fastSUITE
A CENIT PRODUCT

Support of Automation System Engineering and Manufacturing Engineering with Intelligent Parts from Component Libraries

Nikolai D‘Agostino
Head of Research, Digital Factory Solutions
Industry Forum 2018, Augsburg

CAD ENAS

cenit

Agenda

1. **CENIT DFS in brief**
2. Automation-/Manufacturing Engineering with FASTSUITE Edition2
3. Mechatronical automation system model
4. Intelligent parts as mechatronical model
5. Intelligent parts from component libraries
6. Conclusion

Data and facts on CENIT AG

State: 31.12.2016

1988
founded in Stuttgart

At stock market since
1998

Equity ratio
56,2%

Turnover
123,8 Mio. €

EBIT
11,8 Mio. €

FINANCE

ENTERPRISES

Long-term partnerships with leading IT-companies like:

IBM
SAP
Dassault Systèmes

LOKATIONEN

5 Subsidiaries worldwide

9 Branch offices in Germany

- AUTOMOTIVE 27.7 %
- AEROSPACE 23.2 %
- F&A 14.6 %
- FINANCIAL SERVICES 11.5 %
- ITK, MEDIA 7.7 %
- OTHERS 5.0 %
- PUBLIC SECTOR 3.7 %
- CONSUMER 3.7 %
- ENERGY 1.1 %
- CHEMICAL, PHARMA, HEALTH 1.0 %
- RETAIL 0.8 %

STAFF

615 Employees

+40 Apprentices and stundents from universities

ISIN: DE0005407100
WKN: 540710
Stock market ID: CSH
Frankfurt Stock Market
Market Segment: Regulated Market (Prime Standard)

GROUP

494
37
38
19
22
5

615 Employees

OUR EXPERTISE: PLM AND EIM OPTIMIZES BUSINESS PROCESSES

PRODUCT LIFECYCLE MANAGEMENT

PLM

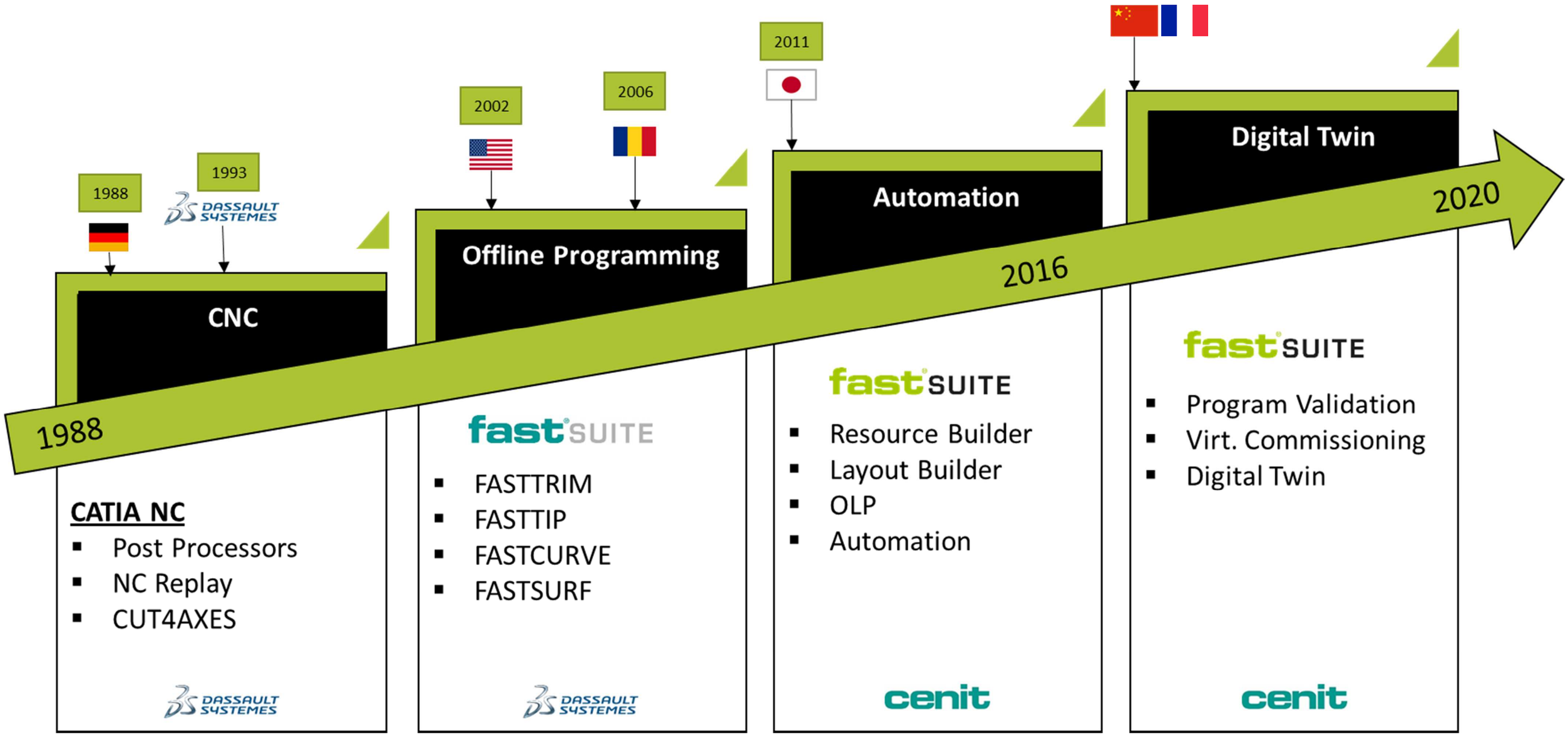
- **Optimization of digital product development, production, modification, order processing and service**
- **Focus on holistic, individualized PLM solutions**
- **More than 1,000 customer projects**
- **Decades of collaboration with customers of the manufacturing industry and PLM / ERP software companies**

ENTERPRISE INFORMATION MANAGEMENT

EIM

- **Over 20 years of professional expertise with Enterprise Content Management, Business Analytics & Optimization and Application Management Services**
- **IT-based management of business-related documents and information within core processes**
- **Integration of PLM and EIM core competencies to create comprehensive solutions with high benefits**

Our Digital Manufacturing History



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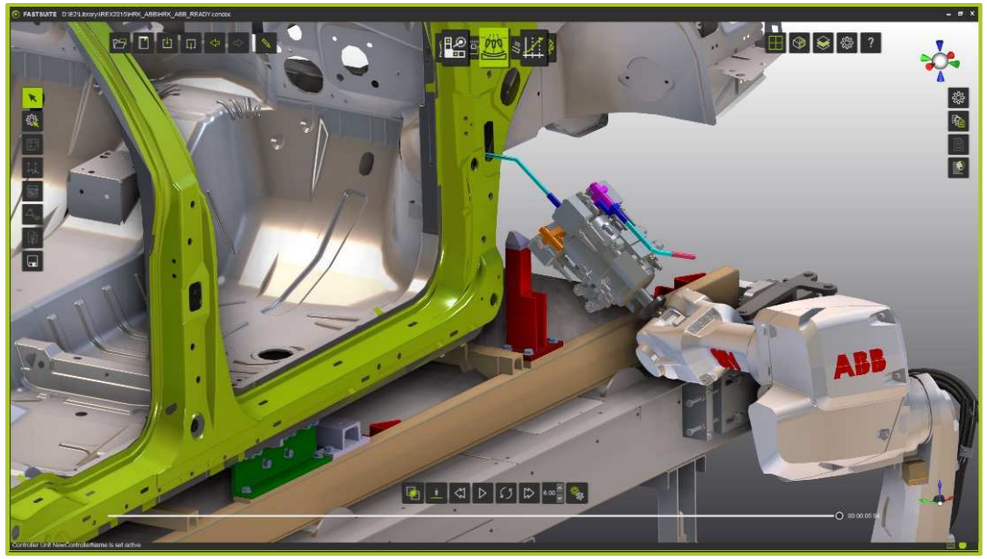
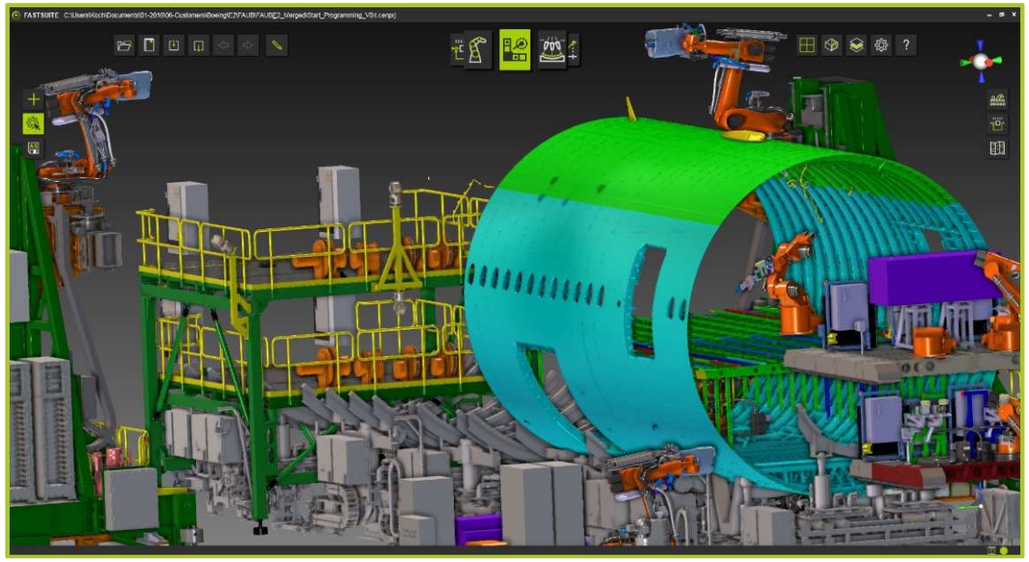
Challenges in the digital factory



