

Effiziente Entwicklung komplexer Systeme/Avioniksysteme

Neue Ansätze

LUFO
Informationstag
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Reinhard Reichel



Example: Fly-by-Wire System

Basic Challenge

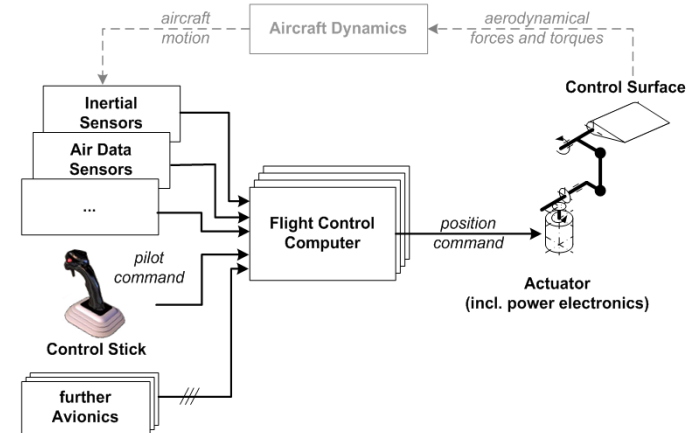
- Multiple complex functions (laws)
- Safety critical
- Multiple modes

Consequences

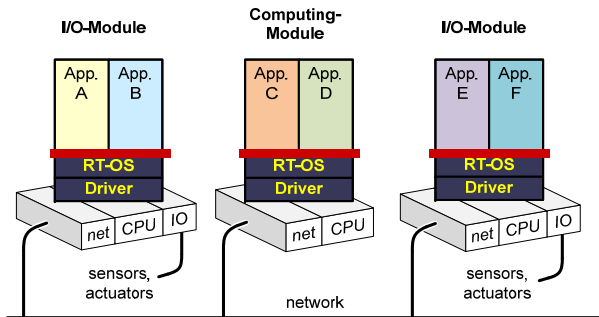
- Highly redundant system
- Complex system management
- System management depends strongly on the application
- Any new system: **High effort, risk, cost**

Key Questions

- How to reduce development/certification effort, risk, cost
- How to make such systems more affordable (CS23, CS27/29)



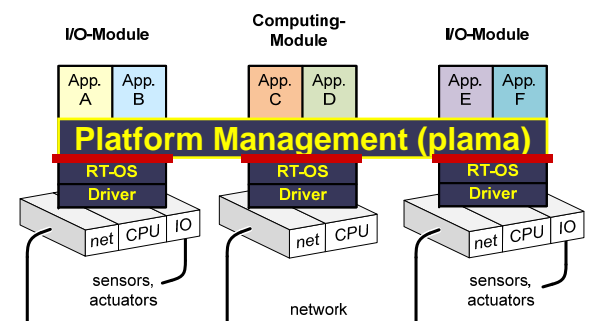
Flexible Platform Approach



Integrated Avionics Architecture

- Application: „Law” and system-management **API**
- Abstraction: Hardware / OS

- Clear Separation of “Laws” and “System Management”
- Generic Approach of System-Management (Platform-Management)

