Towards a European Roadmap for Fostering OSLC Adoption in Systems Engineering Development?

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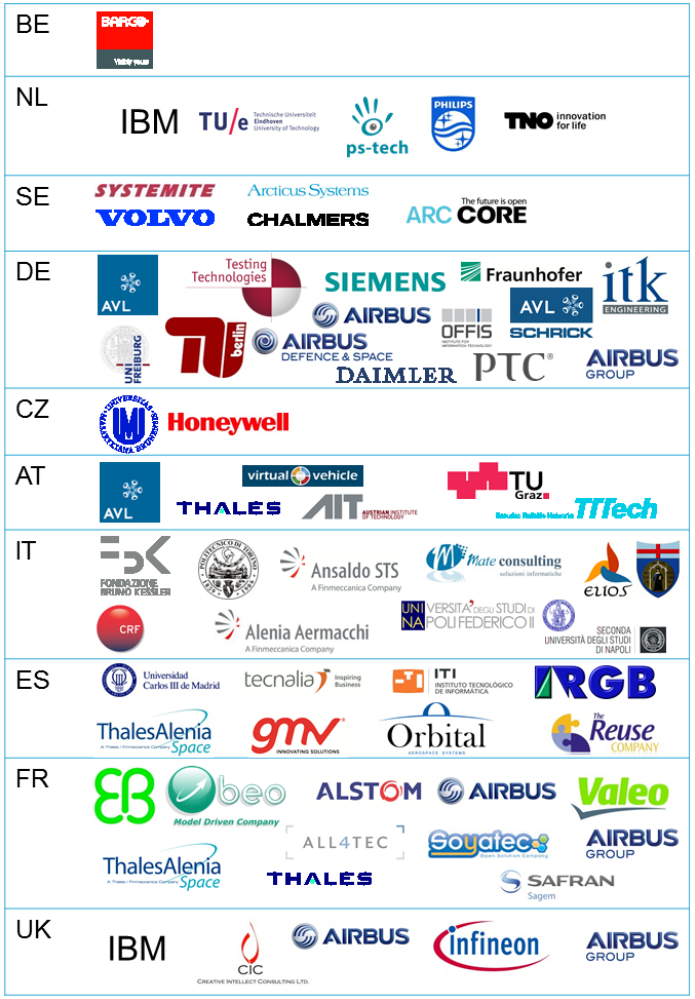
An Example of Large European Project: CRYSTAL



"Seamless Life-Cycle Collaboration for Safety-Critical Systems Engineering"

- **68 partners** from **10 countries**
- **$87M** total budget
- **European key players** from different industrial domains
- Large companies developing embedded systems act as **technology users** and use case providers
- Large tool providers, SMEs and researchers as **technology providers**
- **4 Industrial Sectors (Aerospace, Automotive, Rail, Healthcare)**

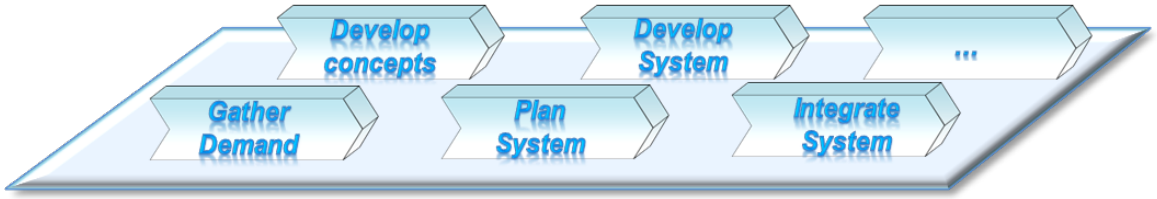
Agenda

- Interoperability related activities in large European projects
- Towards the establishment of a sustainable structure for interoperability specifications (in CP-SETIS)
- Some technical challenges we are facing with OSLC
- Some dissemination material from CRYSTAL
- KTH contributions to the Lyo OSLC reference implementation

