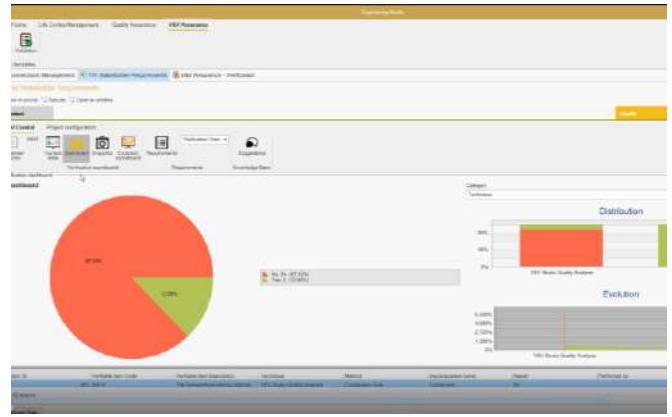


V&V Studio (VAs using Quality Assessment) (2.29 min)

V&V Studio (Manual Evidences) (3.07 min)

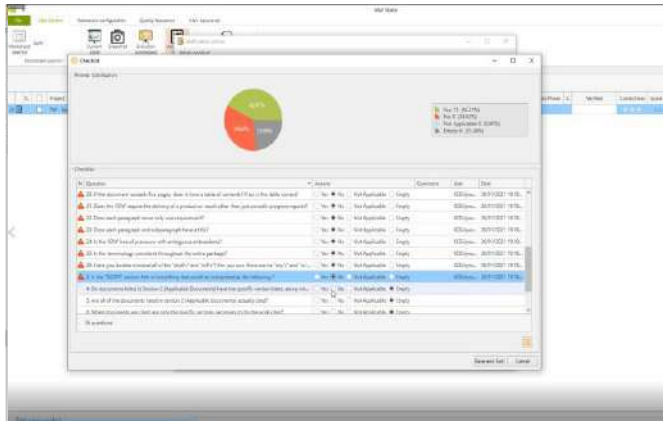


V&V Studio (VAs calculated with Excel) (3.18 min)

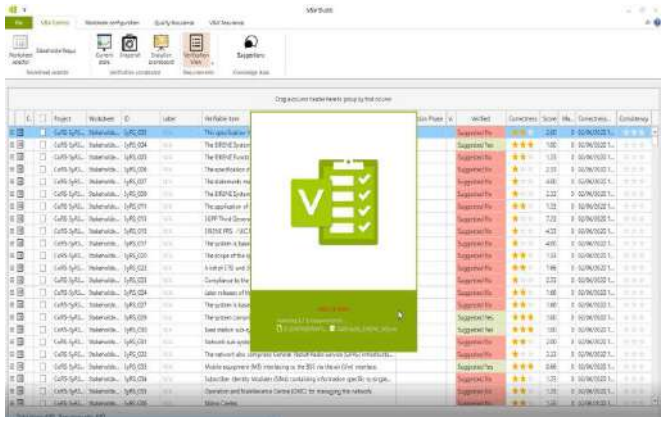


V&V Studio (V&V Evolution and Scoreboard) (5.28 min)

