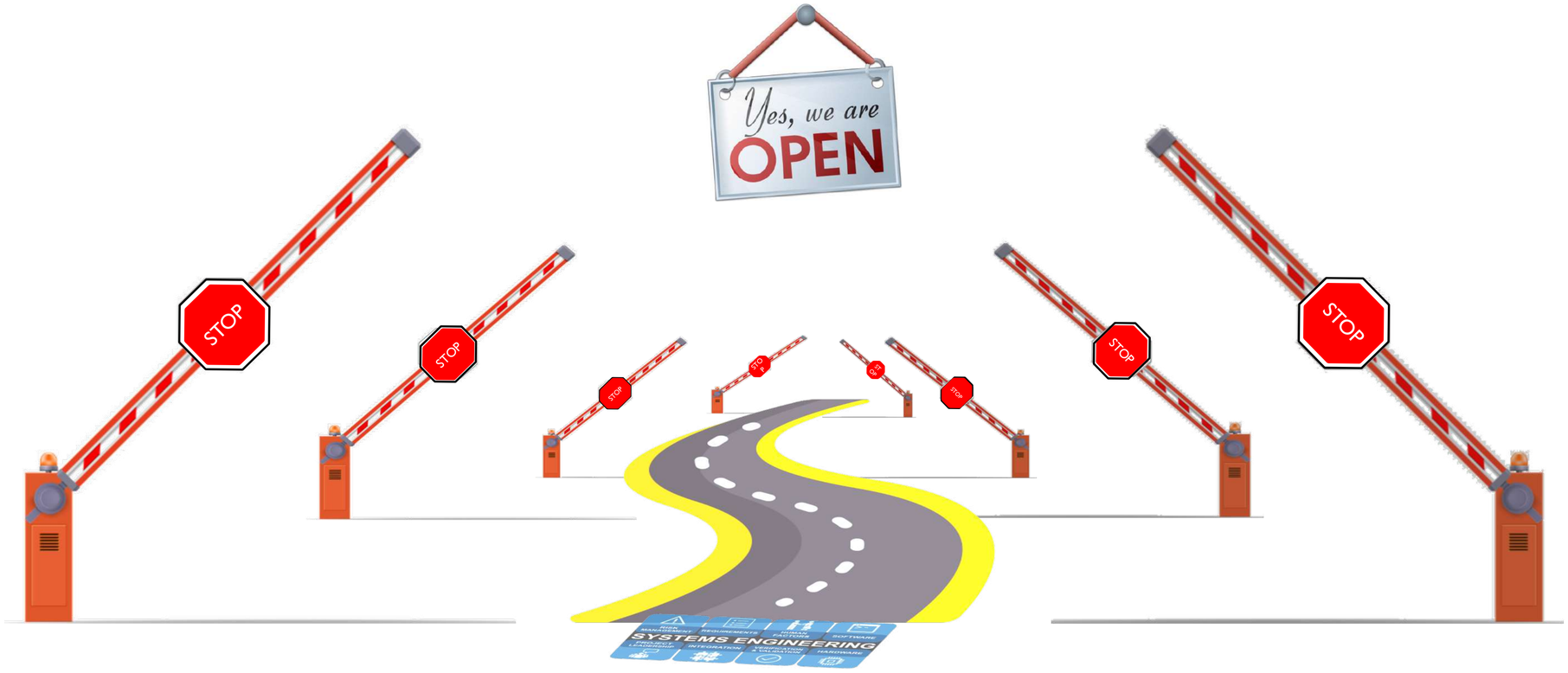
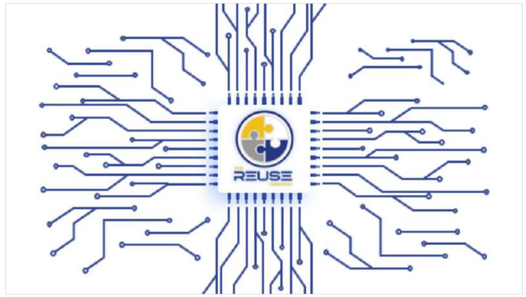


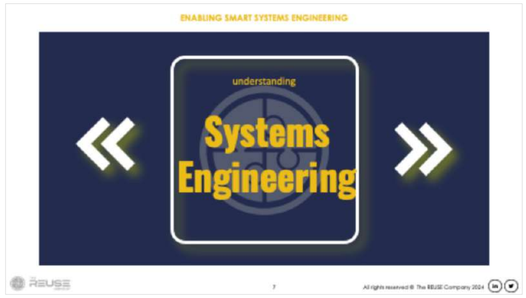
A Passport towards a digital thread without frontiers… or boundaries

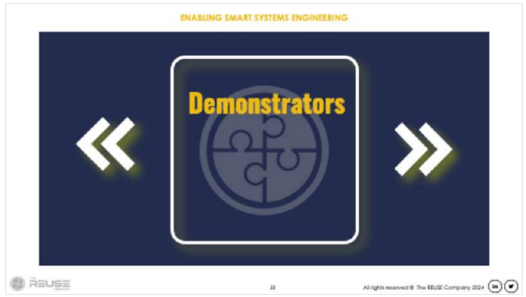
The REUSE Company
juan.llorens@reusecompany.com

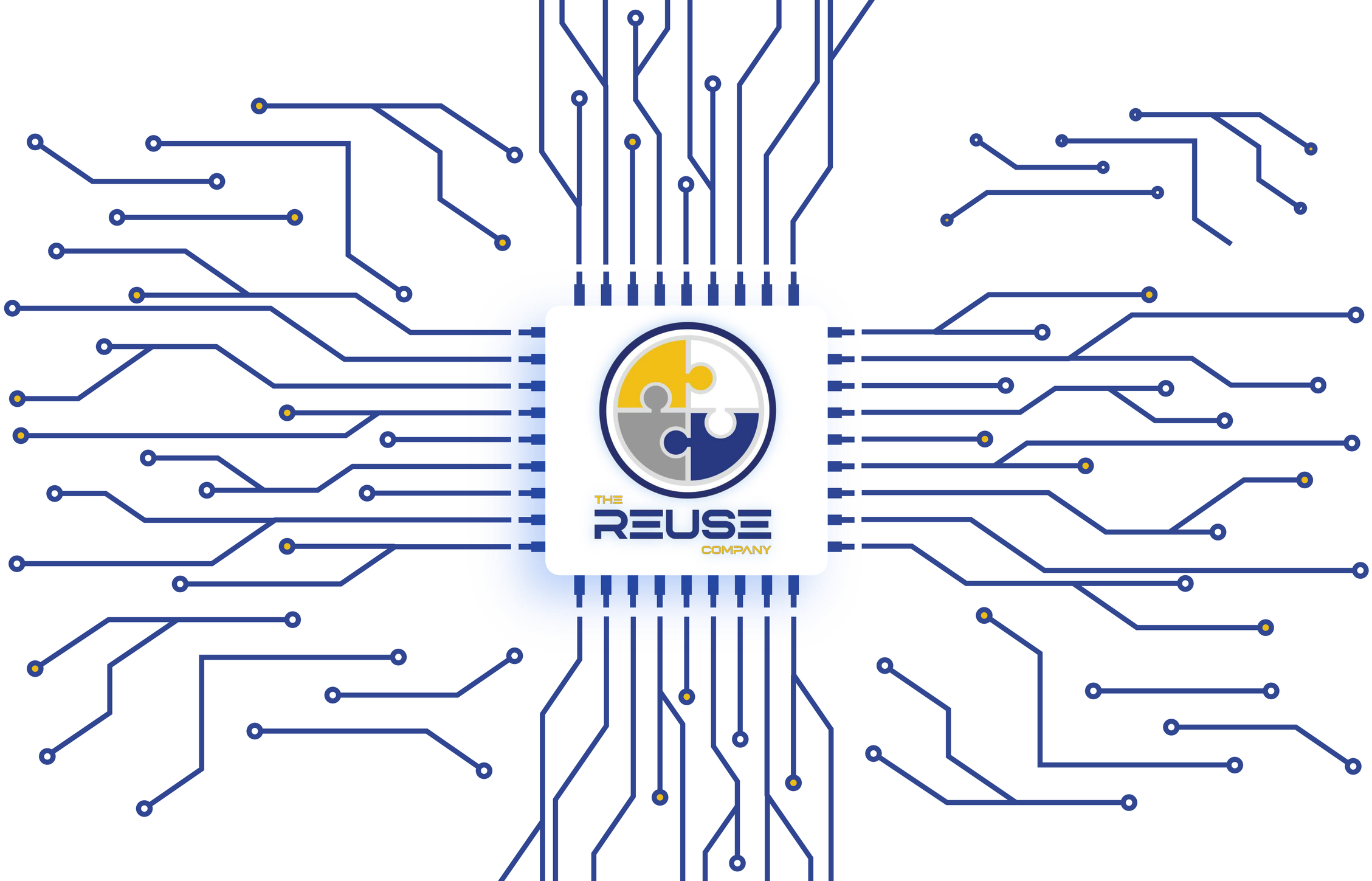
Dr. Juan Llorens

- CTO at The REUSE Company
- Systems Engineering Professor at Universidad Carlos III de Madrid (Spain)
- INCOSE
  - Former President and Technical Director of AEIS (INCOSE Spain)
  - Member of INCOSE RWG / PLEWG / KMWG
  - CSEP / ESEP
- PhD in Robotics with SW Reuse as topic








THE
REUSE
COMPANY

"The REUSE Company is a solutions provider specialized in the application of SEMANTIC TECHNOLOGIES and ARTIFICIAL INTELLIGENCE to improve the DIGITALIZATION of the SYSTEM life cycle following the principles of KNOWLEDGE REUSE."

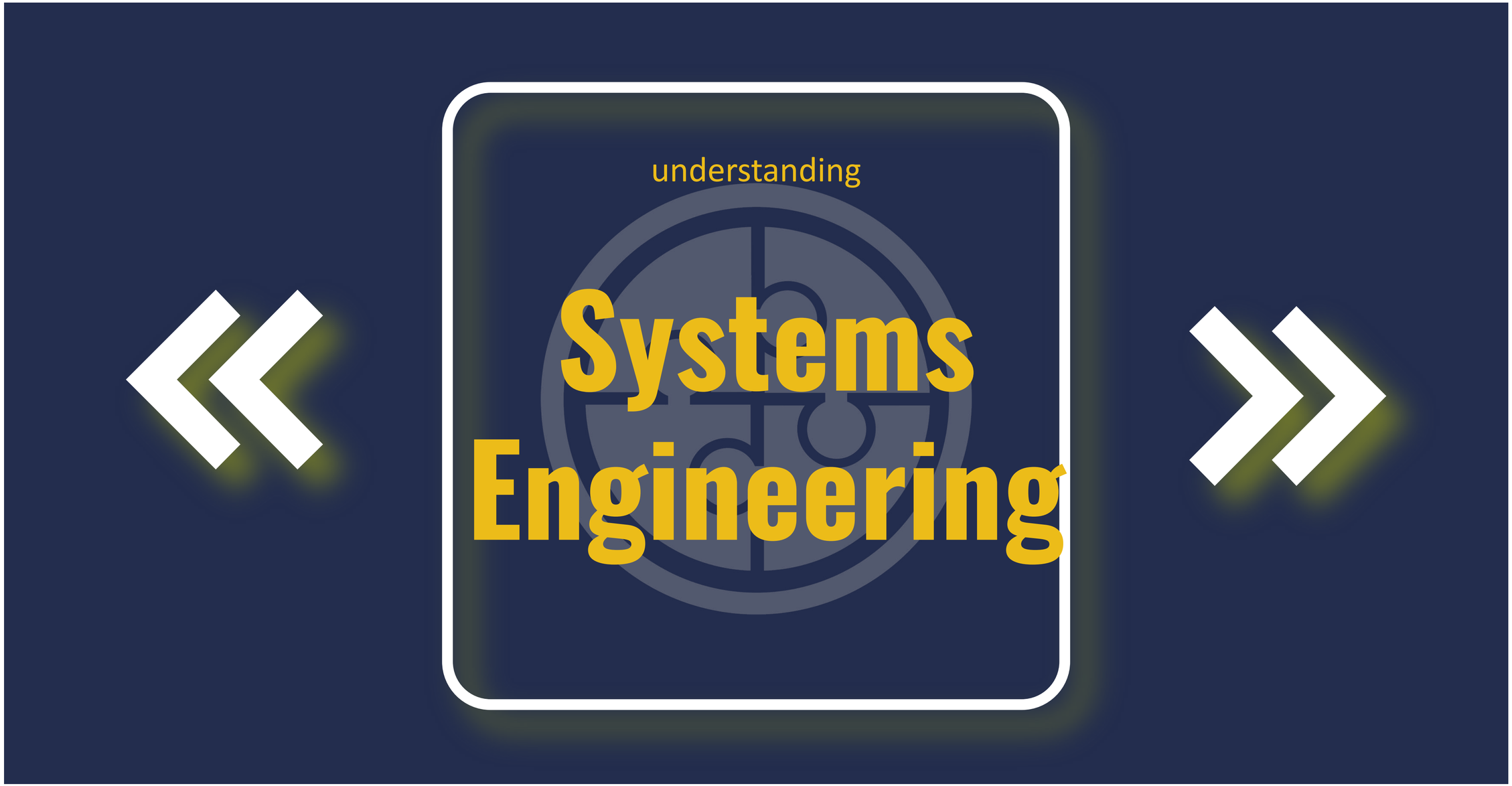
"The REUSE Company is a solutions provider specialized in the application of SEMANTIC TECHNOLOGIES and ARTIFICIAL INTELLIGENCE to improve the DIGITALIZATION of the SYSTEM life cycle following the principles of KNOWLEDGE REUSE."