Increasing complexity

- Manufacturing processes
- Production facilities
  - Robots, machines, AGVs, …
  - Complex kinematic systems
  - Co-operating systems
- Vision systems
- Sensors
- Automation system and process control
  - motion control
  - Programmable logic control
- Savety systems

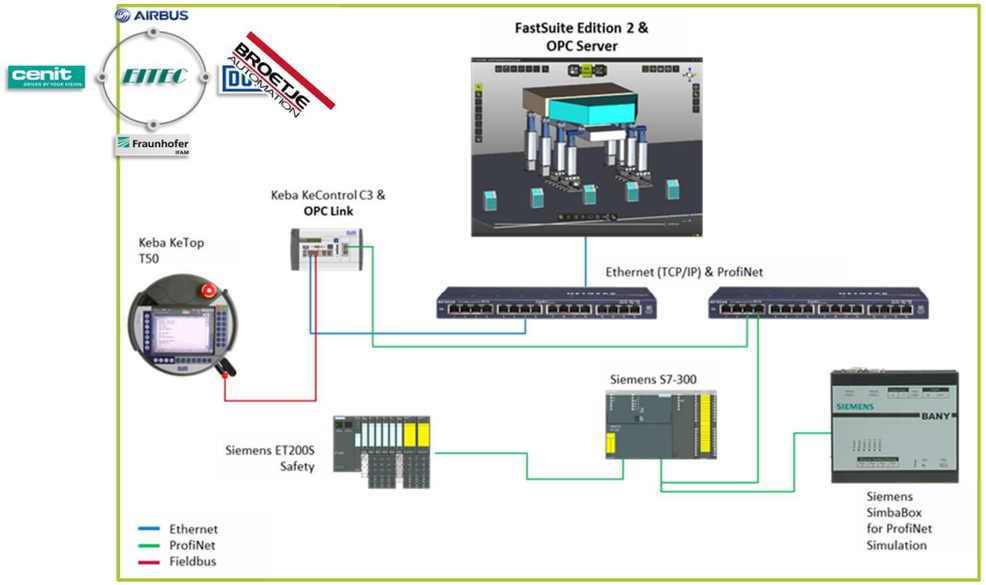
Challenges in the digital factory

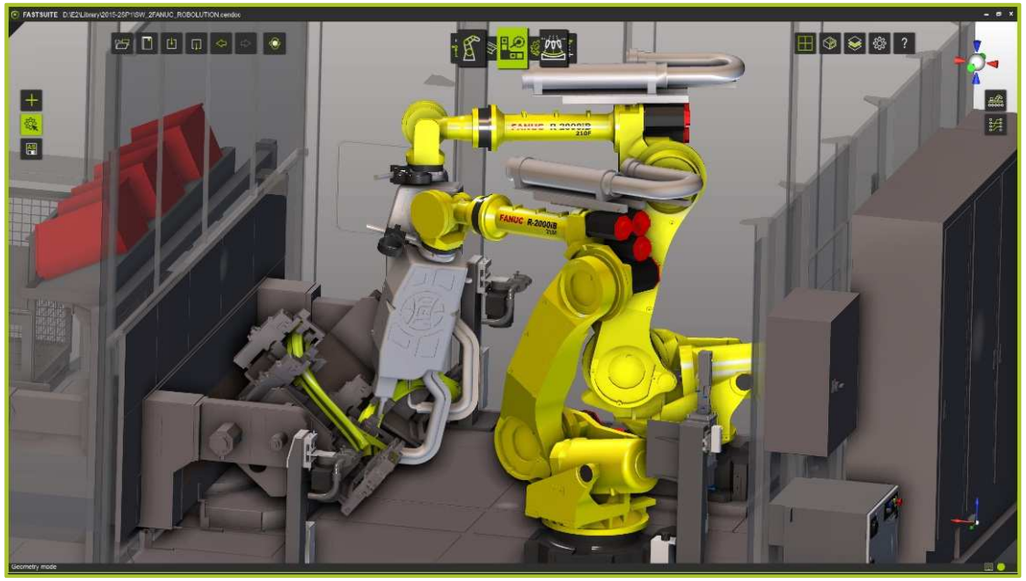


Decreasing controlability and inadequate software solutions

- PLM Environment
- OLP Systems
- PLC Programs
- Inadequateness of available software solutions
  - Performance and accuracy
- Inconsistency between digital and real factory
  - Automation system layoutlayout
  - Bahavior of automation system components
  - Controller emulation versus real control
  - Ideal CAD models versus real system shape

