



SYSMODEL Tools Platform



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Design of Heterogeneous Systems

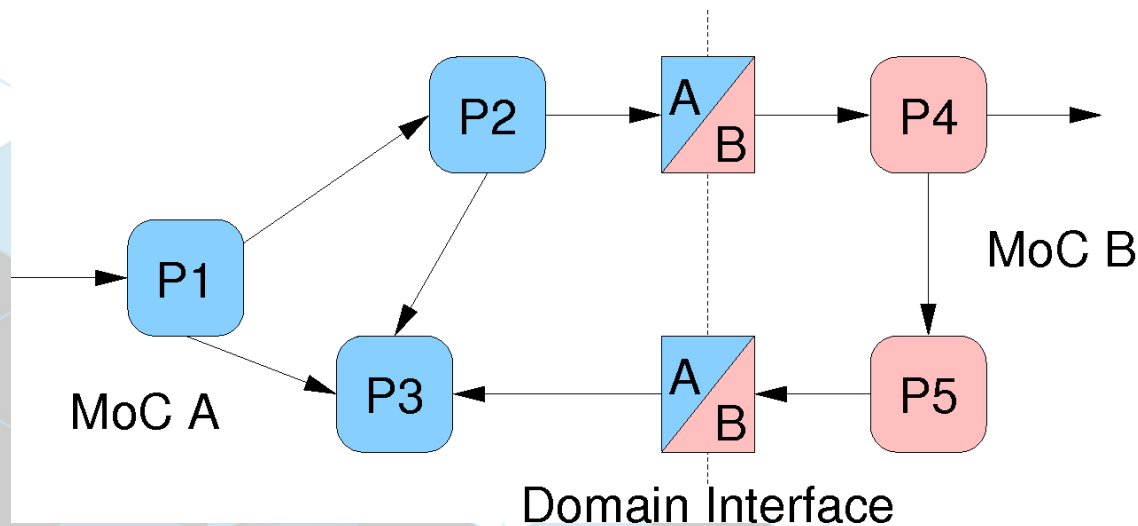


- ▶ SYSMODEL focuses on the design of heterogeneous systems
 - ▷ Heterogeneous applications
 - ▶ Analog signals, digital signals
 - ▶ Variety of protocols
 - ▶ Control vs data-flow
 - ▷ Heterogeneous architectures
 - ▶ Digital HW, Analog HW, Software
- ▶ Most industrial tools focus on a single domain
- ▶ SYSMODEL tool platform based on ForSyDe System Model

ForSyDe System Model



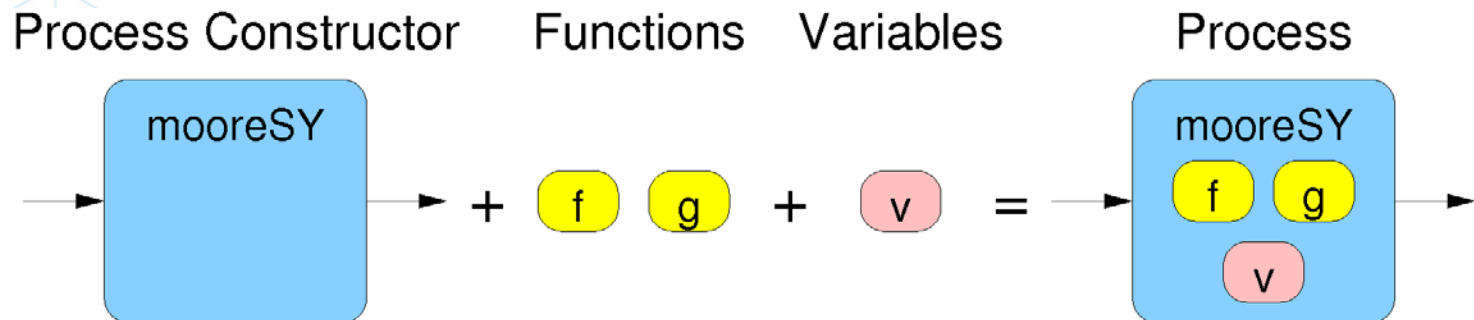
- ▶ A system is modeled as hierarchical concurrent process network
- ▶ Processes of different models of computation (MoC) communicate via domain interfaces
 - ▷ Supported MoCs: Synchronous, Untimed (SDF), Discrete Time, Continuous Time



Designing in ForSyDe Processes



- ▶ A process is always designed by means of a process constructor
- ▶ The process constructor defines the communication interface of the process
- ▶ The process constructor takes side-effect free *functions* and *variables* as arguments and returns a process

