Driving Intelligent Transportation Systems with Capella
Continental Return of Experience

CapellaDay Toulouse / Tuesday 20th of june 2017

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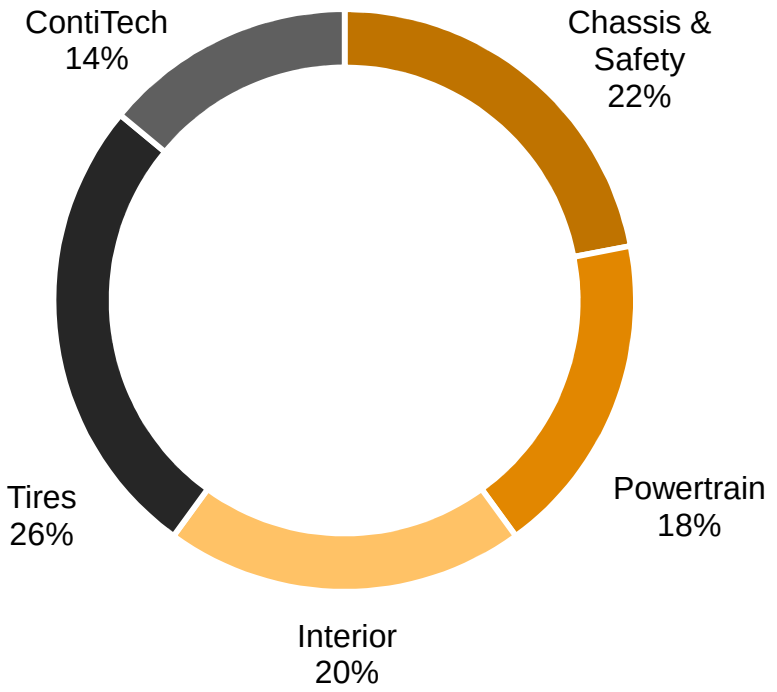
Continental Corporation
Overview 2016

- Since 1871 with headquarters in Hanover, Germany
- Sales of €40.5 billion
- 220,137 employees worldwide
- 427 locations in 56 countries

Sales by division in %



Status: December 31, 2016

Interior division mission: Information management in the vehicle and beyond

Cars of the future will feature electric drives, which will be fully connected and

With our holistic, intuitive and ergonomic **human-machine interface**, we capture commands, prioritize and present information.

We add new functions by providing a holistic **connection to the outside world** as well as value-added **mobility services**.

Driver & Passengers | **Devices** | **Infrastructure** | **Other Vehicles**

Vehicle

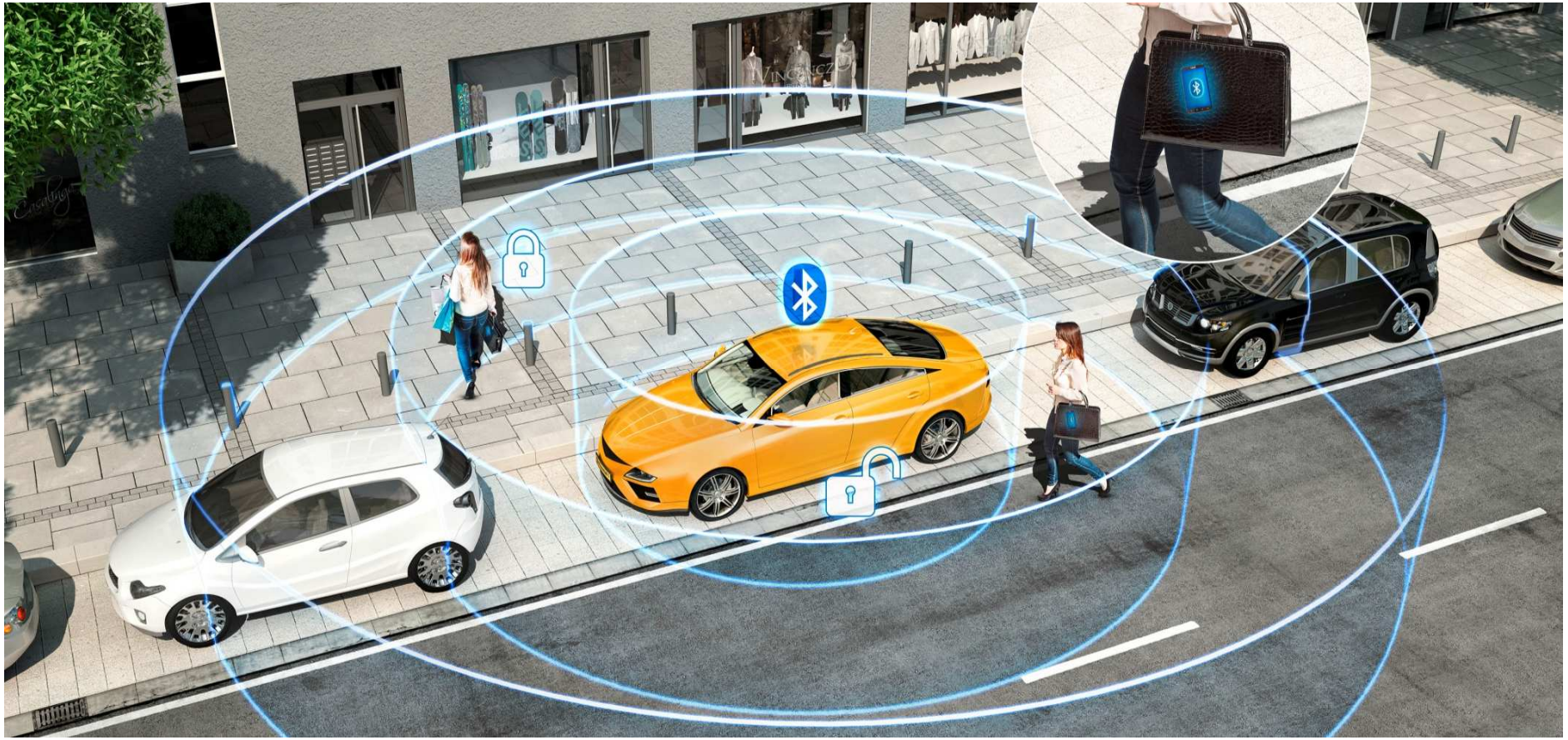
We manage and optimize the information flow by systems integration of components.