We promote system life cycle management methodologies…

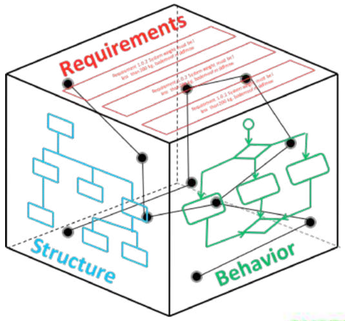
guided by reuse,
driven by a knowledge-centric + model-based approach
(=> supporting authoritative source of truth),
integrating Document Centric views inside MBSE

By…

stating an Integration Hub (Repository)
providing connectivity to all siloed tools in the ecosystem
enabling unlimited interoperability among tools
offering full support to technical management processes for all connections (as defined in ISO 15288)
digitalizing the life cycle management workflow
empowering Microsoft Productivity tools as pure SE solutions



Evolution of System Engineering (SE) to Model Based Engineering (MBE)



VIRTUAL

MODEL BASED PRODUCTION PLANNING

VIRTUAL PRODUCTION SYSTEM

MODEL BASED DEFINITION

VIRTUAL QUALIFICATION

MODELING

SIMULATION

MODEL BASED SYSTEMS ENGINEERING

VIRTUAL CERTIFICATION

BUSINESS MODEL

VIRTUAL OPERATIONS

MARKET (MISSION) MODEL

VIRTUAL SUPPORT

NEEDS

SOLUTIONS

DIGITAL THREAD

PLATFORM PRODUCT

PRODUCTION SYSTEM

SUPPORT & SERVICES

AS-NEEDED

AS-SUPPORTED

AS-OFFERED

AS-DELIVERED

DESIGN

DELIVERY

AS-SPECIFIED

AS-CERTIFIED

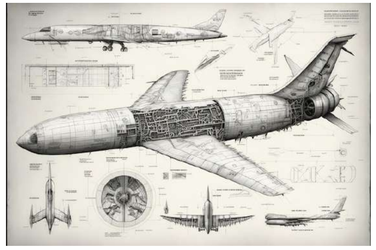
AS-DESIGNED

AS-TESTED

AS-PLANNED

AS-BUILT

PHYSICAL



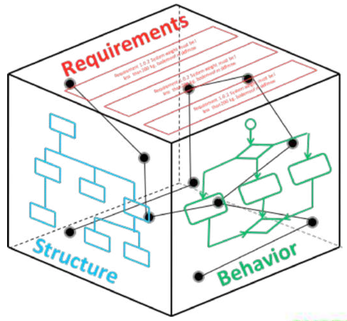
1990s SE V

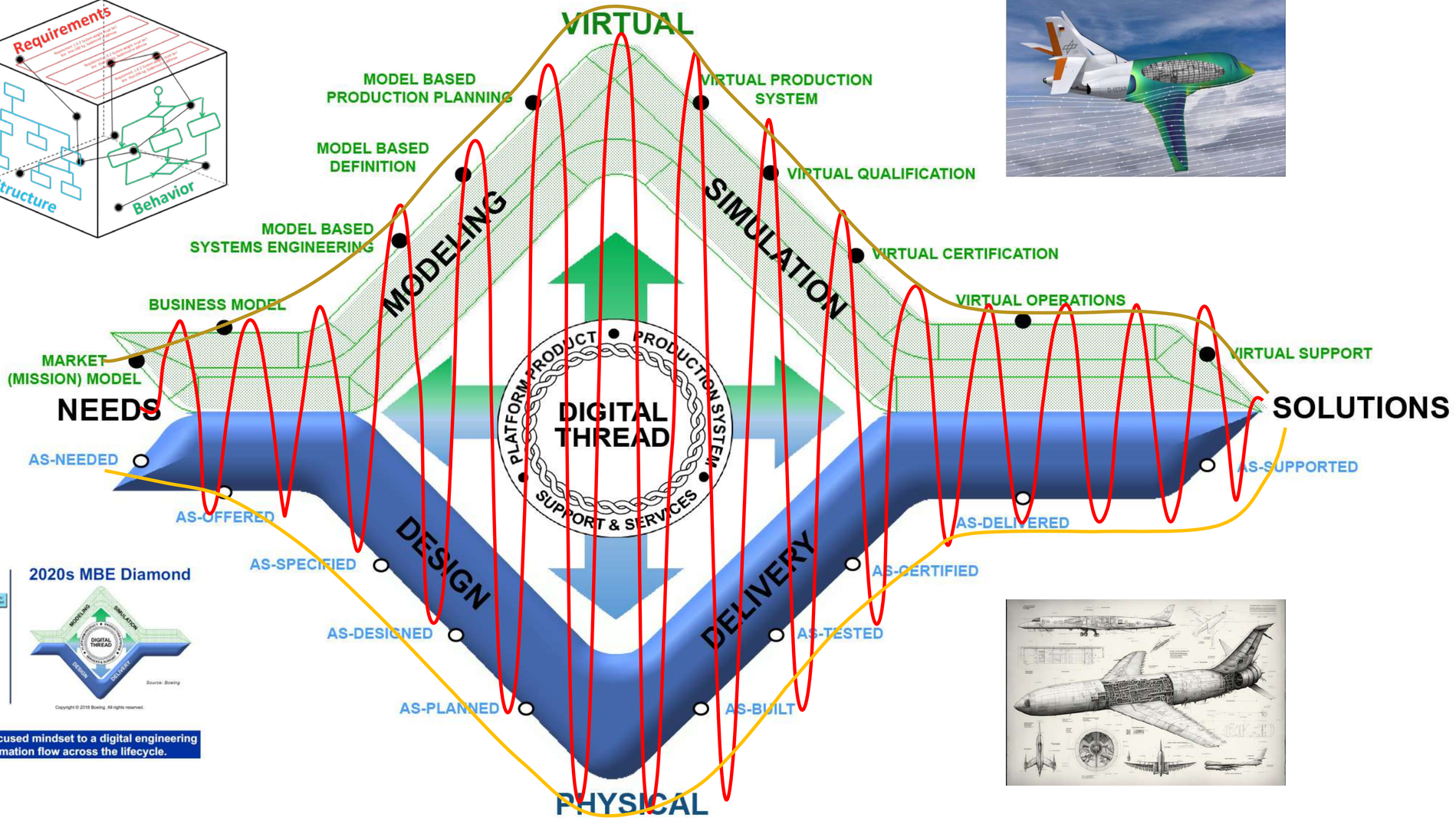
SOURCE: US Department of Transportation Federal Highway Administration

2020s MBE Diamond

Transitioning from a document-focused mindset to a digital engineering mindset that leverages information flow across the lifecycle.

Evolution of System Engineering (SE) to Model Based Engineering (MBE)



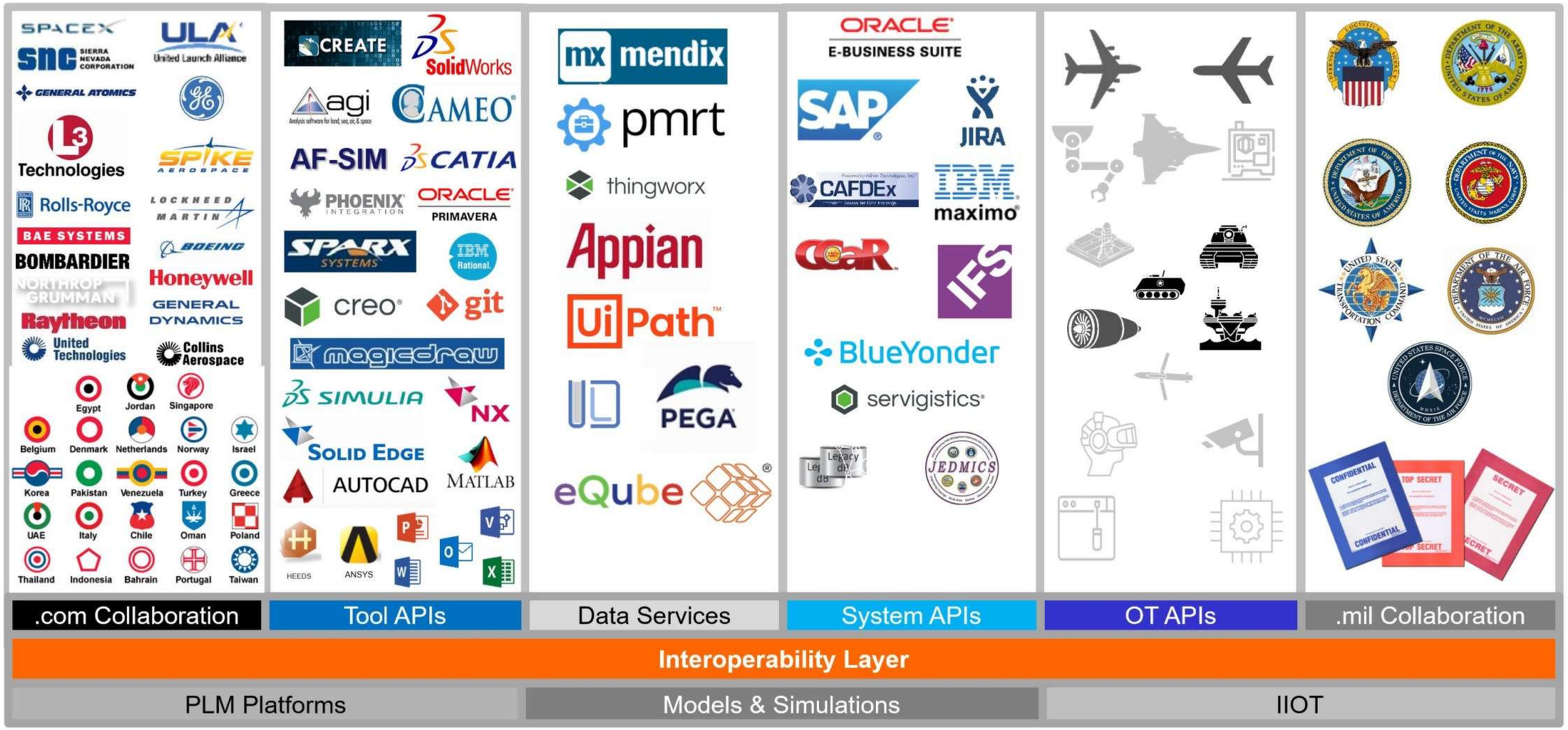


1990s SE V

2020s MBE Diamond

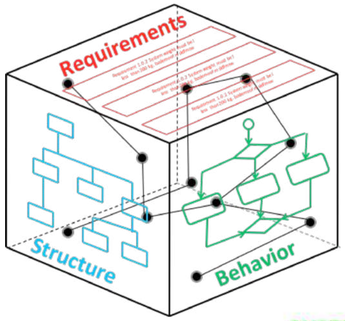
Transitioning from a document-focused mindset to a digital engineering mindset that leverages information flow across the lifecycle.