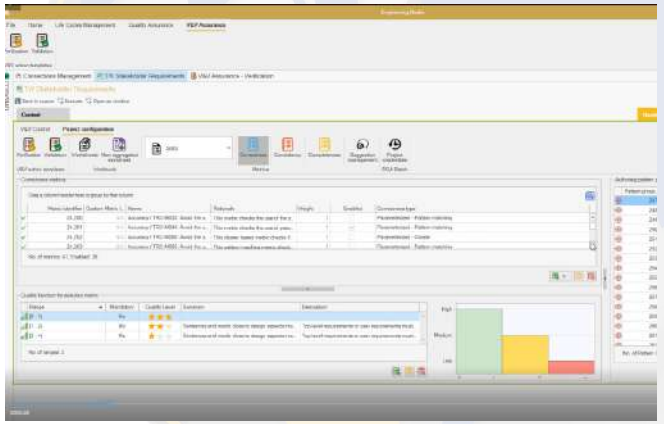
15.36



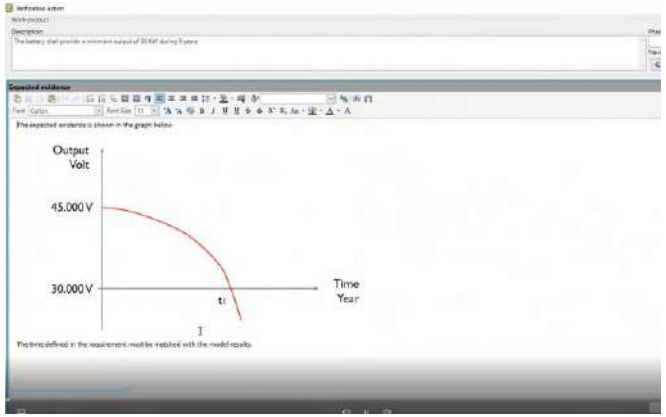
V&V Studio (Custom Check List against Excel) (11.46 min)



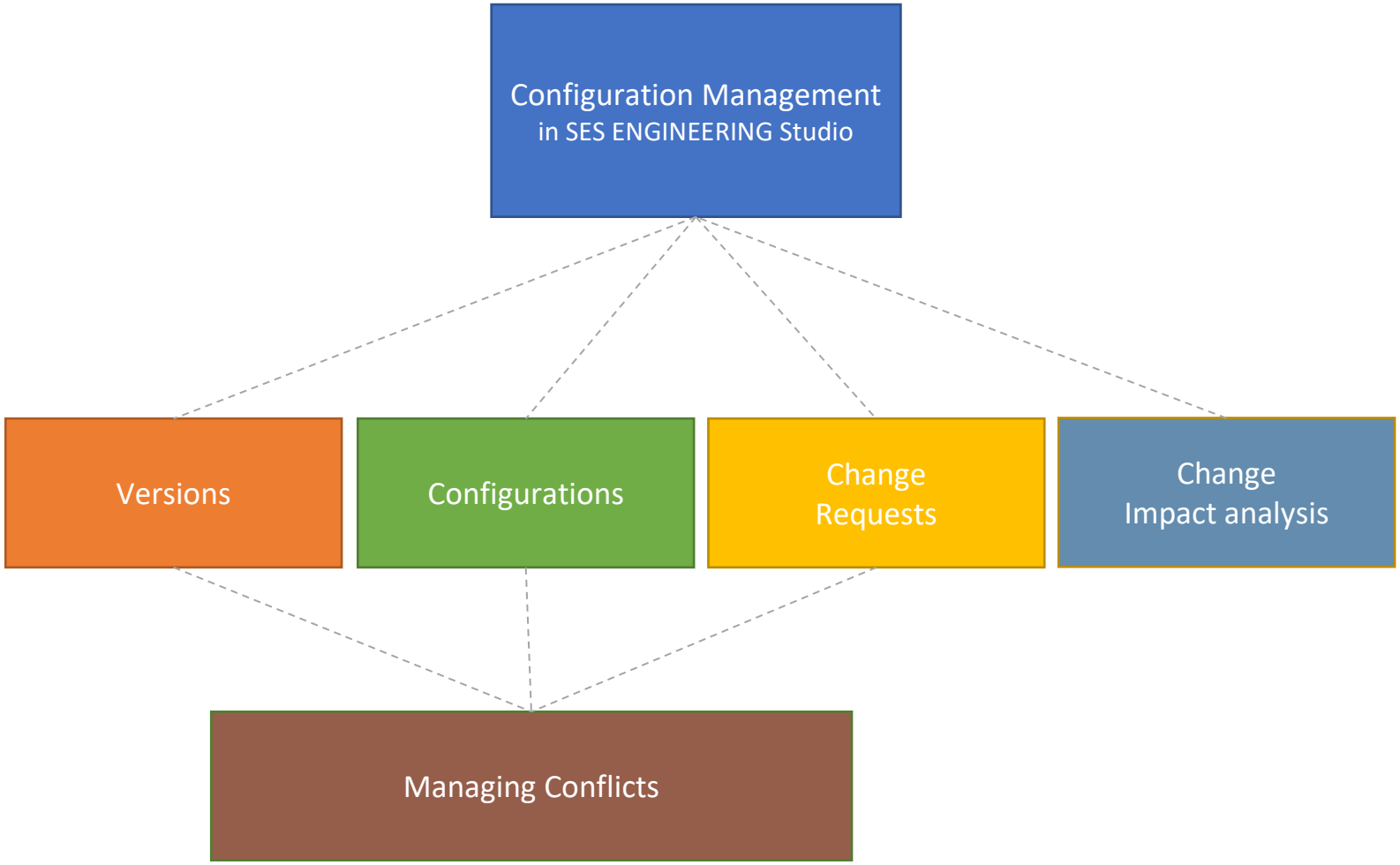
V&V Studio (V18) Webinar Presentation (16.32 min)



