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A global engineering process based on MBSE to master complexity

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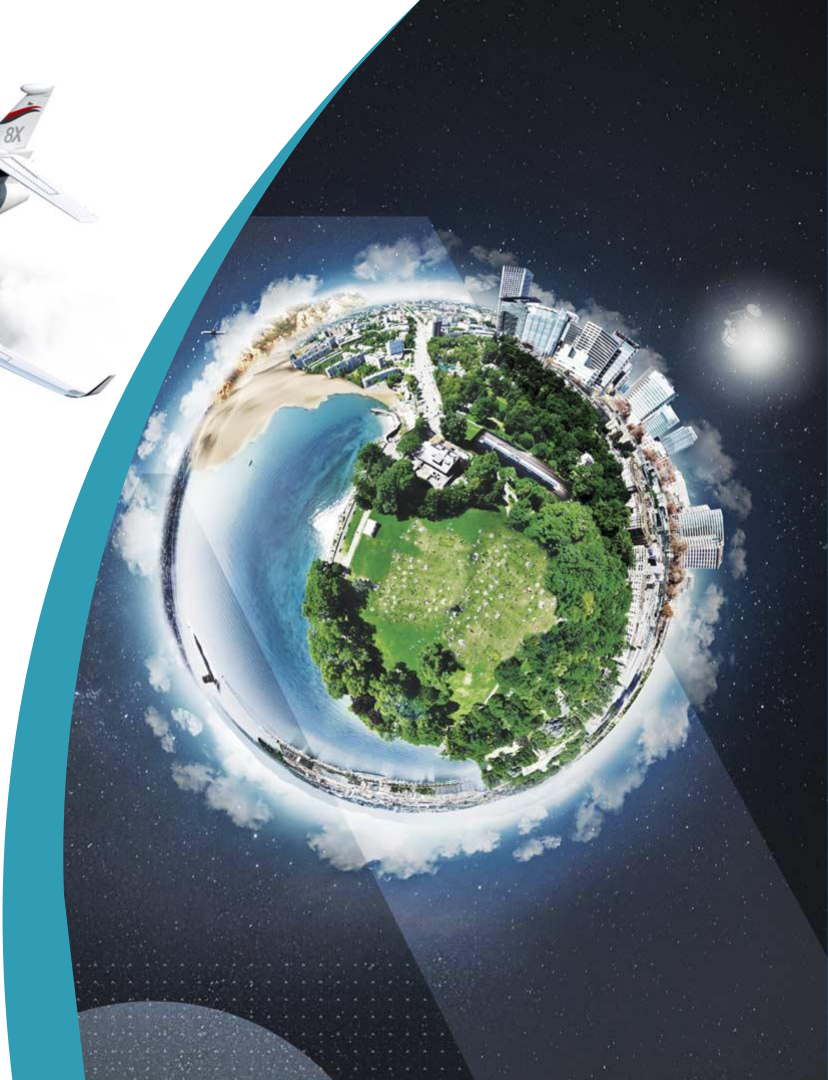

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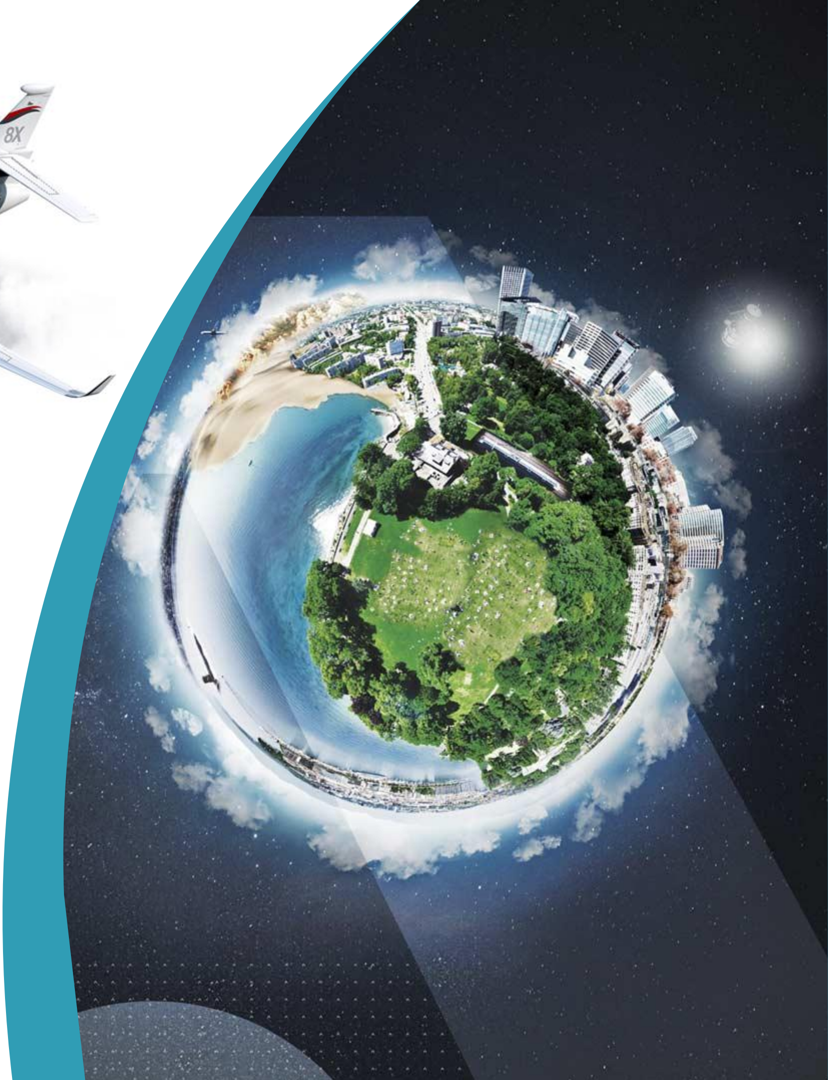
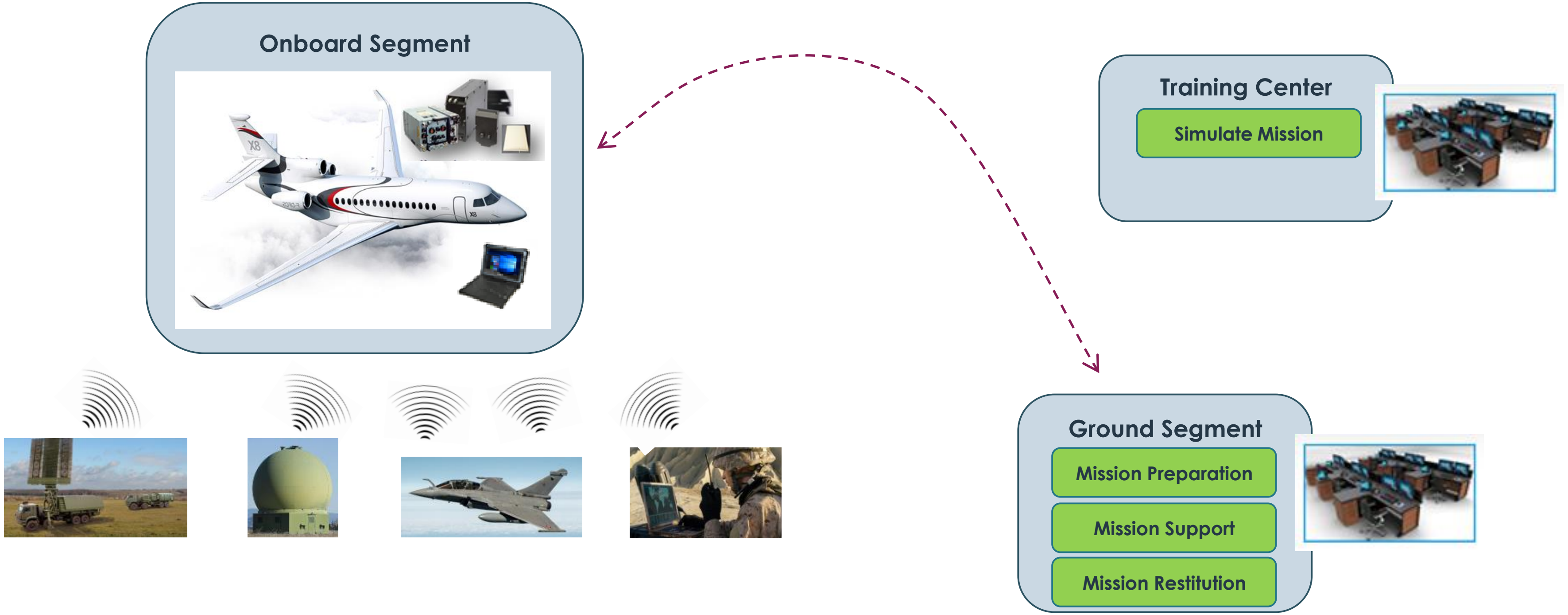
Introduction

ARCHANGE Project and its challenges



What is ARCHANGE ?