System example: Holistic vehicle connectivity
Over-the-air update solutions

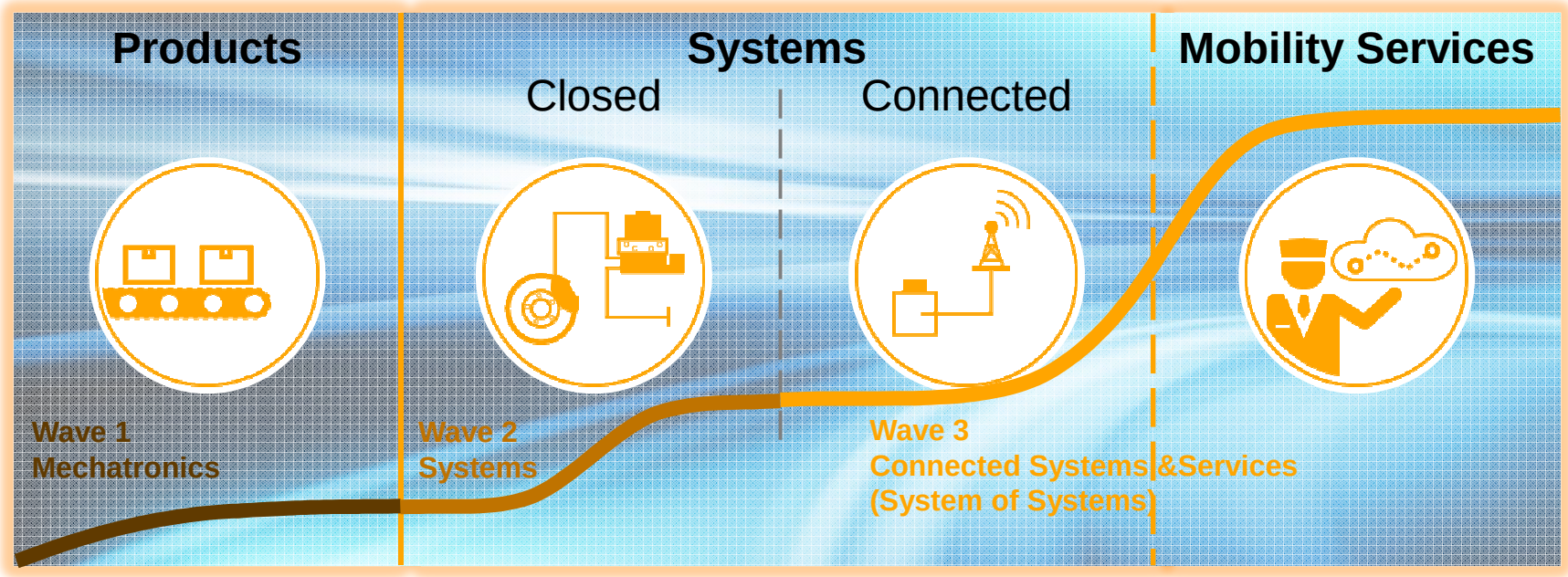
System example: Multifunctional Smart Device Terminal offers wireless charging and NFC functionality

System example: Smart and Secure Automotive Key Systems

Hand Free Access and Engine start via smart devices



Challenge: Shift from Products to Systems to Mobility Services leads to more complex system architectures



Build an effective and efficient product innovation process to **improve quality and cost** of systems

Use Alternative and innovative **System Engineering Tools and Methodologies**

Have a new innovation scheme by joining an **open source community** in the embedded systems

Innovation scheme by building an open source community in the embedded systems

Different approaches for tools:

- "In-House" development
  - Developing tools requires specific skills
  - Heavy costs of development / maintenance

heterogeneous and multiple frontend applications and data backbone does not guarantee efficient traceability

- Commercial tools
  - Tool provider dependency
  - Poor interoperability
  - Customization to support our process is mandatory and associated deployment is very expensive

- **A possible solution with Open Source Engineering Tools**
  - Availability of source
  - Community of users, involvement of universities and schools
  - Based on open standards
  - Low deployment cost

Conditions of success:
1- build a viable and focused community
2- organize the support

Continental and Eclipse

Continental is an Eclipse solution member

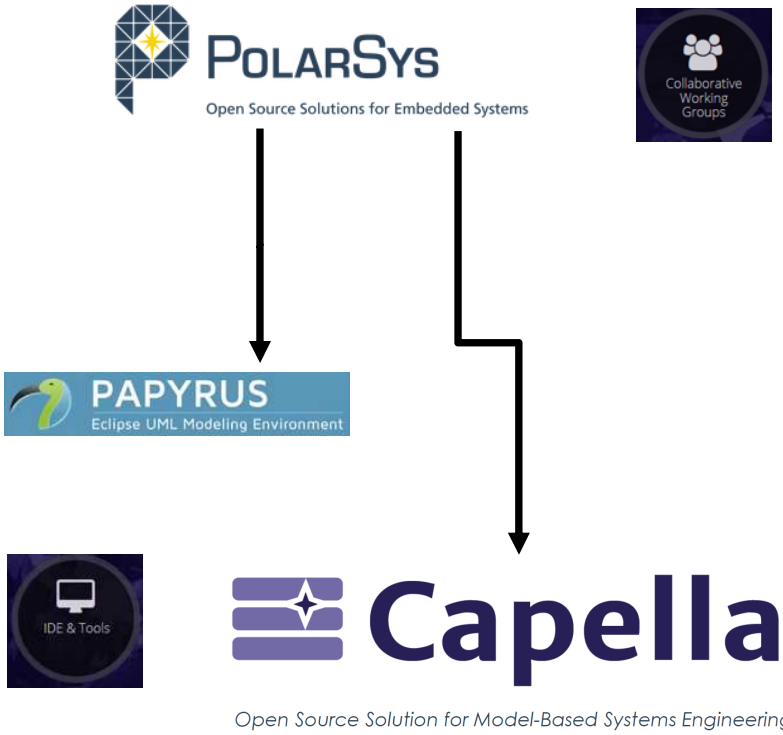
eclipse SOLUTIONS MEMBERS

Continental AG

Continental is one of the world's leading automotive industry suppliers. We want to make individual mobility safer, more comfortable and more sustainable.