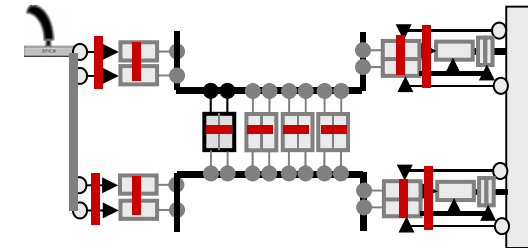
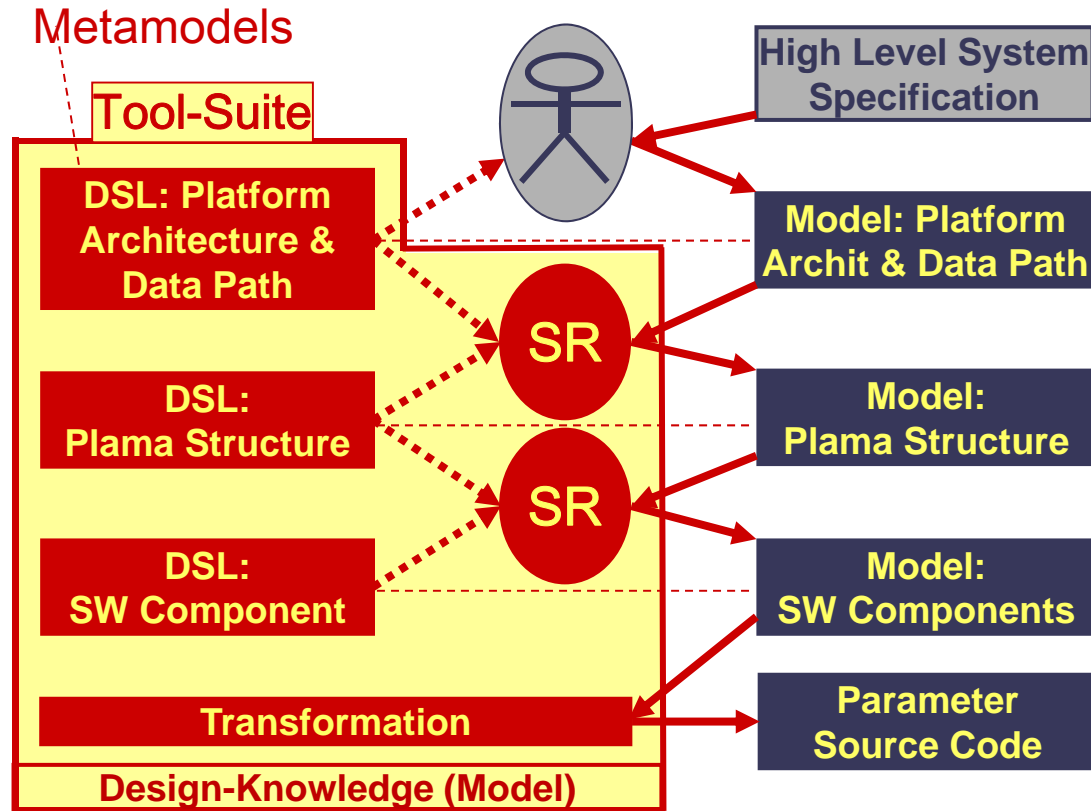


Advanced Platform Architecture

- Application: “Law” (virtually simplex) **API**
- Abstraction: System (red. aggregates,..)
- Abstraction: Platform instance (red. modules,..)
- Abstraction: Modules (internally redundant)
- Abstraction: Hardware / OS

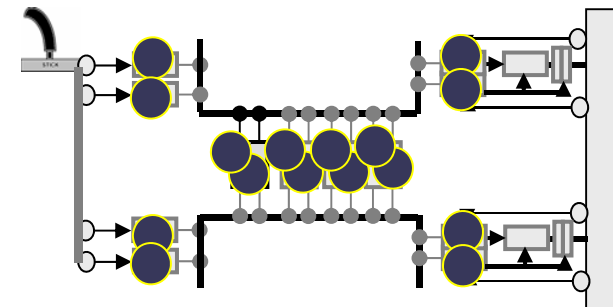
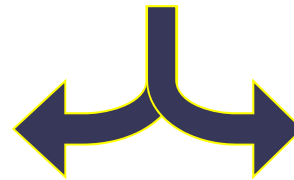
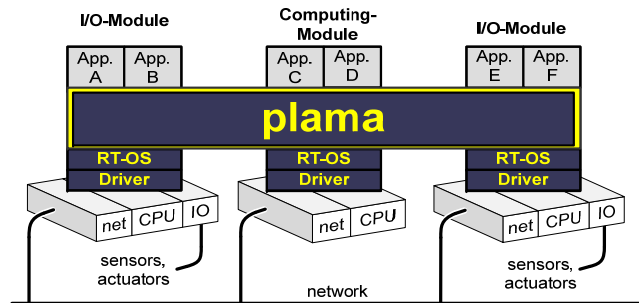
Specialization by Tool-Suite