New generation of French Airborne SIGnal INTeligence (SIGINT) Mission System

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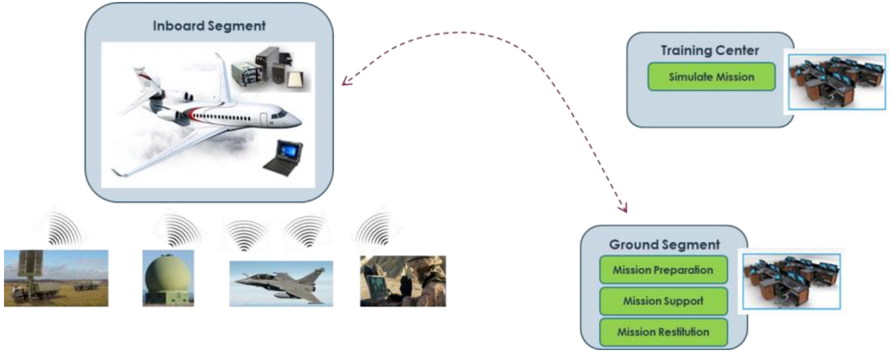
What types of complexity do we have to deal with ?

TECHNICAL COMPLEXITY
OPERATIONAL NEEDS & NON FUNCTIONAL CONSTRAINTS



- Many functional needs
- High sensor sensibility
- High level of cyber security
- Billons of tactical objects to manage
- …

ORGANIZATIONAL COMPLEXITY
INDUSTRIAL ORGANIZATION & HUMAN INTERACTIONS

- Dassault Aviation, Thales (DMS & SIX), Sub-contractors
- 12 geographical places

Need to have a structured tooled-up engineering process that optimizes the whole team's performance

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Engineering practices transformation is also a challenge !

ENGINEERING PRACTICES TRANSFORMATION

All these changes require

- Mindset changes
- Organisation adaptations
- Specific trainings
- Daily coaching
- Engineering practices "champions"
- Time

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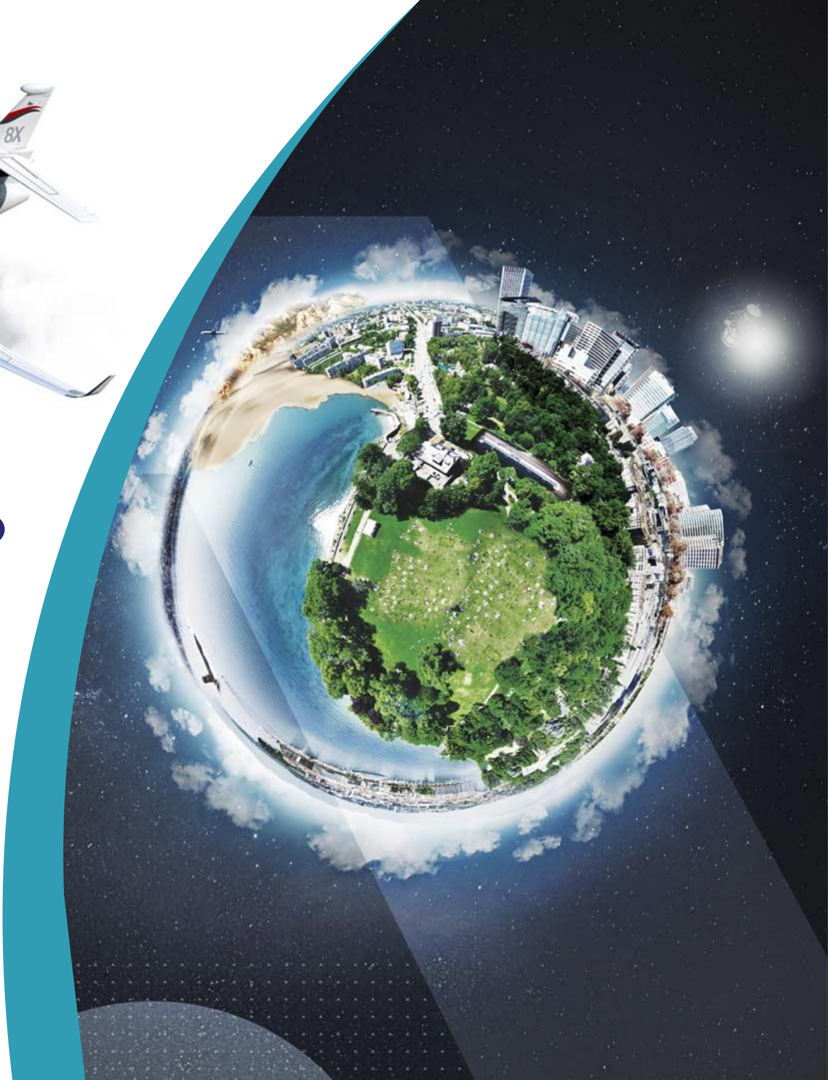
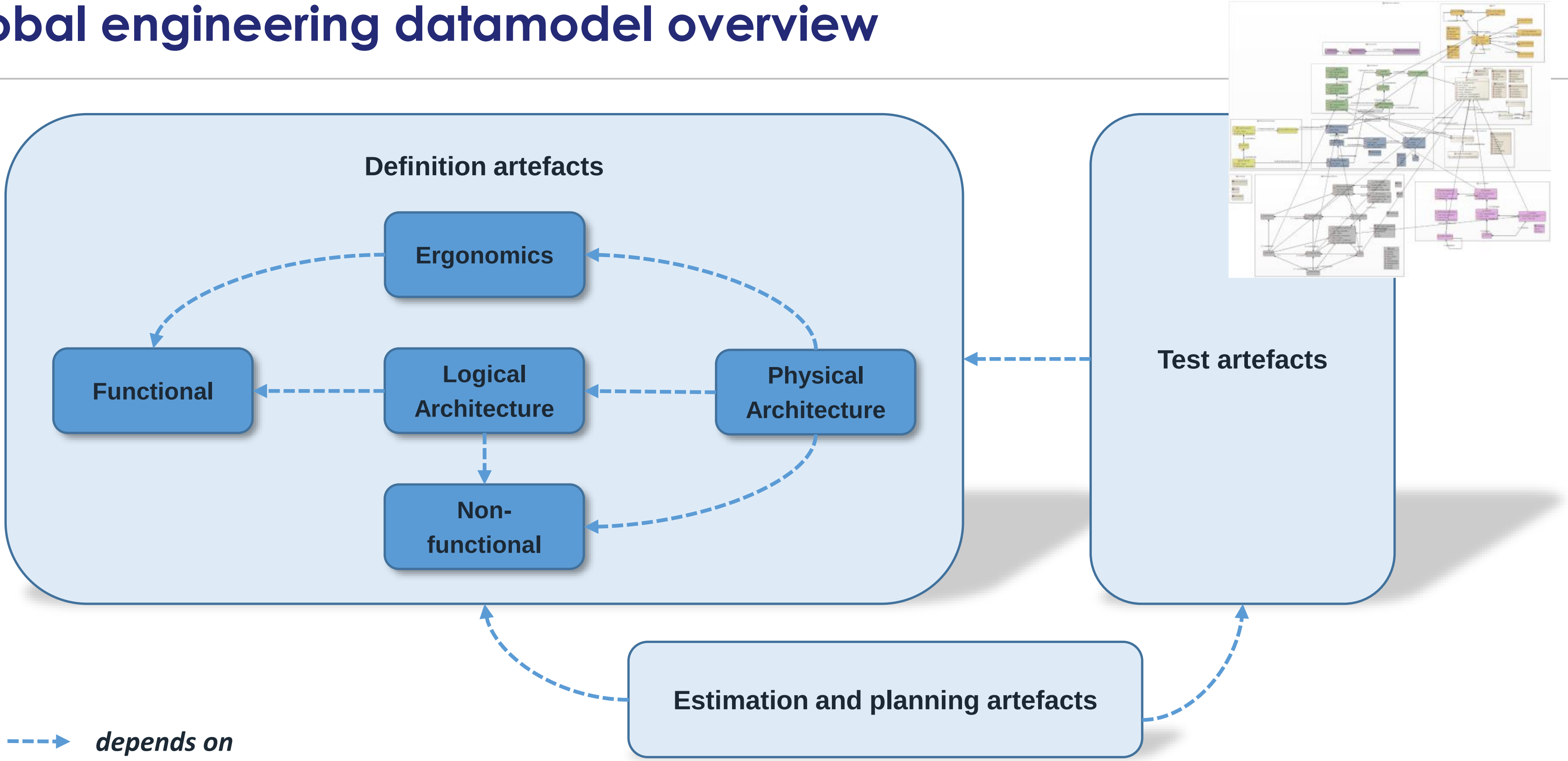
How to master Complexity ?

