CRYSTAL

Seamless Life-Cycle Collaboration for Safety-Critical Systems Engineering

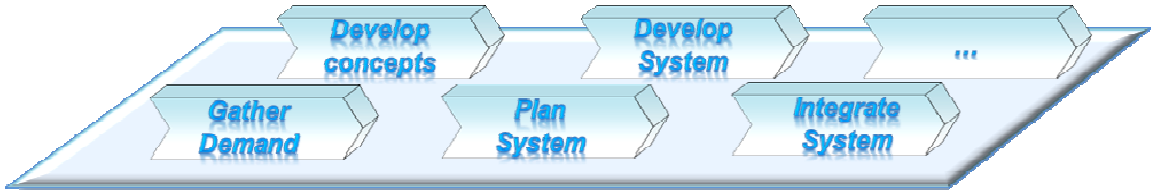
Dr. Christian El Salloum
AVL List GmbH

ARTEMIS-JU project

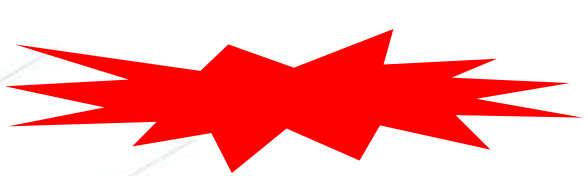
Today's situation at industrial companies

AEROSPACE AUTOMOTIVE HEALTH CARE RAILWAY

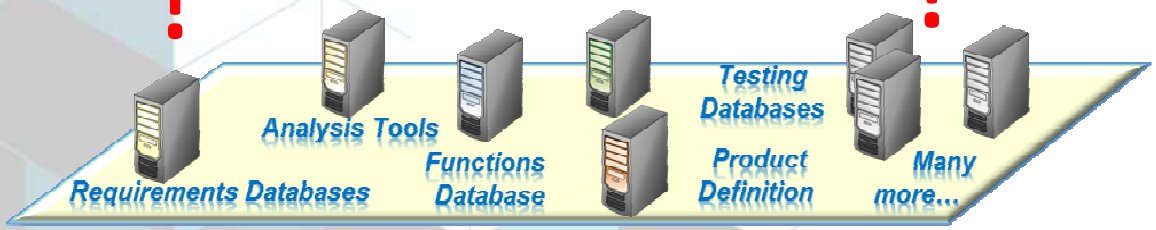
Industrial Workflows



- ***Fragmented** IT*
- ***High maintenance costs***



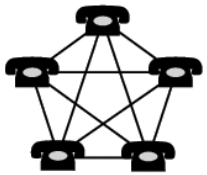
- ***High manual effort** to handle data*
- ***Impact on quality and safety***