Today's situation in industrial companies

AEROSPACE AUTOMOTIVE HEALTH CARE RAILWAY

Industrial Workflows



- *Fragmented IT*
- *High maintenance costs*

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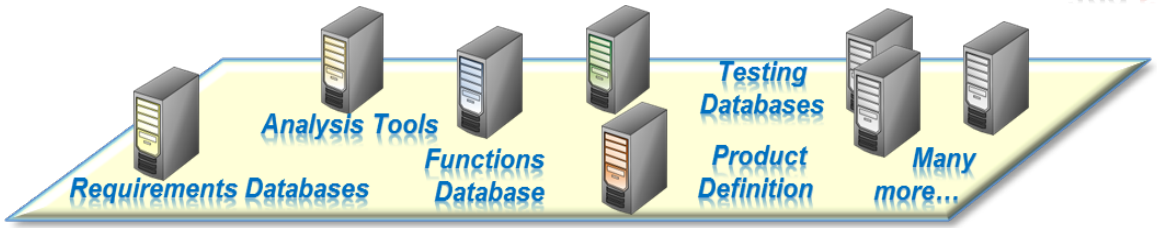
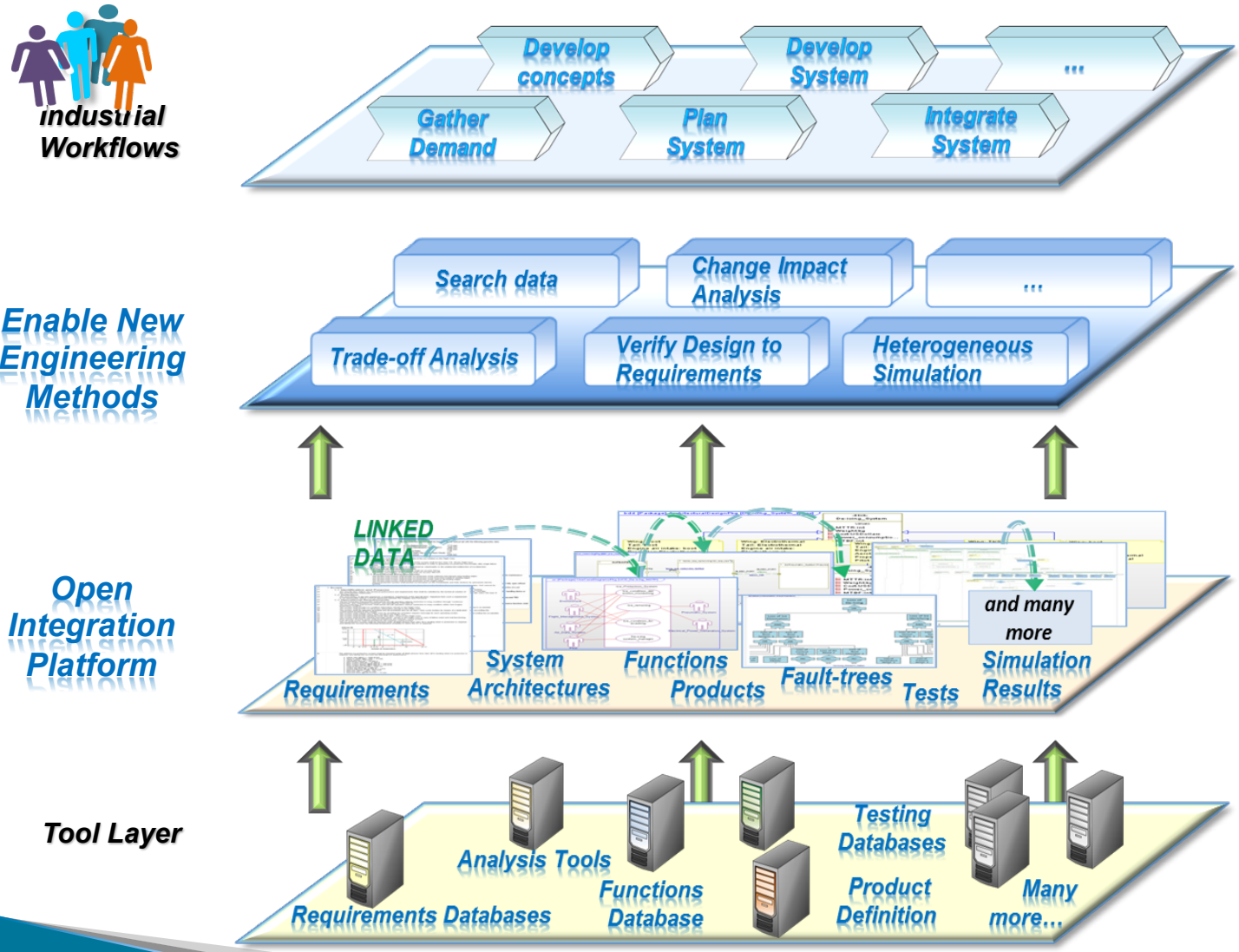
- *High manual effort to handle data*
- *Impact on quality and safety*

Tool Layer



The CRYSTAL Vision



Users get better ways of working

- ***Standardized Interoperability Specifications (IOS)***
- ***Connect tools to expose & link data***

IOS History & Evolution

- **Pre-Project Phase** (from 2010)
  - Safe, iFEST, CESAR, MBAT projects
    - Proof of concept,
    - OSLC as one basis,
    - Extensions to Testing & Analysis