Our approach / objective



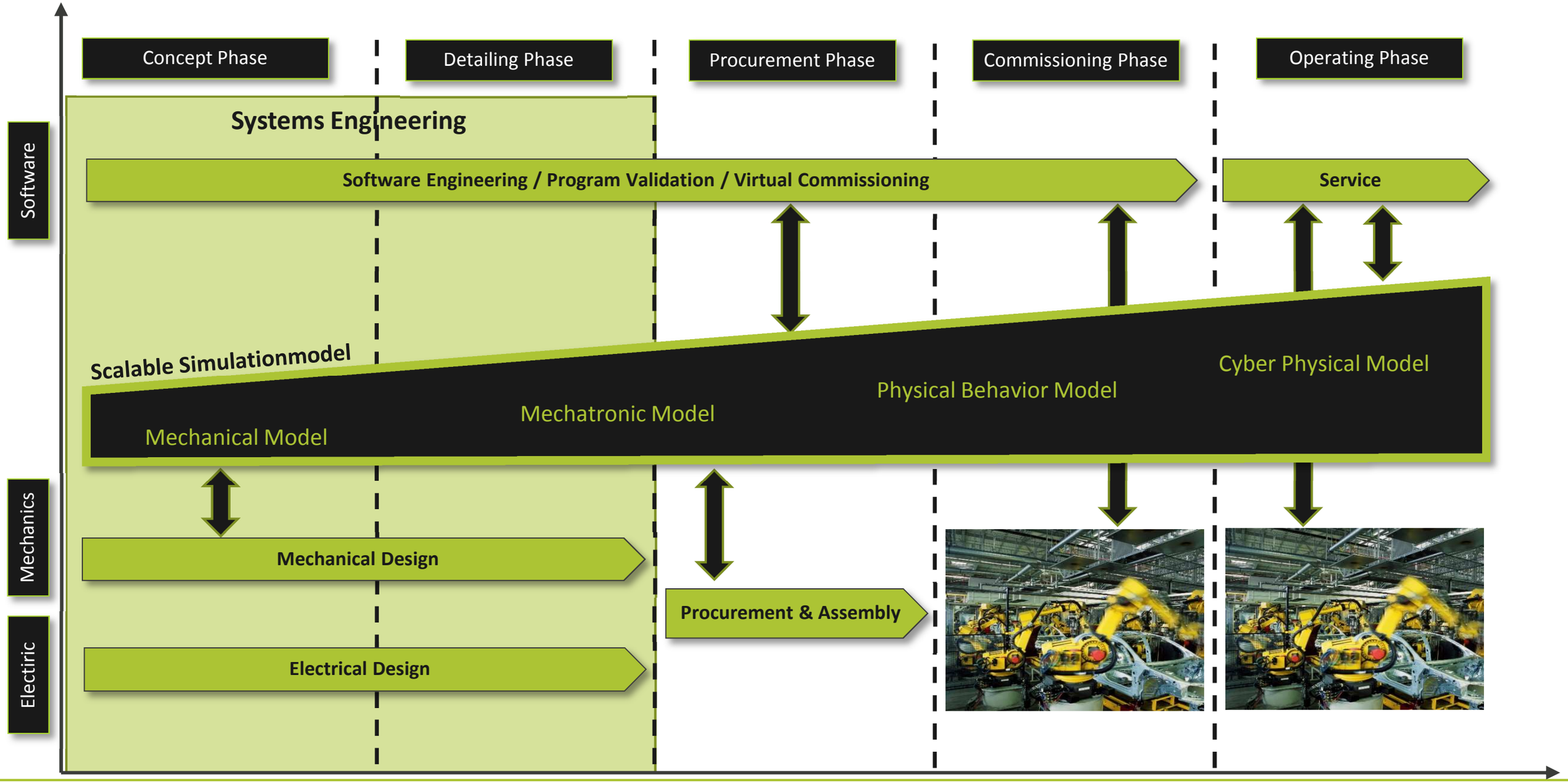


Reduction of complexity der Komplexität …

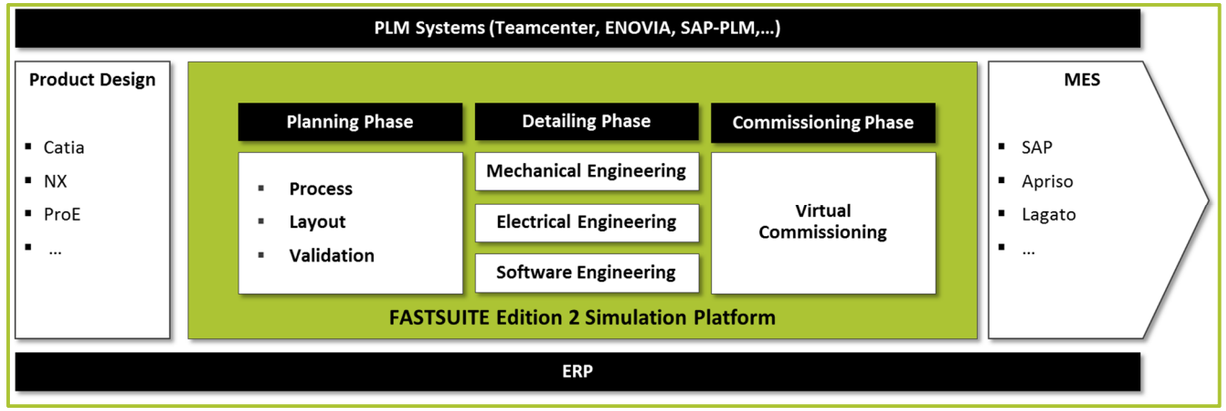
- Increase of process knowledge
  - Invest in research
  - interdisciplinary co-operation with partners
    - Key customers
    - Automation System integrators / manufactures
    - Robot and machine manufactures
    - Research facilities / universities
- FASTSUITE E2 Produktportfolio
  - Requirement oriented, scalable application
  - Easy and intuitive usability

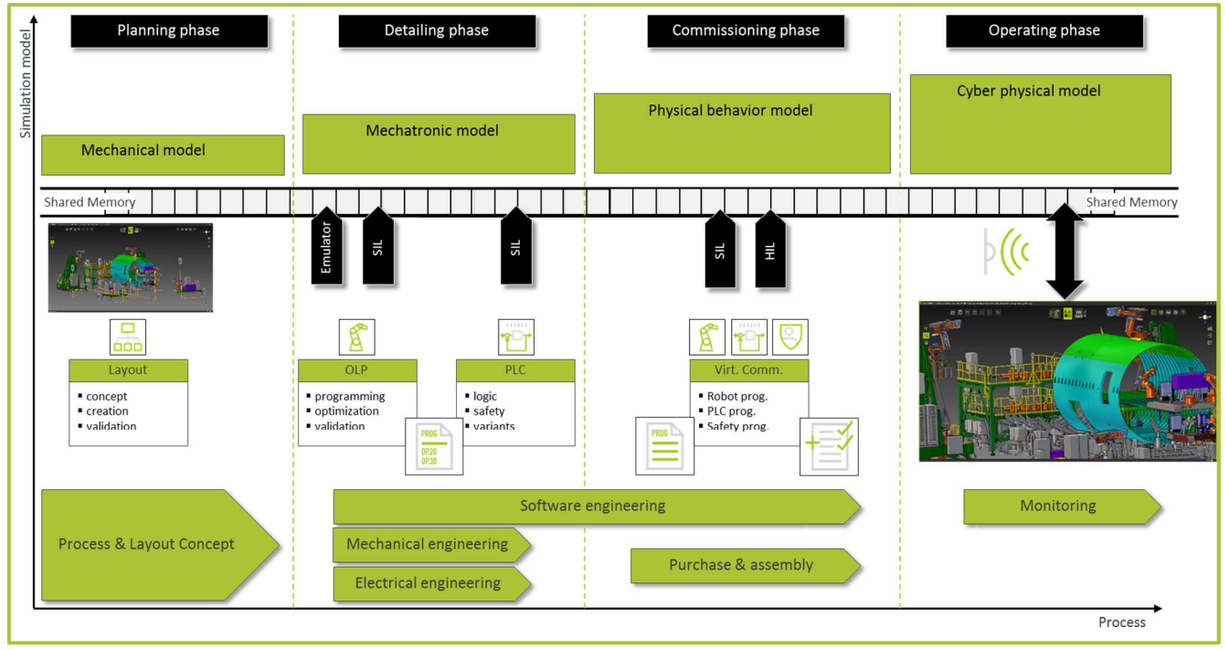
Development of human controlable software solutions !

Simulation based Engineering Process



Unified Simulation platform





Scaleable and open model for the complete manufacturing engineering processes

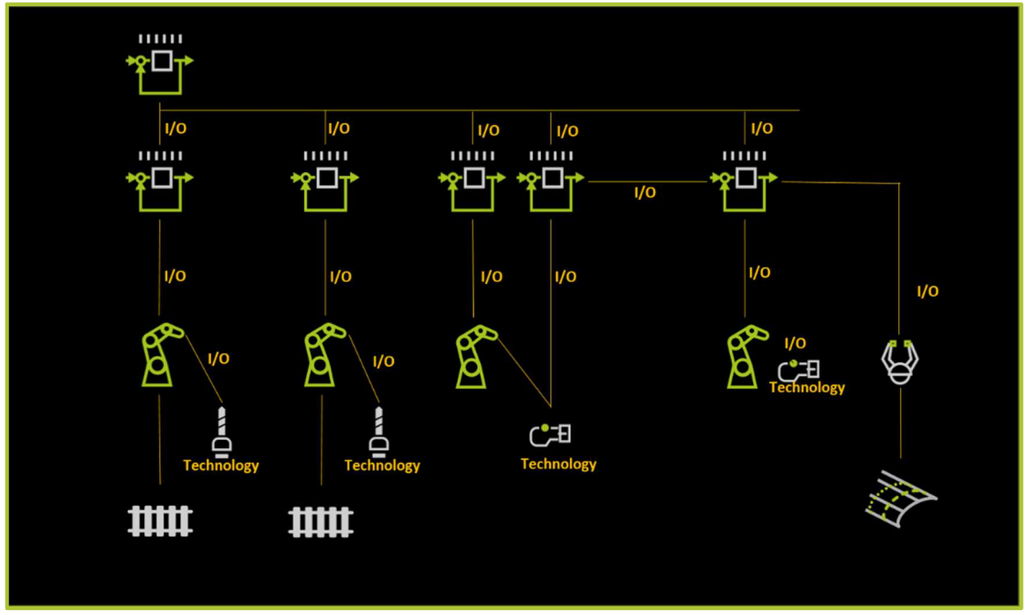
- Single creation of simulation components
- Layout planing
- Detailling of planing
- Layout- and process verification
- Offline programming
- PLC Program Verification
- Virtual commissioning
- Operation and supervisary control

Based on standards for connectivity and interoperability!