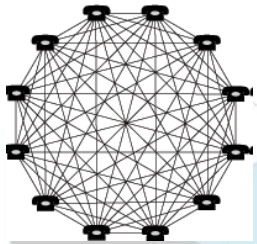


Tool Layer

The tool-integration problem

Point-to-point Integrations don't scale





Creating new integrations is unpredictable

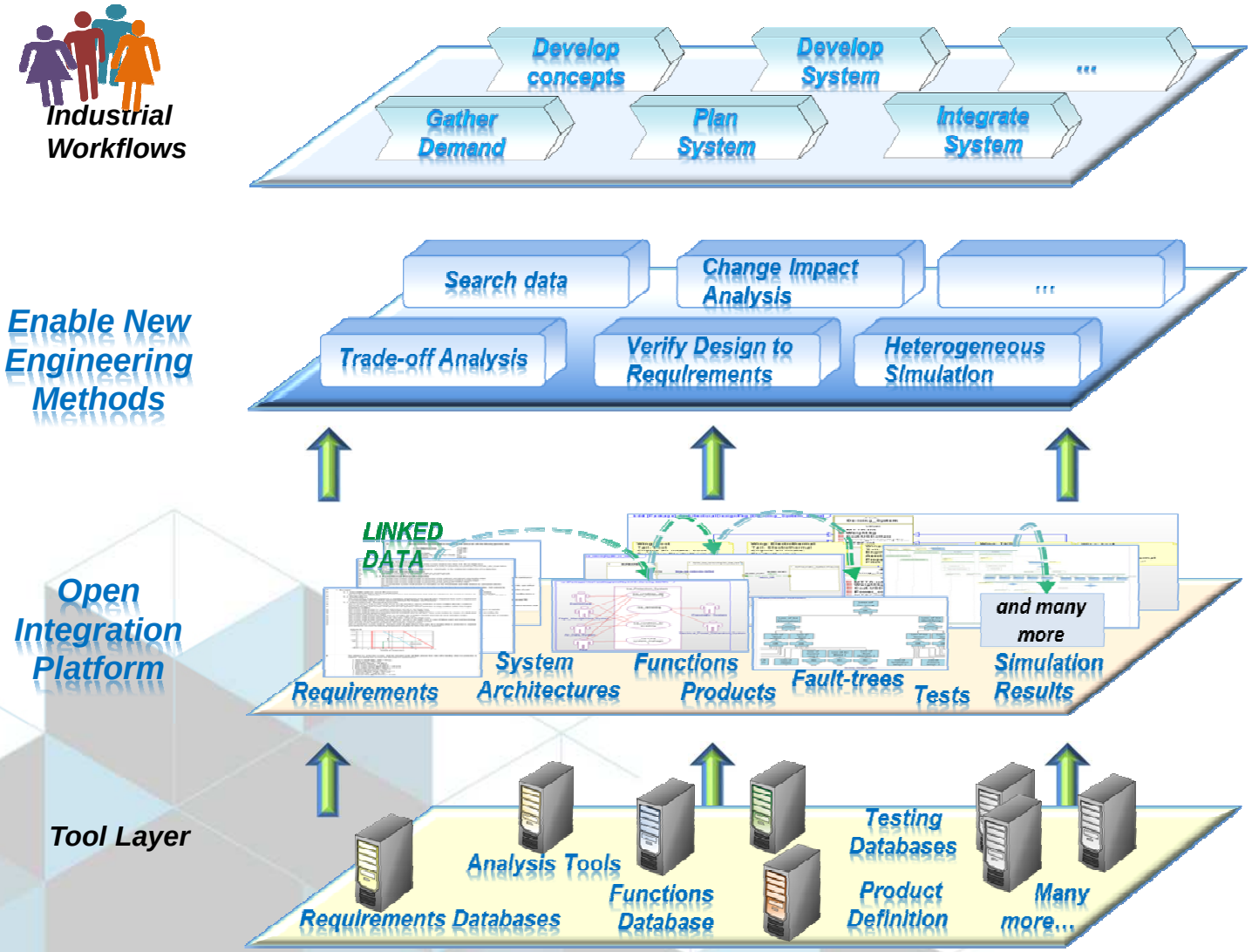
Monocultures lock you in

Past choices restrict present action and future vision

Maintenance, management, and change costs go up over time

Ongoing and unexpected costs drain resources

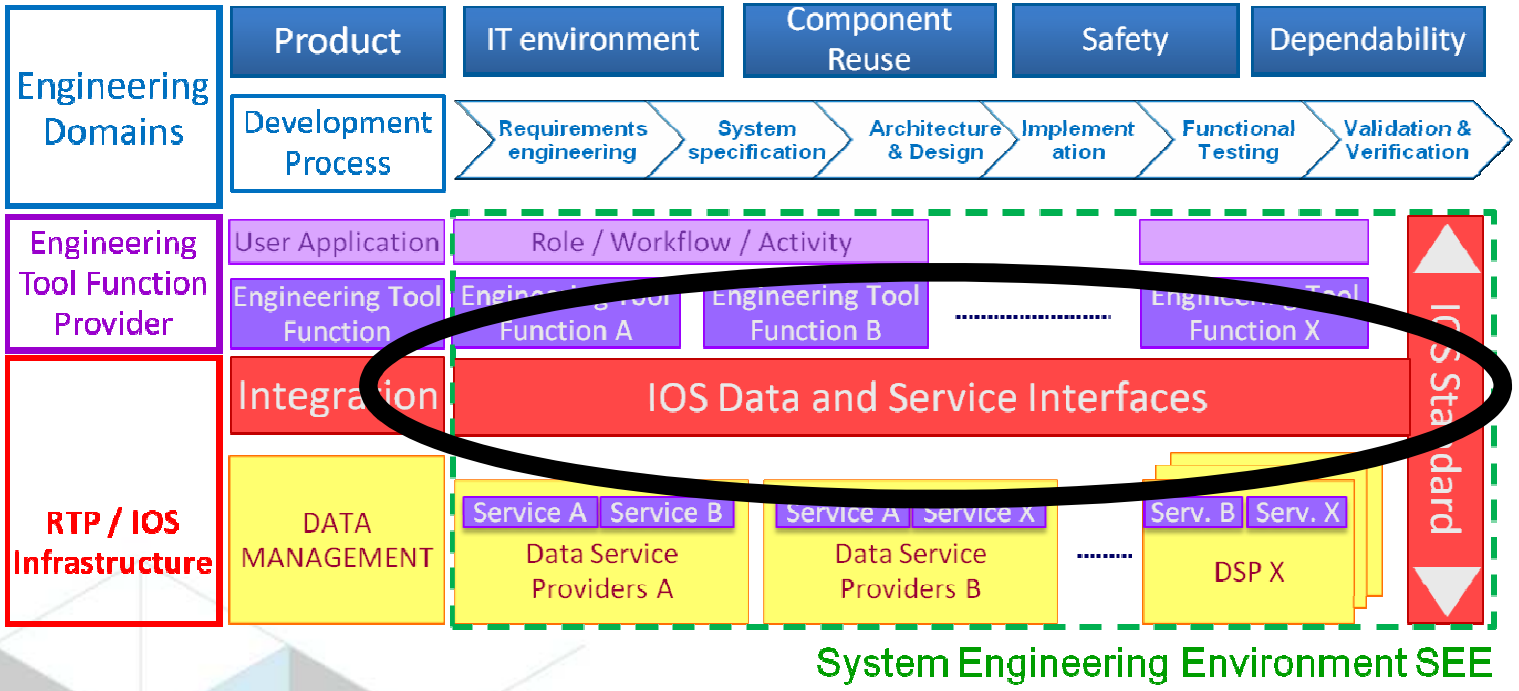
The CRYSTAL Vision



Users get better ways of working

- ***Standardized Interoperability Specification***
- ***Connect tools to expose & link data***

CRYSTAL TECHNICAL APPROACH



- **<u>Standardize tool interaction, but not a tool's capabilities!</u>**
- Separate data from tool functions
- Apply the Interoperability Specification (IOS) as the central standard

Automotive Example (Public Use Case)

Customer Requirement

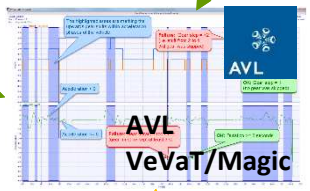
Requirement

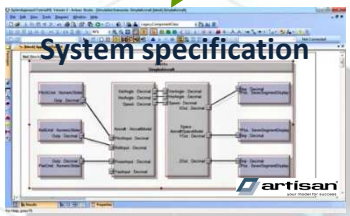
Test Case

System Requirement

Functional Safety Requirement

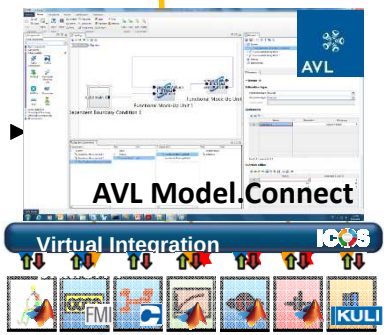
Safety Goal





Simulation results

Parameter mapping



ReqIF

File import

OSLC

Data Mapping

Seamless Lifecycle Collaboration

Road to a Successful Platform

- Build on a technically sound foundation
  - CRYSTAL is based on successful principles like the **Linked Data** principles defined by the **W3C** (World Wide Web Consortium)
- Reach a critical mass
  - CRYSTAL motivated a large group of stakeholders to make initial investments in the technology (**AIPP** and **external** stakeholders)
- Ensure openness & stability
  - CRYSTAL actively supported the creation of eco-systems that creates and govern **open standards** (e.g. OSLC, FMI, ASAM …) based on the developed specifications