Proprietary Demonstrators

Public Demonstrators

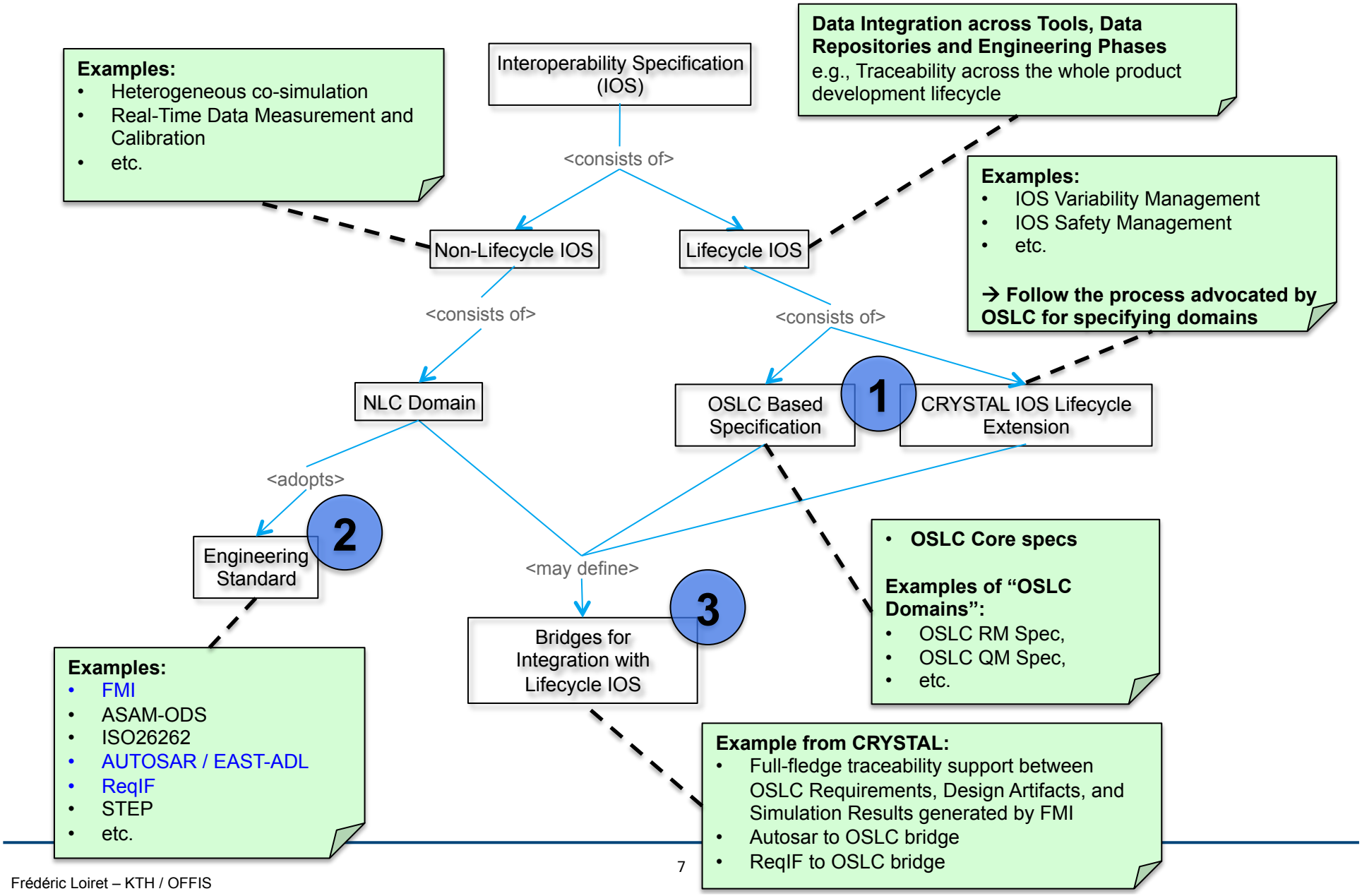
- **CRYSTAL Project Phase** (until mid 2016)
  - Extension of IOS to additional concepts & standards
  - Fostering adoption of IOS by Tool Vendors and Industrial End-Users

Extended Public Demonstrators

- **After Project Phase**
  - Coordination Action (H2020 CP-SETIS)
  - new projects (ITEA3 ASSUME, ECSEL ENABLE-S3)

Industrial End-User Application

CRYSTAL High Level IOS Architecture



Current Content of the CRYSTAL IOS

- **Lifecycle IOS**
  - Adopted from OSLC
    - OSLC Core, CCM, TRS
    - OSLC RM, AM, QM, Asset, Change Request Domains
  - CRYSTAL extensions to existing Domains
    - RM, AM (extensive ones), QM
  - New Domains
    - Knowledge & KPIs Management
    - Formal Requirement Management
    - Verification & Validation
    - **Variability Management**
    - **Safety & Risk Management**
  - New Domains from other projects
    - Human Factor Modeling (from the HoliDes project)
    - AM extensions (from ASSUME/Scania)
- **Non-Lifecycle IOS**
  - FMU/FMI standard for co-simulation
- **Bridges**
  - AUTOSAR / EAST-ADL to OSLC
  - OMG ReqIF to OSLC

Context and current situation

- Current situation is characterized by a **wide variety of activities**, which are only **partly coordinated**
  - Several **follow-up projects** building and extending the IOS
  - **New European projects** emerging that **aim at interoperability** solutions for development tools
  - Interoperability related projects are step-by-step converging towards a common definition of the IOS

Challenges

1. Organizational & Strategical
   - A common vision and mission, shared by all major stakeholders, for supporting lifecycle data and tool interoperability for CPS Engineering has to be established
   - Aligning the as yet only partially coordinated European IOS-related activities and **paving the way for establishing the IOS as a major set of standards in CPS Engineering**.

