

Model-Based Software Tool Suite for the Design of Networked Embedded Control Systems

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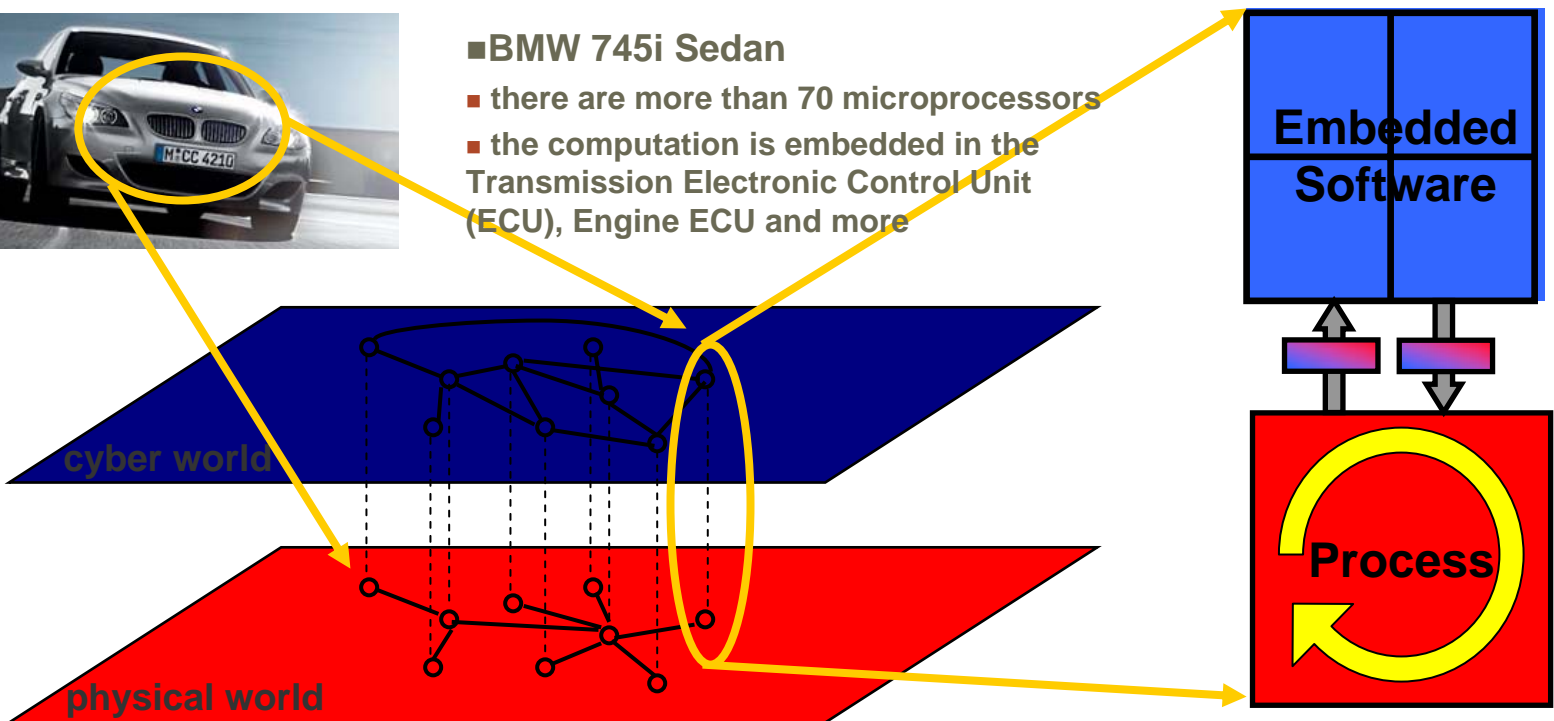
<http://www.vuse.vanderbilt.edu/~kootj/>

Networked Embedded Control Systems

- Networked Embedded control systems close the feedback loops between the cyber and the physical worlds
- Embedded software defines the physical behavior of complex systems