A global engineering process based on MBSE



Gobal engineering datamodel overview



Draw the global engineering datamodel & workflow

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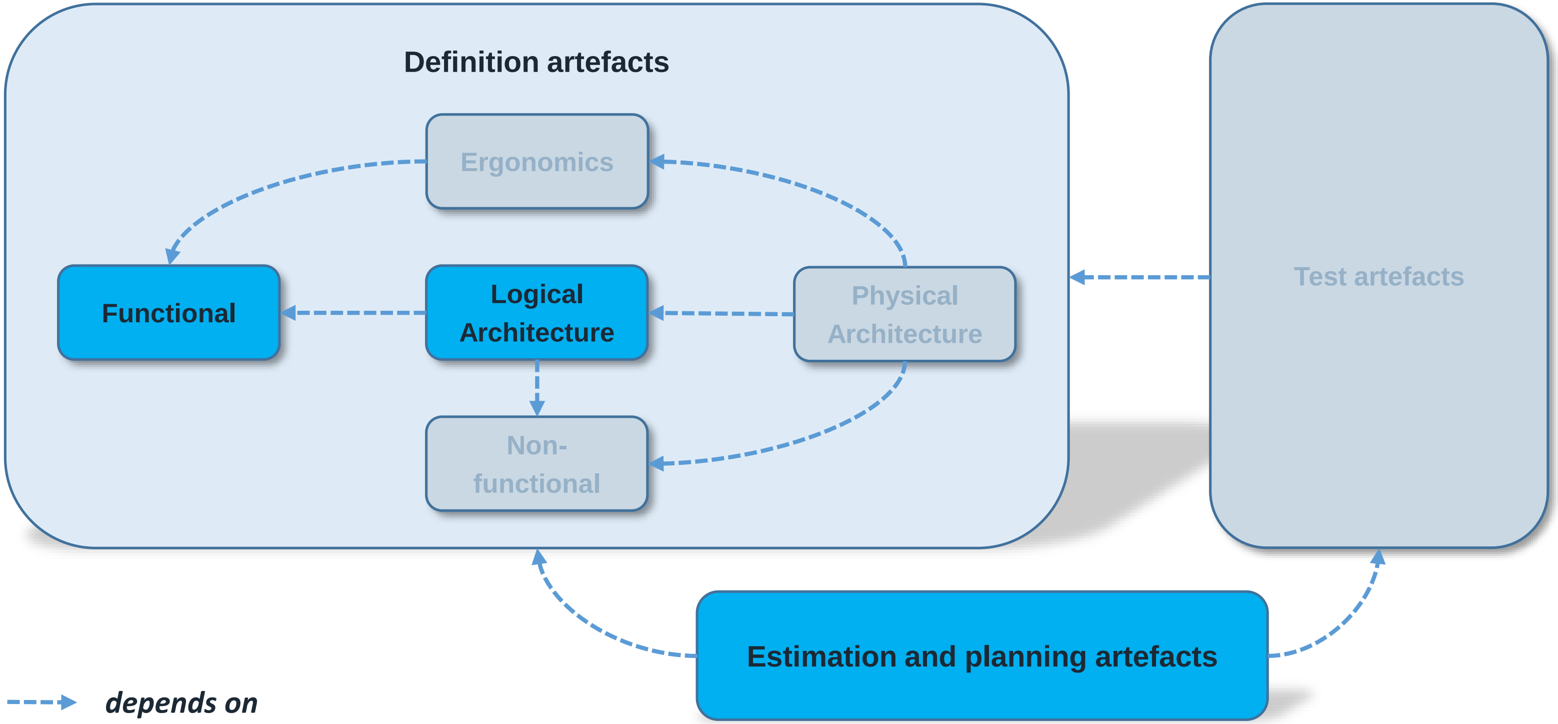
Engineering datamodel overview

What we focus on during this presentation



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Draw the global engineering datamodel & workflow

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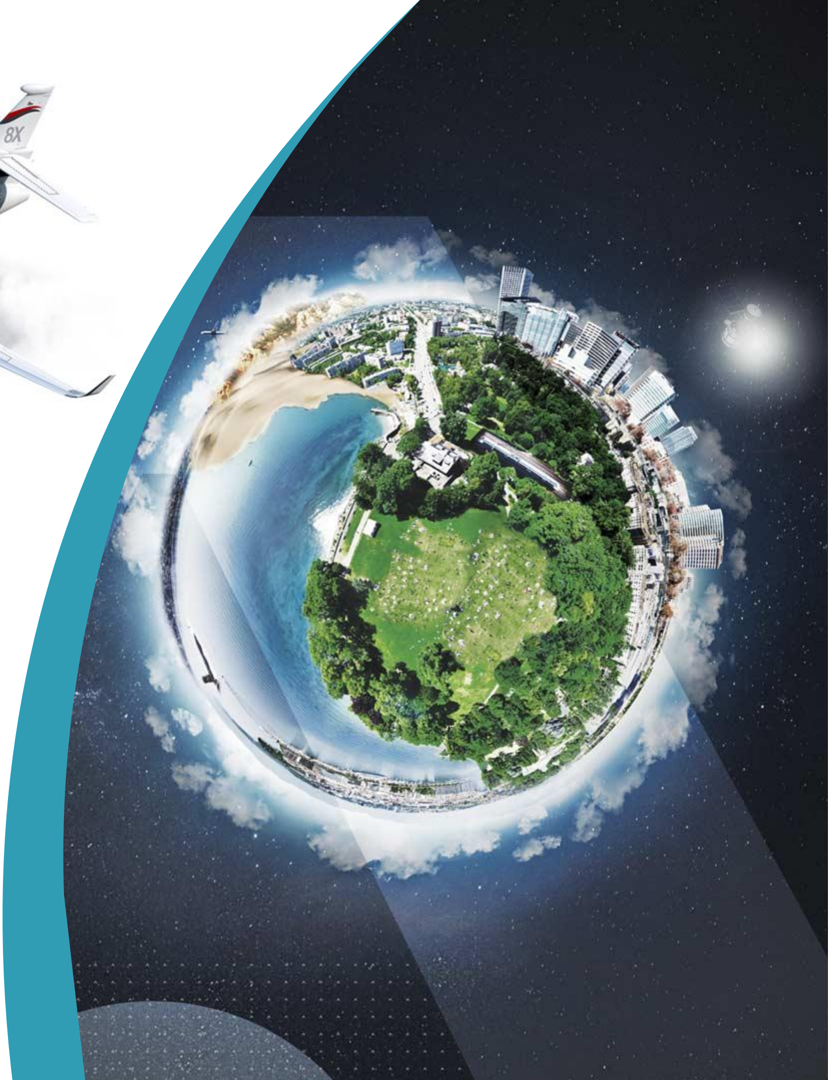
How to master Technical Complexity ?

Project engineering process based on MBSE



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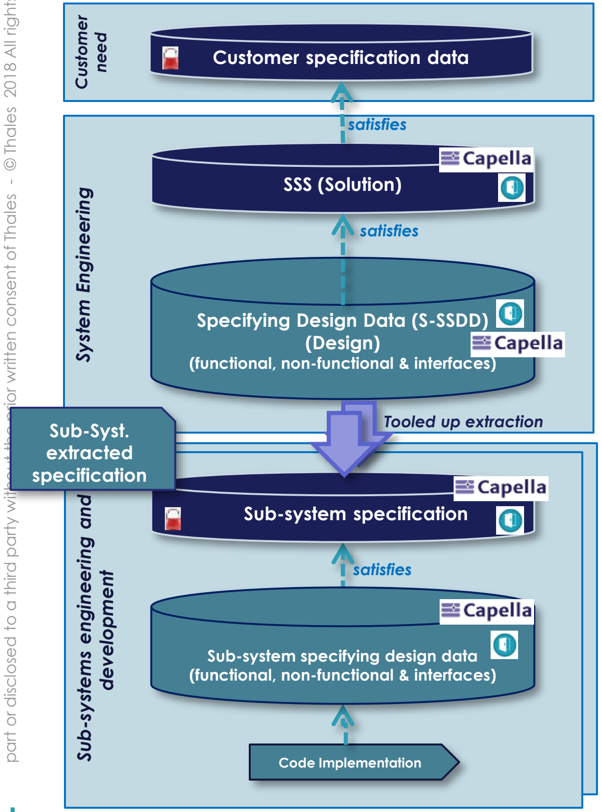
Taylored MBSE instanciation adjusted to the project context

