Driving Intelligent Transportation Systems with Capella
Continental Return of Experience
CapellaDay Toulouse / Tuesday 20th of June 2017
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 %

- Chassis & Safety 22%
- ContiTech 14%
- Powertrain 18%
- Interior 20%
- Tires 26%
- Interior 20%

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 automated.*

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

- **Products**
  - Wave 1: Mechatronics

- **Systems**
  - Wave 2: Systems
  - Wave 3: Connected Systems & Services (System of Systems)

- **Mobility Services**

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

- 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

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

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

Continental is an Eclipse solution member

Eclipse Foundation has many Open Source communities like the Polarsys 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

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<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018-2021</th>
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<tbody>
<tr>
<td><strong>Initiation</strong></td>
<td>learning curve counter-balanced by improved efficiency&lt;sup&gt;1)&lt;/sup&gt;</td>
<td>Set of first decisions to go ahead</td>
<td>eClarity Development</td>
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<tr>
<td>- Training</td>
<td>- Define infrastructure (virtual machine, server, DB)</td>
<td></td>
<td>Implementation of eClarity consortium WP</td>
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<tr>
<td>- Internal communication</td>
<td>- Better integrated and collaborative solution with one IDE</td>
<td>Very positive feedback from teams</td>
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<tr>
<td>- Proof of concept</td>
<td>- Initiate external collaborations with Polarsys members</td>
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<td>@ IBS RD AS TLS</td>
<td>- Internal communication to the management</td>
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### Piloting

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

### Setup

1. **2016**
   - Piloting in defined projects
   - Start with two operational projects in a multi user and multi locations context
   - First reviews with customers

1. **2017**
   - Additional defined projects
   - Requirement elaboration/tests of Capella connectors
   - eClarity consortium member

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<sup>1)</sup> Compared to document centric approach
Setup of a new System Engineering Workbench
All at one place concept based on Eclipse Open Source IDE Platform

![Diagram of System Engineering Workbench Setup]

- **Capella (MBSE)**
- **PureVariants (PLE/Variant Management)**
- **JIRA (Change/Task Management)**
- **DOORS (Requirement Engineering)**
- **GIT (Configuration Management)**
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)

1. Push model to a repository
2. Work on shared model
3. Pull model from a repository
4. Archive, Compare, Continue Working, send to SCM, etc...

Live Collaboration
Time Saved
One Source of Truth

Space for Sender Information
Public
© Continental AG
Evaluation process in System Engineering Environment

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

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

Arcadia Levels
Operational Analysis
System Analysis
Logical Architecture
Physical Architecture

SE platform model / Capella
Mapping
Feature Model / Pure::Variants
Derivation i.e. generation of variants using internal traceability of Capella elements

SE project model / Capella

«reuse»

Assets Management

Evaluation in System Engineering Environment
Pure::Variants connector and Assets Manager
Evaluation process in System Engineering Environment

Next steps

Established

Future
Evaluation process in System Engineering Environment

Next steps

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!