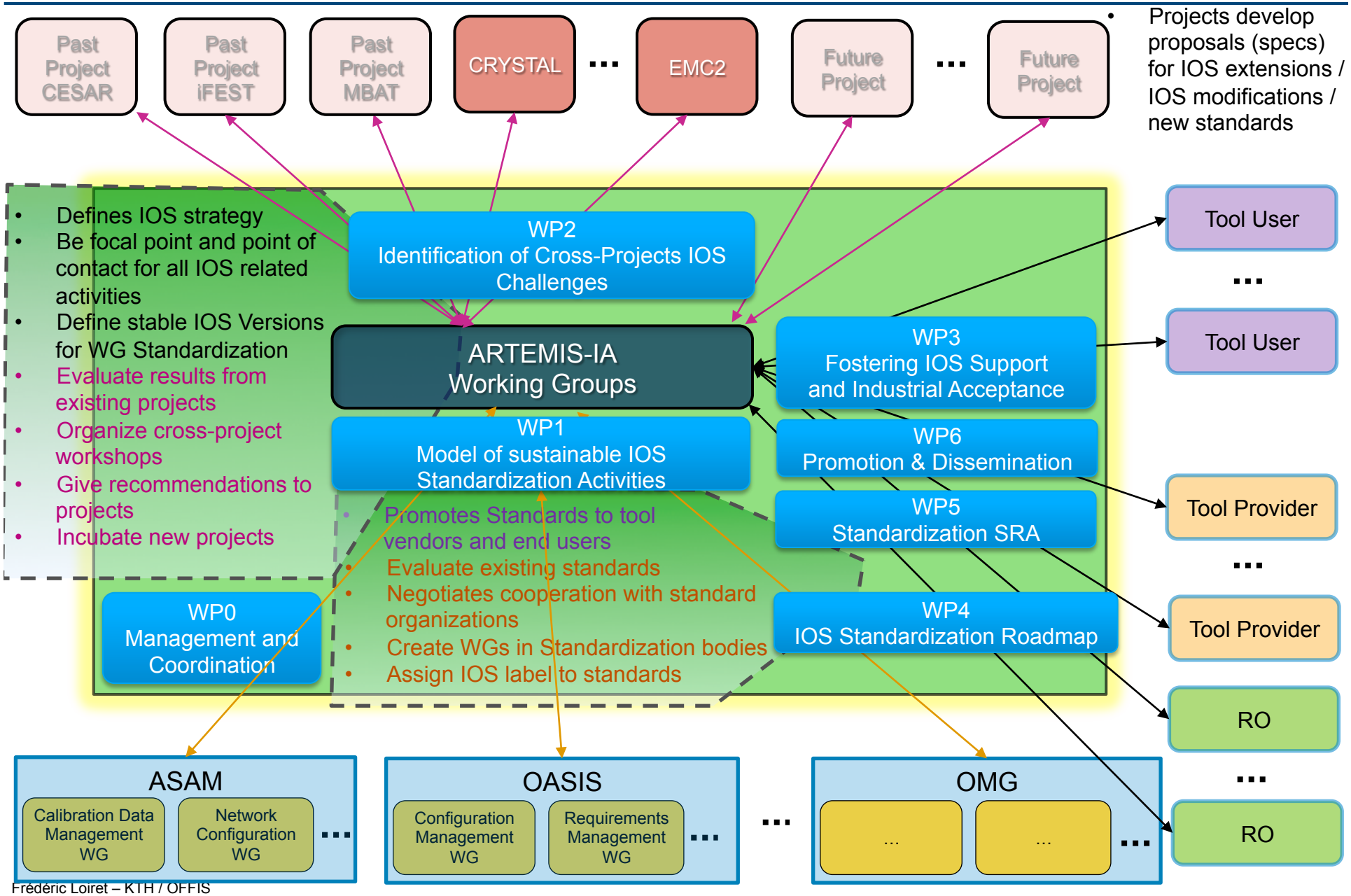
2. Technical
   - Coordination of IOS cross-project extensions (complementary & orthogonal concerns)
   - A clear bridge has to be defined between the on-going definition of the IOS and other wide spread Interoperability and Engineering Standards commonly used by European developing organizations
     - **related to "*Data Exchange*" besides "*Data Integration*"**

CP-SETIS – Coordination Action kick-started in 2015
Goals

- **Align all IOS related forces** within Europe to support a **common IOS Standardization Strategy**, aiming at **formal standardization** process of the IOS

- The definition and implementation of **sustainable IOS Standardization Activities** supporting both, formal standardization of ‘stable’ IOS versions as well as extensions of IOS, if possible within existing structures that survive the lifespan of single projects

CP-SETIS WPs & Possible Implementation



Partners

Core Partners

Austrian Institute of Technology (AIT), Austria

ARTEMIS-IA Industrial Association, Europe

AVL, Austria

Royal Institute of Technology (KTH), Sweden

OFFIS, Germany

SafeTRANS, Germany (coordinator)