Context: Enormous Tools Ecosystem within one organization (to fulfil with modern SE)



https://www.linkedin.com/pulse/digital-engineering-interoperability-chris-sharbaugh/

Evolution of System Engineering (SE) to Model Based Engineering (MBE)



VIRTUAL

MODEL BASED PRODUCTION PLANNING

VIRTUAL PRODUCTION SYSTEM

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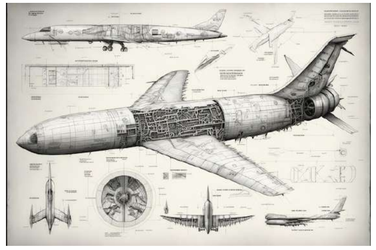
PHYSICAL



1990s SE V

SOURCE: US Department of Transportation Federal Highway Administration

2020s MBE Diamond

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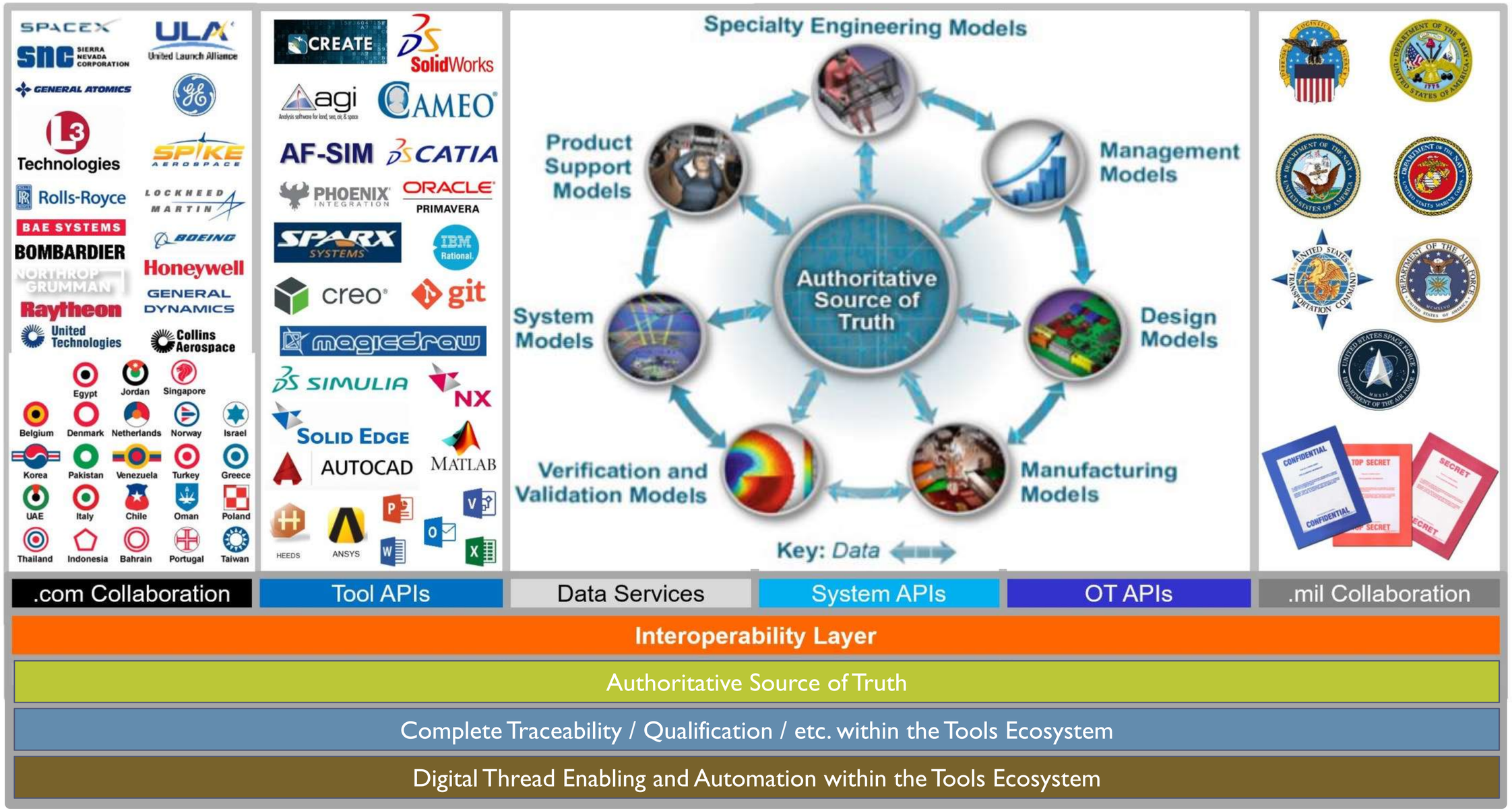
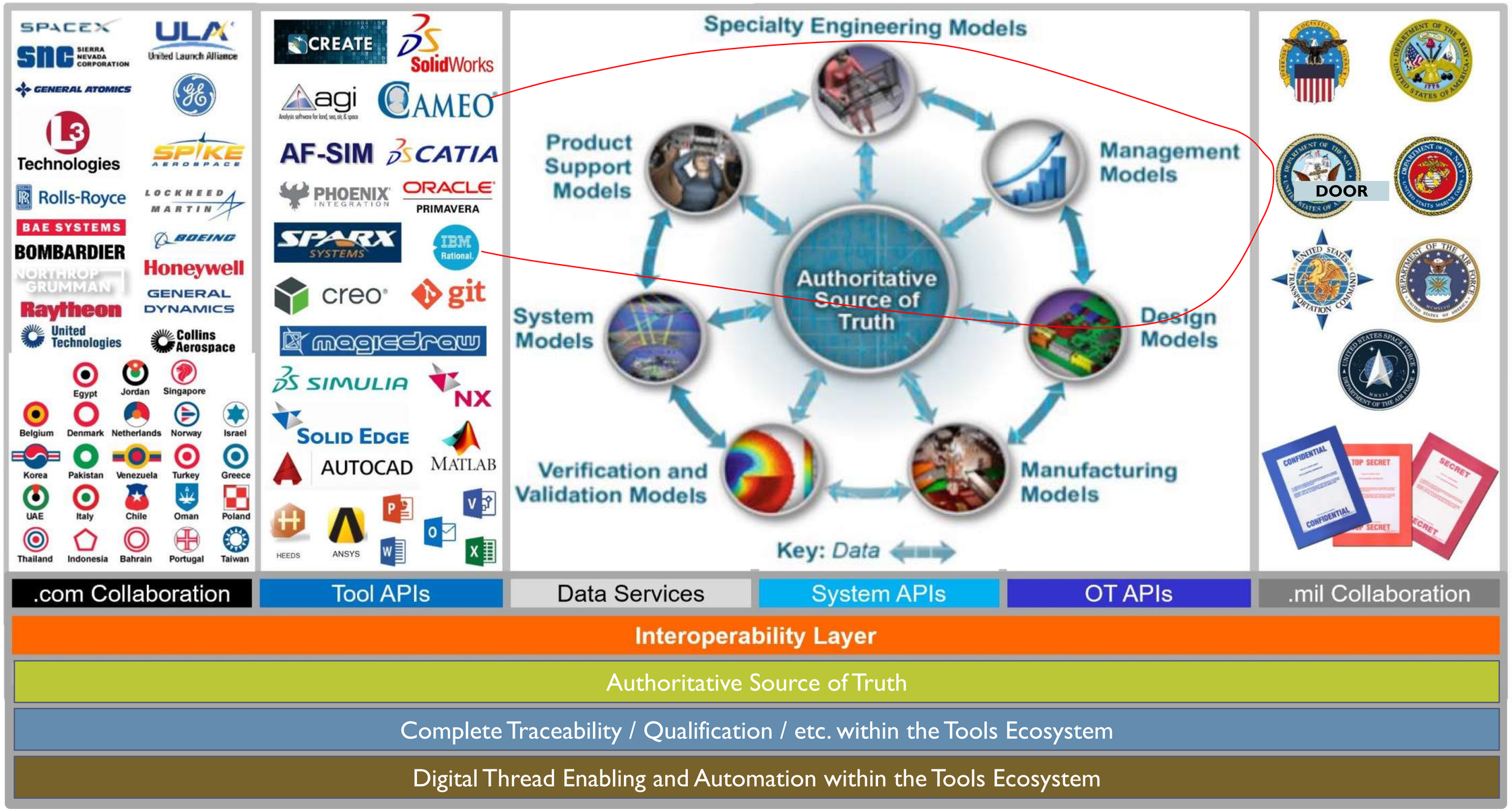
Transitioning from a document-focused mindset to a digital engineering mindset that leverages information flow across the lifecycle.

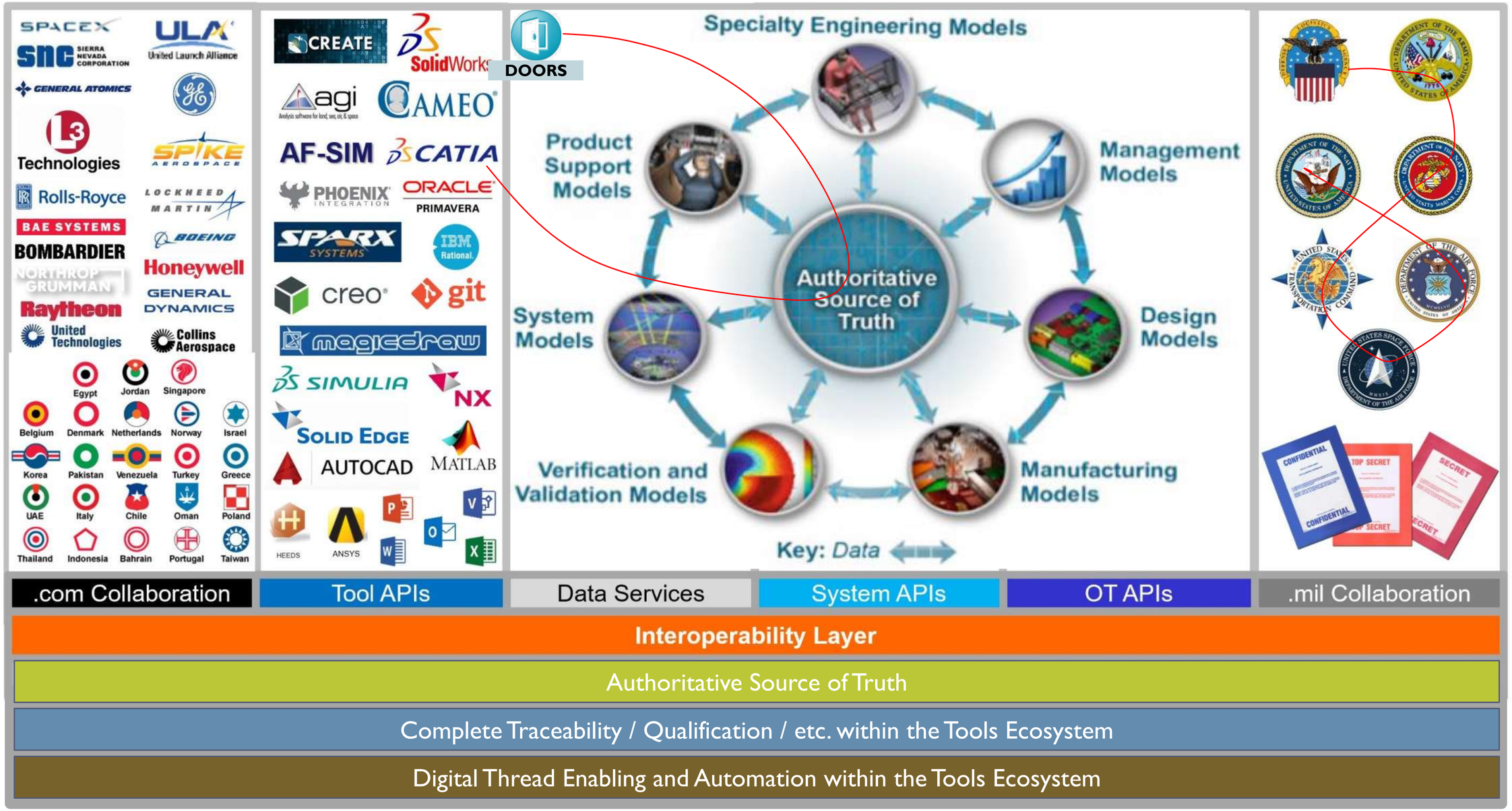
Context: What the NEEDS seem to be



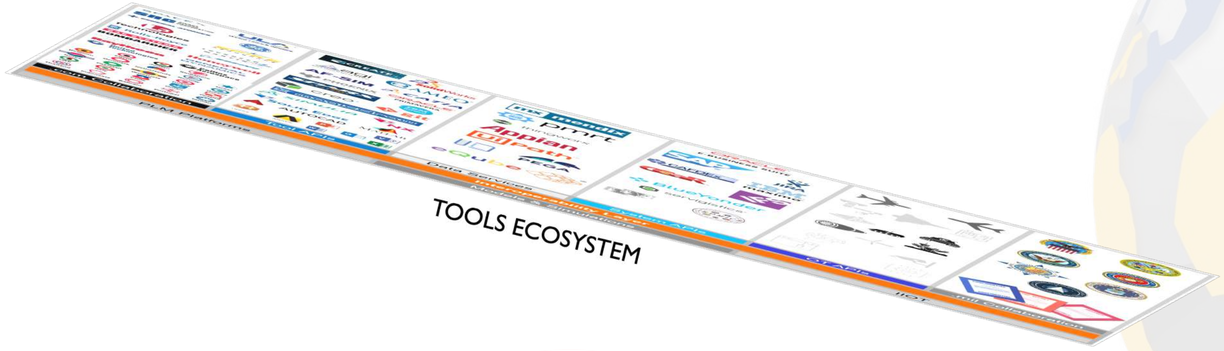
Need of Interoperability within same Engineering Domain