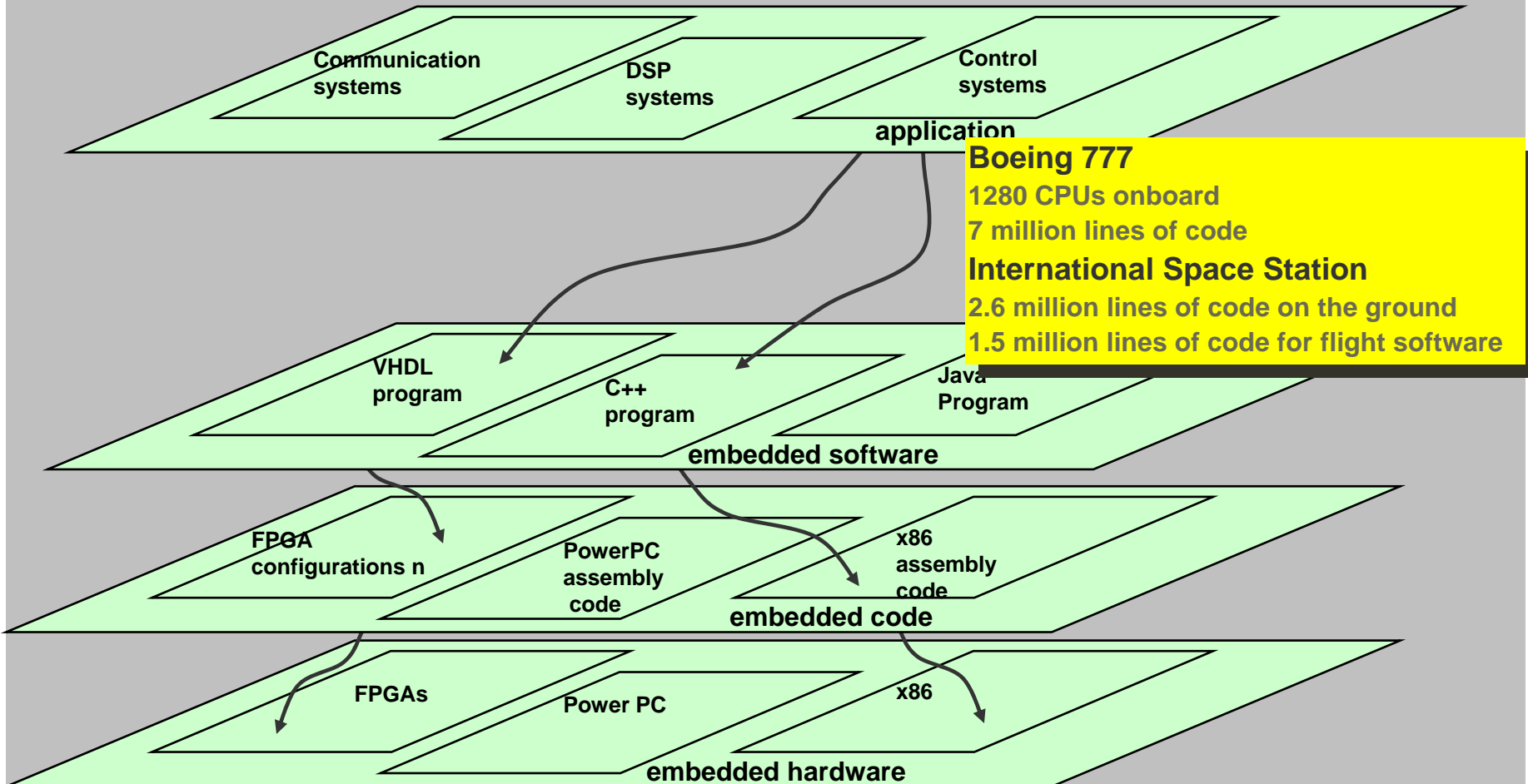
- BMW 745i Sedan
 - there are more than 70 microprocessors
 - the computation is embedded in the Transmission Electronic Control Unit (ECU), Engine ECU and more