- Facilitate uptake by new stakeholders
  - CRYSTAL provides tools to **ease the adoption** of the technology
  - CRYSTAL provides **reference solutions**
  - CRYSTAL builds up an **developer community**

CRYSTAL has the critical mass to generate impact

- **68 partners** from **10 countries**
- **€82M** budget
- **European key players (competitors)** from different industrial domains
- Large companies developing embedded systems act as **technology users** and case providers
- Large tool providers, SMEs and researchers as **technology providers**

Project Outcomes

- CRYSTAL **Interoperability Specification (IOS)**
  - Open specification
  - Enables seamless integration of tools and full traceability across the product life cycle
- CRYSTAL IOS compliant **Implementations**
  - Engineering Tools
  - SDKs for developing IOS adaptors
  - Tools for specifying and instantiating a System Engineering Environment (platform builder)
- CRYSTAL **Use-Cases** as reference scenarios
  - Demonstrators with high level of maturity
- CRYSTAL IOS **Developer Community**
  - Moderated implementer forum

Market Innovation

- Reduced system development costs due to **smart integration** of tools
- **Increased flexibility** for OEMs
  - Avoidance of vendor-lock-in
- New **market opportunities** for tool providers
  - Facilitate innovation and market entry
  - Great opportunities for SMEs
- Ensure Europe's leading edge position in development of **safety-critical cyber-physical systems**

Thank you for your attention!

Technical Coordination:
Dr. Christian El Salloum (AVL List GmbH)

Adminstrative Coordination:
Annemarie Hamedler (AVL List GmbH)