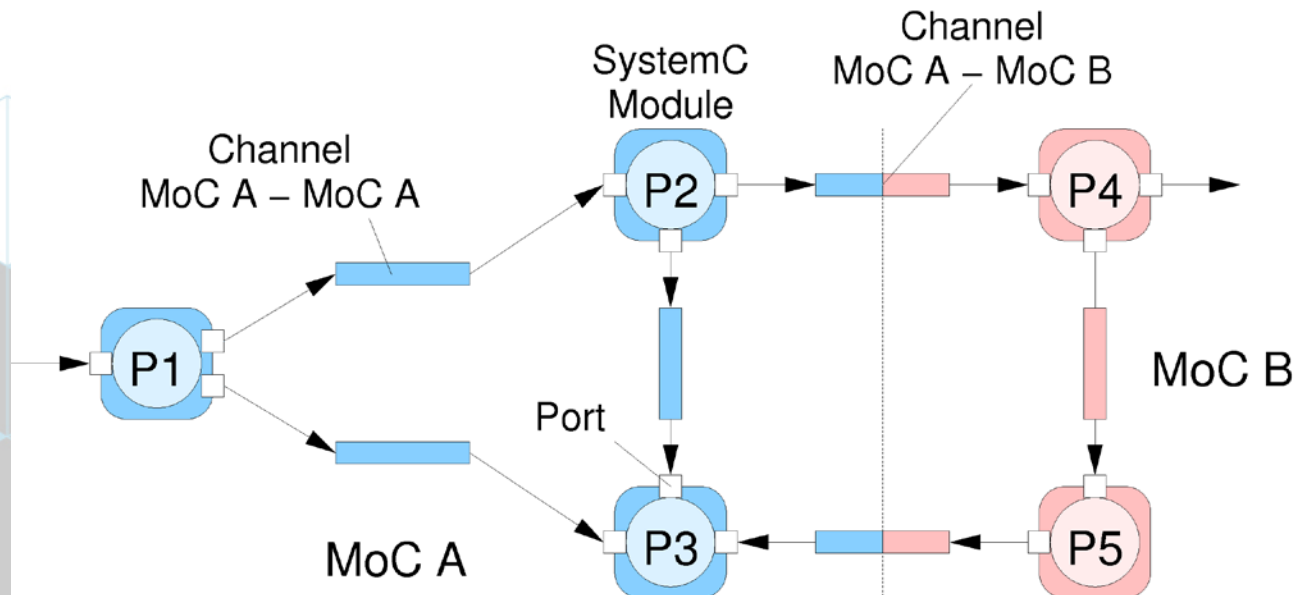


ForSyDe processes and system models are deterministic!

ForSyDe compliant SystemC



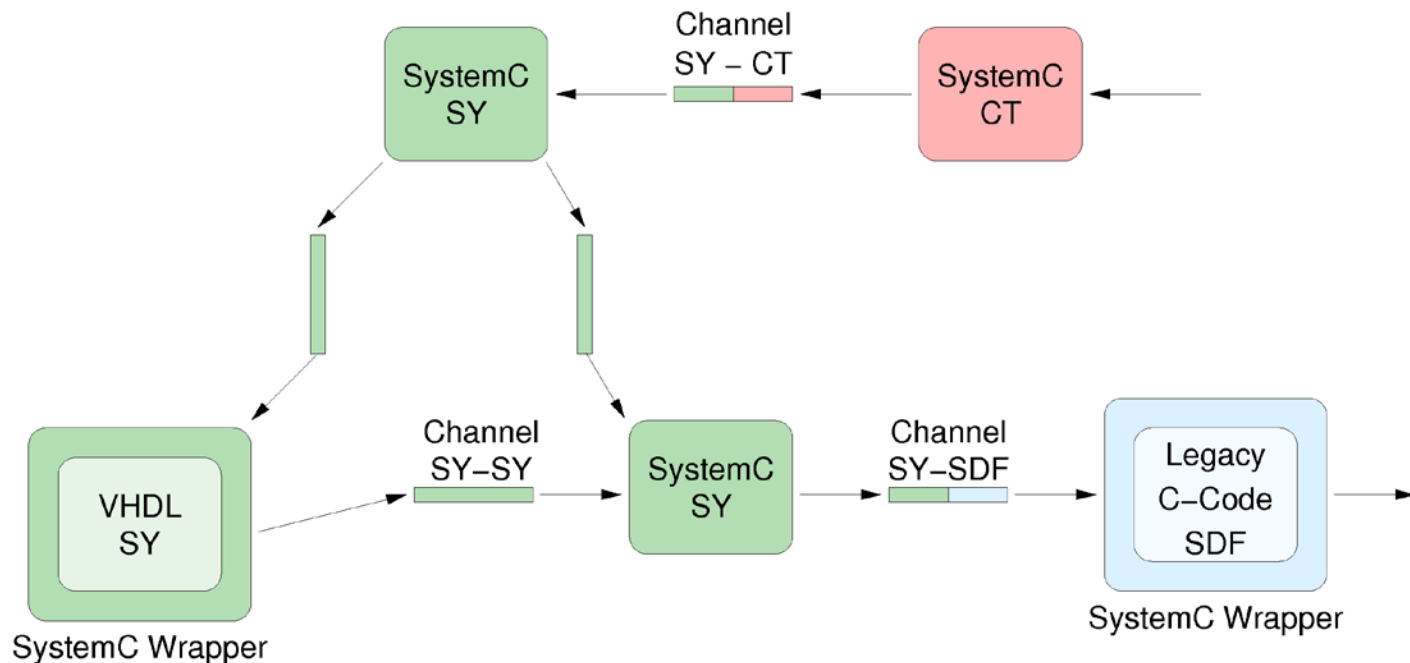
- ▶ Project developed SystemC libraries that
 - ▷ are based on the formal foundations of ForSyDe
 - ▶ Concept of process constructor
 - ▶ Well-defined execution semantics
- ▶ Project developed modeling guidelines