OPC FOUNDATION
The Interoperability Standard for Industrial Automation™

<AutomationML/>

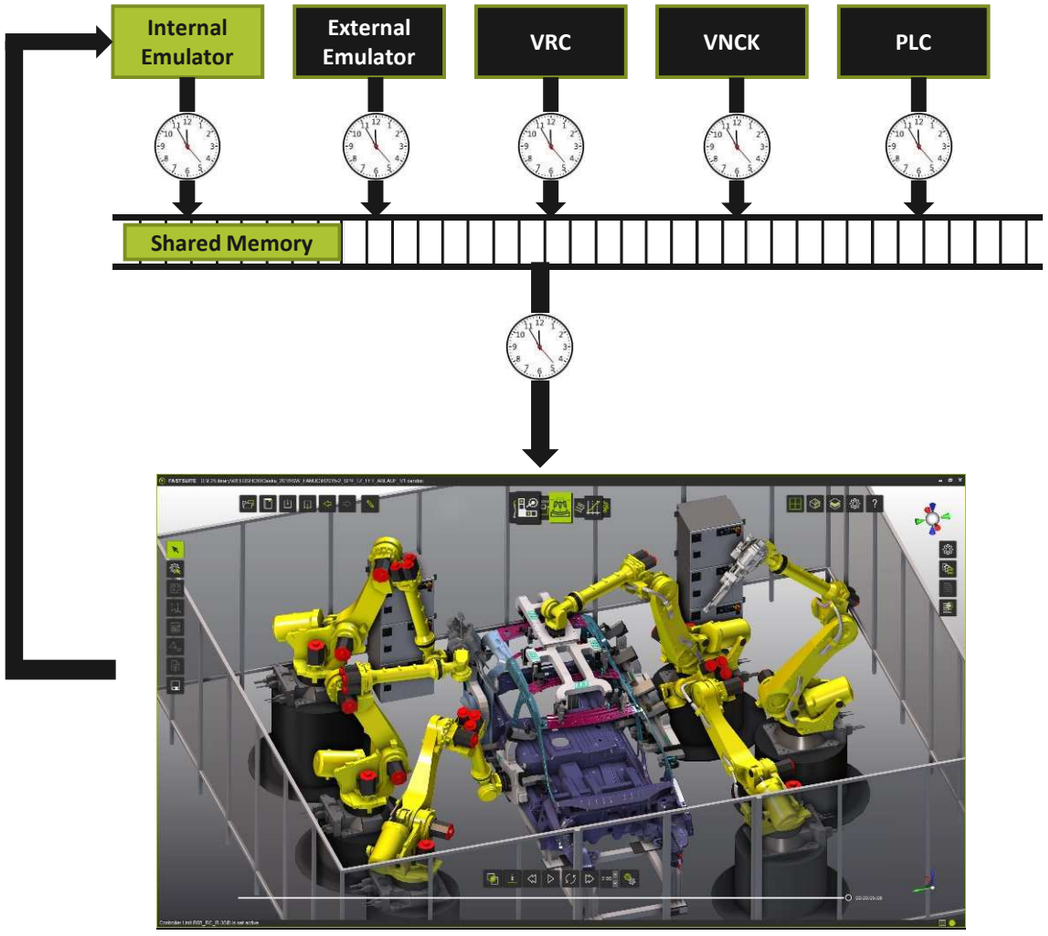
Unified simulation platform



Digital copy of physical environment

- Digital simulation models as representatives of physical automation systems
  - Robots, maschines, jigs&tools, …
  - Controls
    - PLC, RC, CNC
    - Cell controls
  - Connections
    - Mechanical
    - Electric
  - Sensors, Signals, actors
- Performance optimized simulation model layouts, which widley behave like their physical pendants

Unified simulation plattform



Different simulation requirements

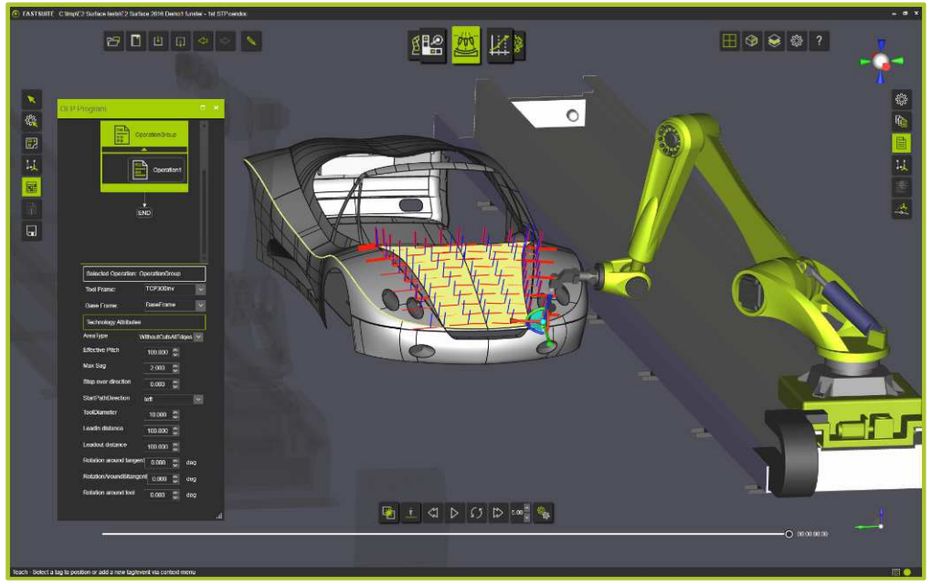
- Layout- und Process verification
  - Accessability investigations
  - Geometric shape verification

  Simulation can base on emulation in an early development phase
- Offline Programming
  - Partial simulation (forward, backward)
  - Collision avoidance
  - Process verification

  Simulation shall base on RCS und VRC modules
- Virtual commissioning
  - Production system simulation (Multi-Resource)
  - Simulation of Logic and behavior

  Simulation bases on VRCs (SIL) und HW (HIL)

Process-oriented solutions



For all relevant processes / technologies

- User interface
- tool path calculation
- optimisations
- Technology parameter
- Download content
- Process model (optional)

Advantages:

- Technology optimized programs
- From R&D maintained technologies
- Customisable