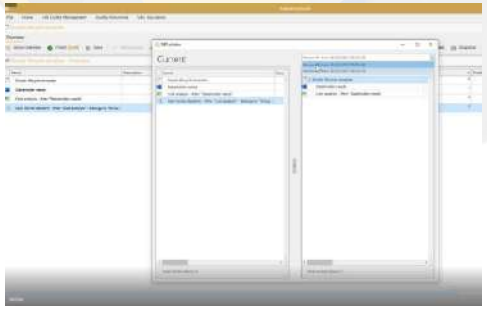
V&V Studio (Full 6 videos demo) (17.33 min)



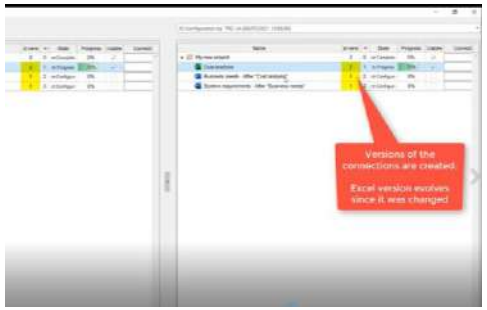
V&V Studio (V18) VA Executing FMU (2.20 min)



Change Management in MS Word (6.50 min)



Providing Versions to Lifecycle Templates (3.29 min)



Providing Configurations to Projects (4.50 min)

Systems Engineering Life Cycle Management (SELM)

SES ENGINEERING Studio (SES)