Model Based System Engineering

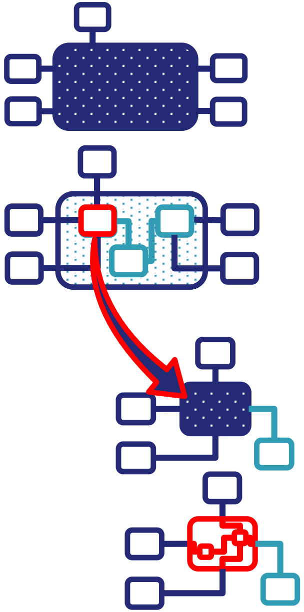


- **WHY** - Customer need expression
- **WHAT** - What the system shall do to cover the need
- **HOW** – How the system is built to cover the need

  System ⬄ Sub-Systems : strong co-engineering

  In order to define each sub-system contract

- **WHAT** - What the system shall do to cover the need
- **HOW** – How the system is built to cover the need



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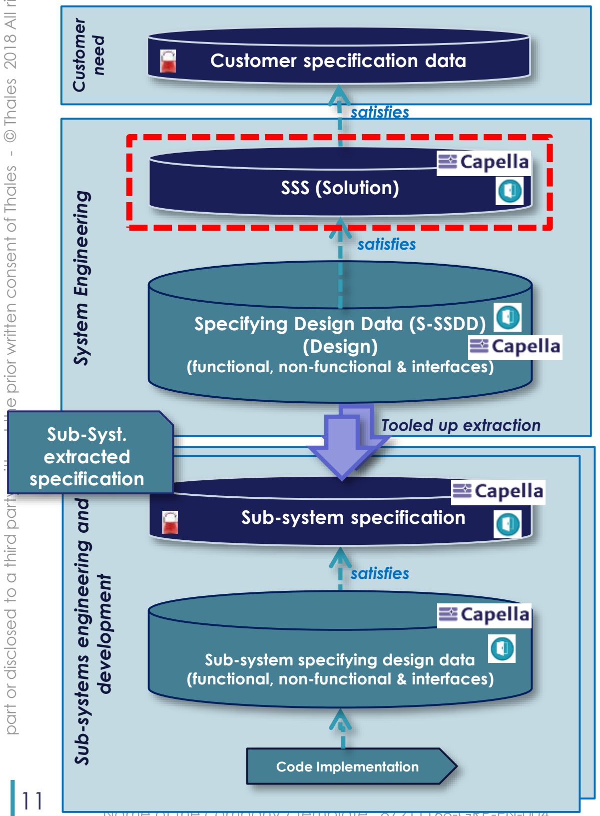
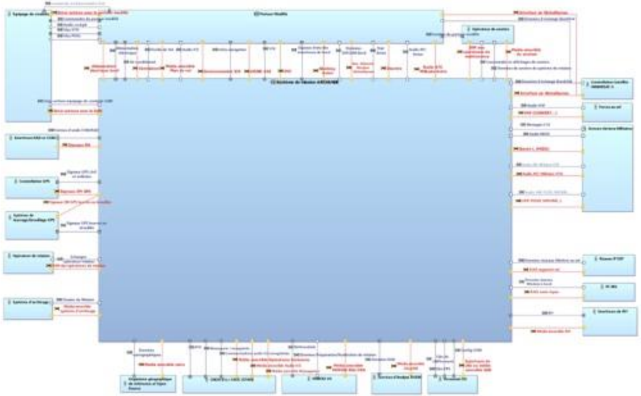
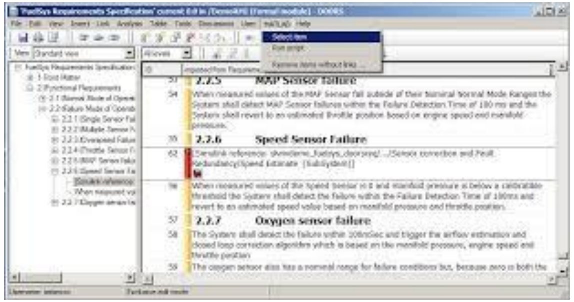
MBSE – SSS

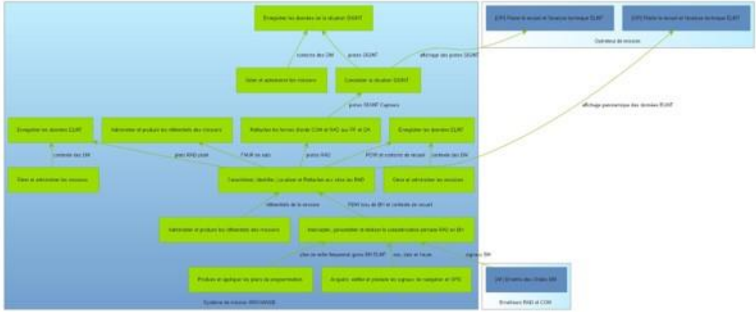
DEFINE THE ACTORS THAT INTERACT WITH THE SYSTEM, DEFINE THE SYSTEM EXTERNAL INTERFACE, DEFINE AND TRACE FUNCTIONAL CHAINS, WRITE FUNCTIONAL AND NON FUNCTIONAL REQUIREMENTS







- Capabilities
  - CAPA_A - Restitution
  - CAPA_B - Preparation
    - CAPA_B-01 - Preparation 1
    - CAPA_B-02 - Preparation 2
    - CAPA_B-03 - Preparation 3
    - CAPA_B-04 - Preparation 4
  - CAPA_C - Management
    - CAPA_C-01 - Success management
    - CAPA_C-02 - Problems management
    - CAPA_C-03 - Ordinary management
    - CAPA_C-04 - Solution management
  - CAPA_D - Record
    - CAPA_D-01 - Record this
    - CAPA_D-02 - Record that
  - CAPA_E - Replay
    - CAPA_E-01 - Replay this
    - CAPA_E-02 - Replay that
    - CAPA_E-03 - Replay all
    - CAPA_E-04 - Replay nothing
  - CAPA_F - Dispay
    - CAPA_F-01 - Display this
    - CAPA_F-02 - Display that
  - CAPA_G - Show
    - CAPA_G-01 - Show everything
    - CAPA_G-02 - Show this
    - CAPA_G-03 - Show that
    - CAPA_G-04 - Show nothing
    - CAPA_G-05 - Show important things
  - CAPA_H - Communication
    - CAPA_H-01 - External communication
    - CAPA_H-02 - Internal Communication
  - CAPA_I - Report
    - CAPA_H-01 - Mission report
  - CAPA_J - Training
    - CAPA_J-01 - Global training



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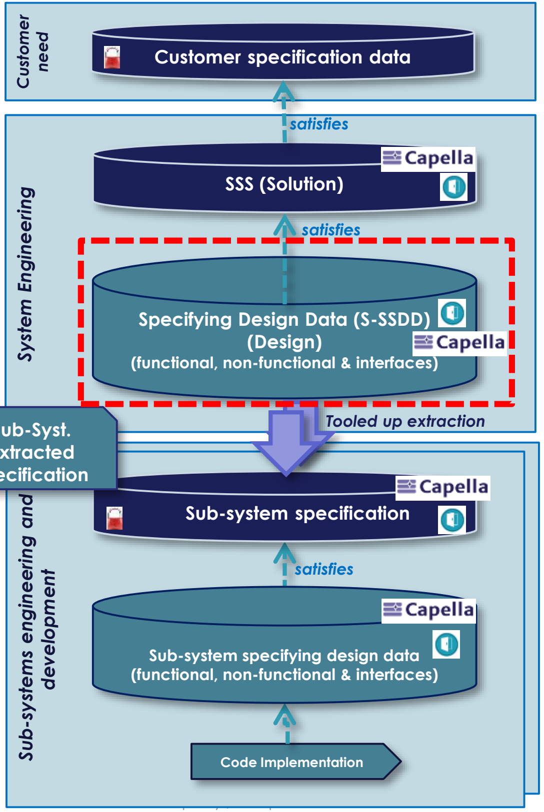
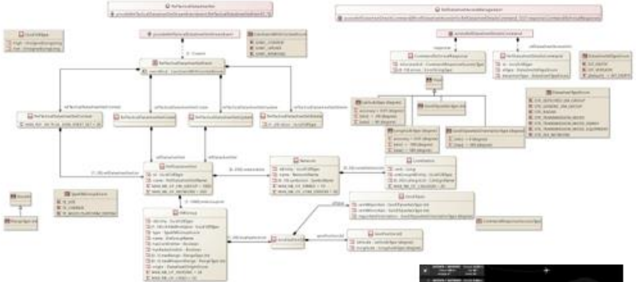
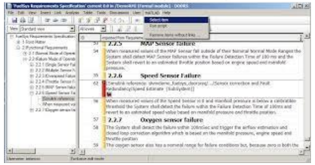
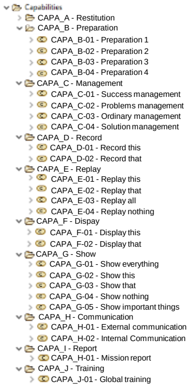
MBSE – Specifying Design Data – SSDD