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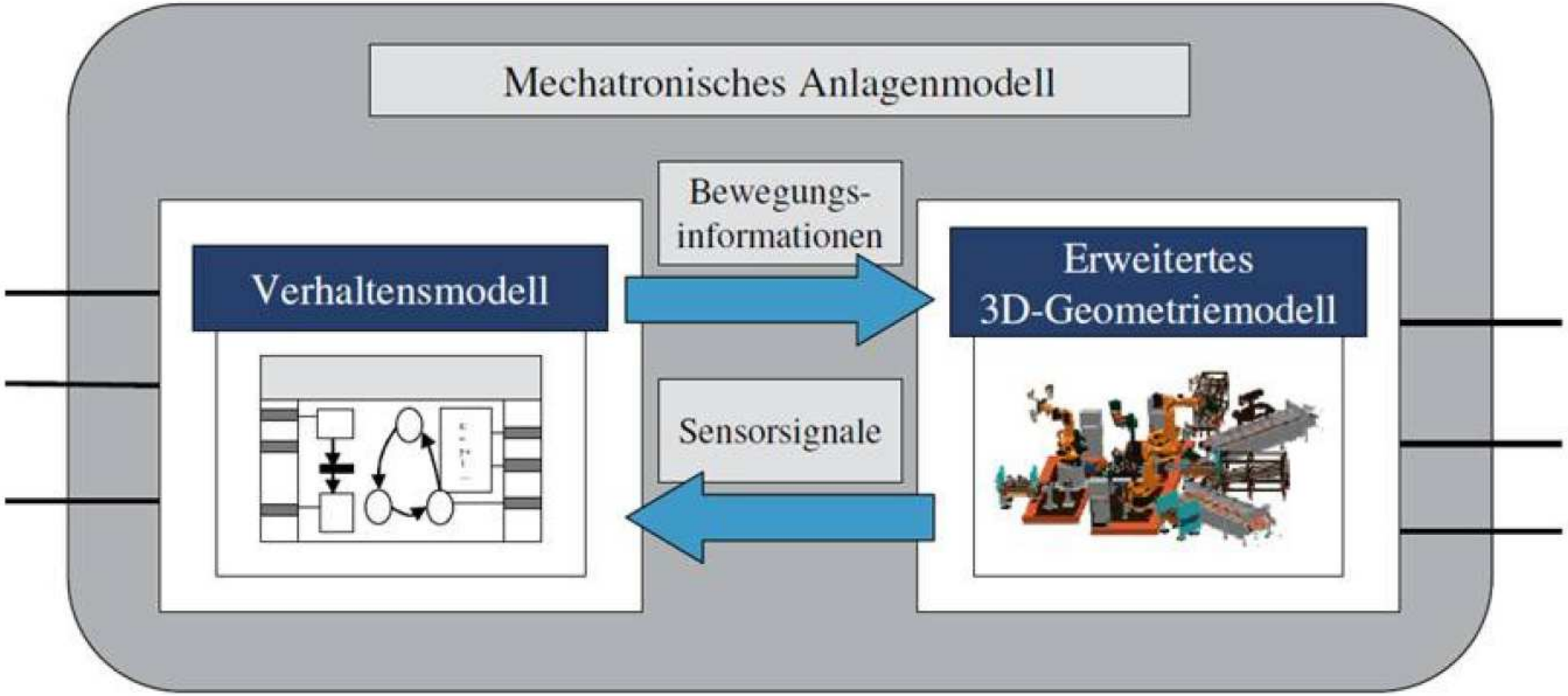
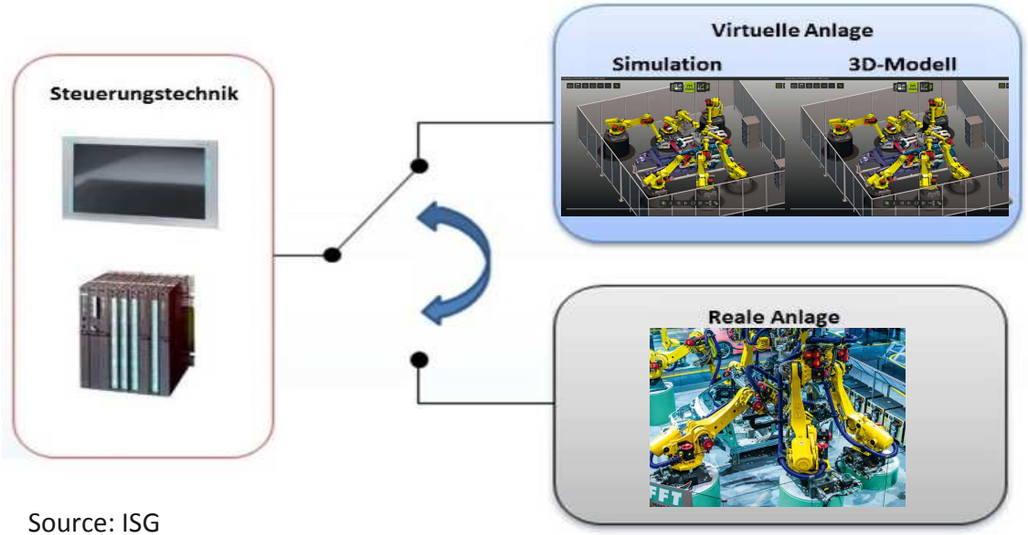
Mechatronical system model

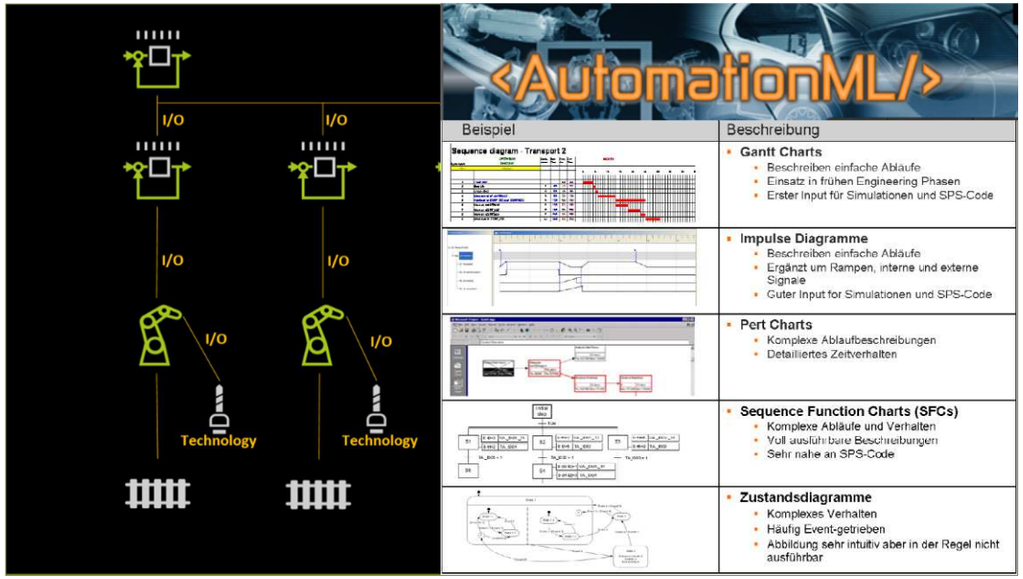


Quelle: Kuka

Strategy – Virtal Commissioning



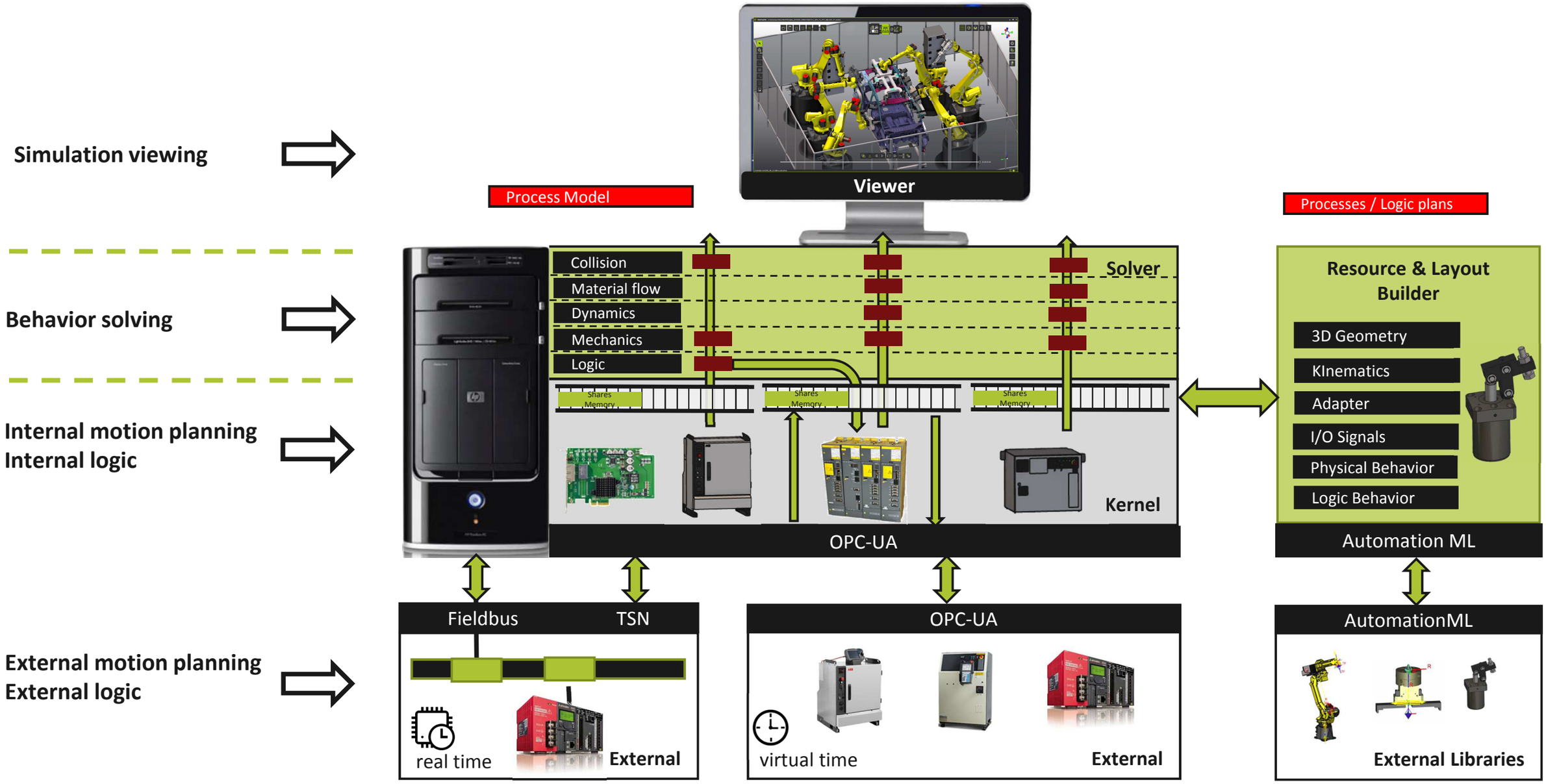
Source: ISG



Increase of efficiency

- Commisioning of electric and control systems comprises approximately 90% of complete effort
- A share of 70% is caused by software errors
- Usage of E2 simulation model
  - function description
  - behavior model
  - Connection to PLC programming
  - Transfer of functional description via AutomationML (SFC)
  - Validation of PLC programs during development
  - Commissioing of automation systems