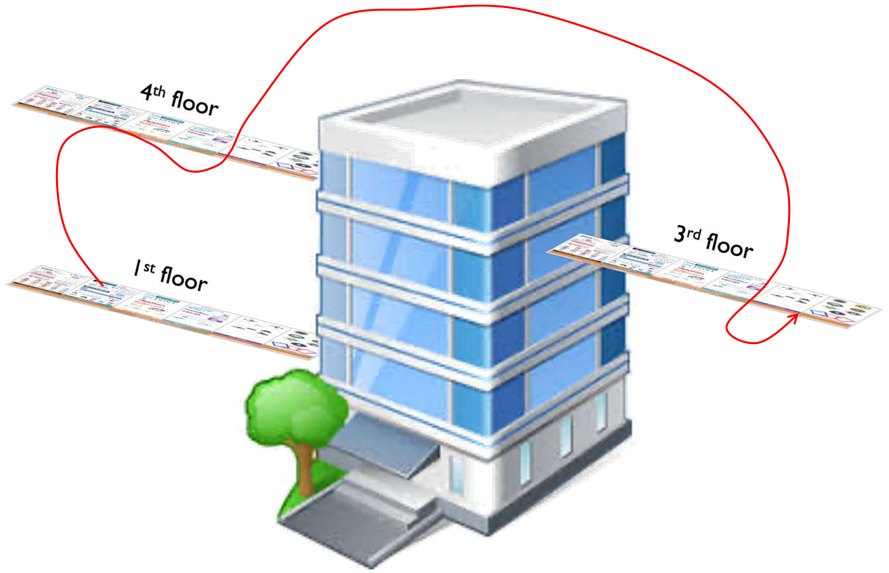


Need of Interoperability between Engineering Domains



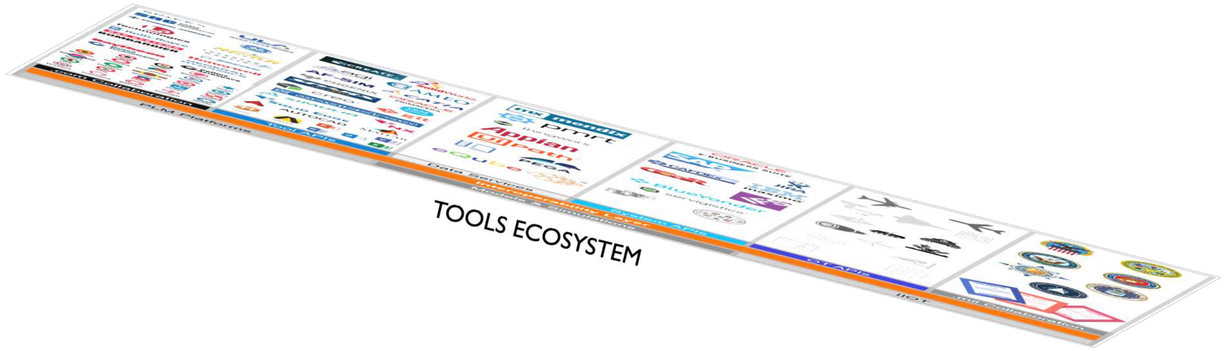
Need of Interoperability within Departments of the same organization

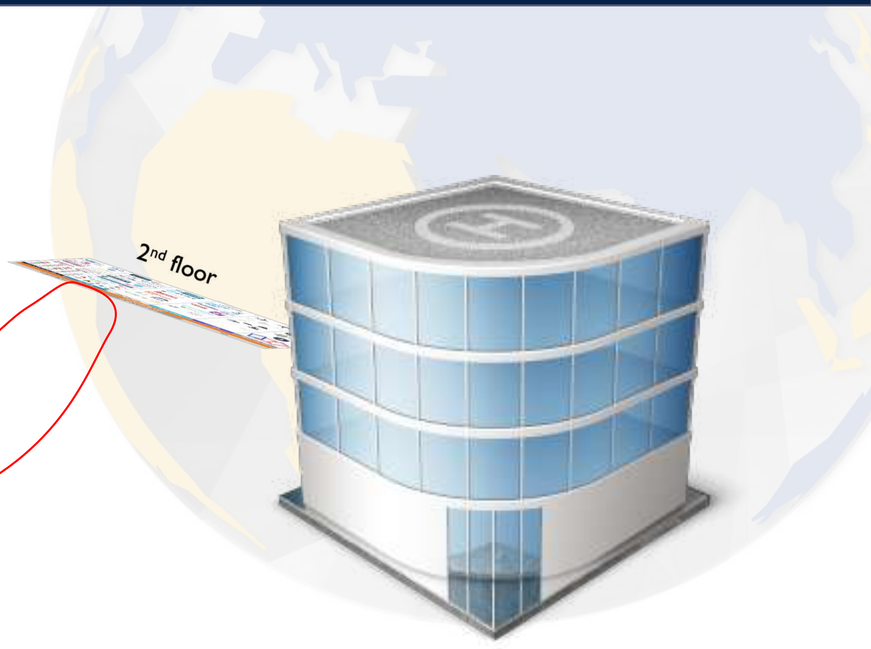




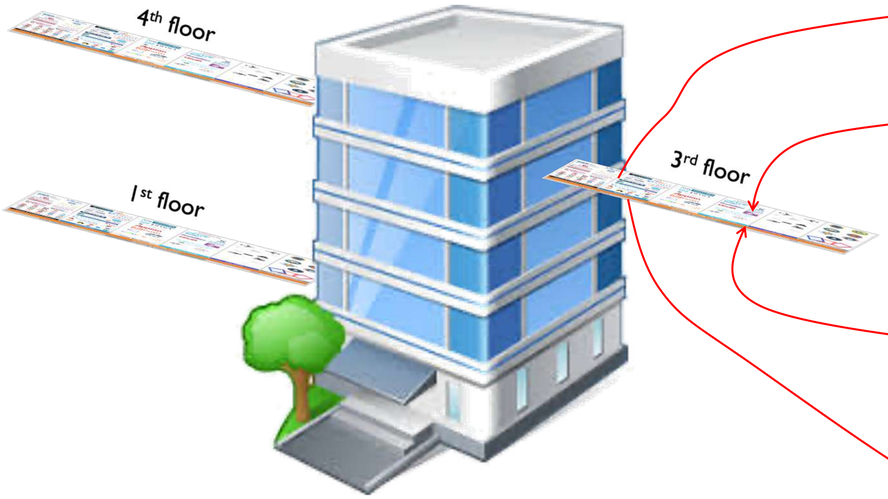
Organization A

Need of Interoperability within Departments of the same organization

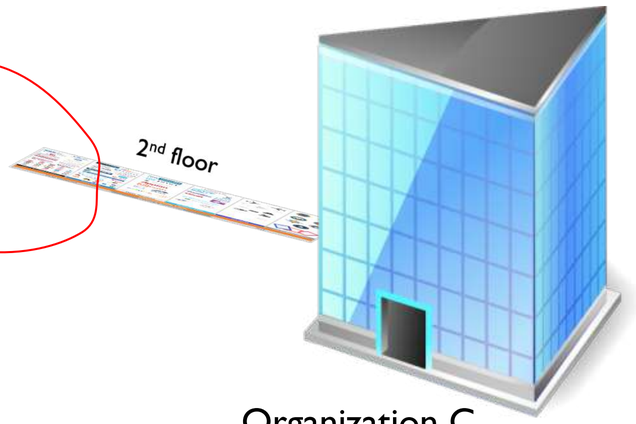




Organization B



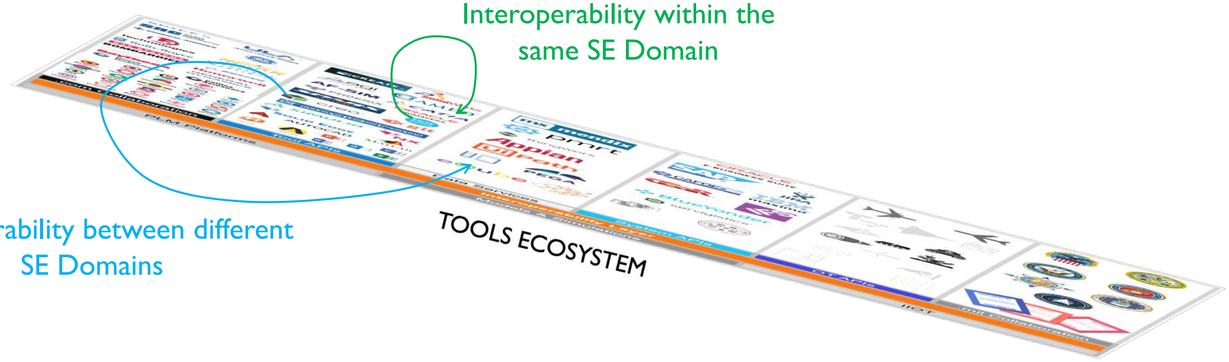
Organization A



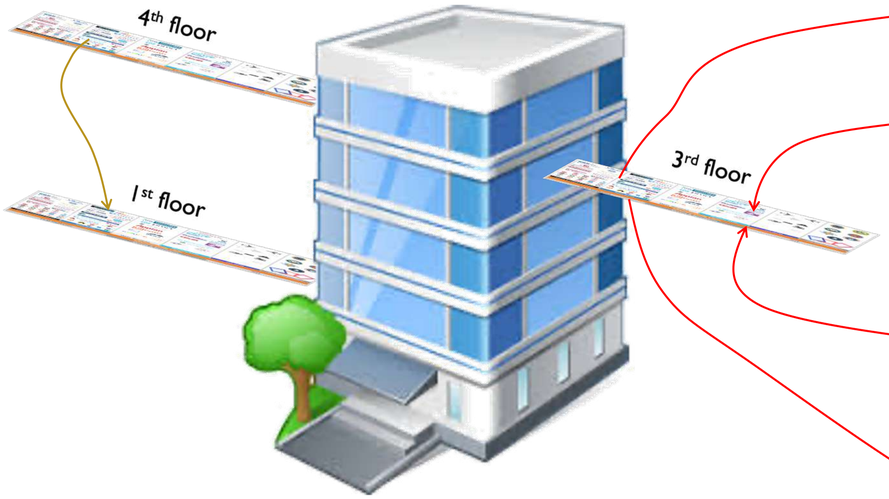
Organization C

Interoperability within the same SE Domain

Interoperability between different SE Domains

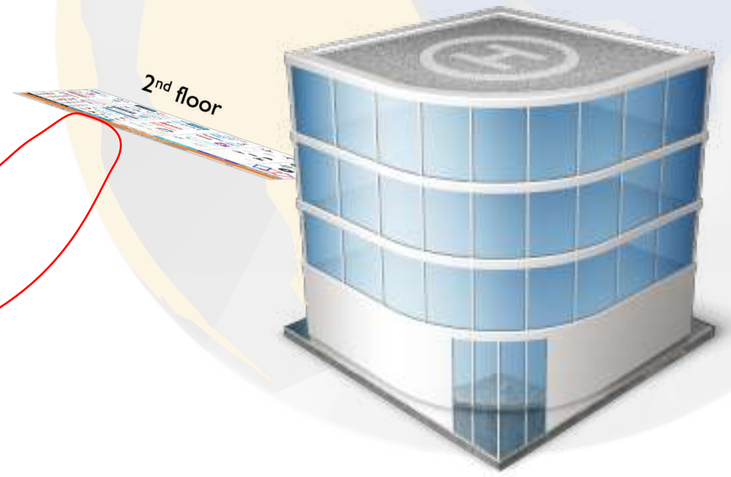


Interoperability between departments of same organization

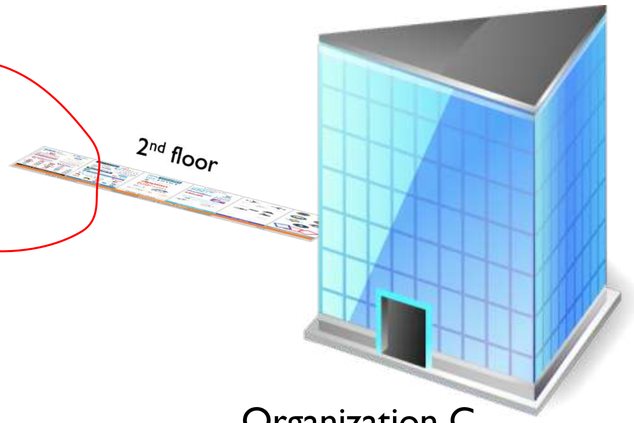


Organization A

Interoperability between different organizations:
OEM-Tier
Collaborative Development
etc