Siemens, Germany

Thales, France

Associated Partners
(initial list to be extended)

ABB, Sweden

Airbus, France, Germany, UK

ASAM, Europe

Daimler, Germany

Volvo, Sweden

European Telecommunications Standards Institute (ETSI), Europe

→ More are being invited to join

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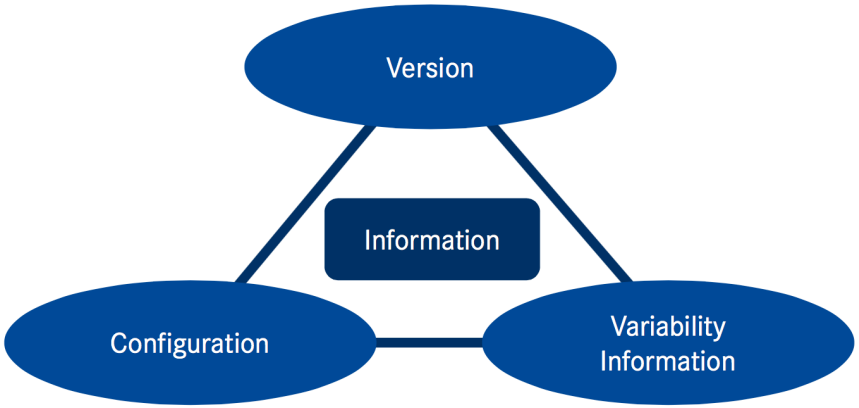
Some Technical Challenges of OSLC specs

- Specification / Guidelines for handling **Data Exchange** scenarios
  - Via engineering standards
  - Via company-specific “OSLC domains”
  - Via basic “raw” file exchanges

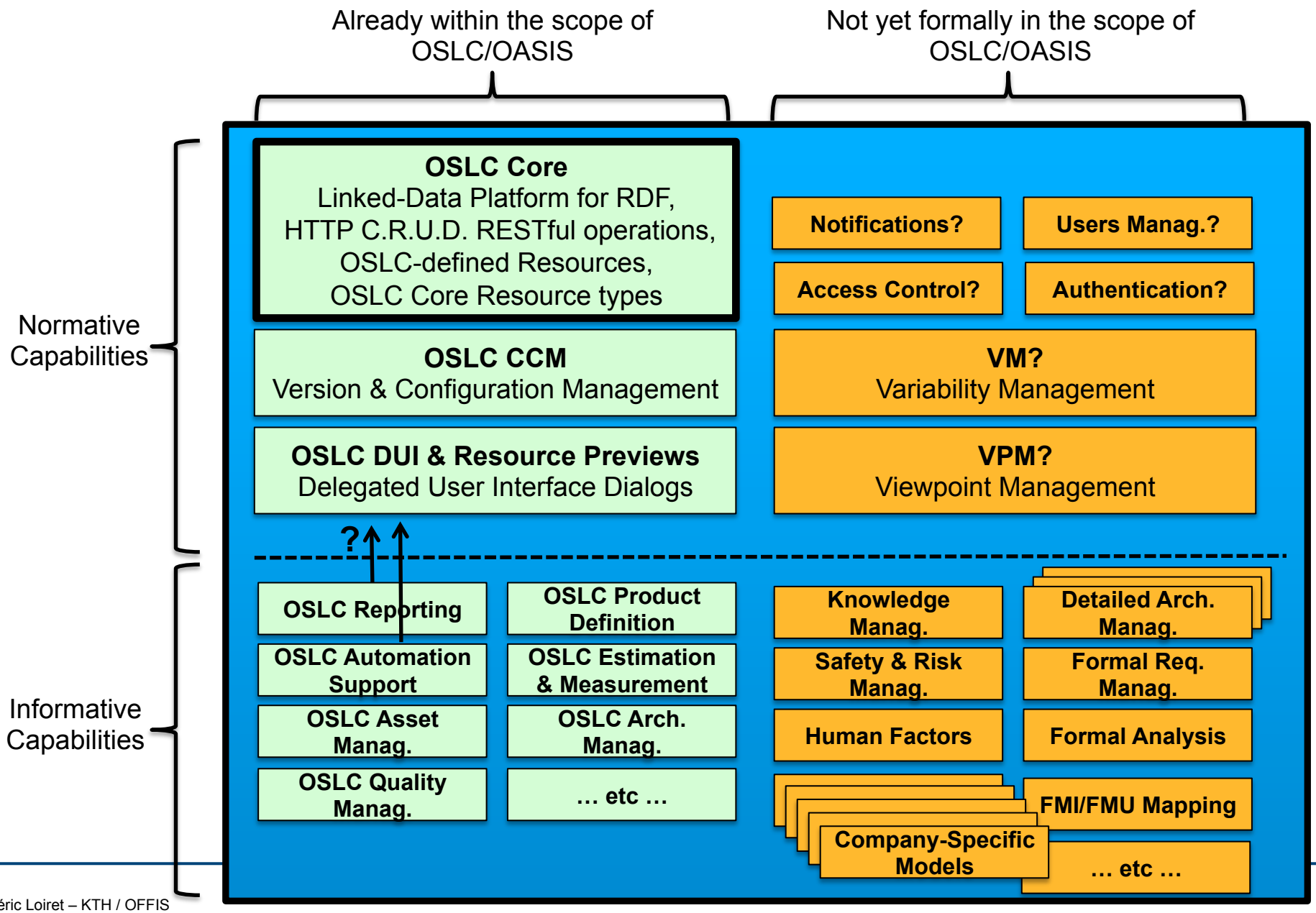
- The “Magic Triangle”
  - Version / Configuration / Variants



- Authentication & Access Rights Management not standardized

Towards a new distinction between normative and informative OSLC specs?