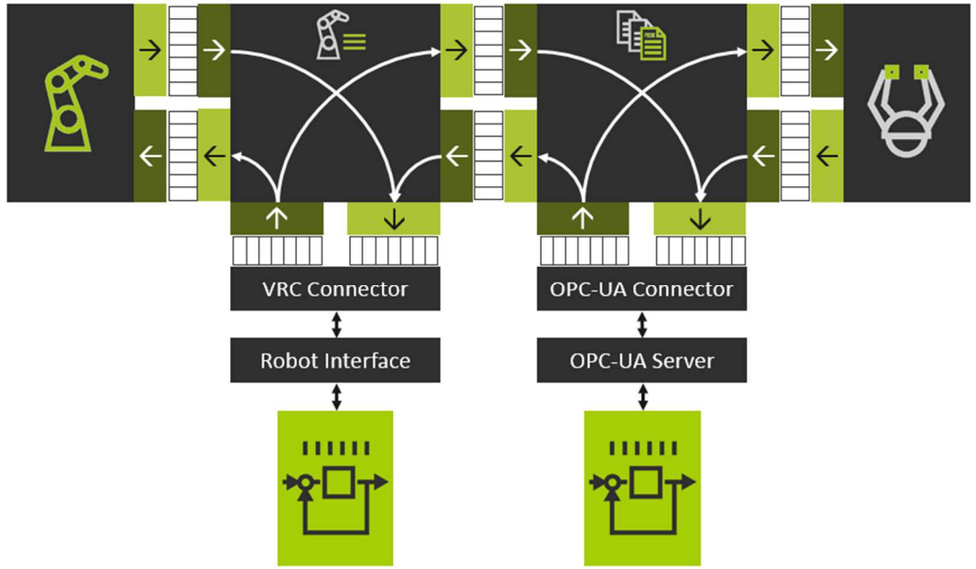
Simulation infrastructure of FASTSUITE Edition 2



Examples of signal communication with external controls

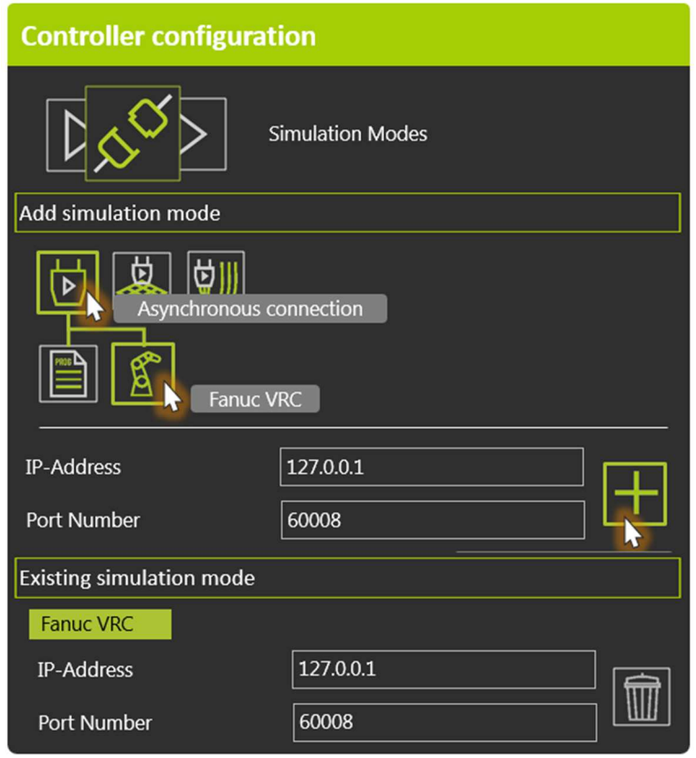
OPC-UA (Mitsubishi)

- Connection to Mitsubishi PLC
- Protocol: OPC-UA (standardised)



Fanuc Robot Interface

- Connection to Fanuc VRC
- Protocol: Fanuc Robot Interface (proprietary)



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Features of an intelligent system component model

- Geometrical shape (3D model)
- Kinematics chain
- Kinematics parameter
  - Axes limits
- Connection positions
  - mechanical
  - electrical
- Behavior model parameter
  - Joint speeds
  - Joint acceleration
- Signals
  - Joint values
  - Sensor values
  - Control registers

Quelle: CADENAS, Zimmer Group

Creation of intelligent system component Fastsuite E2

fast SUITE
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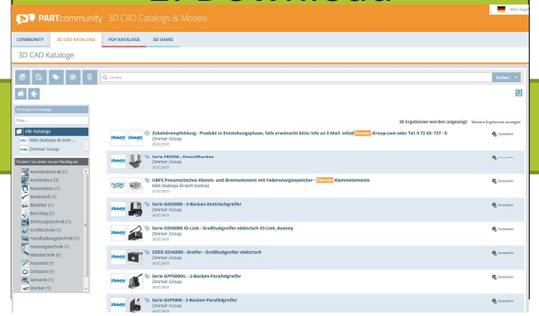
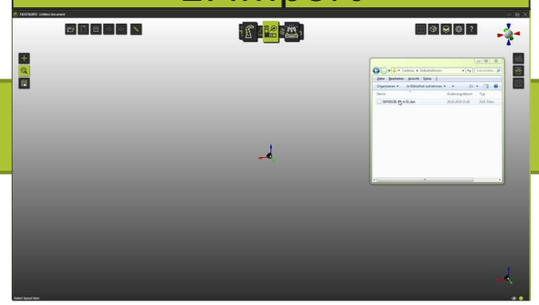
1. Download