System architecture definition, Functional chains, functional and non-functional requirements flowdown on sub-systems through co-engineeering, interface definition between sub-systems









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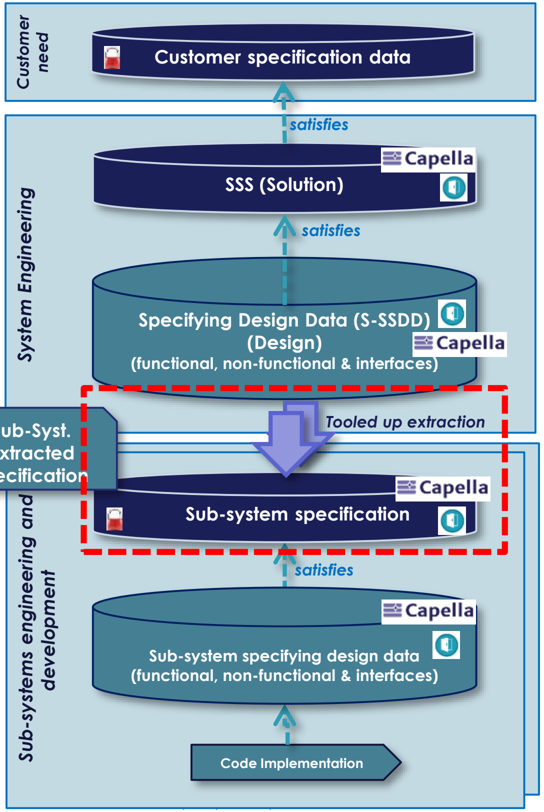
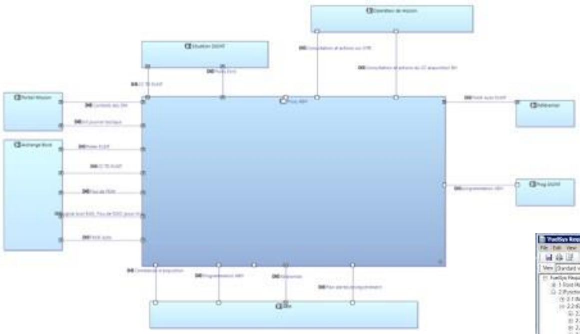
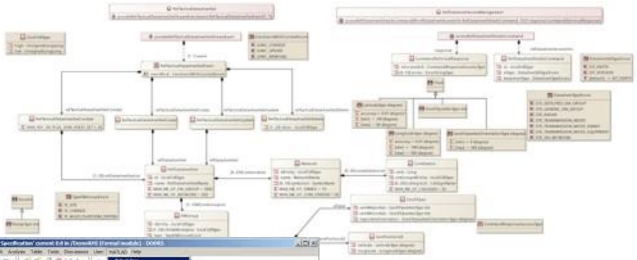
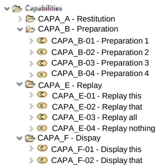
MBSE – System to Sub-Systems transition

Tooled up engineering data extraction for each sub system (Actors, Functional chains, Allocated functions, Functional and non-functional requirements)









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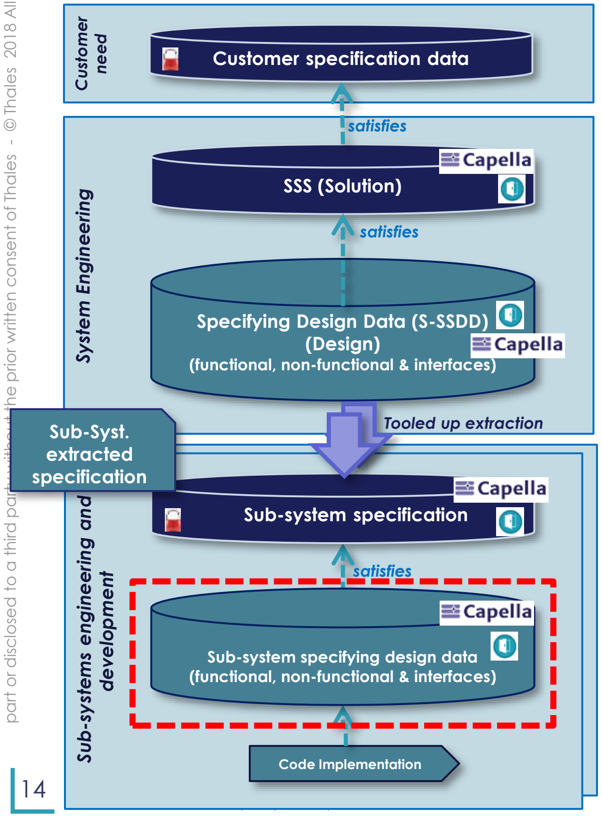
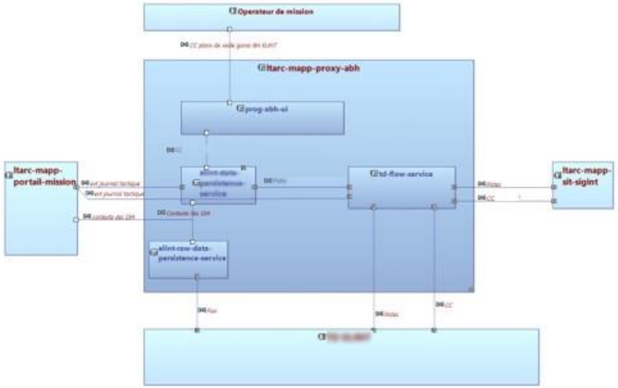
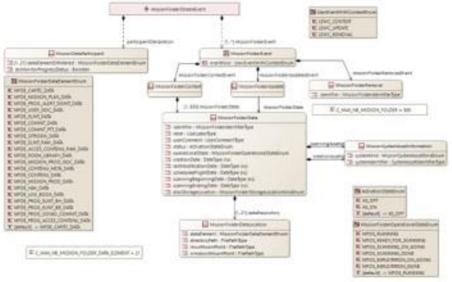
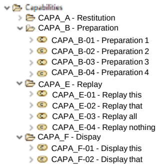
MBSE – Sub-system Design Specification

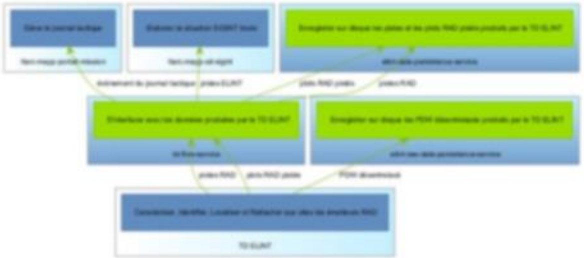
Software architecture definition, Functional chains, functional and non-functional requirements flowdown on software components, Interface definition betwwen software components











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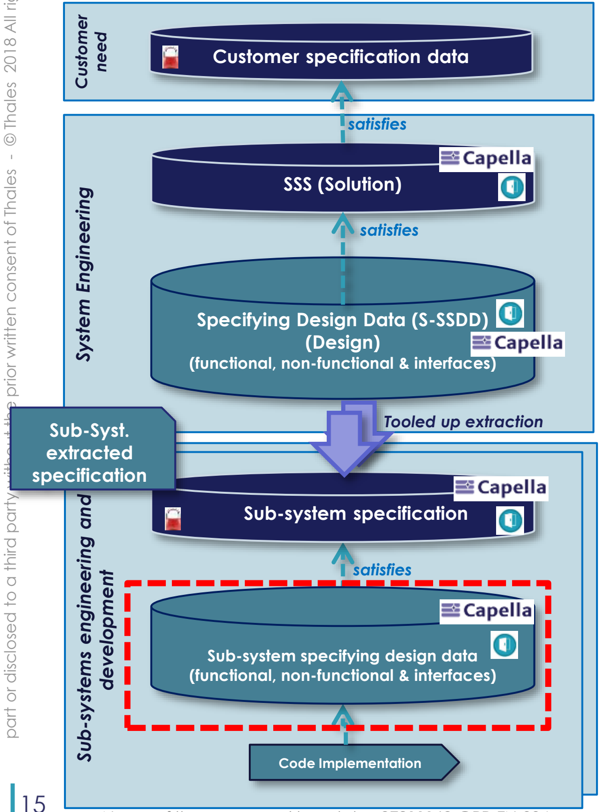
MBSE – Software development transition