CONNECTIVITY

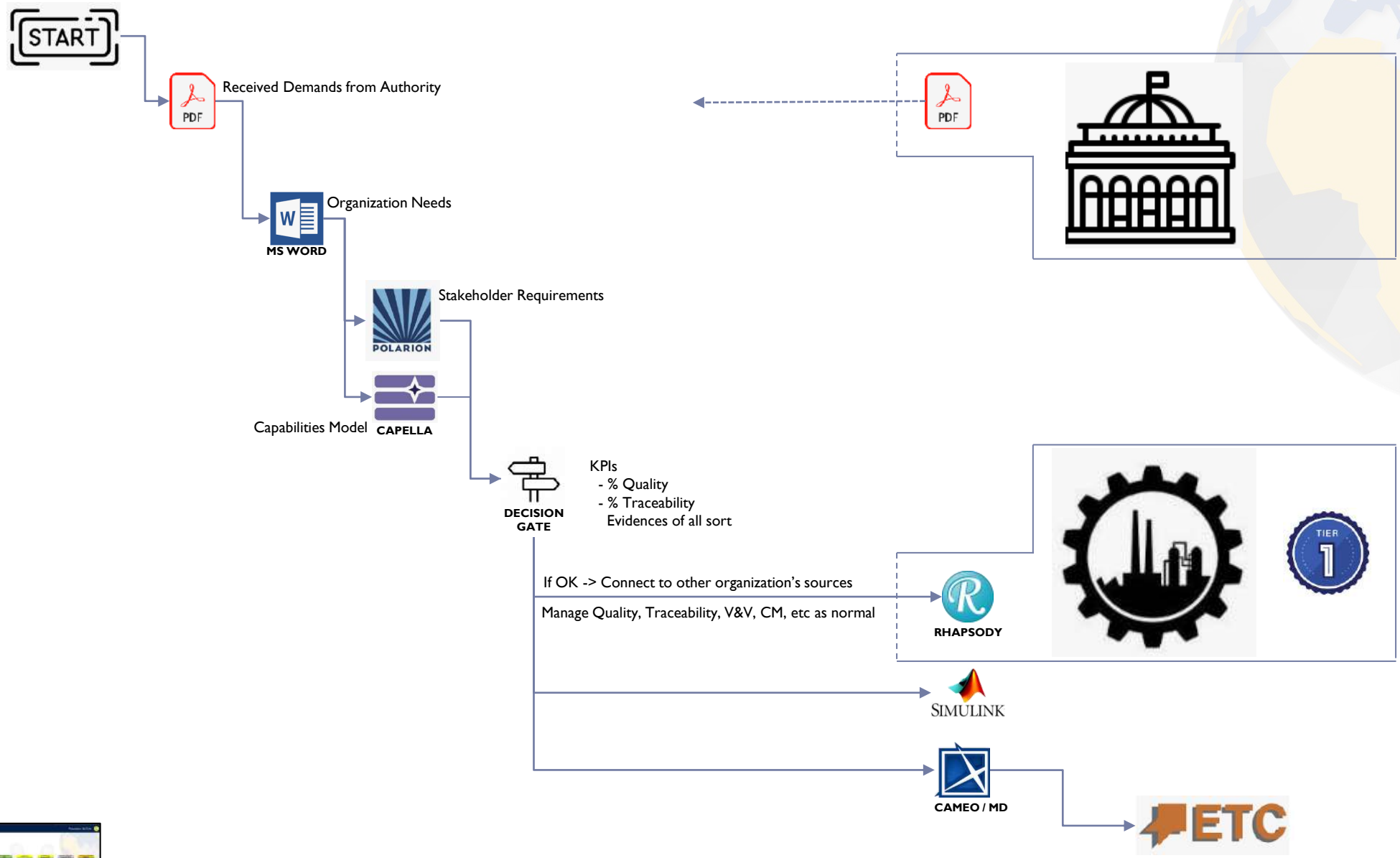
INTEROPERABILITY between connections

TECHNICAL MANAGEMENT Processes Digitalization

LIFECYCLE MANAGEMENT Digitalization

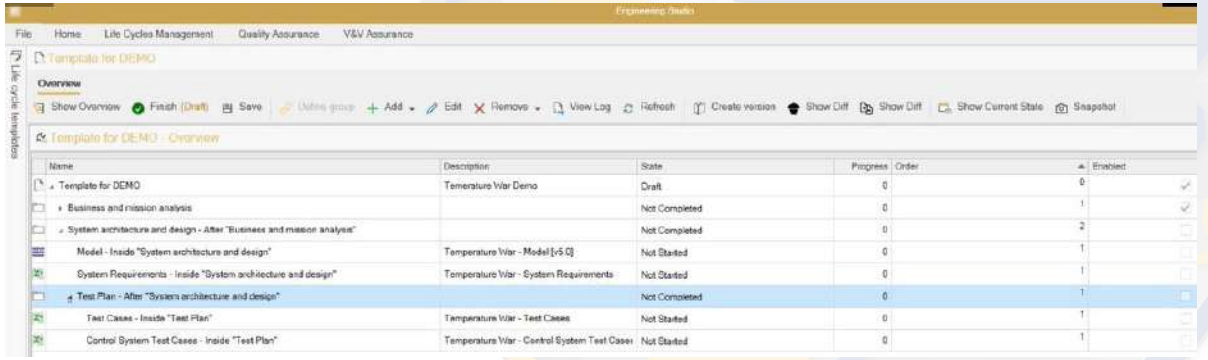
Lifecycle Management

Lifecycle Management Concept in SES ENGINEERING Studio

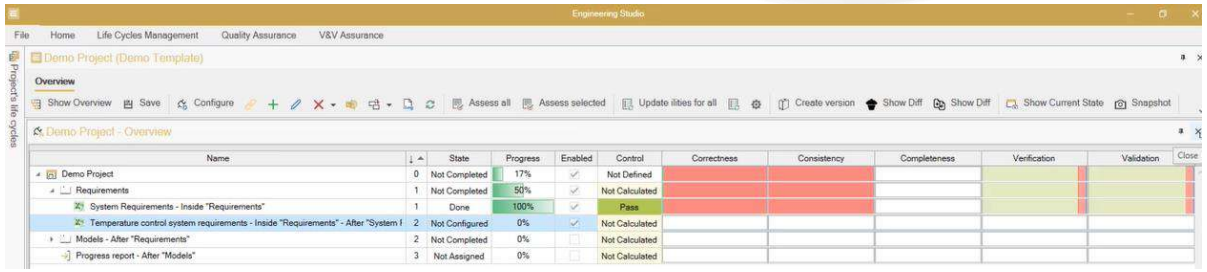


Lifecycle Model Management : Capabilities

- Lifecycle template
  - Reusable and instantiable into projects
  - Defines Activities as connectors / connections
  - Defines Folders to group activities
  - Defines Decision Gates to manage project evolution and collect evidences.