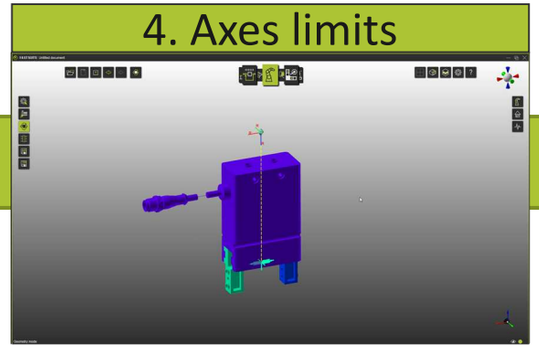


2. Import

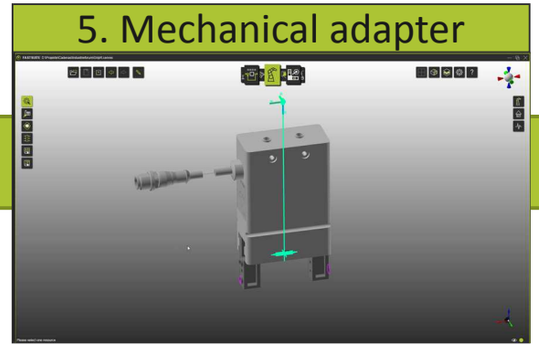


3. Kinematics

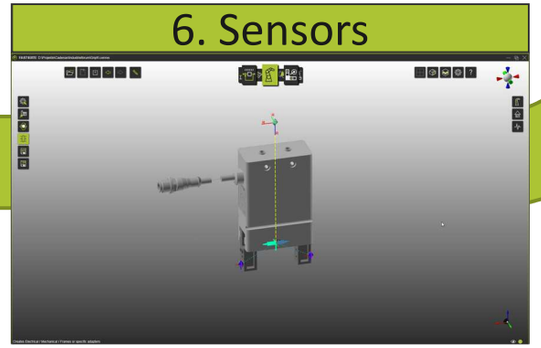
4. Axes limits



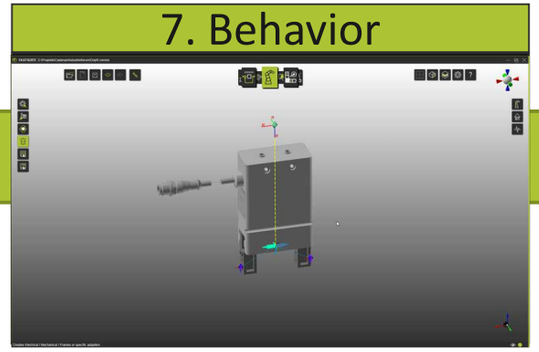
5. Mechanical adapter



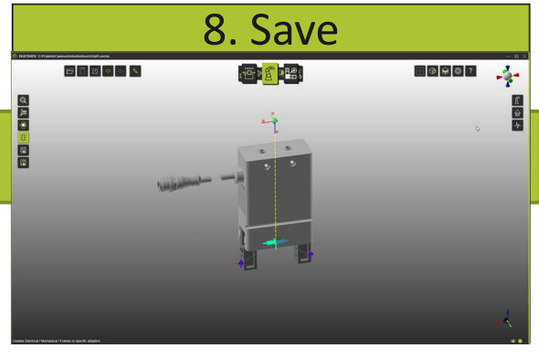
6. Sensors



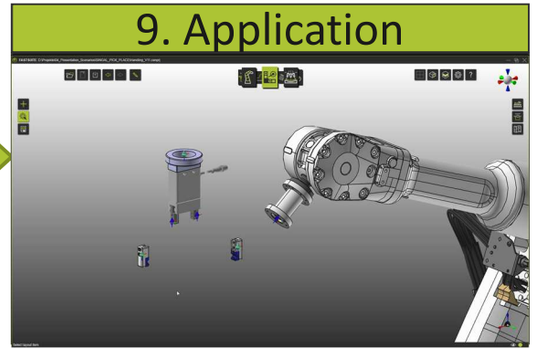
7. Behavior



8. Save

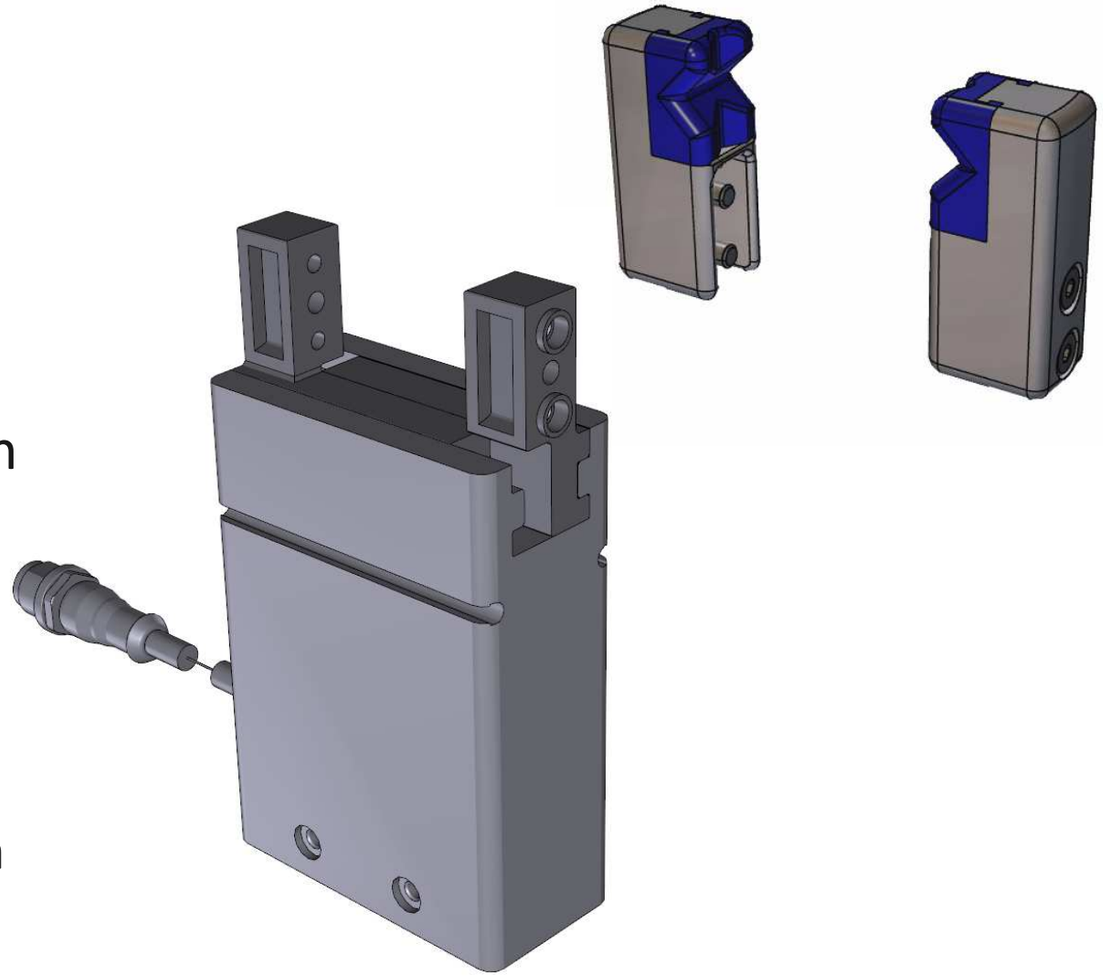


9. Application



Comprehensive transfer of intelligent system component models from CADENAS parts library

- Direct integration of CADENAS library access in FASTSUITE E2
- Advantages
  - Scalable information content, depending on manufacture
  - Considerable reduced effort for simulation model creation
  - No manual modelling afterwords necessary
  - Error free trabsfer of manufacturer specific components
  - Fullfills pre-requisite of complete digital twin of an automation system



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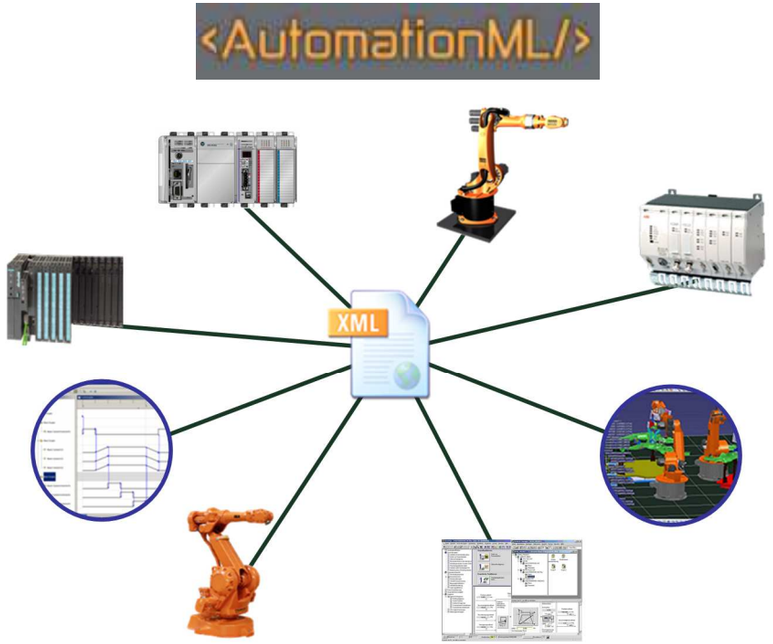
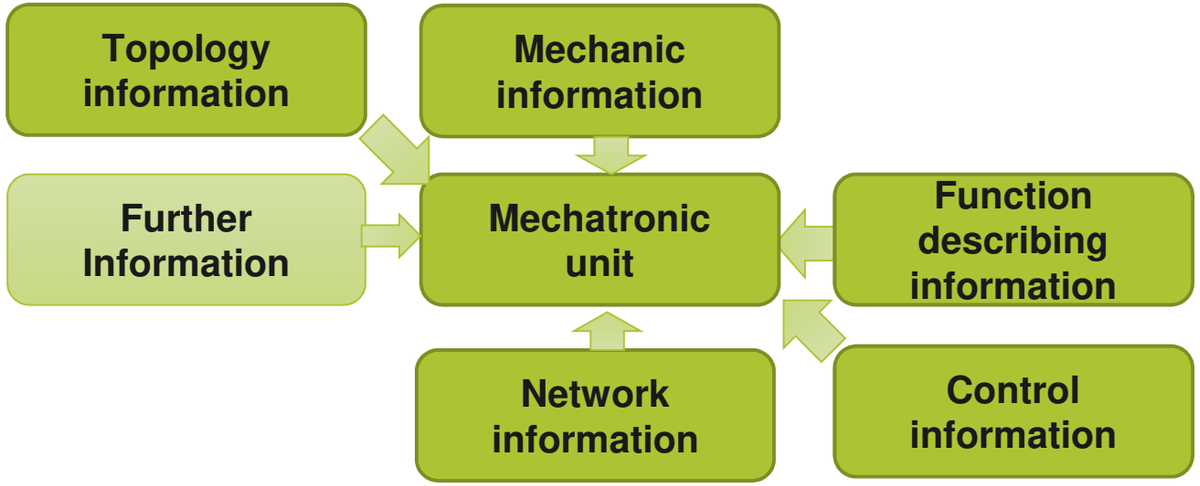
Neutral comprehensive description of models in component libraries with AutomationML