Eclipse Foundation has many Open Source communities like the Polarsys Working Group

Polarsys Collaborative Working Group



PolarSys is an Eclipse **Industry** Working Group created by large industry players and by tools providers to collaborate on the creation and support of Open Source **tools** for the development of **embedded systems**.

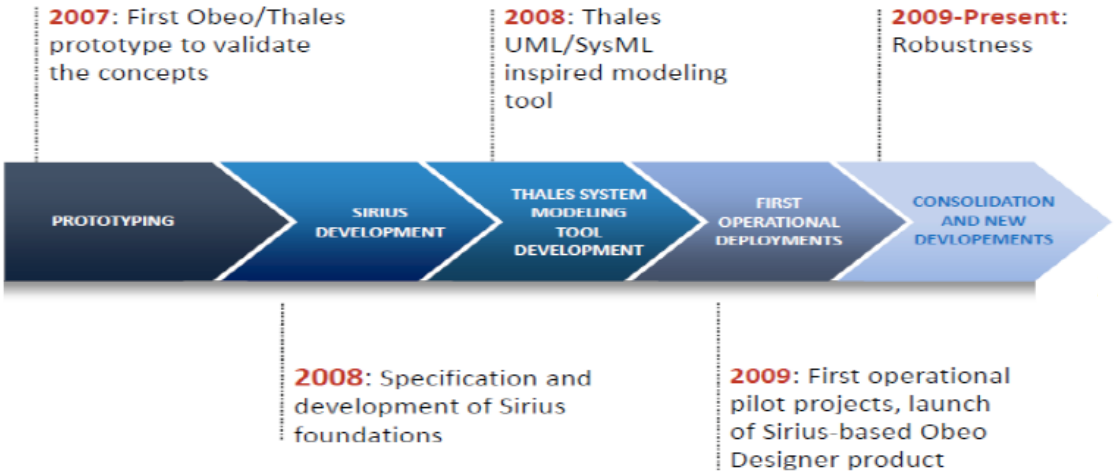
Domains such as aerospace, defense and security, energy, health care, telecommunications, transportation are represented.

Objectives:
Mutualization of development costs,
sharing of standards choices, technology & innovation

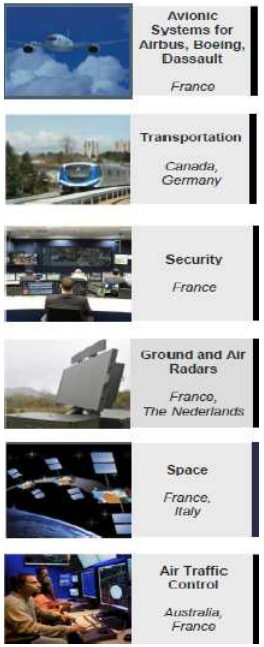
Capella is an Open Source solution hosted at polarsys.org**.**
Capella provides a process and tooling for graphical modeling of systems, hardware or software architectures, in accordance with the principles and recommendations defined by the Arcadia method

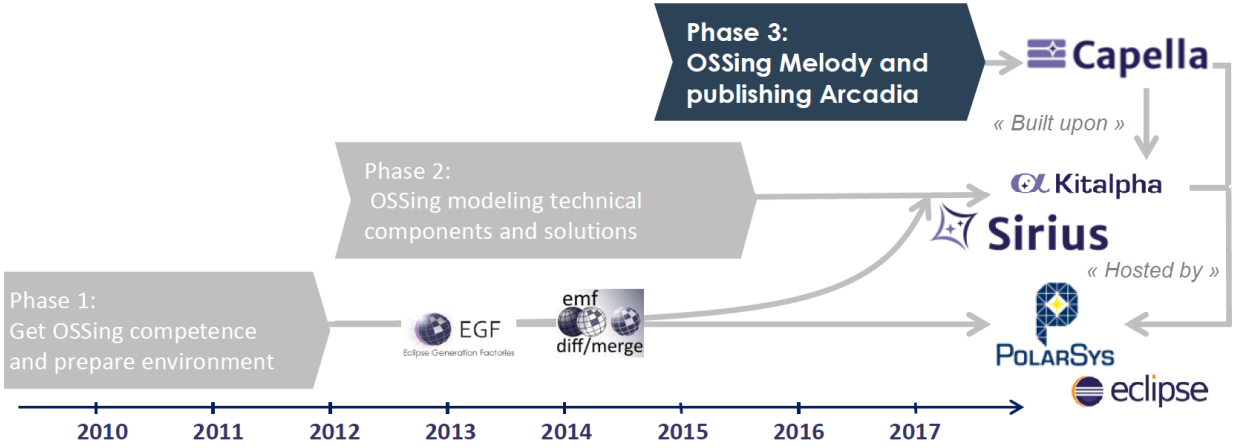
History of Capella in Thales group

10+ years of feedback capitalized both in the method and the tool



CAPELLA has been designed in close collaboration with operational engineering teams *in the domain of safety critical embedded systems*