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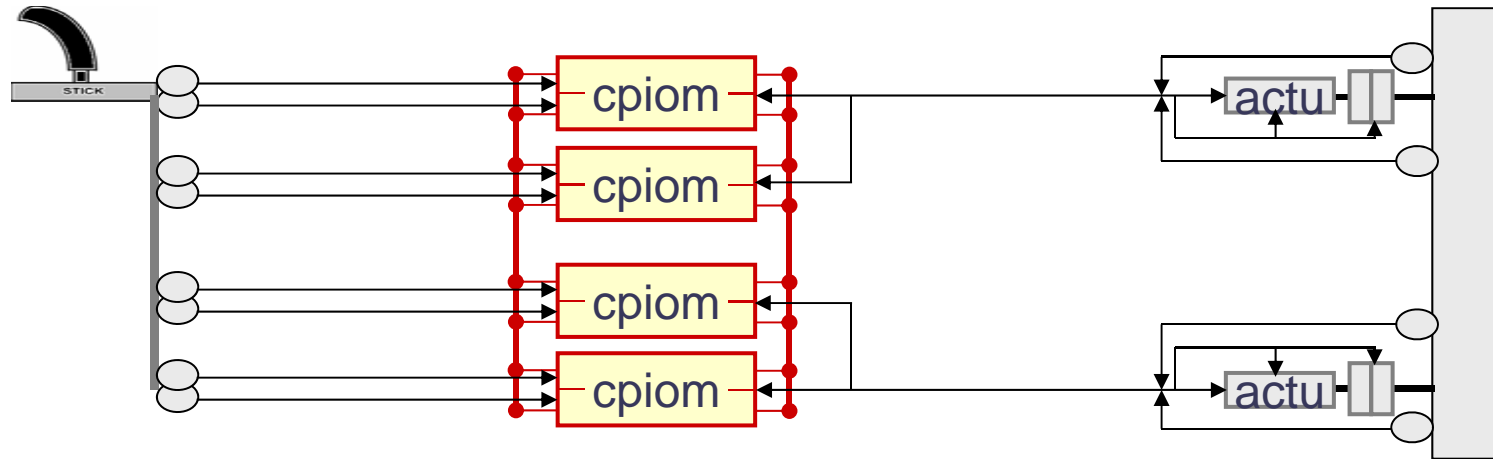
DSL Domain Specific Language