Just a brainstorming!



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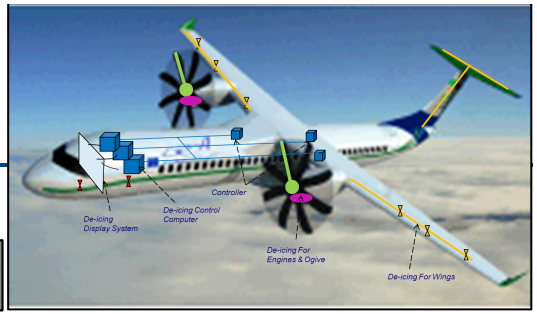
  - Public Use Cases
  - Generic Engineering Methods
- KTH contributions to the Lyo OSLC reference implementation

Purpose of the CRYSTAL Public Use Cases

- Describe typical engineering challenges with respect to (tool) interoperability for specific industrial sectors
  - In particular for Aerospace and Automotive
- Perform prototyping of IOS concepts
- **Facilitate the presentation of CRYSTAL results in publications without facing IPR concerns**
  - Documented ***Engineering Methods*** (or "*Integration Scenarios*") and their mapping onto IOS concepts
  - Engineering Models available

Example of the CRYSTAL Aerospace Public Use Case

Definition of De-icing System for Regional Turboprop Aircraft



Clustering of Engineering Methods

RTP related

Set-up of SEE, including user rights

Process Management

System Design and Analysis related

Analyze Requirements

Define Domain Model

Extend for FMU Export

Heterogeneous Simulation

Add Safety

Generate Fault-trees / TBD

Verify Design Against Requirements

Trade-Off Analysis

Add Feature

Product Line Engineering

"Common Services" related

Search Data

Traceability/ Change Impact Analysis

Support collaborative working

Put all data under Configuration Control

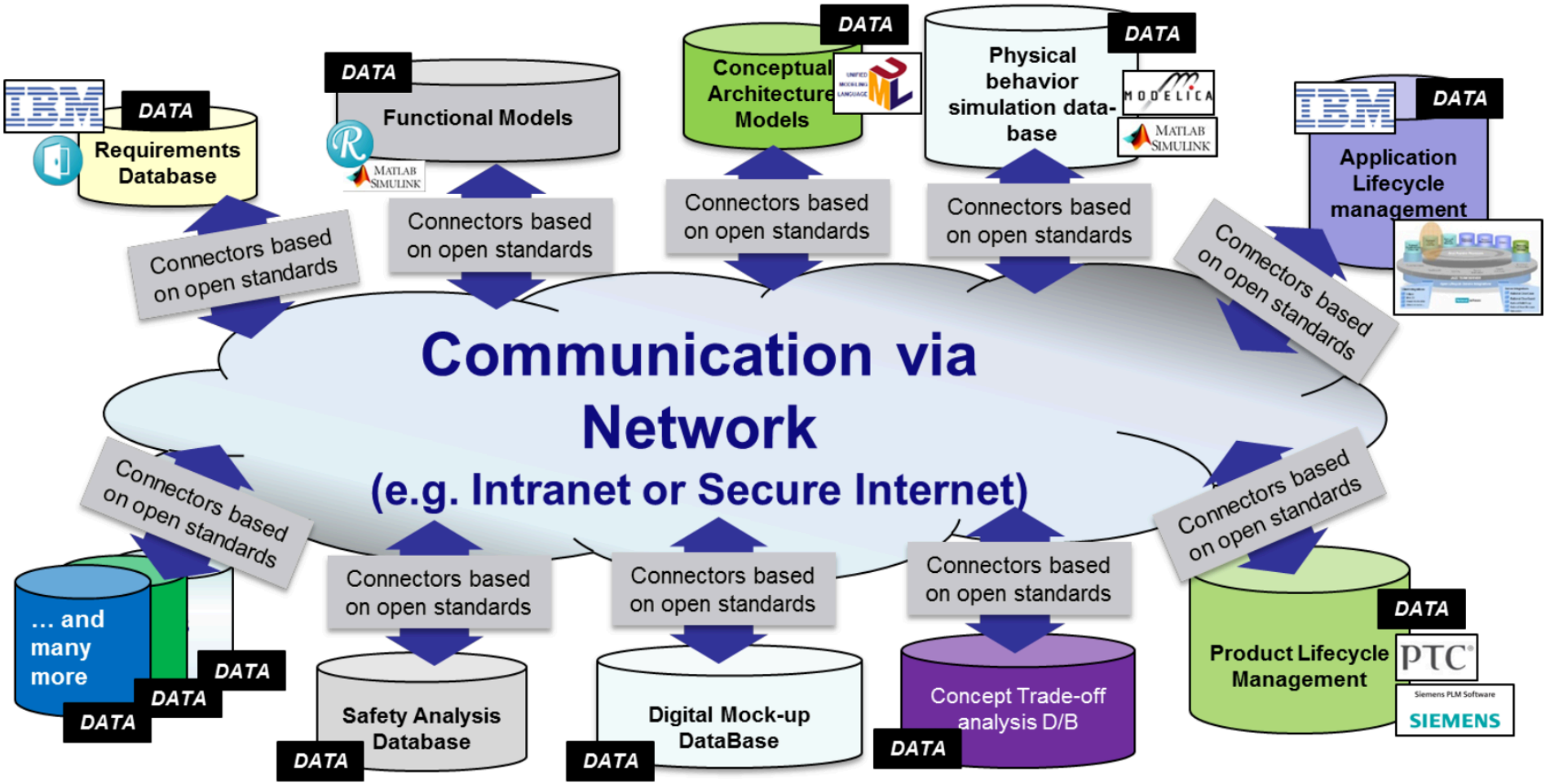
Test Support

Provide Specification

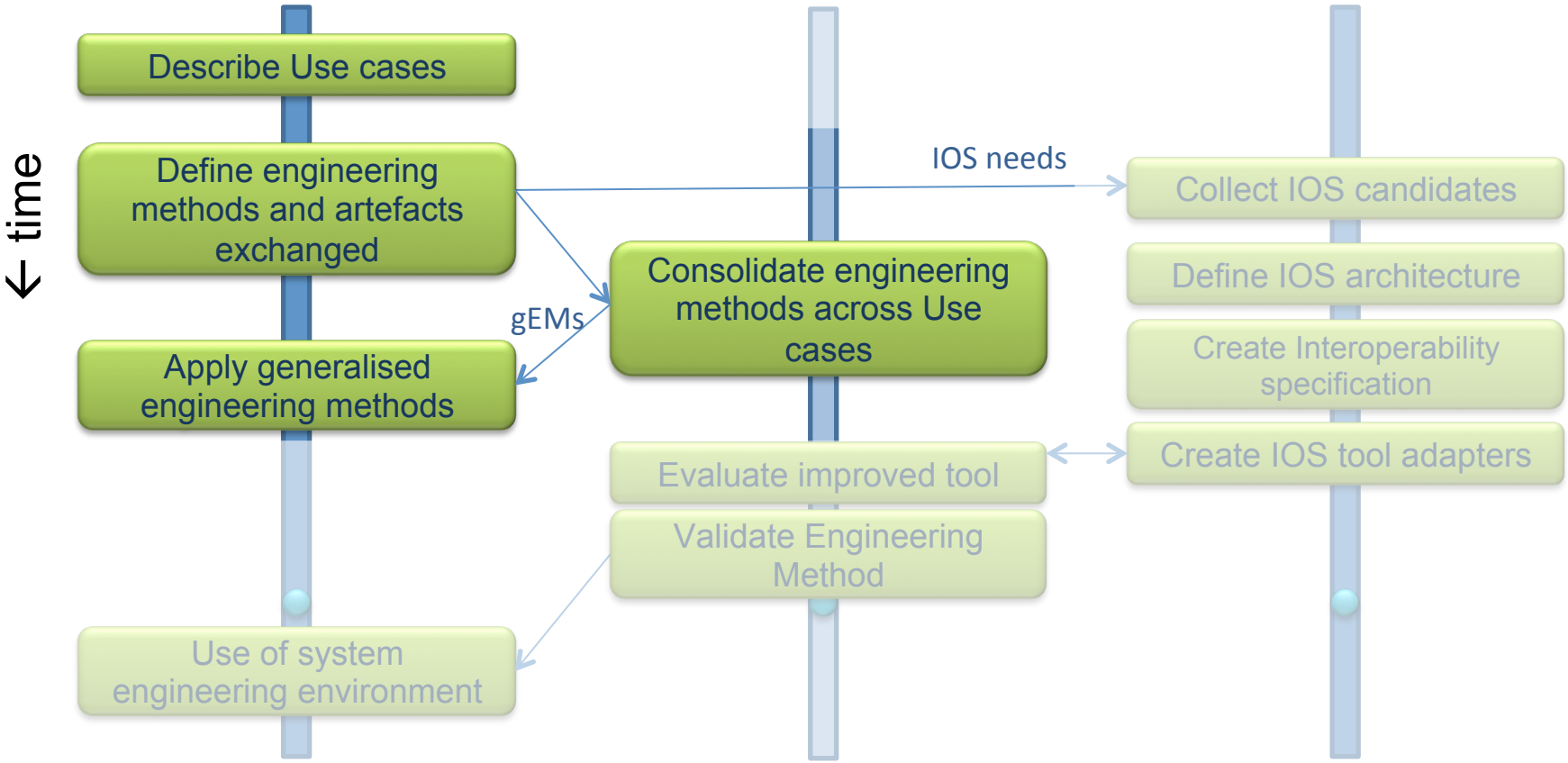
Maintain Consistency between multi-viewpoint models