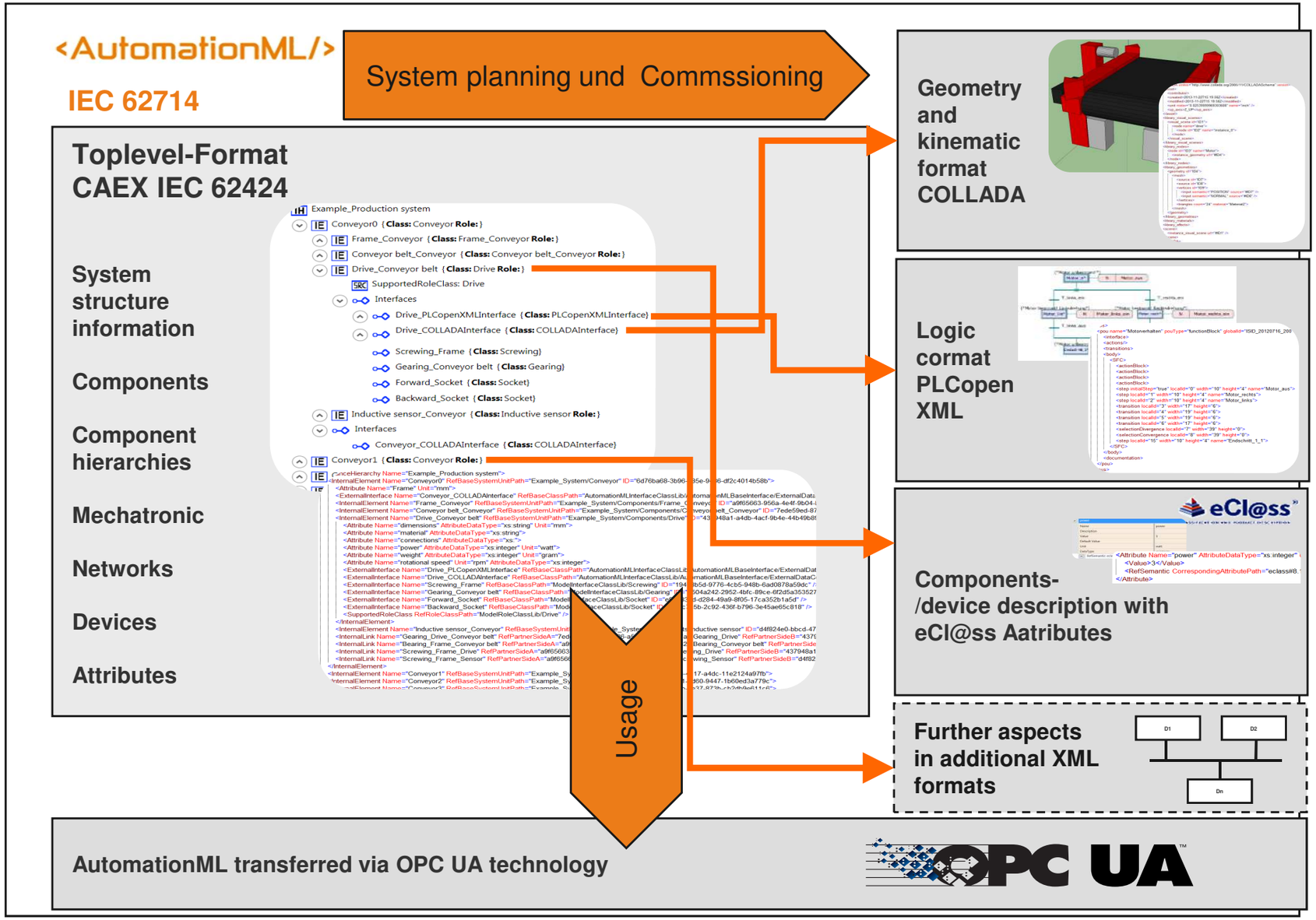
- AutomationML allows complete neutral descritpon of automation system components
- Fits perfectly with requirements for model representation in component libraries like CADENAS
- It is an international standard IEC 62424 which can be used free of charge.



Comprises following information:



AutomationML Architecture



Status on intelligent parts from component libraries

Fastsuite E2 transfer of automation components from CADENAS librariy

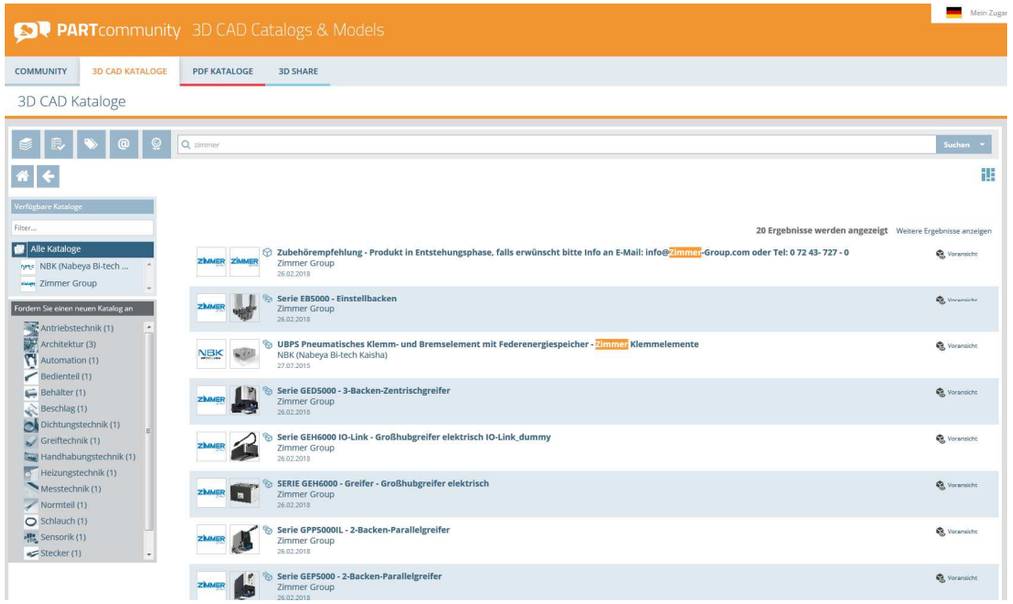
Currently available

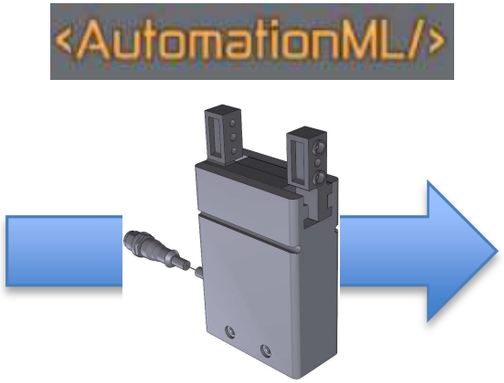
- Geometrie (CAD-Formate, Collada 1.4.0)
- Kinematik (Collada 1.5.0)

Future concept: Transfer with AutomationML is currently investigated in AutomationML working group „AML-Component“

- Adapter elektric, mechanic, fluidic (AutomationML)
- Verhalten und Signale (AutomationML mit PLCOpenXML)

CADENAS https://b2b.partscommunity.com





CENIT Fastsuite Edition 2

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Support of Automation System Engineering and Manufacturing Engineering with Intelligent Parts from Component Libraries

- Support in all phases of automation system and process engineering with digital factory solution Fastsuite Edition 2
  - Concept phase, detailling, commissioning and operation
- Definition of intelligent parts as mechtronical model in FASTSUITE E2
- Scalable information content based on information provided by manufactures
- In future:
  - Usage of AutomationML for extended data exchange for comprehensive component models from CADENAS parts library
  - Integration of direct acces to CADENAS parts library in FASTSUITE E2

Thank you for your attention!

Questions?

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