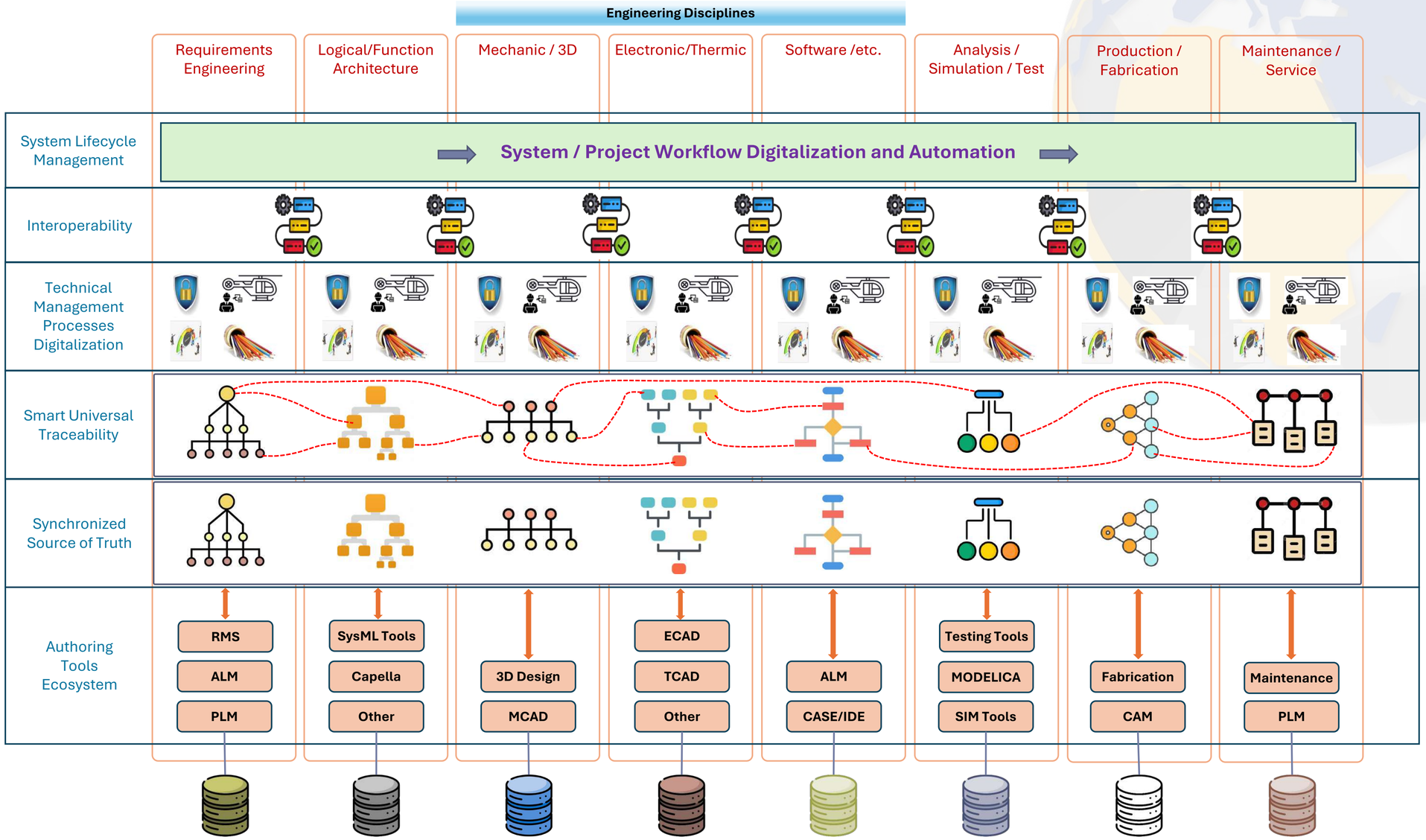


Organization B



Organization C

The theoretical solution: A passport

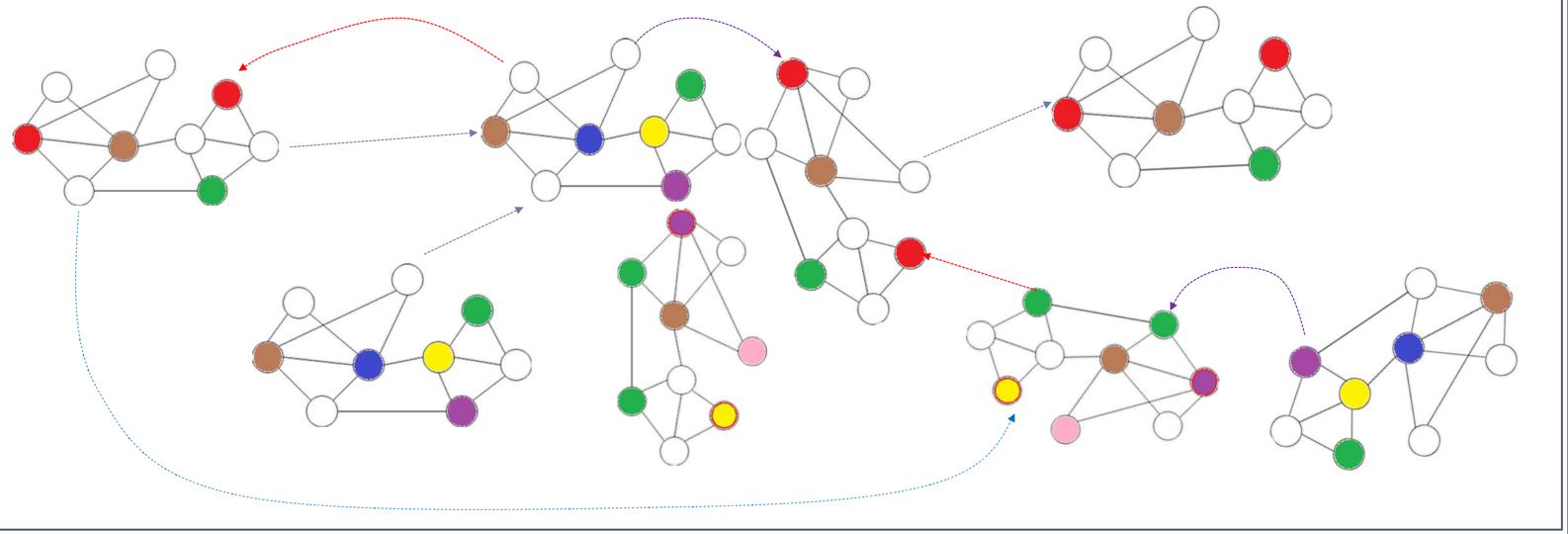


The passport content

Information Management (Technical Management Process) and Knowledge Management (Organizational Process)

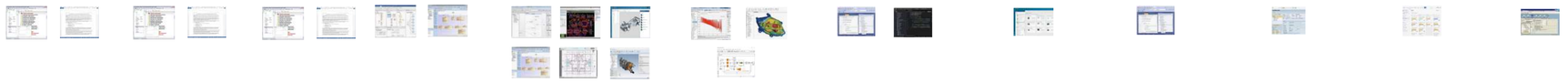
Measurement (Technical Management Process)

- Acquisition & Supply
- **AGREEMENT PROCESSES**
- Human Resources Management
- Portfolio Management
- Infrastructure Management
- Quality management
- Lifecycle model management
- **ORGANIZATIONAL PROCESSES**
- V&V (TRC considers it a TM process)
- Quality Assurance
- Configuration management
- Risk management
- Decision management
- Project assessment and control
- Project planning
- **TECHNICAL MANAGEMENT PROCESSES**



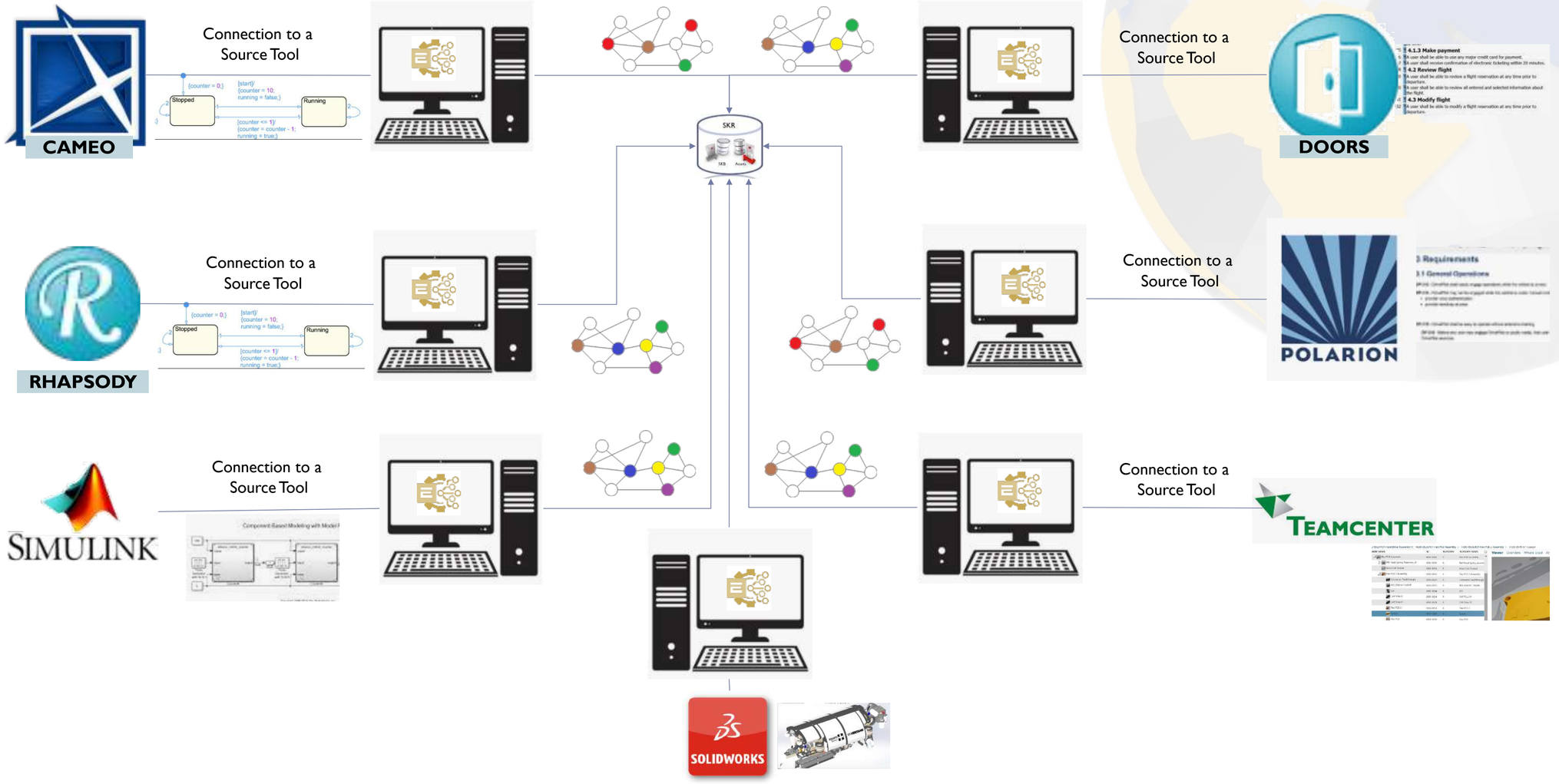
Connectivity
Traceability
Interoperability

Authoring Systems



TECHNICAL PROCESSES												
Business or mission analysis	Stakeholder needs and requirements definition	System requirements definition	Architecture definition	Design definition - Engineering Discipline tools	System analysis	Implementation	Integration	Transition	Operation	Maintenance	Disposal

The philosophy of the Connectivity capability



SOURCE Tool

- Content Managed by Source Tool
  - No changes in the way you work
- Functionality 100% available
  - F1(), F2(),.. Fn()
- SE Capabilities sometimes available
  - Versions, Traceability,

INTEROPERABILITY Hub

- Access to Source Tool content (API)
- Access to Source Tool Functions (API)
- CRUD operations when available
- ALL Technical Management processes available
  Traceability, Configuration, Changes, Conflicts, Decision, Quality. V&V
- States Management Source / Repository
  Off-line Changes shown on the fly is SES
- Lifecycle Management workflow on top of connections

REPOSITORY (SKR)

- Synchronized Source of Truth (SSoT)
- Manages Source content changes, baselines, Versions, differences etc.
- Stores all Technical Management data
  Quality, Risks, Alerts, Decisions, V&V,..
- Core of Archiving, Information and Knowledge Management processes
- Means to connect OEM and Supply Chain

The philosophy of the traceability capability

Connector to Work-products

Connection

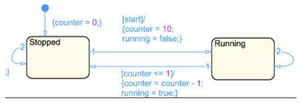
Work-products representation

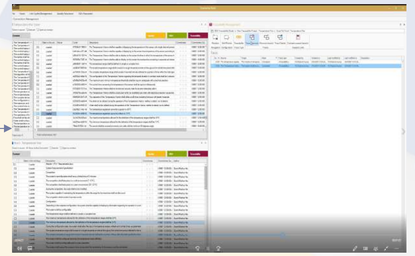
Manual or Automatic Mapping

Connector to Work-products

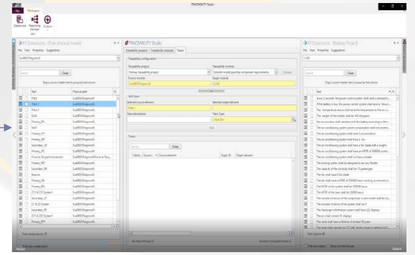
Connection

Work-products representation

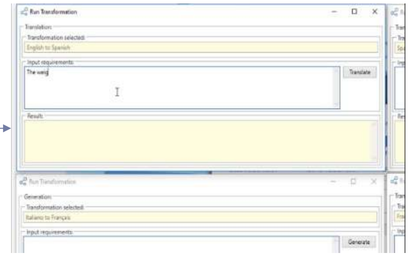




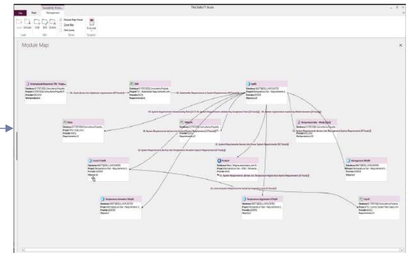
Managing Traces (6.22 min)