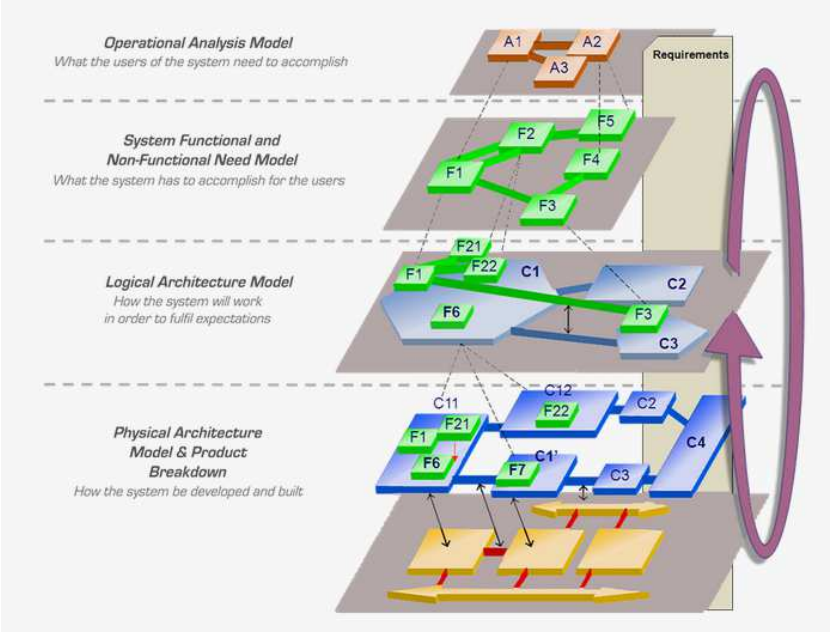




Alternative and innovative System Engineering Tools and Methodologies

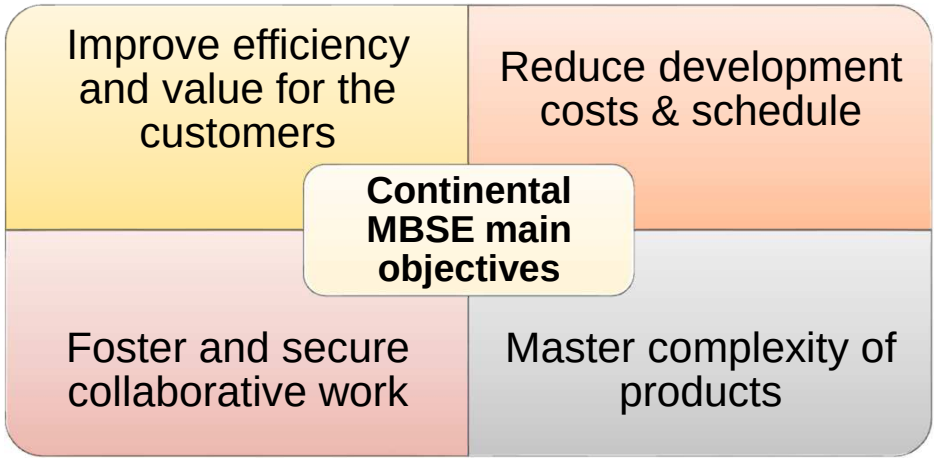
- System Engineering requires specific modelling means providing ad-equate abstractions and, ideally, some accompanying methodology. In Continental, **we decided to evaluate the *CAPELLA*** formalisms and toolset
- What makes ***CAPELLA*** singular with respect to other tools in the domain of system engineering stands in the fact that it has been designed to support a specific **engineering methodology**, called ***ARCADIA***
- The associated Capella language covers the complete “system development process” in 4 main phases, from the early phase of *operational* analysis to the late phase of *physical architecture design*.

Driver 1: Integrated Arcadia methodology
Driver 2: operational analysis level for clarification of user operational needs of new ITS systems
Driver 3: challenge efficiency of our current MBSE solutions



Foreseen capability of Capella open source platform in Continental

- Get an operational and functional analysis of the System, within a **coherent model of the complete system.**
- The model shall be used since beginning of the project (even at request for quotation) to analyze and capture requirements
- At best in collaboration with customers (speak semi-formal and unambiguous language with them)
- The produced models shall be **reusable** from one project to another, to speed up initial phase of the projects
- Need to set a **collaborative environment** for continuous integration without any fragmentation of models



Evaluation process in System Engineering Environment

Time Schedule & Key milestones

2015	2016	2017	2018-2021

Initiation

-Training
-Internal communication
-Proof of concept
@ IBS RD AS TLS

learning curve counter-balanced by improved efficiency[1)]

Setup

Set of first decisions to go ahead

-Define infrastructure (virtual machine, server, DB)
-Better integrated and collaborative solution with one IDE
-Initiate external collaborations with Polarsys members
-Internal communication to the management

Piloting

Very positive feedback from teams

-Piloting in defined projects
-Start with two operational projects
in a multi user and multi locations context
-First reviews with customers

Piloting phase 2

-Additional defined projects
-Requirement elaboration/tests of Capella connectors
-eClarity consortium member