SR Synthesis Rules



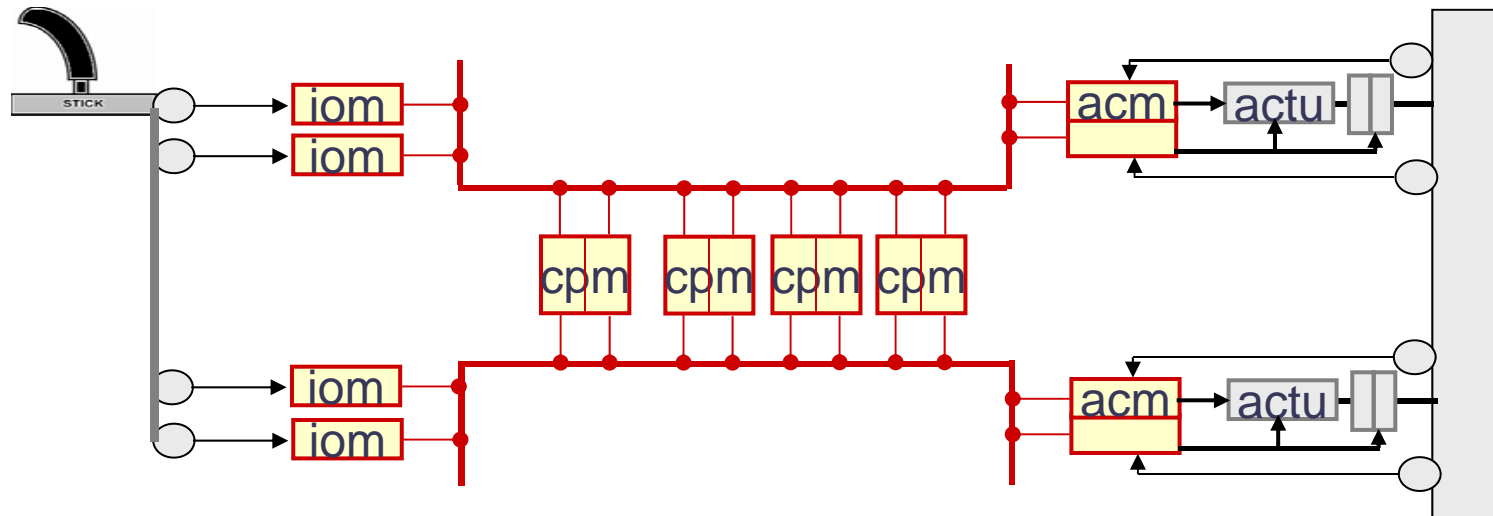
Platform Instance / Architecture

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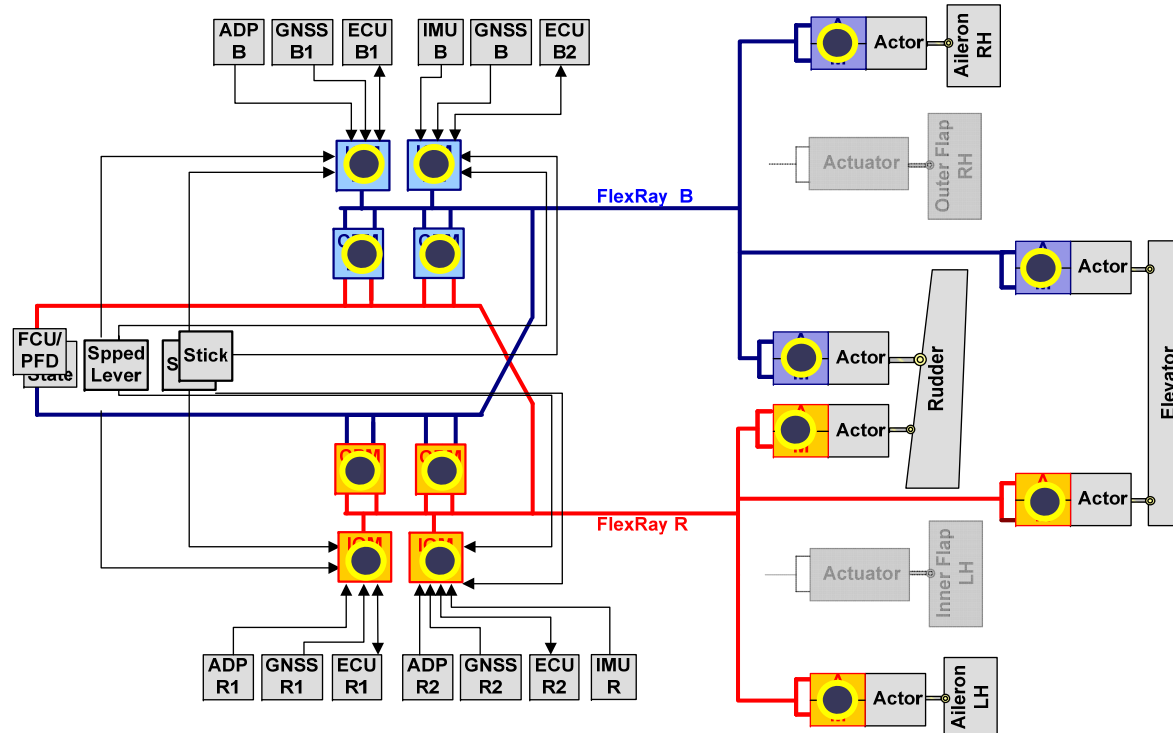


Centralized Architecture

Distributed Architecture



Fly by Wire Platform for CS23 Aircraft



Implemented Functions

- Primary Flight Control, Secondary Flight Control, Landing Gear Control, NWS, Braking,..
- 4D-Autopilot, ATOL, (Flight Management, Vehicle Management)

Demonstrators

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SPARC / Partner: Daimler e.a. / Source: Daimler

X-by-Wire System
Steer-, Brake-, PowerTrain-by-Wire
Autopilot, Driver-Monitor.....