SMART Suspect Links (V18-V22)

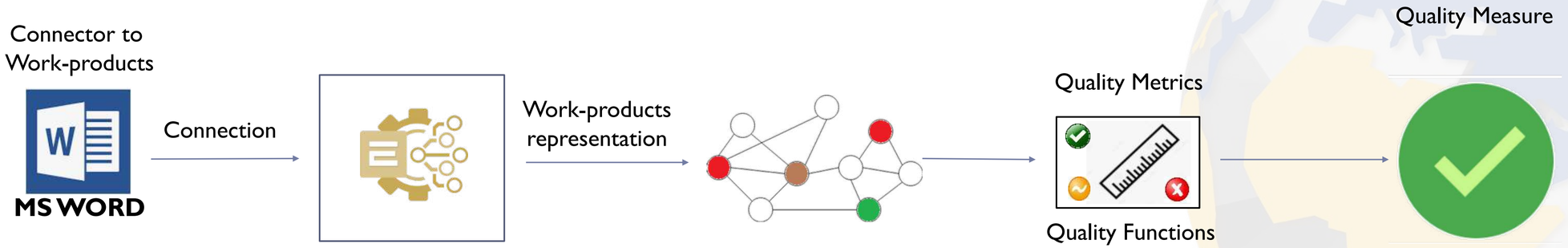


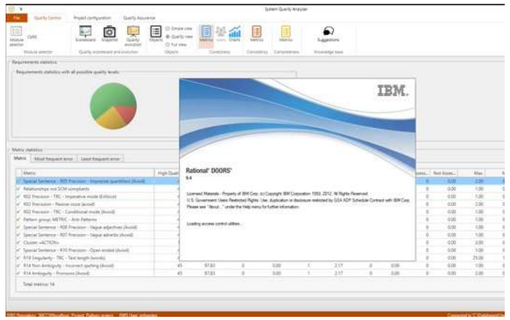
Discovering and Suggesting Traces (8.02 min)



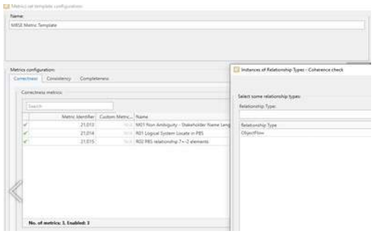
Traceability Studio V18 full Demo (44.28 min)

The philosophy of the quality capability

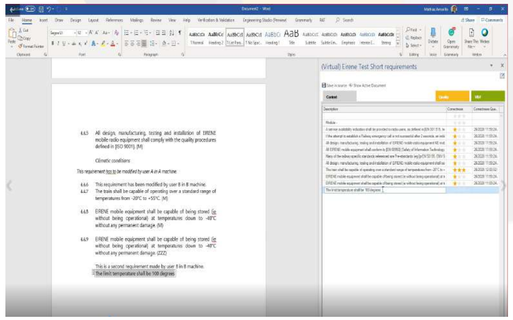




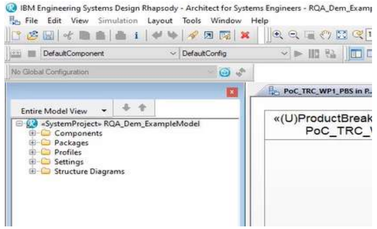
CCC Demo using a Railway example (28 min)



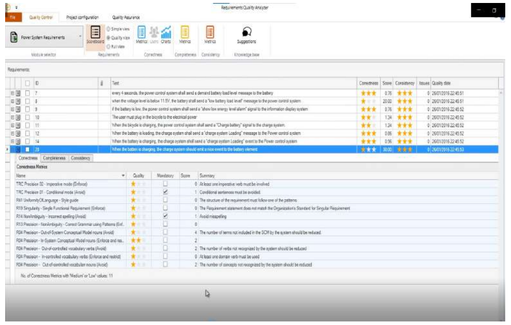
Models Quality Patterns (Rhapsody) (5.38 min)



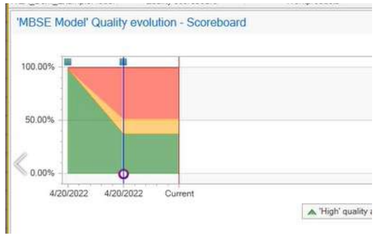
Managing the Quality of MS Word Requirements (9.44 min)



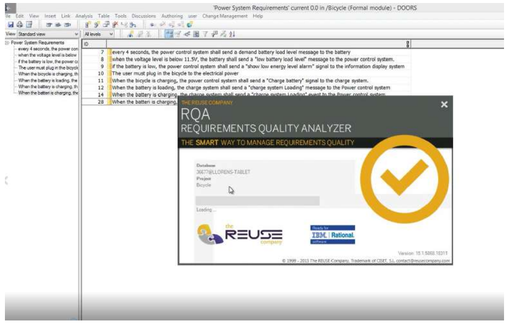
Models Quality Checking (Rhapsody) (9.58 min)



Requirements Quality Assessment and Management (4.42 min)



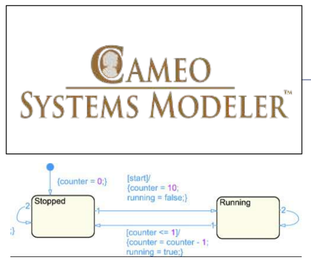
Models Quality Reporting (Rhapsody) (2.07 min)



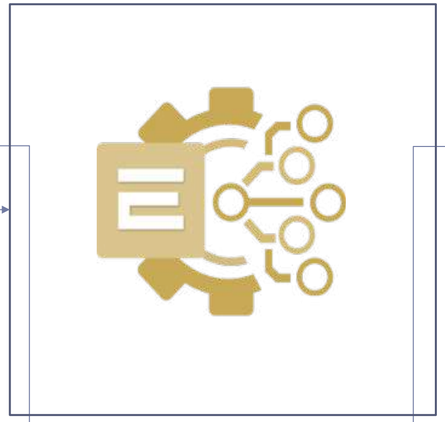
RQA Quality Studio and RAT (V15) in IBM DOORS (4.42 min)

The philosophy of the V&V capability

Items to be VERIFIED / VALIDATED

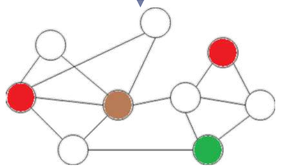


Connection

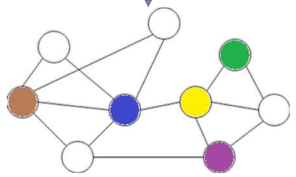


Connection

SOURCE Items

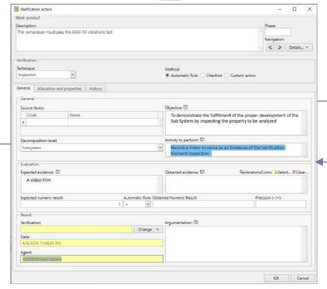


Items to be VERIFIED / VALIDATED



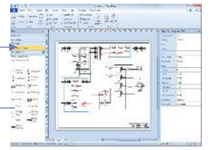
Source Items (Requirements, etc.)

Inspection | Demonstration | Test | Analogy or Similarity | Sampling | Analysis / Simulation



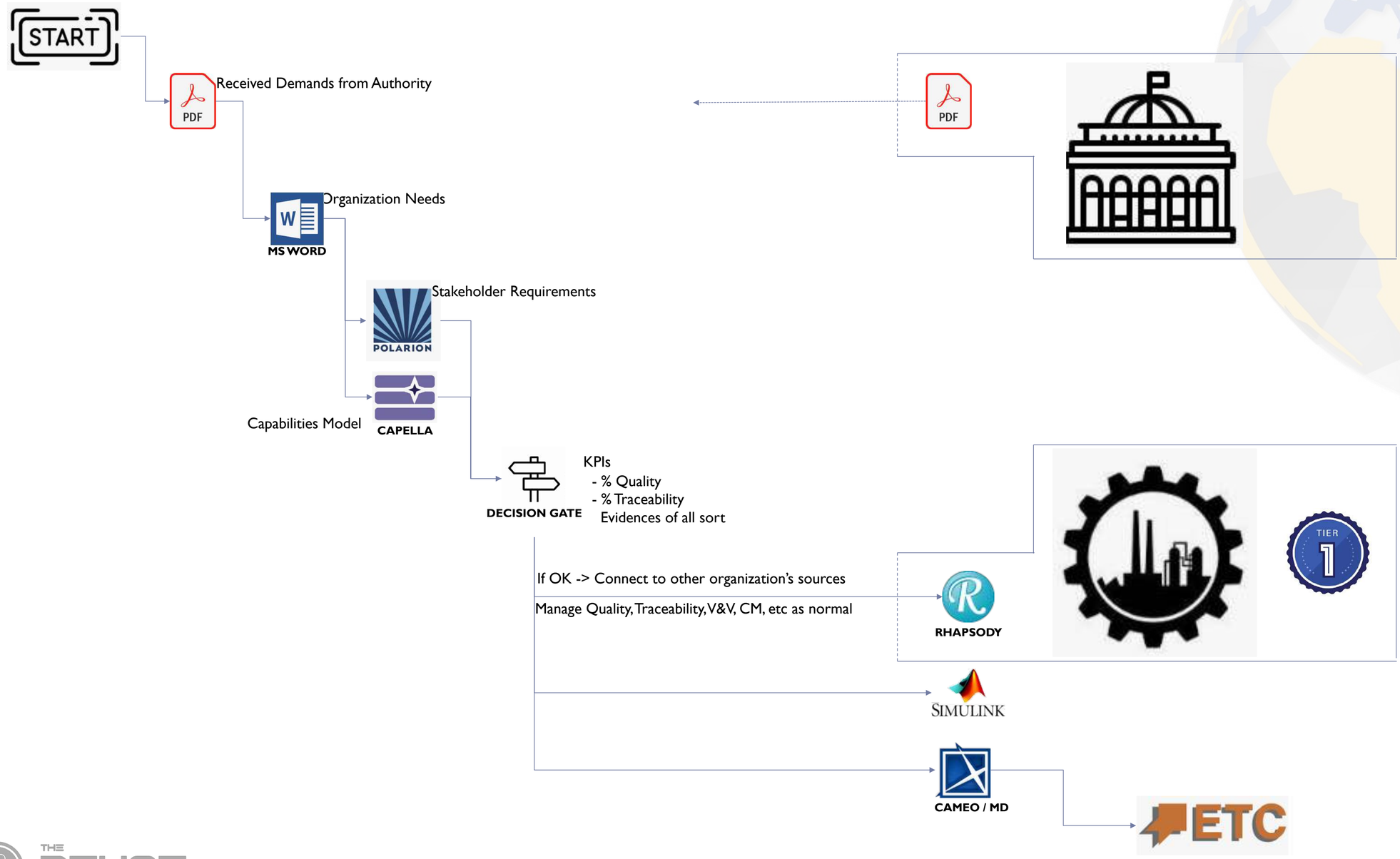
Evidences stored in a Verification Action (VA)

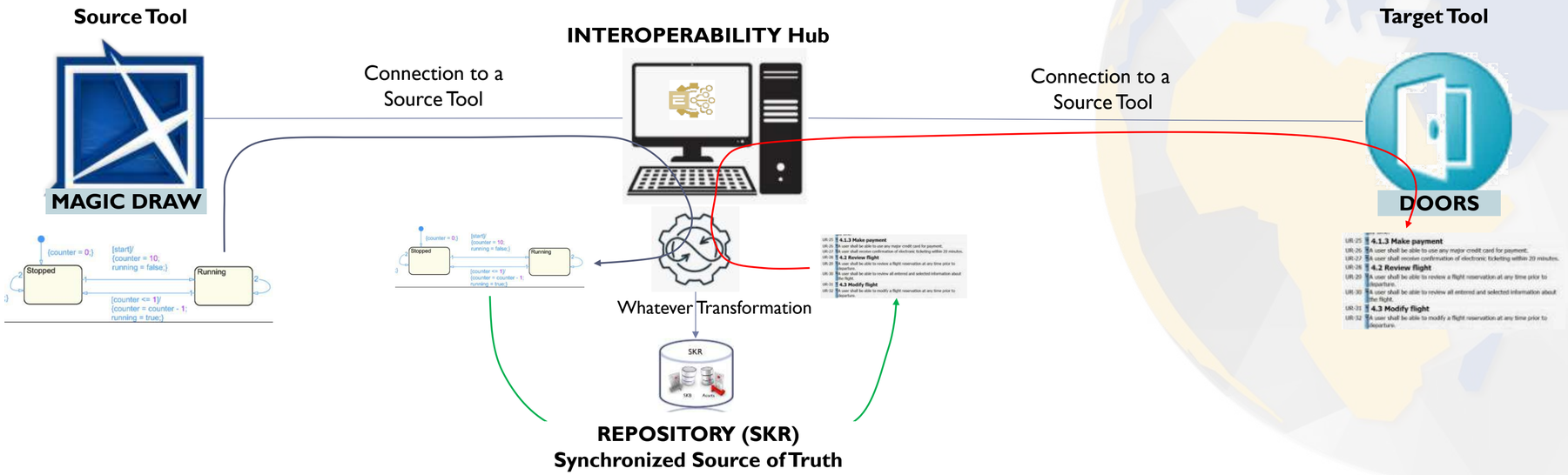
Connection



External Tools Support

The philosophy of the Digital Thread automation capability





INTEROPERABILITY

- Possibility of connecting content (traceability)