CONSISTANT NECESSARY DATA GENERATION FOR THE SOFTWARE DEVELOPMENT

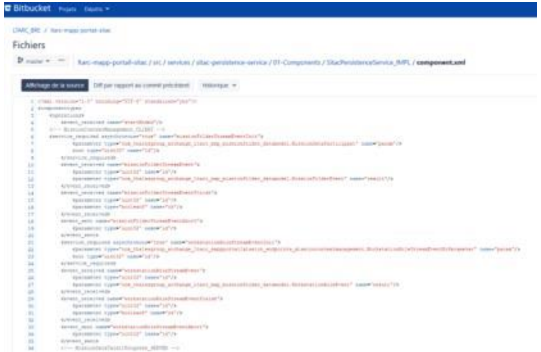
(DIGITAL INTERFACES, HTML PAGES FOR SPECIFICATIONS, …)



Specification documents generation

Components interfaces and skeletons generation

protobuf
Protocol Buffers



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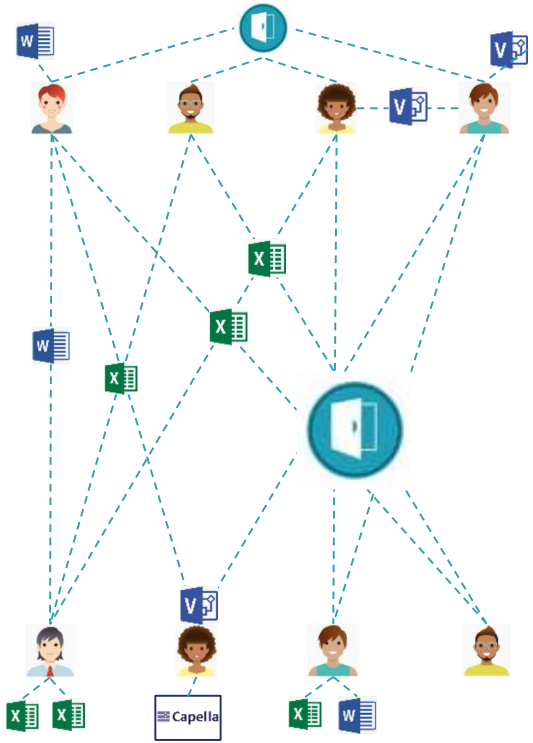
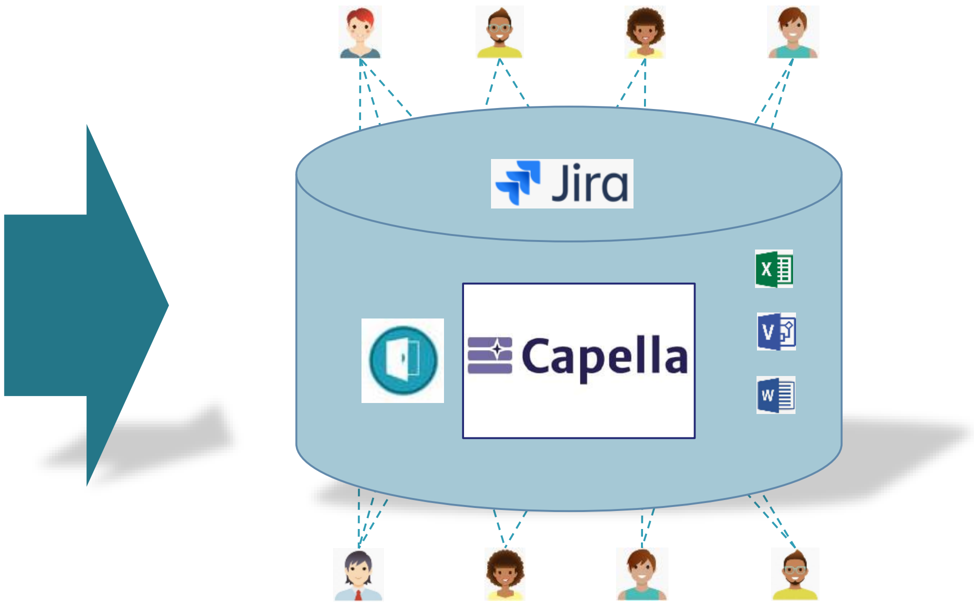
How to master organizational complexity ?

MBSE is necessary but not sufficient

Co-engineering to fight against sillos





Promoting global efficiency over local efficiency

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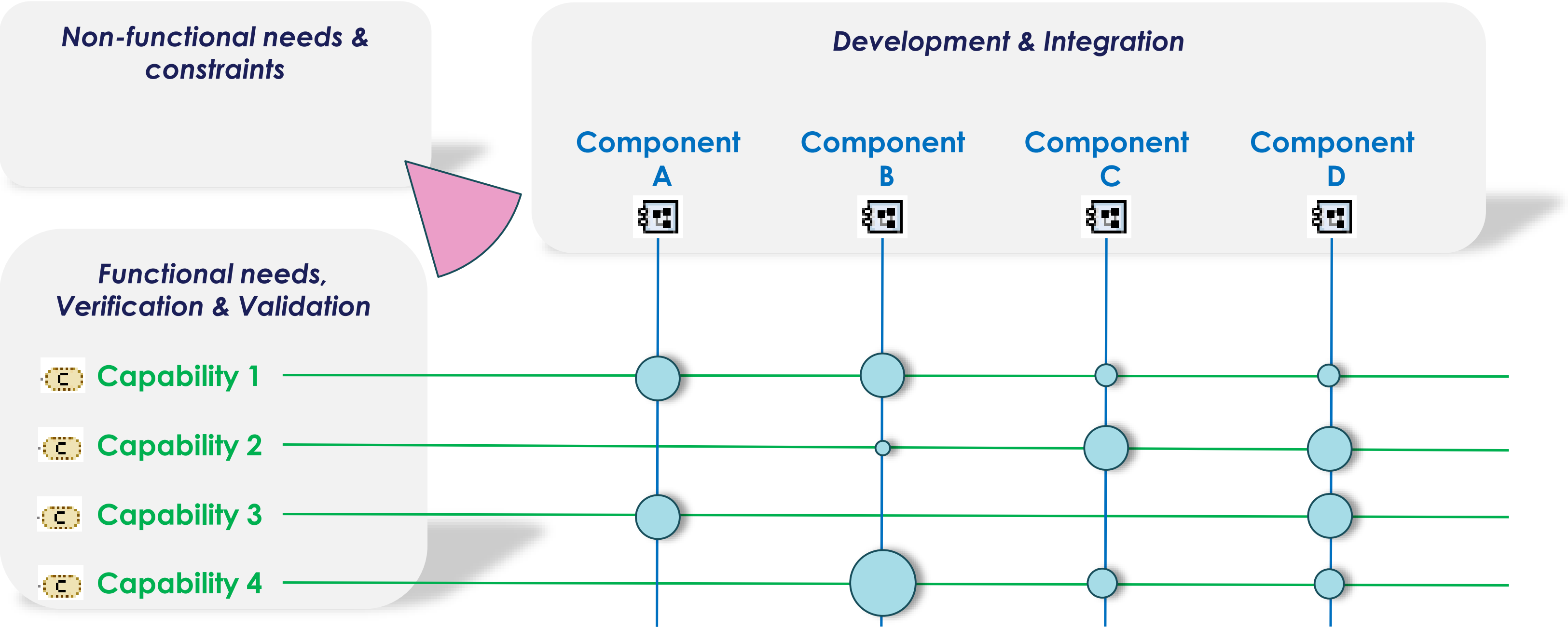
Functional ⇔ Non-functional ⇔ Component



Find the right balance between Functional needs, non functional constraints and Components point of view