Embedded Software for NECS

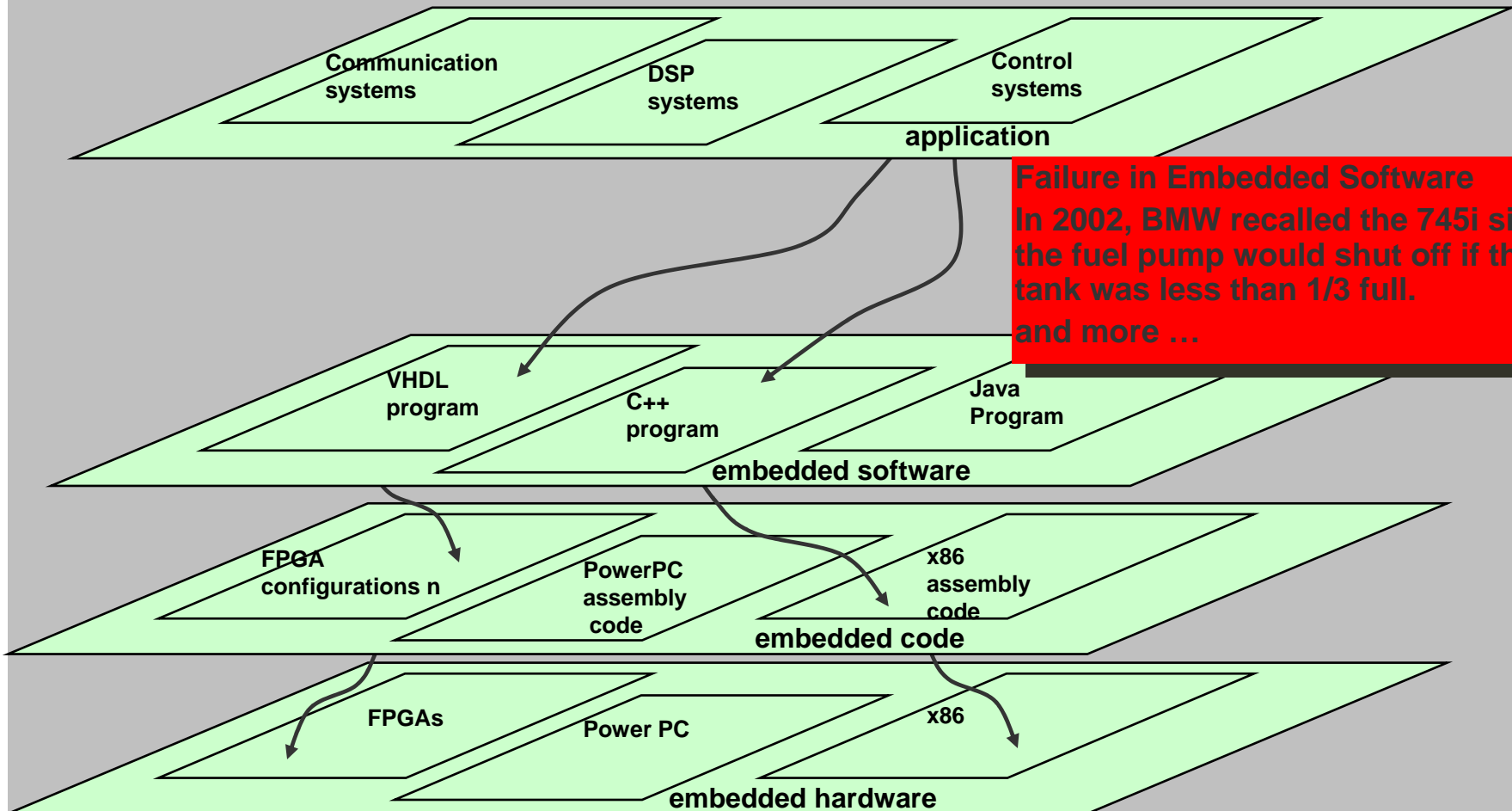
Current Design Practice





Embedded Software for NECS

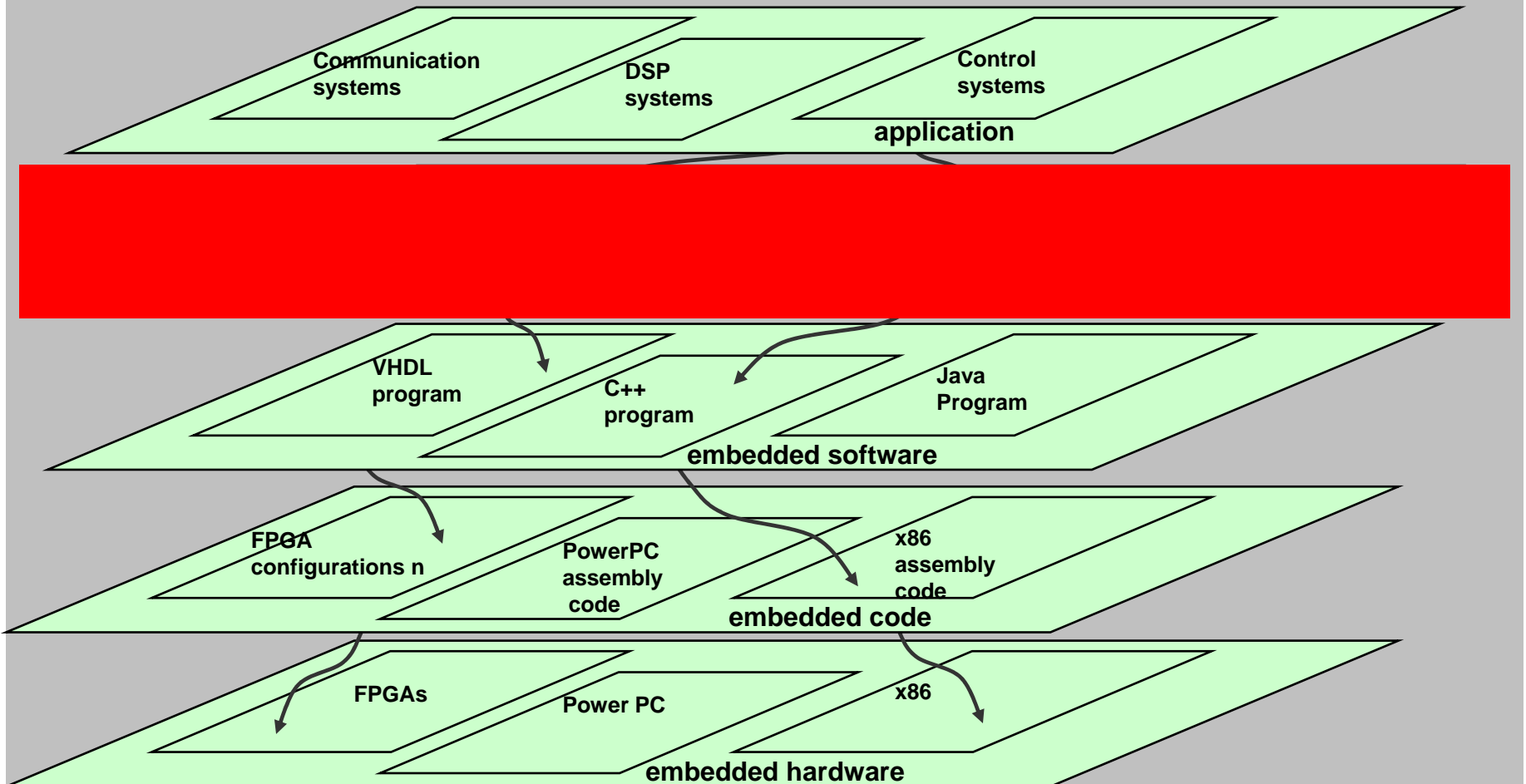
Current Design Practice





Embedded Software for NECS

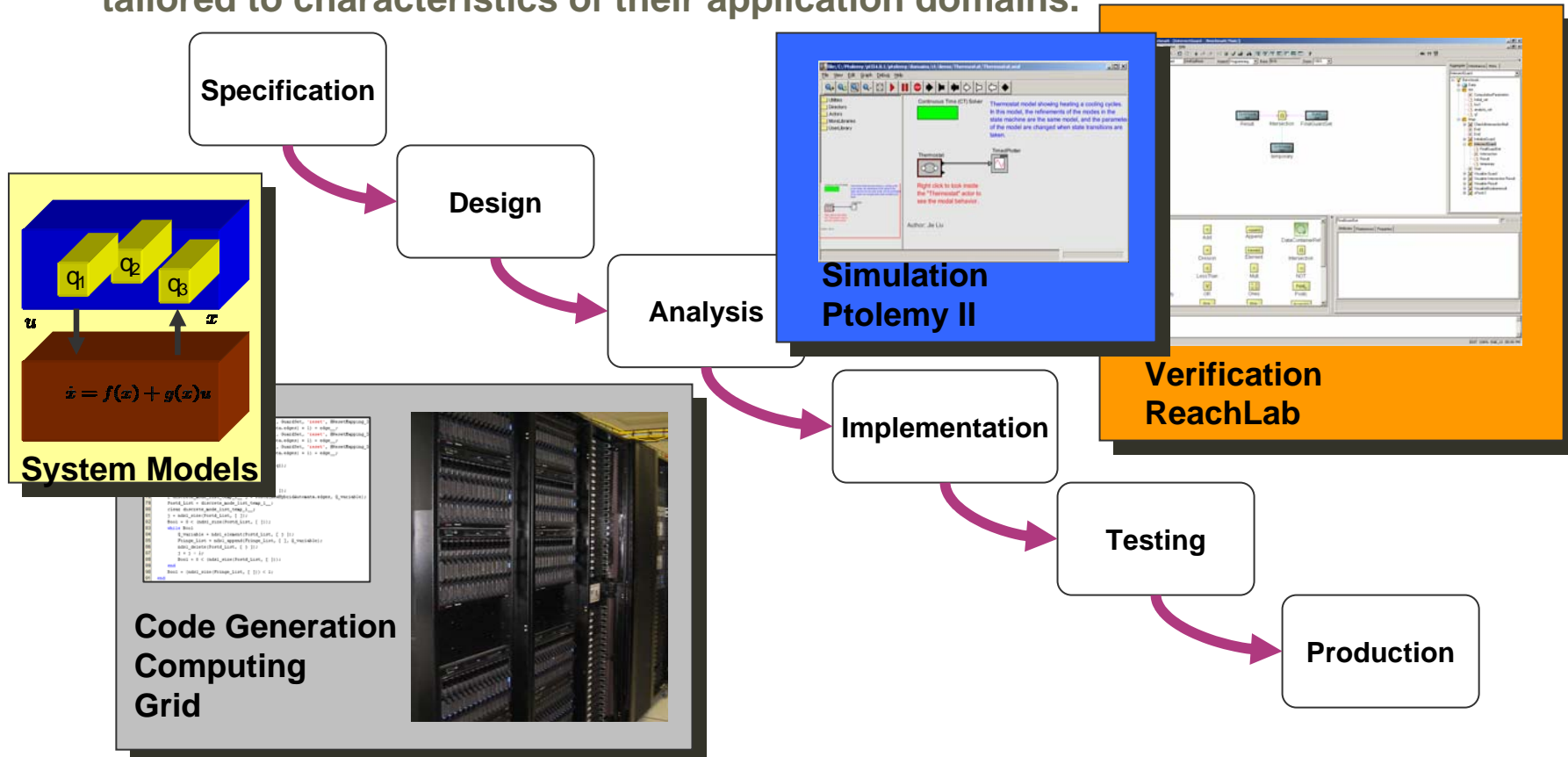
Model-Based Design



Design Tools for NECS Tools

Model-based Design Tool Chain

- Domain Specific Modeling Languages (DSMLs) are developed to capture the concepts, relationships, integrity constraints, and semantics of the application domain and can allow users to program declaratively through model construction but the modeling concepts and notations that are tailored to characteristics of their application domains.



Design Challenges for NECS

■ Fact

- Existence of Strong Interactions between the Physical world and the Cyber world!!

■ Approach

- Focusing on the development of model-based tools as the enablers for analysis and synthesis of networked embedded control systems. Strong theory and computation components in the tool development process.

■ Research Areas

- Deployment of metamodels and models in system design
- Development of methodologies for semantics-preserving transformations among DSMLs
- Development of modern system theory
- Development of effective algorithms for analysis and synthesis purposes