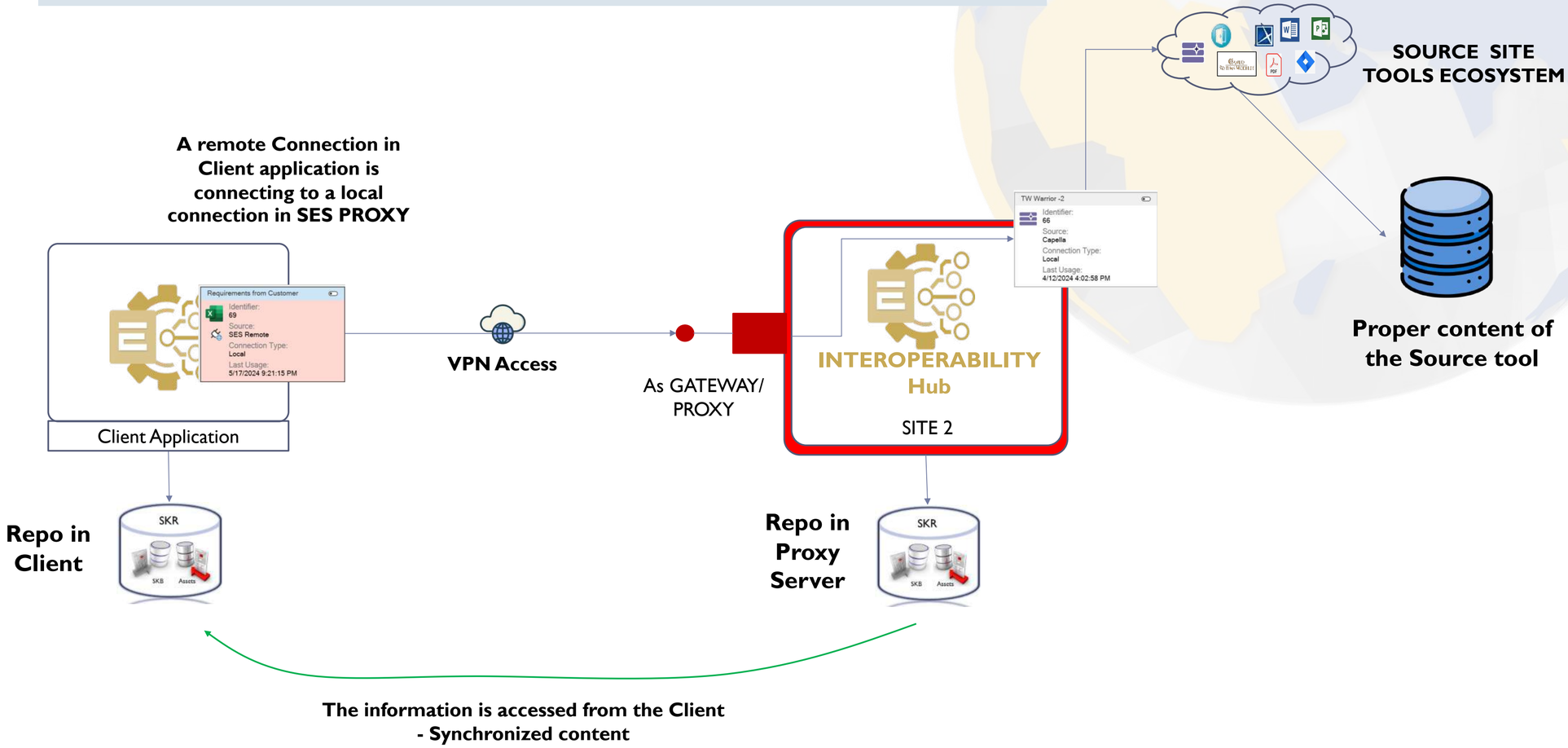
- Connecting outputs from source connections to Inputs of Target connections
  - Simulating requirements, sending information to simulations, etc.

- Automating processes
  - Digital Thread Changes in one engineering item automatically produce the changes in the manuals, etc..

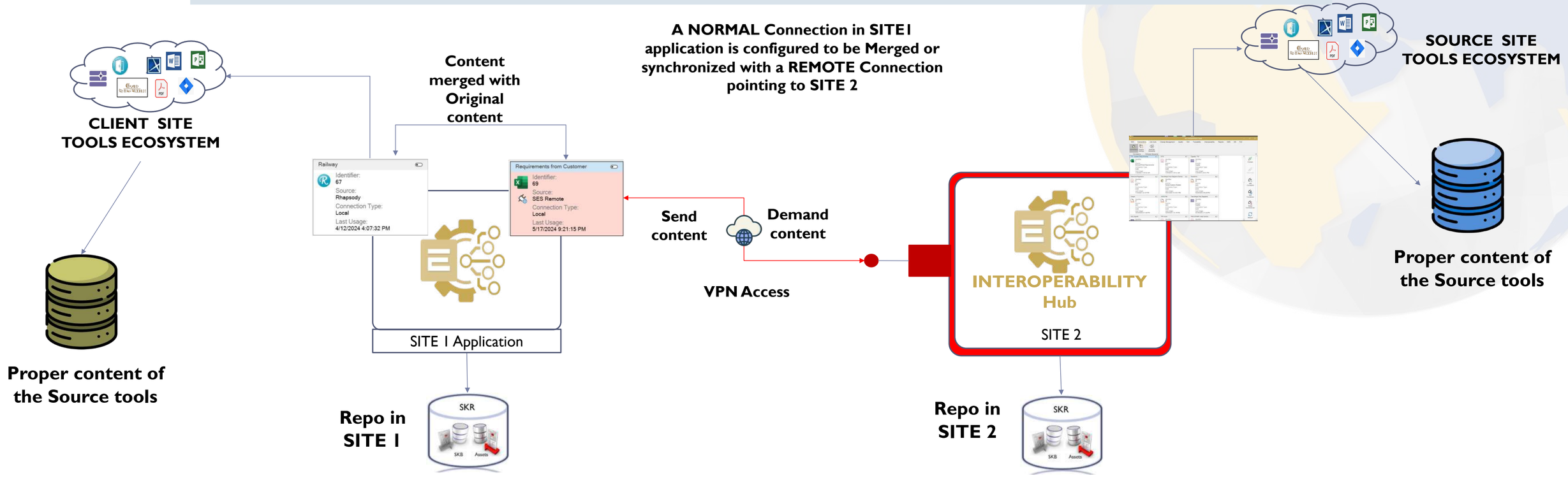
- Creation of content in one connection from content of other connection
  - Automatic generation of models, requirements, test cases etc.

- A Lifecycle Management Project can be created defining workflows of connections

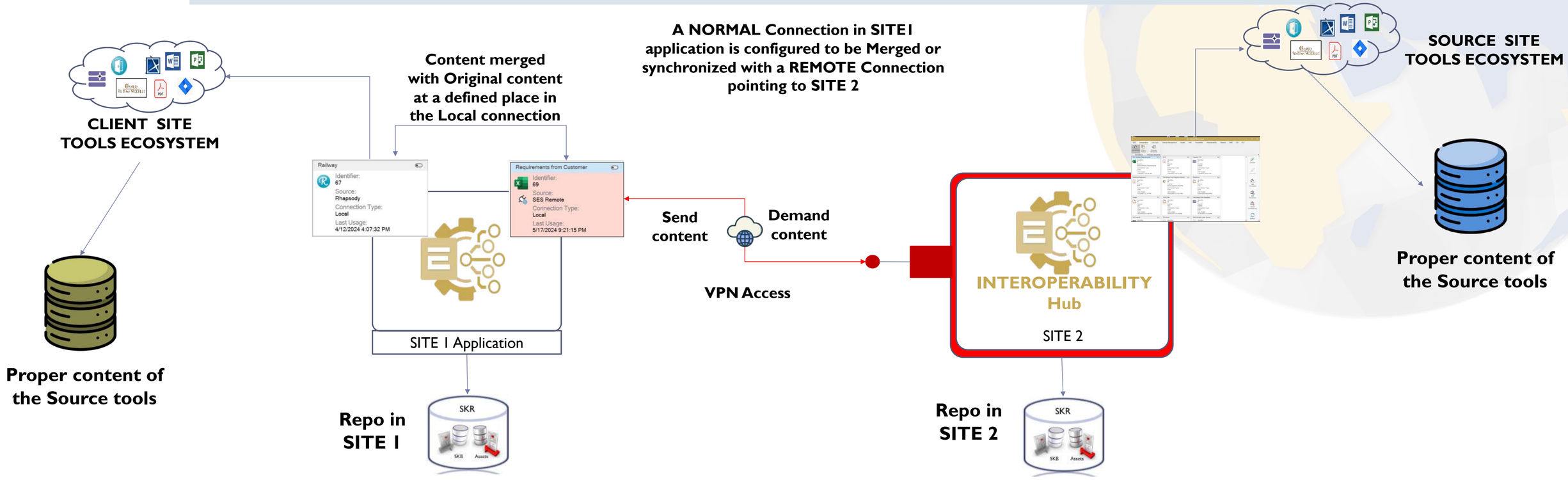
USE CASE 1: REMOTE ACCESS



USE CASE 2: COLLABORATIVE (MERGED OR SYNCHRONIZED) WORK

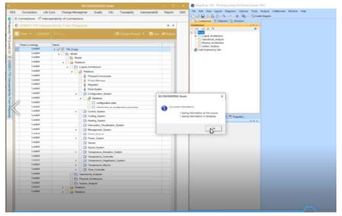


USE CASE 3: DISTRIBUTED WORK OEM / TIER



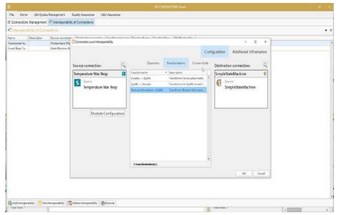
ALL FUNCIONALITY IS THE SAME AS FOR USE CASE 2

INTEROPERABILITY BETWEEN TOOLS ECOSYSTEM



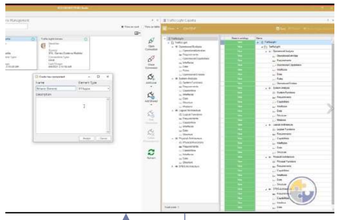
RHAPSODY CAMEO SYSTEMS MODELER

Interoperability Rhapsody - Cameo

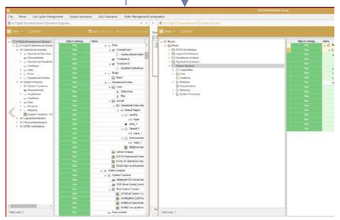


TEAMCENTER CAMEO SYSTEMS MODELER

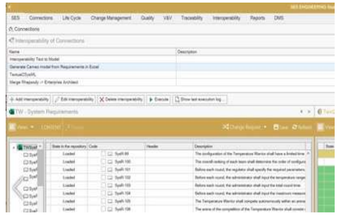
Automatic Generation of Models from Requirements



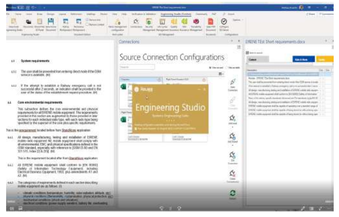
CAPELLA CAMEO SYSTEMS MODELER



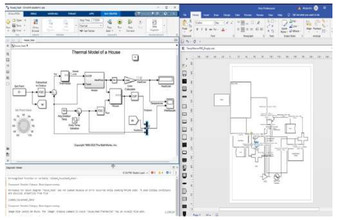
Model Round trip (Cameo-Capella) (5.55 min) and (Capella-Cameo) (3.45 min)



Generate Models in Cameo from Requirements in Excel and synchronize the Model in Enterprise Architect (4.47 min)

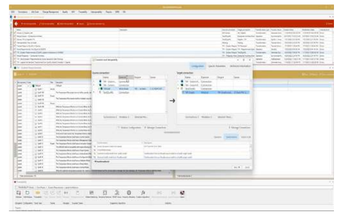


Requirements Simulation (Word-Excel) (4.47 min)



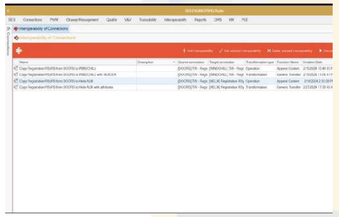
SIMULINK Visio

Physical Model Interoperability Simulink - Visio (3.52 min)