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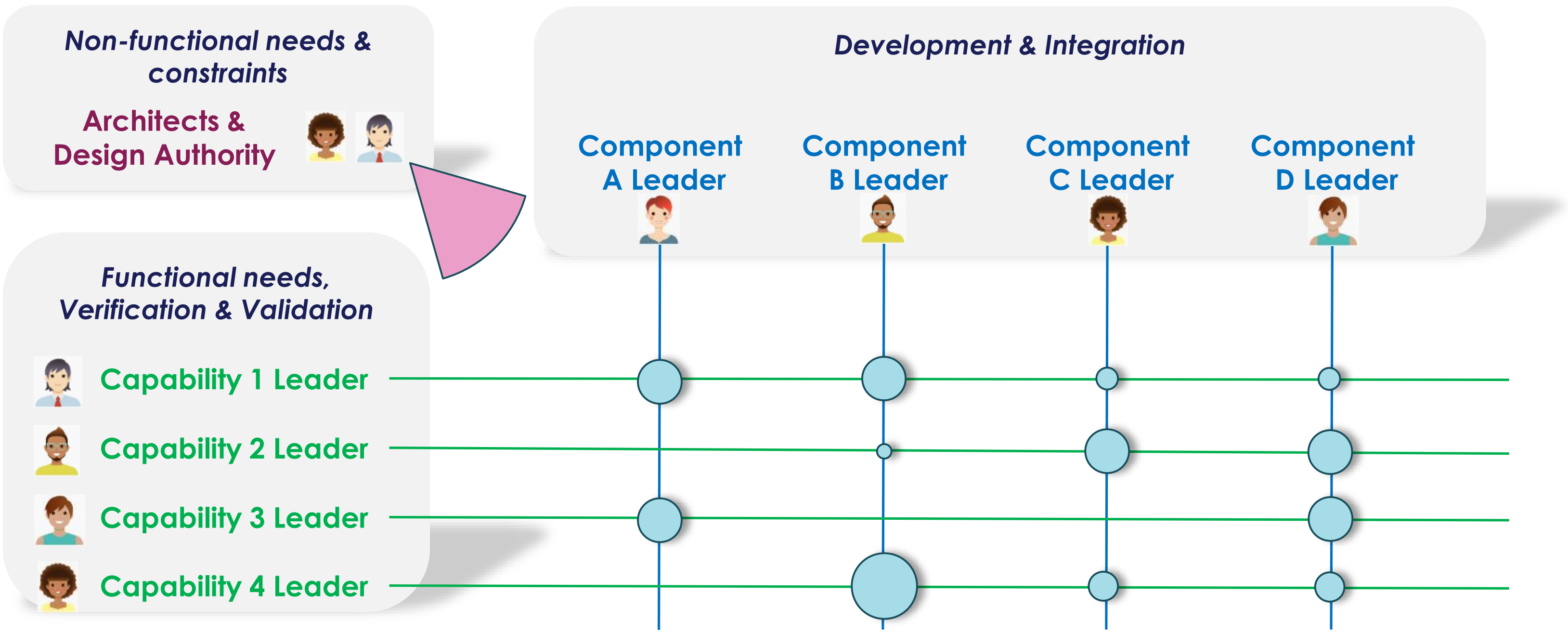
Functional ⬄ Non-functional ⬄ Component - OBS



A leader for each point of view

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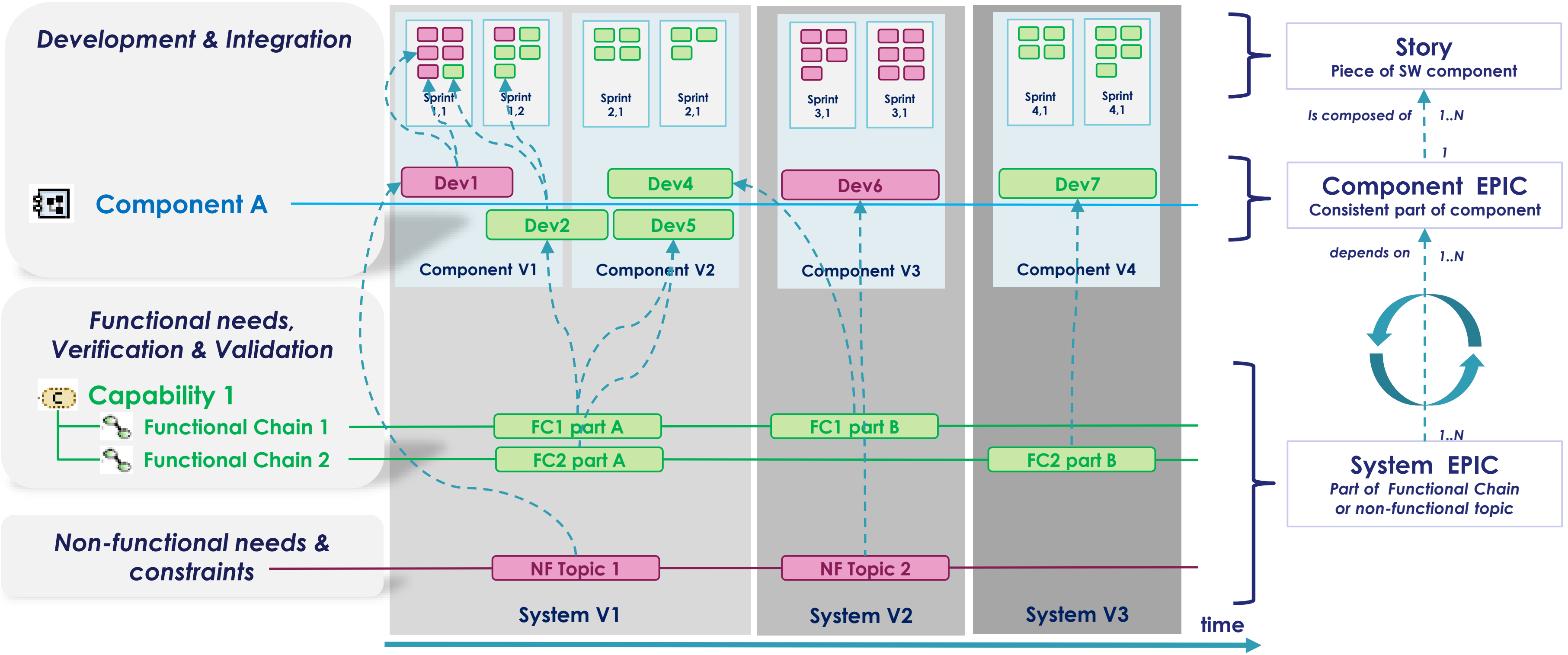
Functional ⇔ Non-functional ⇔ Component - Planning



Take component development constraints into account in functional chains and non functional constraints planning

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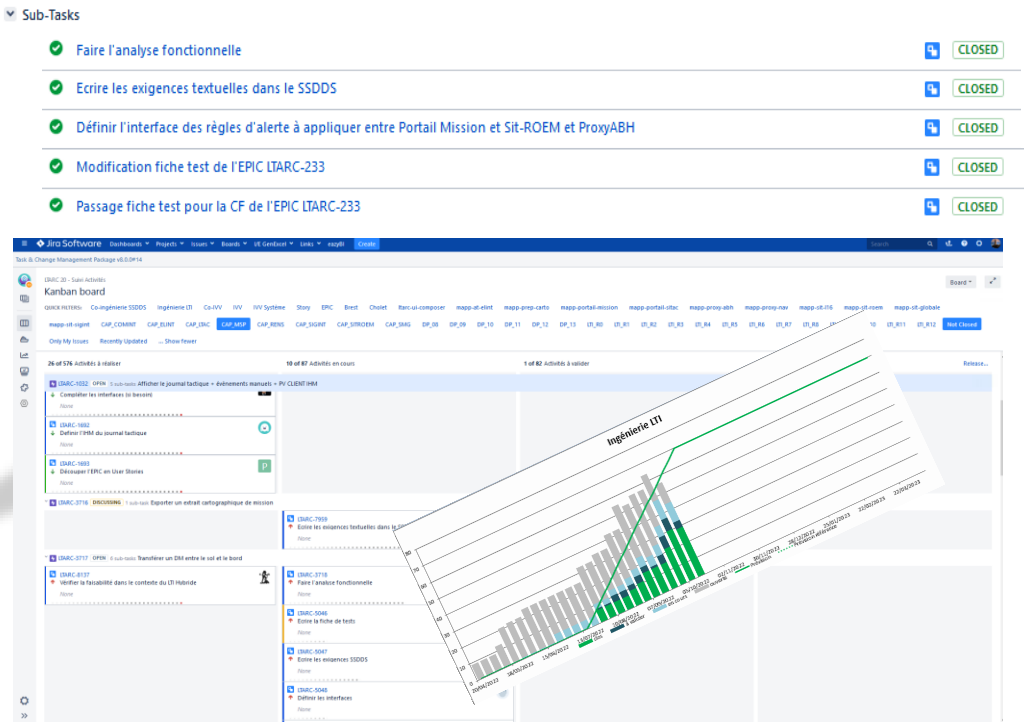
Engineering tasks management and team workflow

Jira

Don’t worry, we know what we have to do and we’ll be on time !