eClarity Development

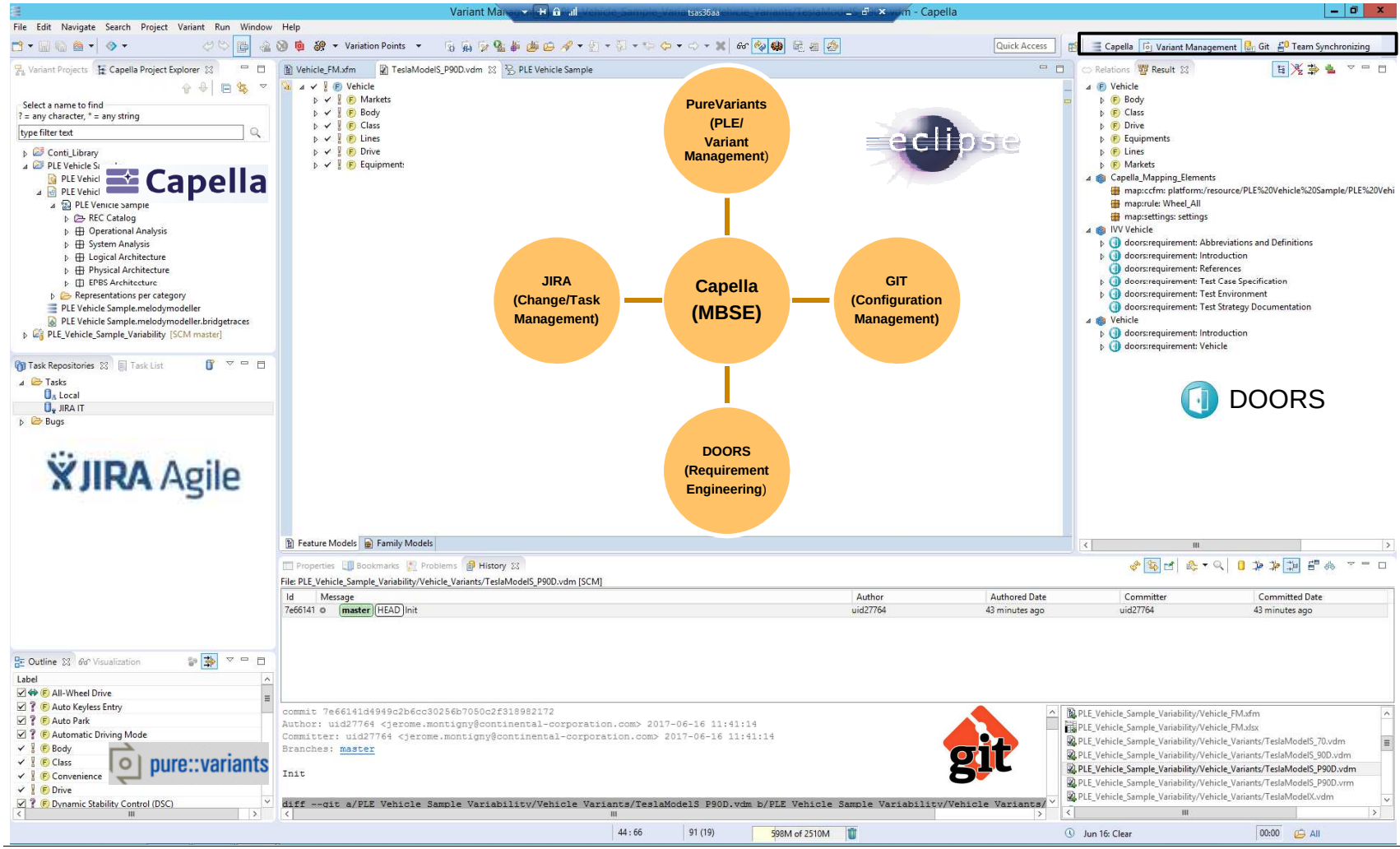
Implementation of eClarity consortium WP

1) Compared to document centric approach

Setup of a new System Engineering Workbench

All at one place concept based on **Eclipse** Open Source IDE Platform

Setup



Evaluation process in System Engineering Environment

Piloting Capella in new industrial projects: REX

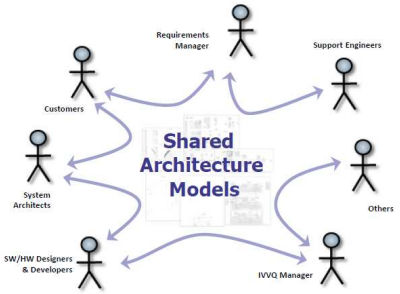
+ Capella open source platform ***overcomes actual gaps identified in commercial tools*** **for MBSE**, in particular due to methodological automation aspects (such as automatic transitions and validation rules), that really facilitate the usage of the tool on the field and brings some rigor.

+ the tool is **usable**: (i) ergonomics is fine, (ii) the tool scales up (in particular, reaction times remain acceptable even with large models), (iii) it does not crash; three necessary conditions for any **usage in an industrial context**.

+ Simultaneously working with **TeamForCapella save time** to resolve conflicts generated by concurrent updates

+ **Better and effective communication** with customers and among the Engineering domains (reviews with HW/SW) throughout the project's life cycle

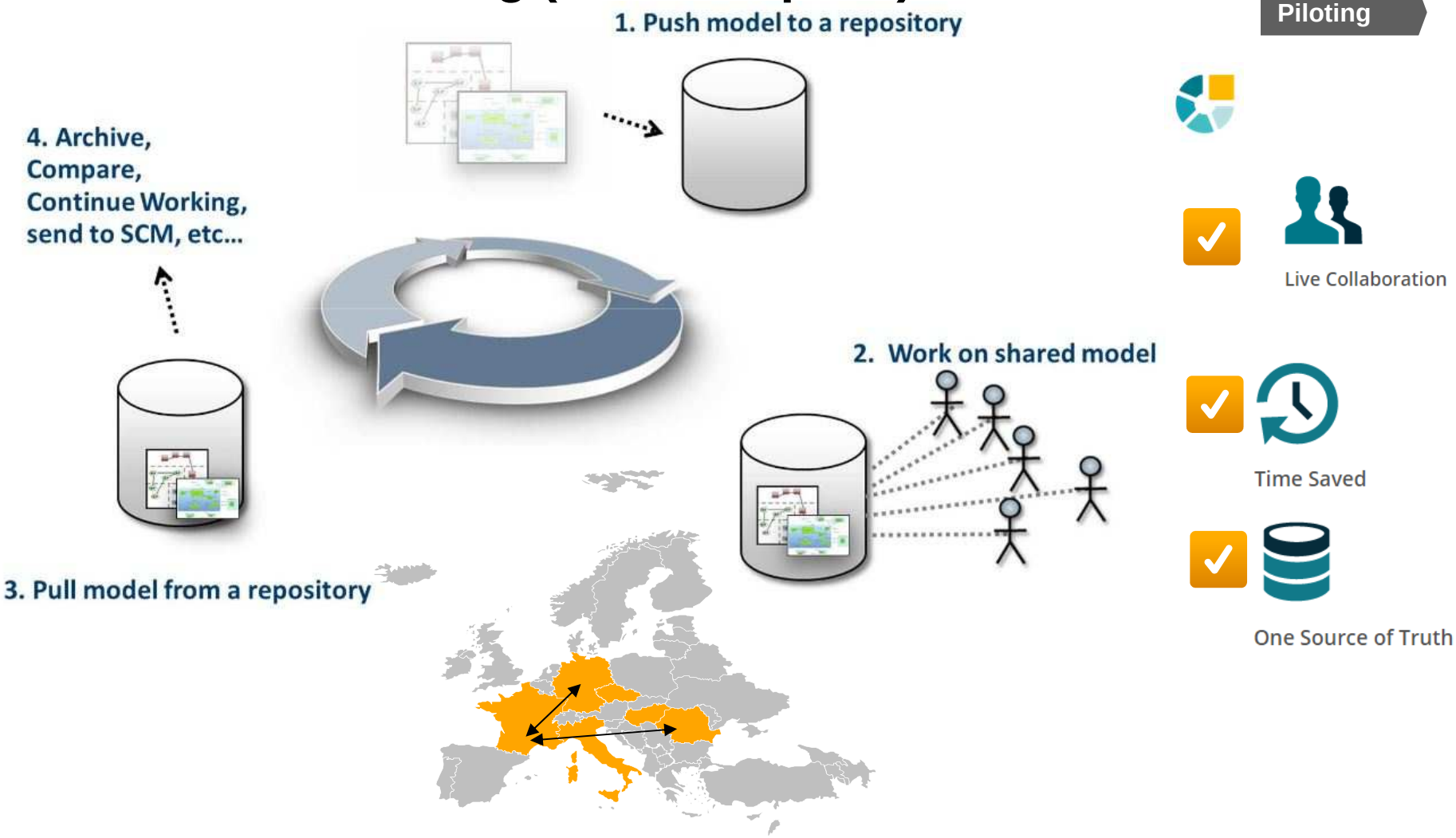
– Better integration with other tools like Matlab/Simulink or AUTOSAR models