  - Defines a Workflow to manage how to proceed with the activities



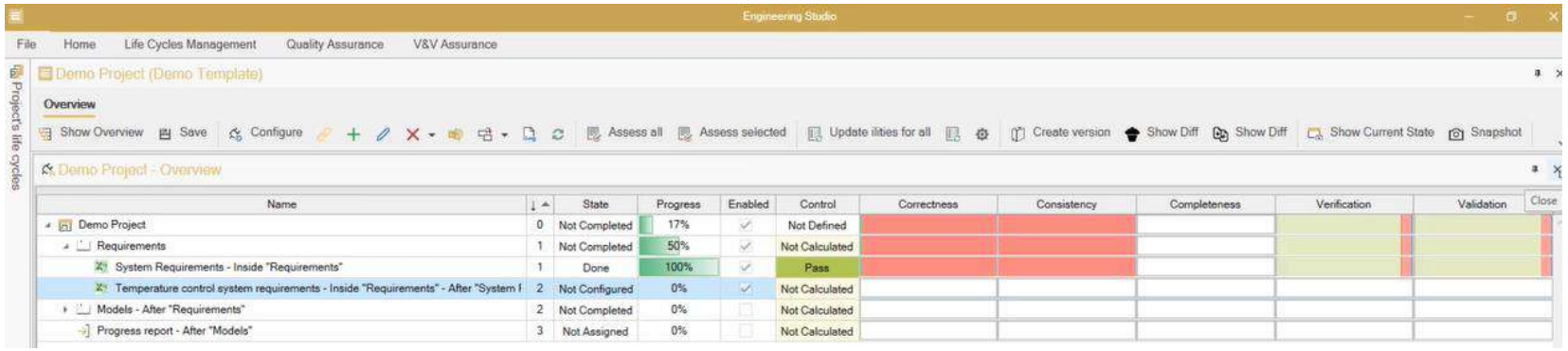
- System Project
  - Created instantiating Lifecycle template and/or by defining specific activities
  - Allows to operate "with and in" the connections (CRUD)
  - Allows to interoperate between connections
    - For automatization purposes
  - Operates the workflow
  - Monitors the progress by help of technical management processes
  - Every Activity can be assigned an activity control (Verification Action)
    - To digitalize the evidences management
    - To automatically review the Activity
  - A project can be used as image to define a Lifecycle template