Integration of Existing Models

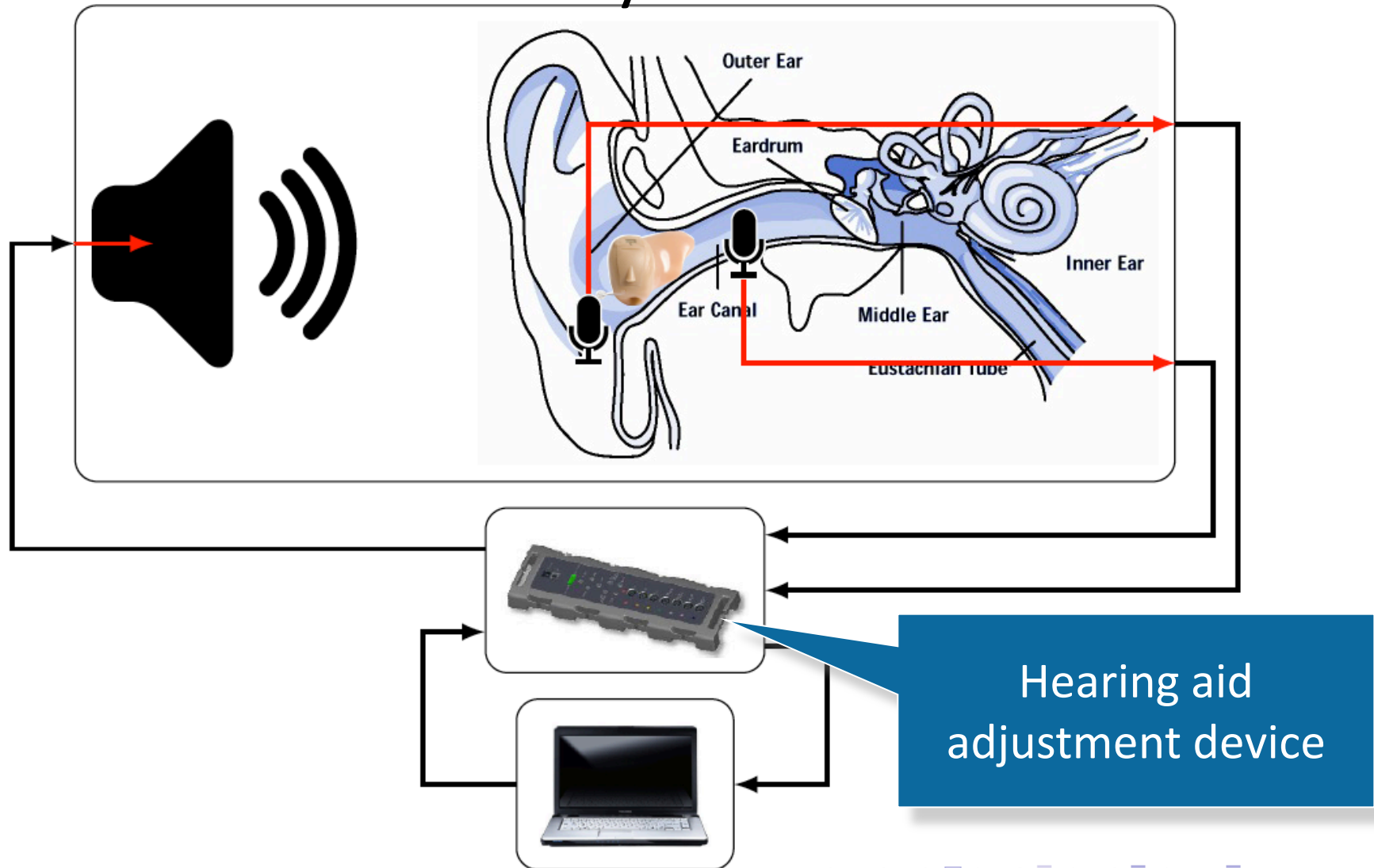


- ▶ Reuse of existing models in other design languages
- ▶ **SystemC-wrappers** allow to integrate “legacy code”
 - ▷ Matlab, C, VHDL