Evaluation process in System Engineering Environment

Collaborative working (Team4Capella)

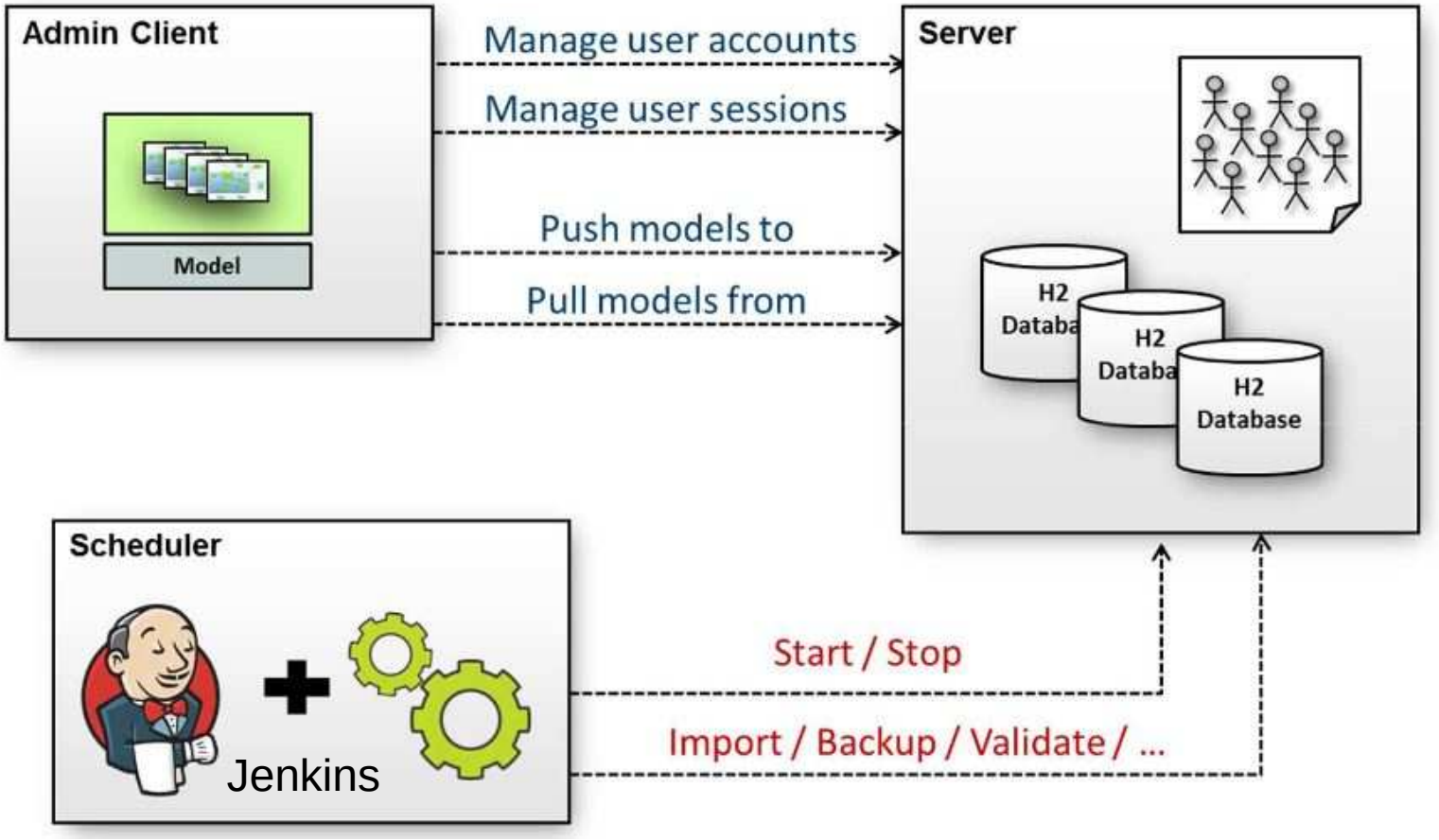
Piloting



Evaluation process in System Engineering Environment

Administration tasks

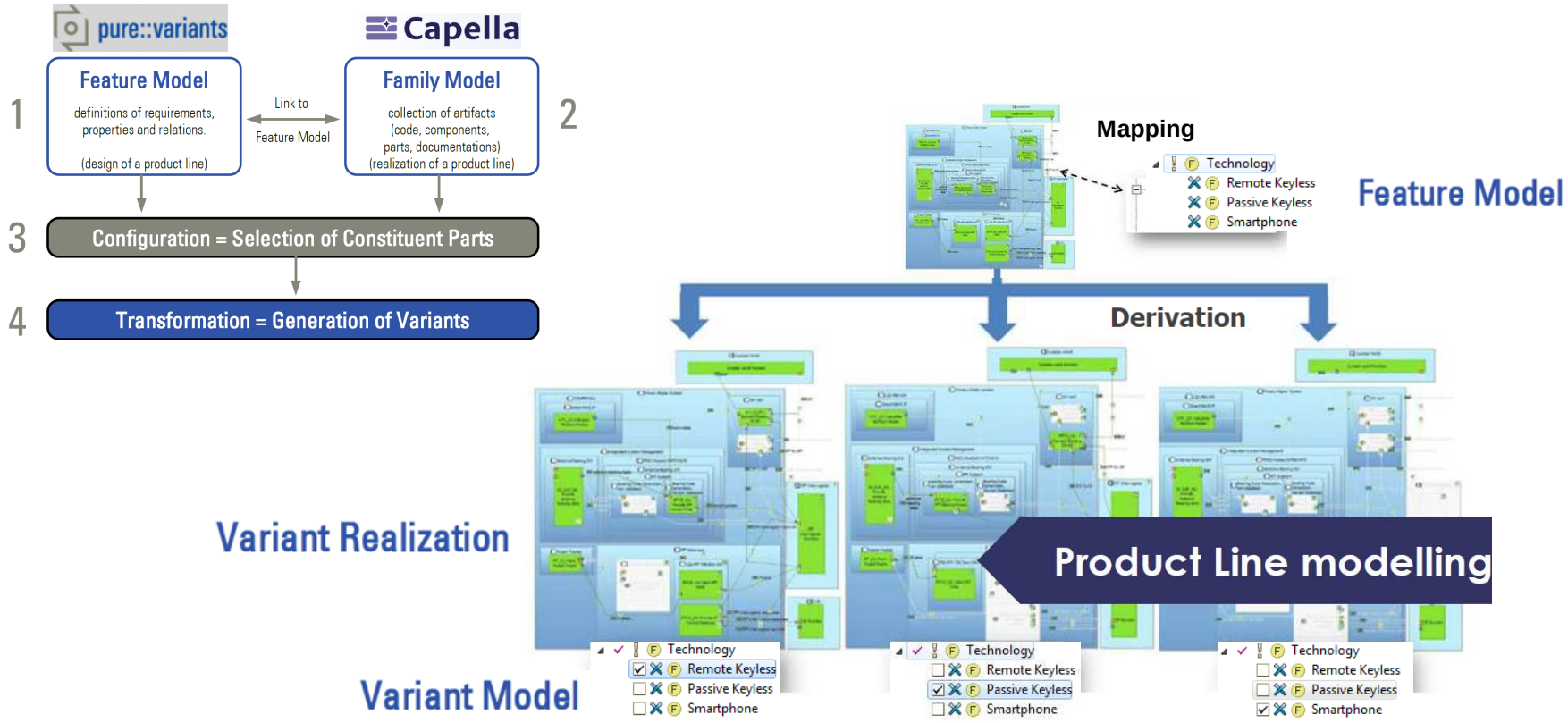