Versioning / Archiving

Envisioned Prototype for Implementation



Developing IOS and generic Engineering Methods in CRYSTAL



CRYSTAL Generalised Engineering Methods

- **How to use IOS for a typical work process?**
  - Sample generalised Engineering Methods show how to map to IOS
  - Cross-domain engineering steps and engineering functions
  - Categorised according to ISO 15288
  - Based on Engineering methods collected in Use cases
- **Current gEMs being developed in CRYSTAL**
  - Tests coverage of requirements
  - Simulation management
  - Version & configuration management
  - Safety management
  - Certification (draft)
  - *Drafts: Variability Management / ReqIF-OSLC / Trade-off Analysis*

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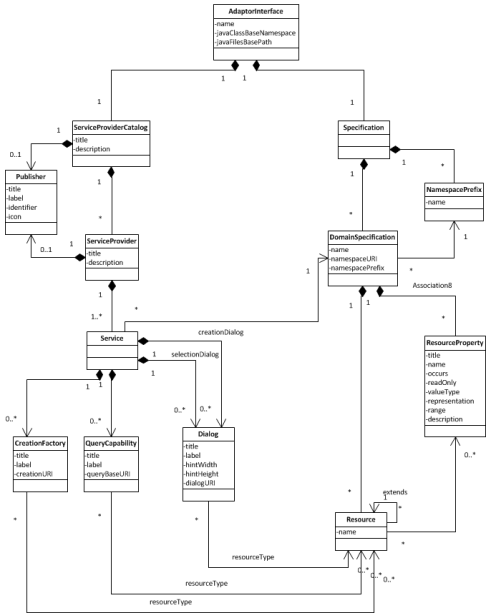
OSLC Reference Implementation / Community Building

- Building up momentum around Lyo should be fostered!

- KTH contributions so far
  - OSLC4J code generators (part of Lyo)
  - Modeling support for Linked Data

OSLC EMF Meta Model



Automatic Generation

Generated OSLC4J Front-Ends

Vocabulary based on Linked Data
- An Eclipse Graphical User Interface

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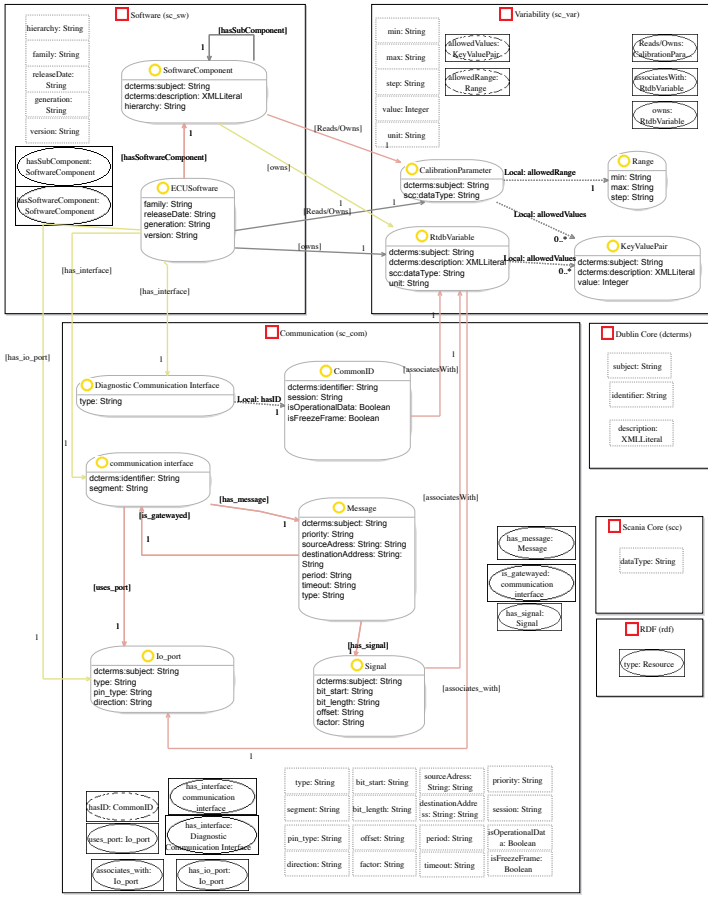

Thanks for your attention!

CRYSTAL website

http://www.crystal-artemis.eu

CP-SETIS website (under construction)

http://cp-setis.eu

CRYSTAL IOS V2 & Public Use Case Deliverables (publicly released)

http://www.crystal-artemis.eu/deliverables.html

Lyo/KTH Code Generators

https://wiki.eclipse.org/Lyo/AdaptorCodeGeneratorWorkshop