Partner: Stemme, Techical University Berlin

F/O-Autoflight System with ATOL
Inflight Demonstrator



SAFAR, FlySmart
Partner: CAS, DAI, SET, e.a. Source: DAI

Fly-by-Wire Inflight Demonstrator DA42

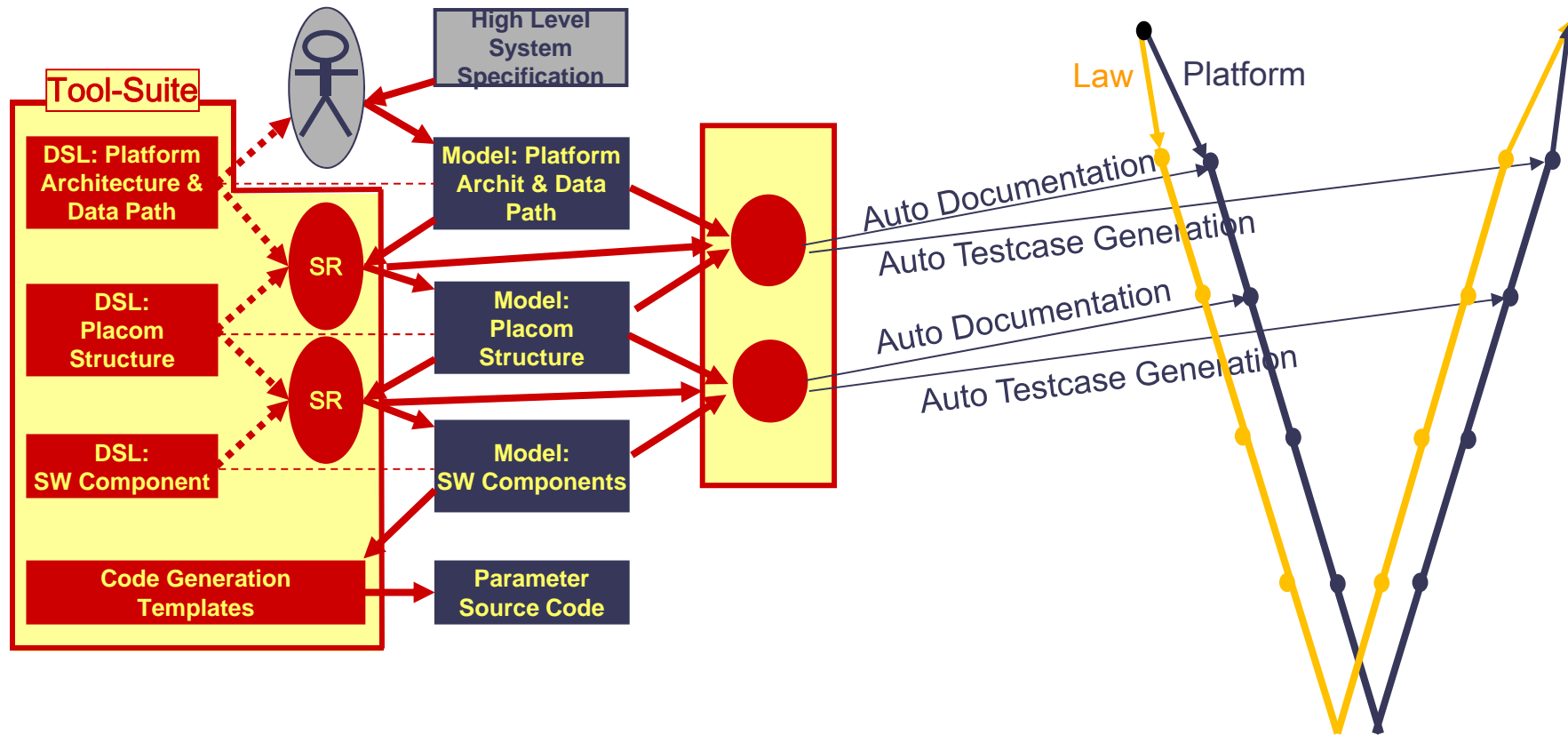


HC_FBX
Partner: Eurocopter, DLR, LLI e.a./
Source: Wikimedia Commons, CC-BY-SA-3.0

Fly-by-Wire System / Lab-Demonstrator

Extension of the Specialization-Tool-Suite

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Technology Step towards 2030: Adaptive Platform

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Short term research

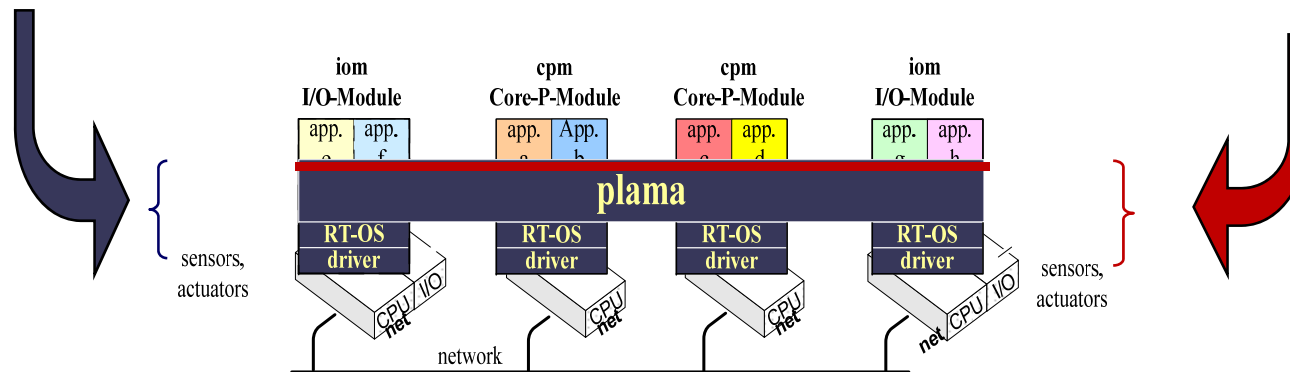
Specialization

- by automatic instantiation
- by model scaling

Long term research

Auto-Adaptation

- request for open SW Architecture
- request for self **adaptive** middleware



Flexible Platform

Adaptive Platform