Piloting



Evaluation process in System Engineering Environment
Pure::Variants connector for Capella

Piloting

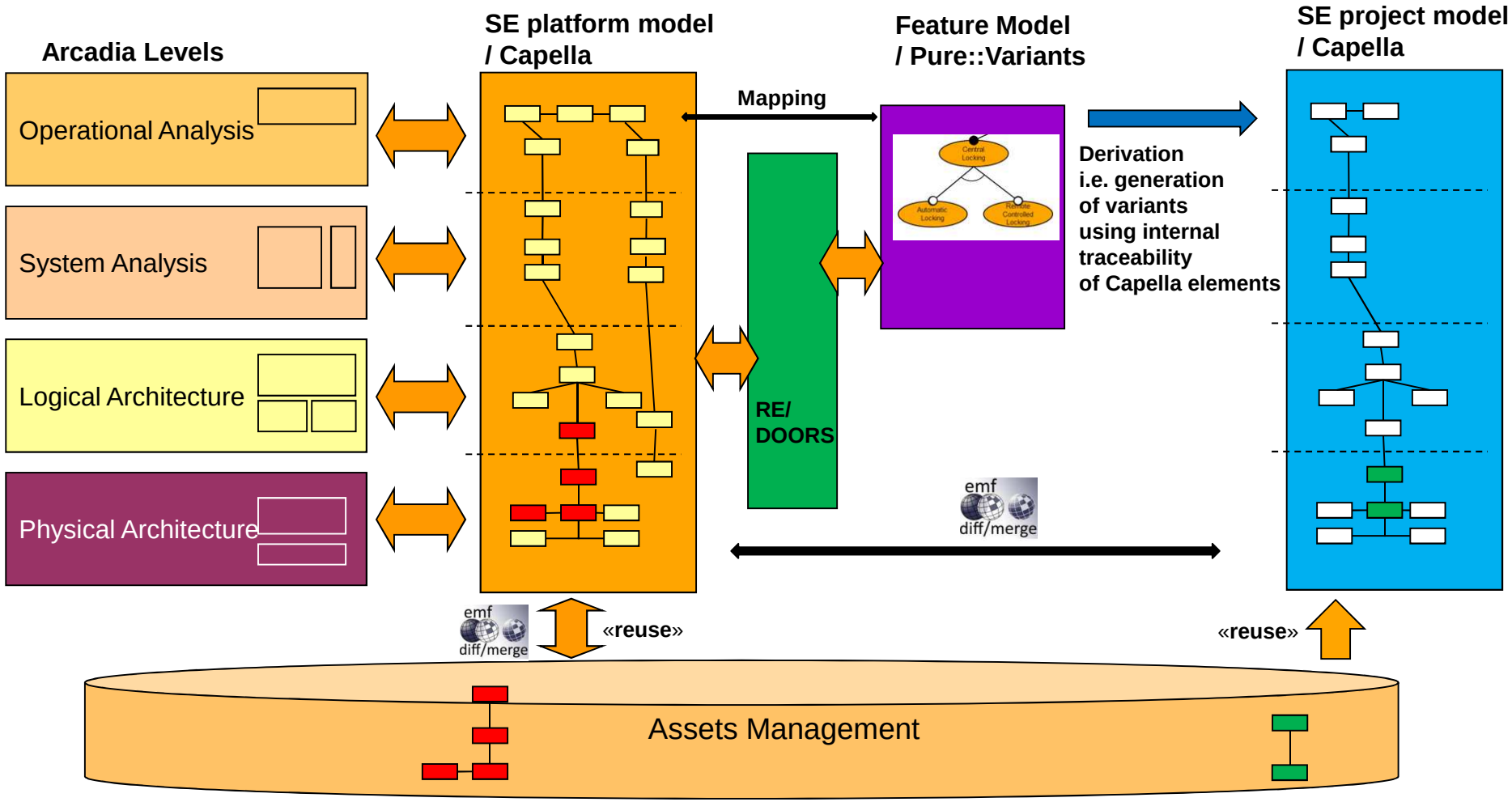
by a seamless integration of Product Line aspects in the SE landscape by coupling Pure::Variants and Capella