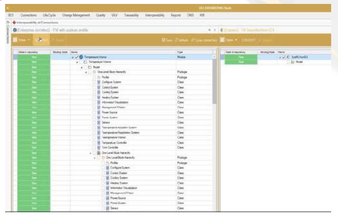


EXCEL WORD CAMEO CAPELLA JIRA

SES ENGINEERING Studio - Interoperability Demonstration

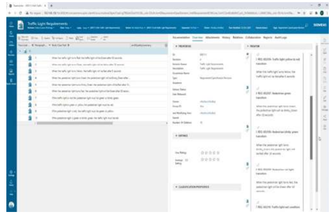


Interoperability DOORS - Helix



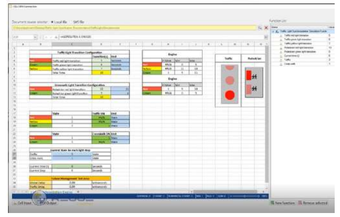
ENTERPRISE ARCHITECT CAMEO SYSTEMS MODELER

Interoperability Enterprise Architect- Cameo



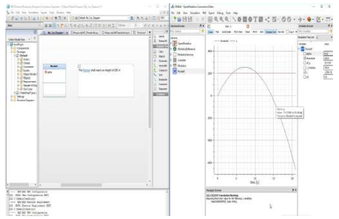
SIMULINK TEAMCENTER

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



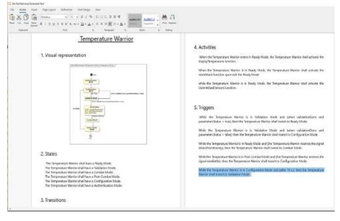
CAPELLA EXCEL WORD

Requirements Extraction and Management, Traceability, CRUD, Quality, Authoring, Simulation against Excel (24.45 min)



RHAPSODY fmi FUNCTIONAL MOCK-UP INTERFACE

Executing Requirements using FMU and Rhapsody (4.27 min)



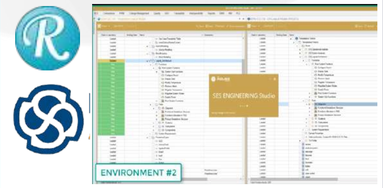
CAMEO SYSTEMS MODELER

Automatic Generation of Requirements from Models

INTEROPERABILITY WITHIN DIFFERENT ORGANIZATIONS

Remote connection to Requirements

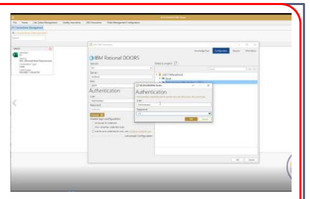
Remote connection to Requirements



Remote Interoperability of MBSE

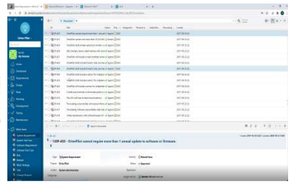
CONNECTIVITY TO TEXT BASED SOURCE

DOORS



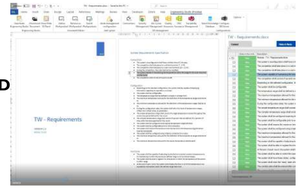
Integrating DOORS in SES (4.48 min)

POLARION



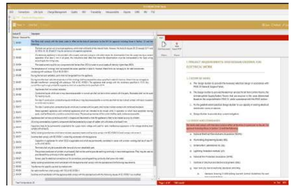
Connector to Polarion + RAT (2.10 min)

MS WORD

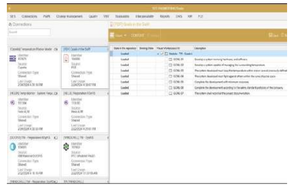


RMS inside MS Word (5.50 min)

PDF



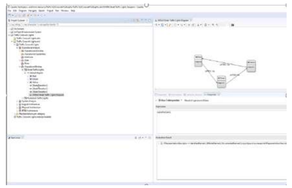
Managing PDF – Trace and Versions (21.58 min)



Managing Helix Requirements+ Traces

CONNECTIVITY TO LOGICAL MBSE SOURCES

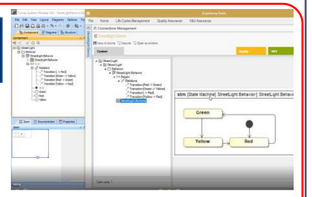
CAPELLA



Integrating Capella in SES (5.48 min)

CAMEO

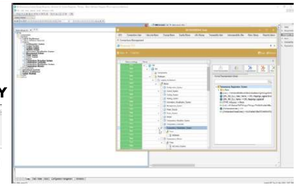
(5.35 min)



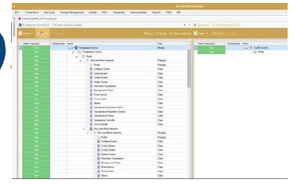
Managing Cameo from SES (3.12 min)

RHAPSODY

(3.15 min)



Managing Rhapsody from SES (2.37 min)

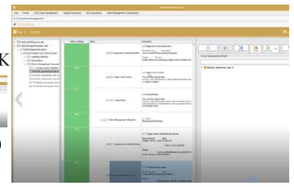


Merge Enterprise Architect- Cameo

CONNECTIVITY TO PHYSICAL AND OTHER SOURCES

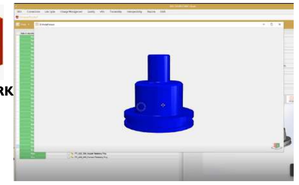
SIMULINK

(2.14 min)

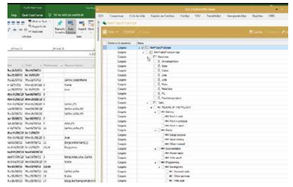


Managing Models and Requirements (2.15 min)

SOLIDWORK

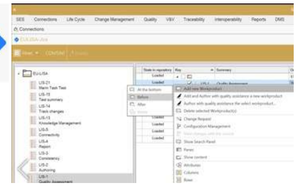


Integrating SolidWorks in SES (3.32 min)



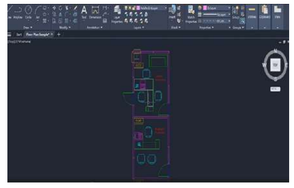
Managing MS Project from SES (2.01 min)

JIRA



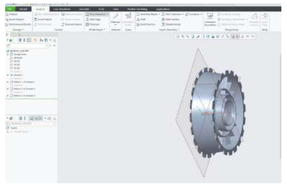
Managing JIRA from SES (2.29 min)

Autocad



Managing Autocad from SES

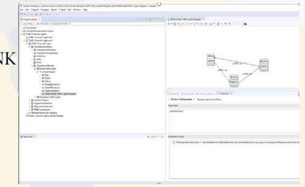
creo



Integrating PTC Creo to SES

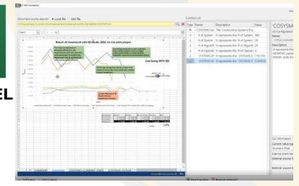
CONNECTIVITY TO FUNCTIONALITY

SIMULINK



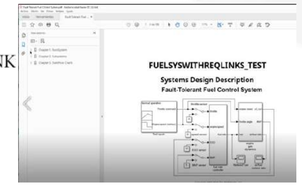
Connecting to Simulation Functionality

MS EXCEL



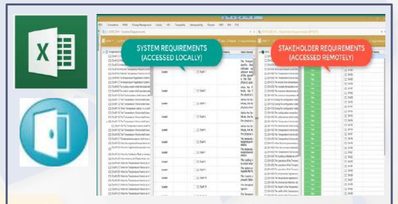
Connecting to Excel Functions (3.25 min)

SIMULINK



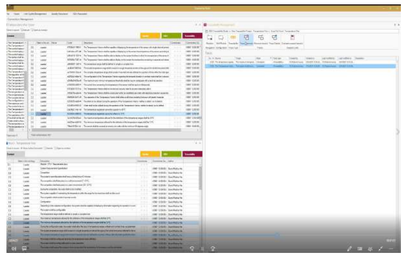
Connecting to Documenting Capability

EXTENDING CONNECTIVITY REMOTE CONNEXIONS

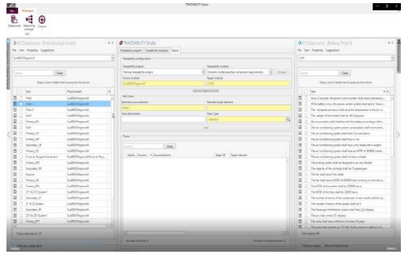


Remote connection to Requirements

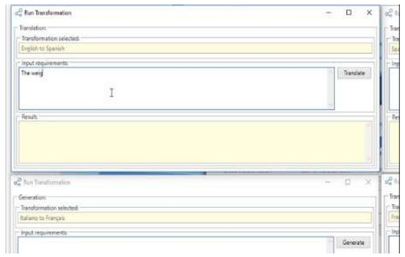
TRACEABILITY MANAGEMENT



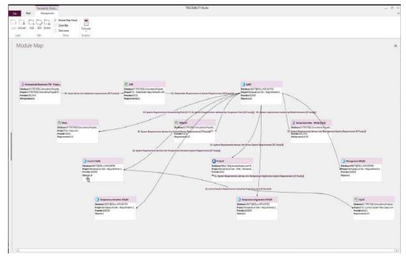
Managing Traces (6.22 min)



SMART Suspect Links (V18-V22)

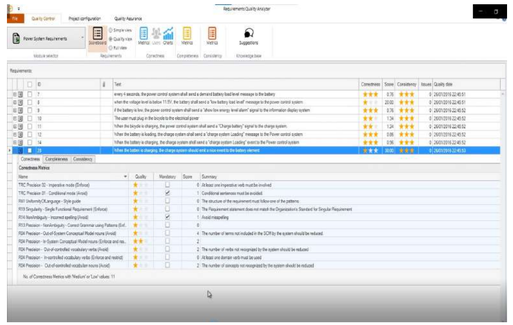


Discovering and Suggesting Traces (8.02 min)

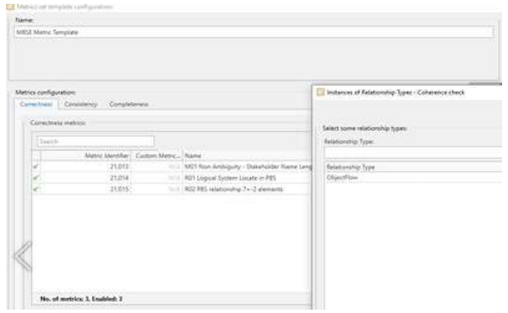


Traceability Studio V18 full Demo (44.28 min)

CCC Demo using a Railway example (28 min)

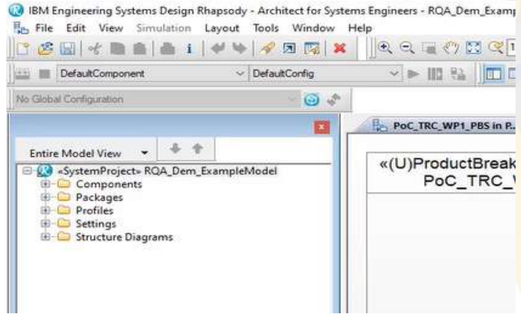


Requirements Quality Assessment and Management (4.42 min)

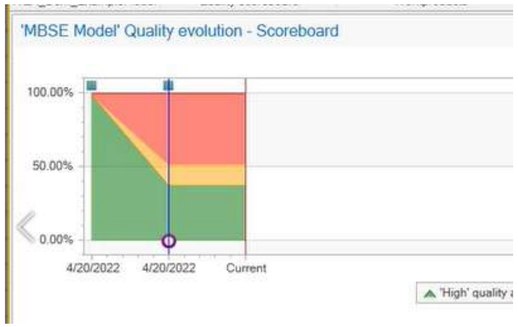


Models Quality Patterns (Rhapsody) (5.38 min)

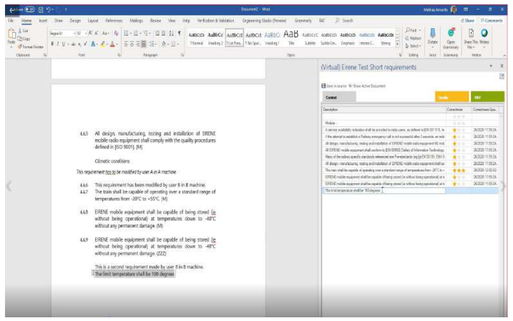
QUALITY MANAGEMENT



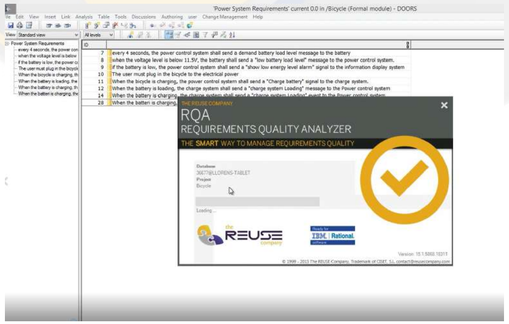
Models Quality Checking (Rhapsody) (9.58 min)



Models Quality Reporting (Rhapsody) (2.07 min)



Managing the Quality of MS Word Requirements (9.44 min)



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

Providing a
knowledge-centric
approach to enable
SMART system
engineering activities
in our customers

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