Formalize your engineering tasks and workflows and use them to build your reporting

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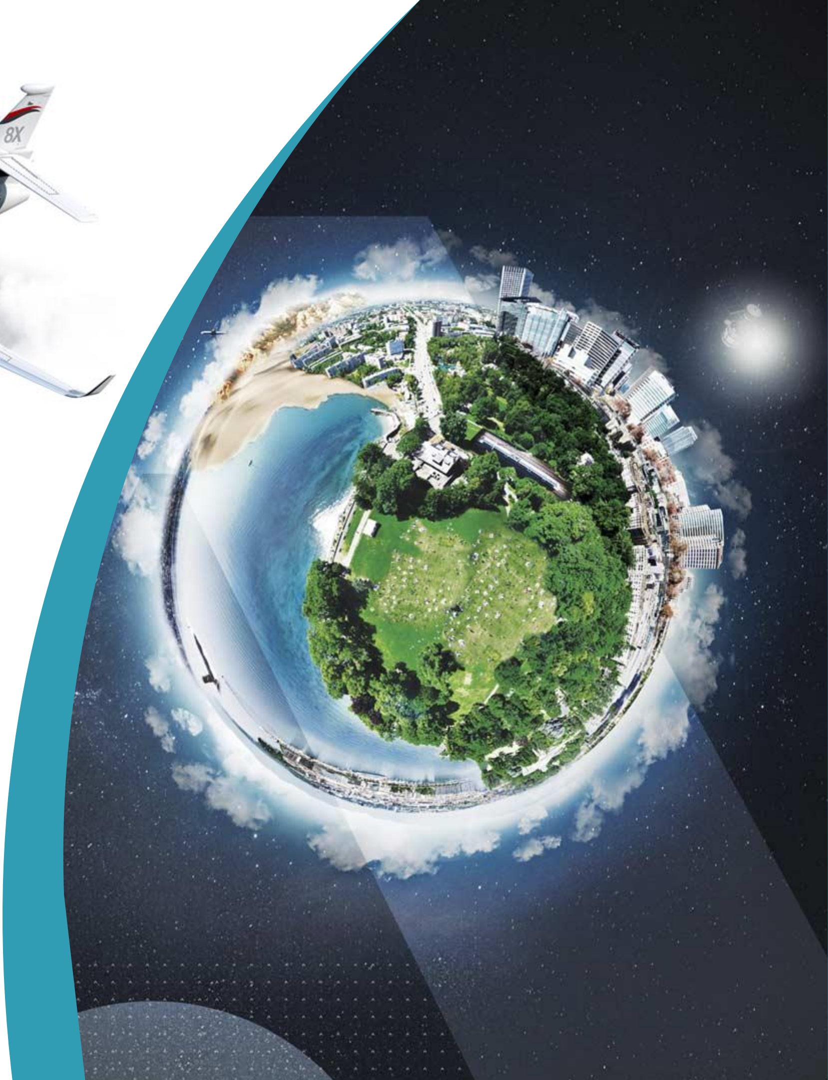

Conclusion & feed forward

Lessons learnt

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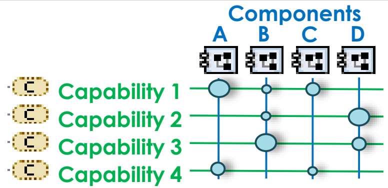
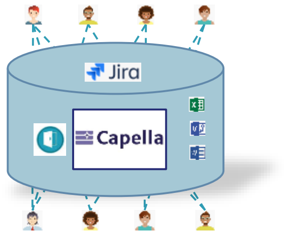
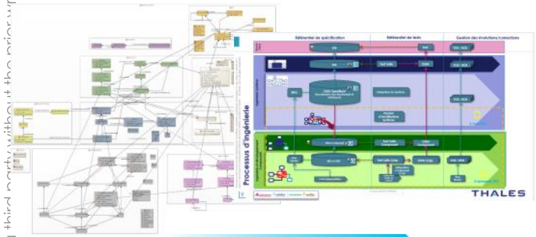






Capabilities and components are the two fundamental dimensions that structure the engineering workflow

Capella model shall be the reference backbone of the engineering data

- Capella model shall be used everyday by everyone
- Capella shall be connected to other engineering or management tools
- Data consistency shall be an obsession; tool unicity should not

2 essential keys to success :

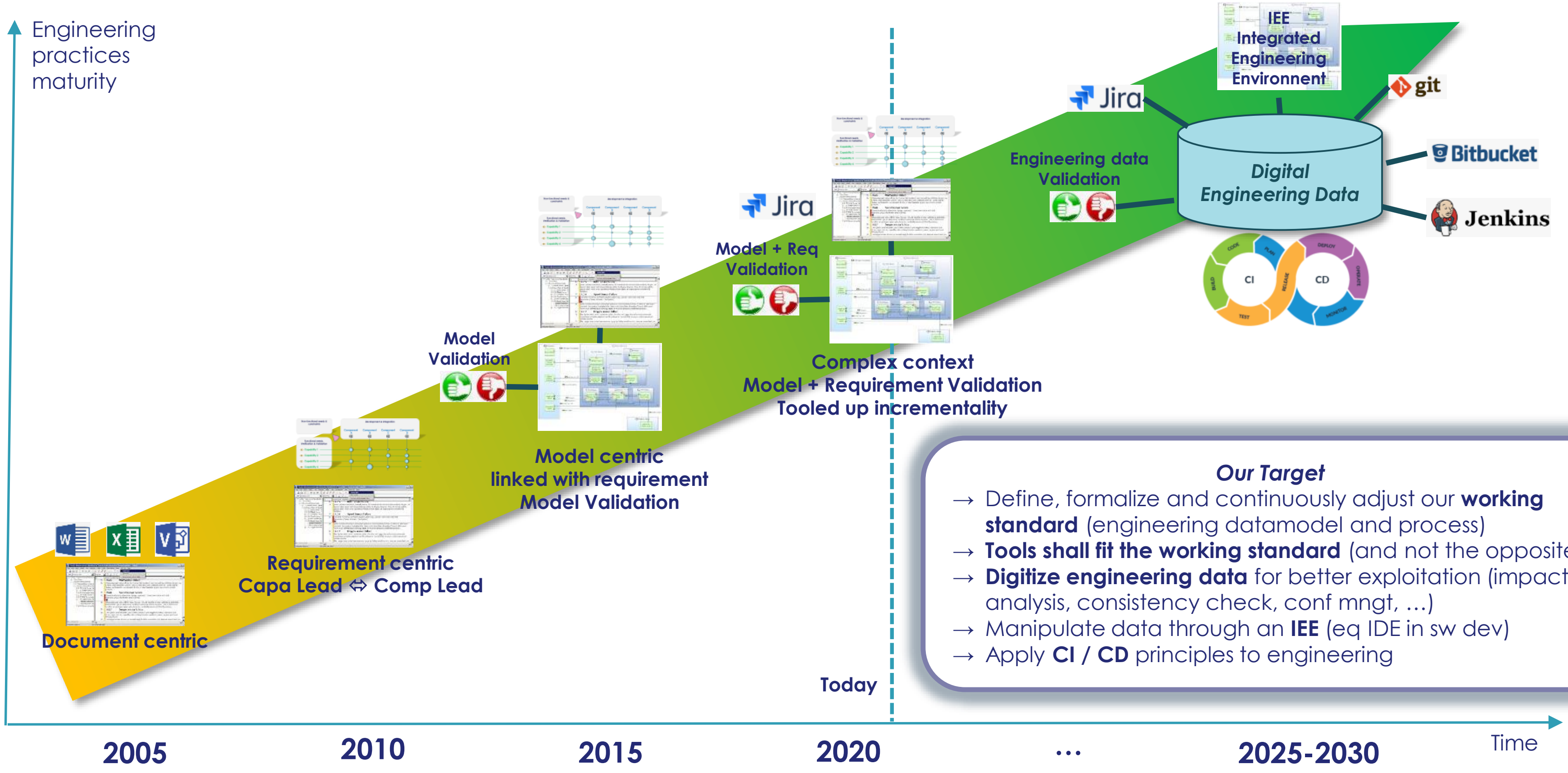
- Early definition of the global engineering data model
- Early definition of the engineering process

Do not underestimate the engineering transformation challenges

- Teams needs training and coaching
- Managers shall be sponsors of these changes

The efforts are worth the results !

Our engineering practices evolution



Our Target

→ Define, formalize and continuously adjust our **working standard** (engineering datamodel and process)
→ **Tools shall fit the working standard** (and not the opposite)
→ **Digitize engineering data** for better exploitation (impact analysis, consistency check, conf mngt, ...)
→ Manipulate data through an **IEE** (eq IDE in sw dev)
→ Apply **CI / CD** principles to engineering

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