Evaluation process in System Engineering Environment

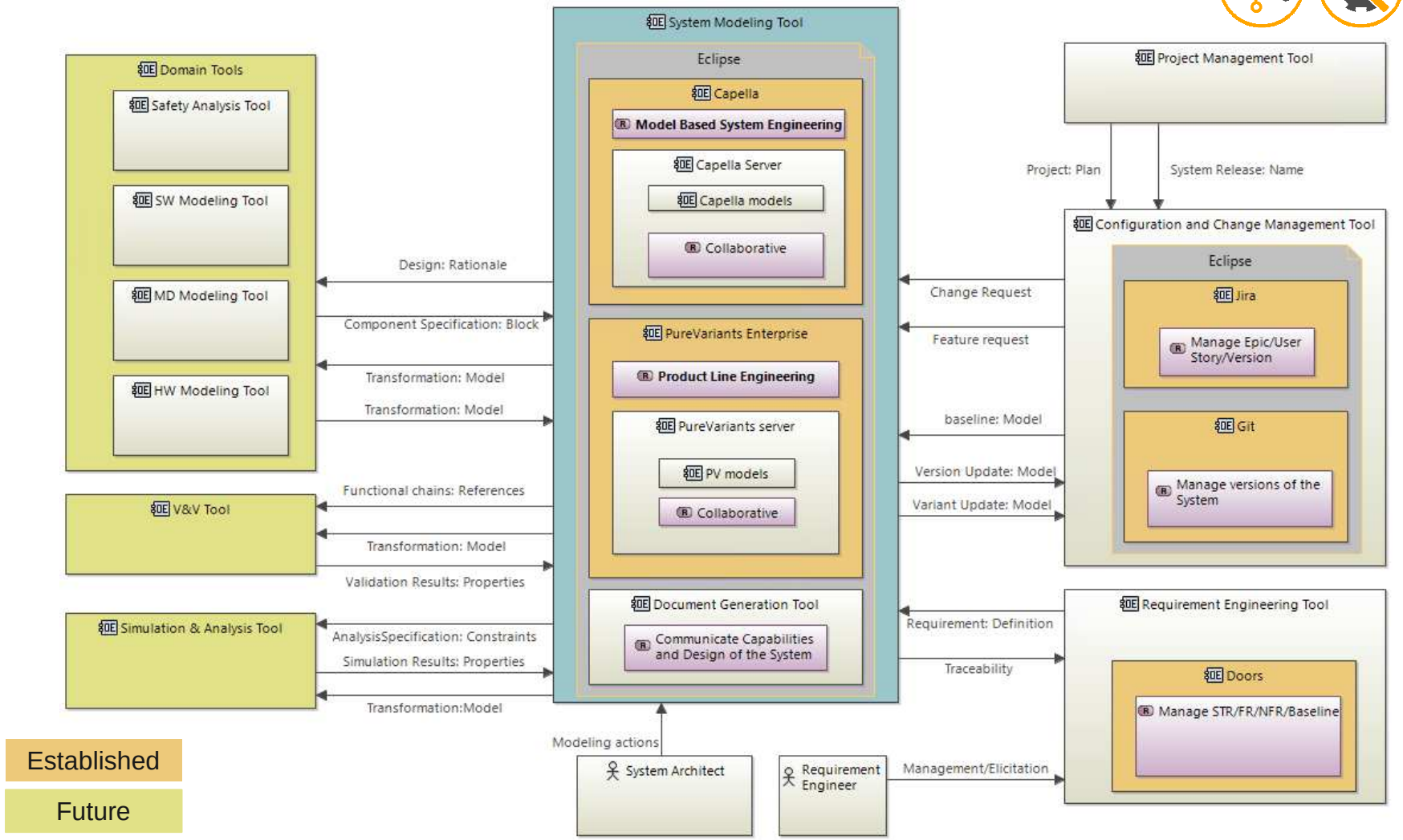
Pure::Variants connector and Assets Manager

Piloting



Evaluation process in System Engineering Environment

Next steps



Evaluation process in System Engineering Environment

Next steps

Piloting

Capella Industrial Consortium: Ecosystem of major actors (industrials, integrators, technology providers, consultants) centered on the MBSE solution Capella and its extensions (http://polarsys.org/capella/industry-consortium.html)

eCLARITY project (EU ECSEL): starting Q1 2018, orientation towards European and Automotive partners, including **Continental Automotive France and Austria** (http://www.clarity-se.org/)

Thank you
For your attention!