- One Project opened at a time

- Project Views:
  - Performance View
  - Gantt View
  - Dashboard View

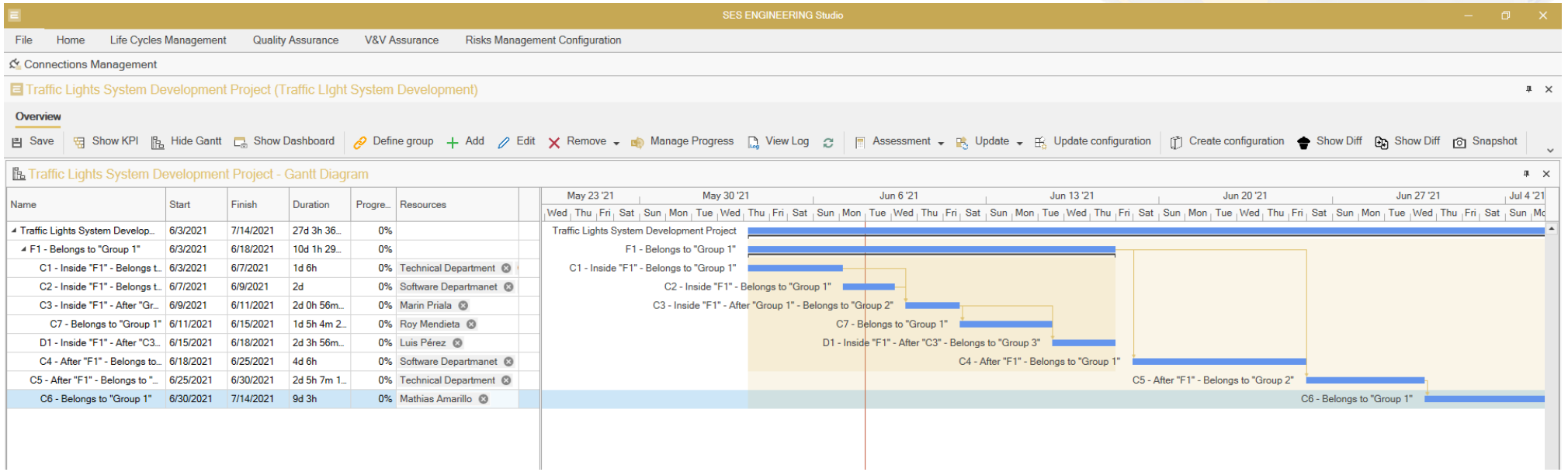
- Performance View



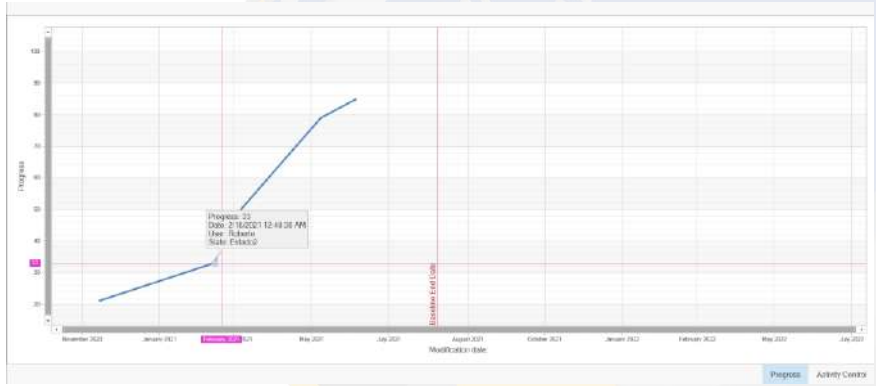
- Activity Control (a Verification Action for the Activity)
- Performance KPIs
  - Connection's work-products Correctness KPI
  - Connection's work-products Consistency KPI
  - Connection's work-products Completeness KPI
  - Connection's work-products Verification KPI
  - Connection's work-products Validation KPI
  - Connection's work-products Traces Completeness KPI
  - Connection's work-products Suspect Links KPI

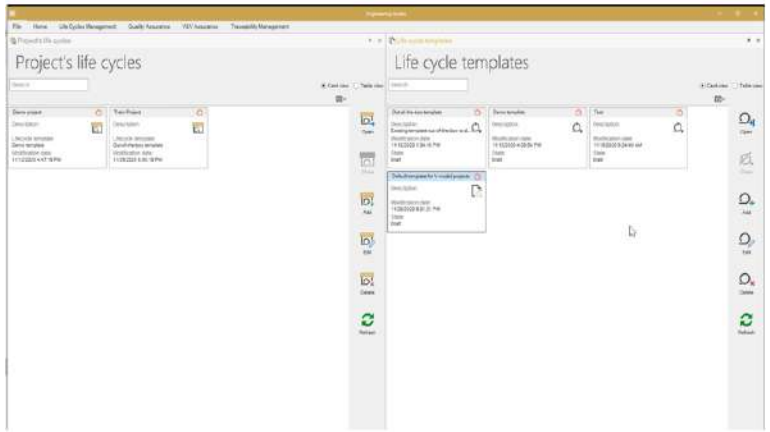
Temporal Resources View

- Temporal / Resources View (GANTT)
  - Baselines
  - Activity's starting and ending dates
  - Dependencies between each activity
    - Show inconsistent dependencies
  - Progress
  - Assign Resources
  - Drag and move tasks

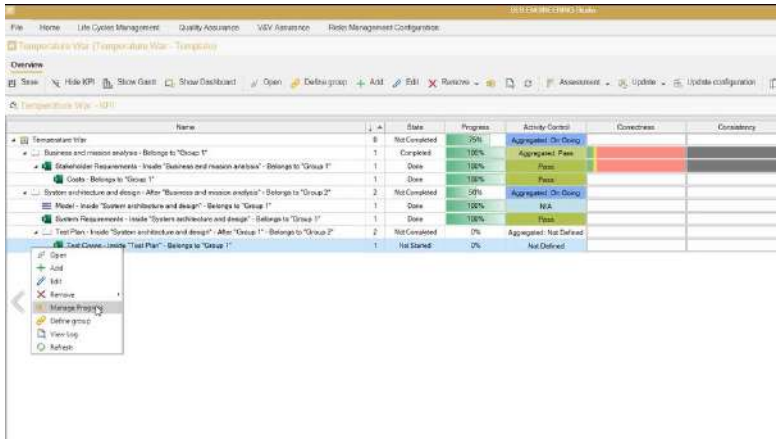


- Dashboard
  - Compiling the project information at any stage
- Security Management
  - At connection level
  - At functional level
- Communications policy
  - At functional level
  - At result level
- Configuration Management and Version Control
  - Project Status versions = a System Configuration
    - Activities Versions / Decision Gates Versions
    - Traceability Version
  - Templates Versions

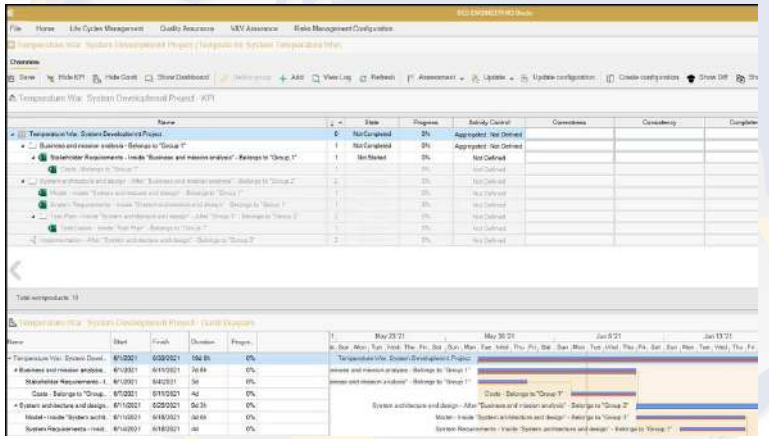




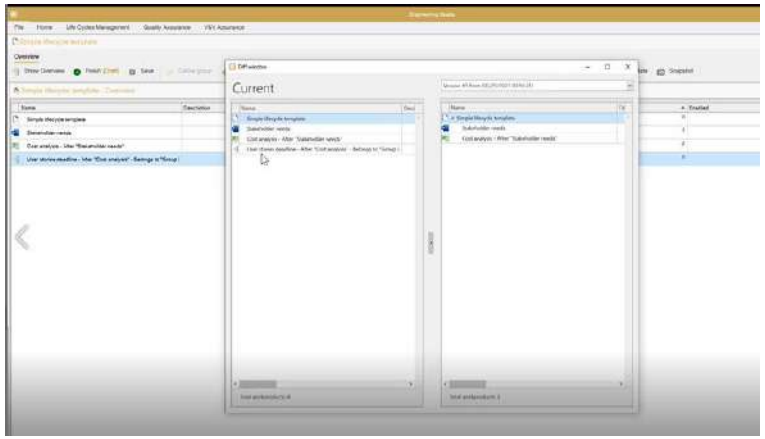
System Lifecycle Management – Creating Lifecycle Template



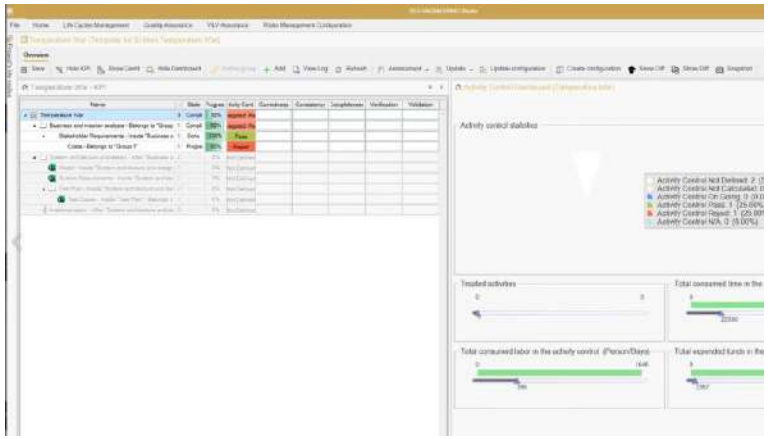
System Lifecycle Management – Managing Project using KPIs (4.03 min)



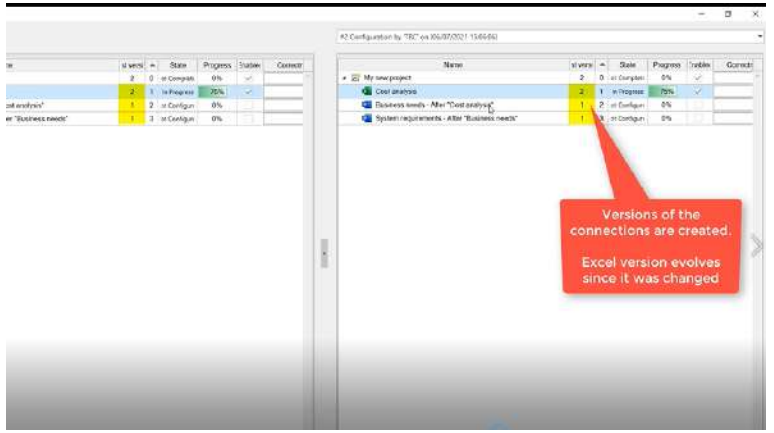
System Lifecycle Management – Managing Time and Resources (4.55 min)



System Lifecycle Management – Versioning Templates



System Lifecycle Management – Dashboard (1.34 min)



Providing Versions to Projects (4.50 min)

SUMMARY

- SES ENGINEERING Studio offers solutions for the digital management of the Systems Engineering Lifecycle by:
  - Connecting to your existing TOOL Ecosystem
  - Allowing process integration and automatization by applying Interoperability between connections
  - Offering complete technical management support to whatever Connection, independently of the origin and the nature of the source tool (or file)
    - quality analysis, IV&V, traceability, configuration management, decision management, knowledge management
  - Providing the possibility to create Life cycle workflows (with dependencies and decision gates) by simply selecting the preferred source tools of your ecosystem

Interested?

- Contact us at contact@reusecompany.com

Or

- Contact directly the presenter

Requirements Management: Managing data over entire life cycles

Management of requirements according to ISO/IEC/IEEE 29148

June 14, 2022 June 16, 2022