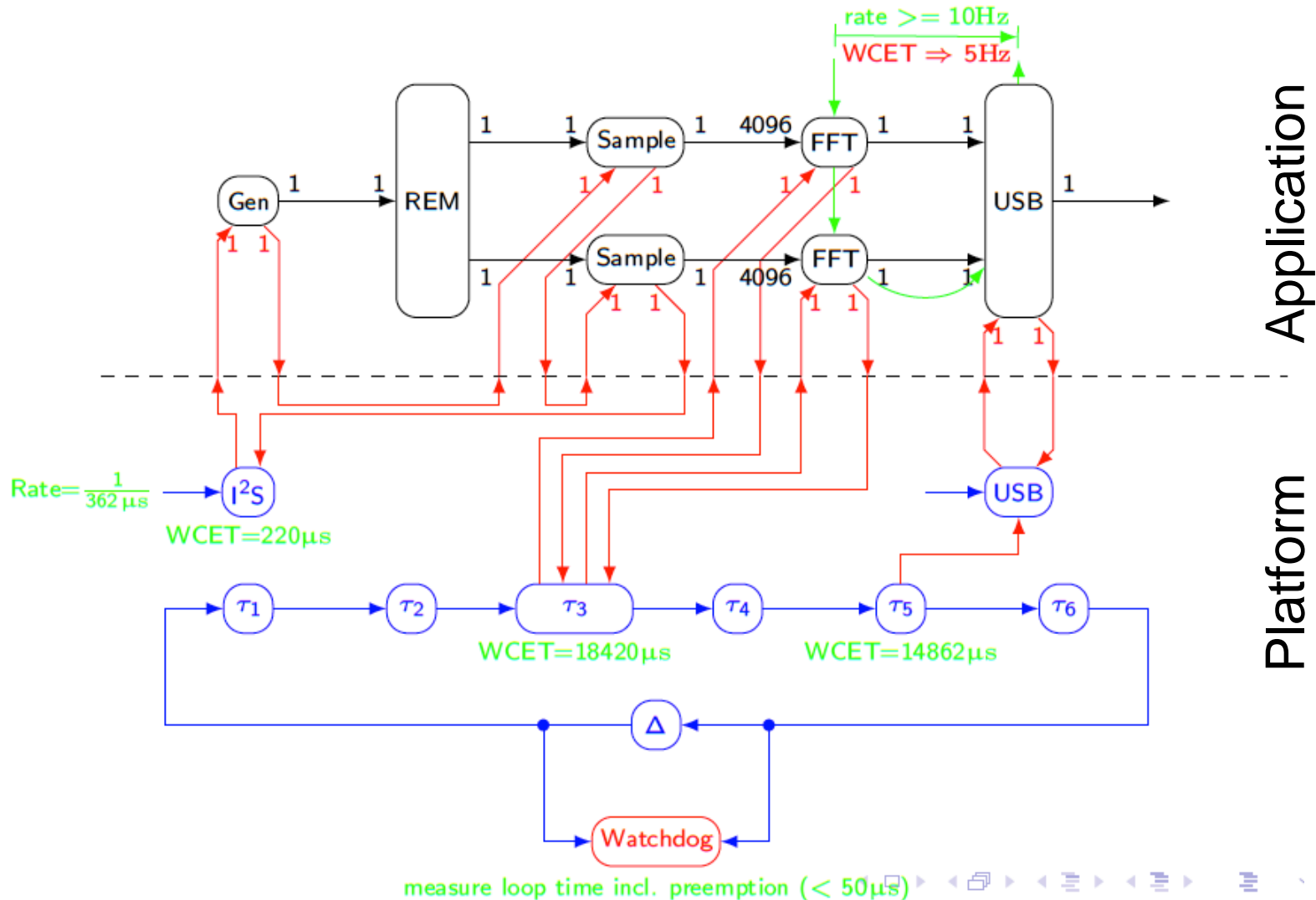


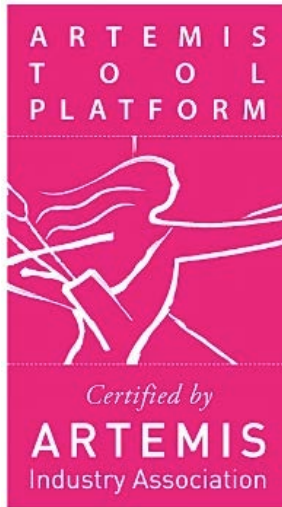
SYSMODEL System Model

Validated on industry cases



Hearing aid adjustment device: System Model & Analysis

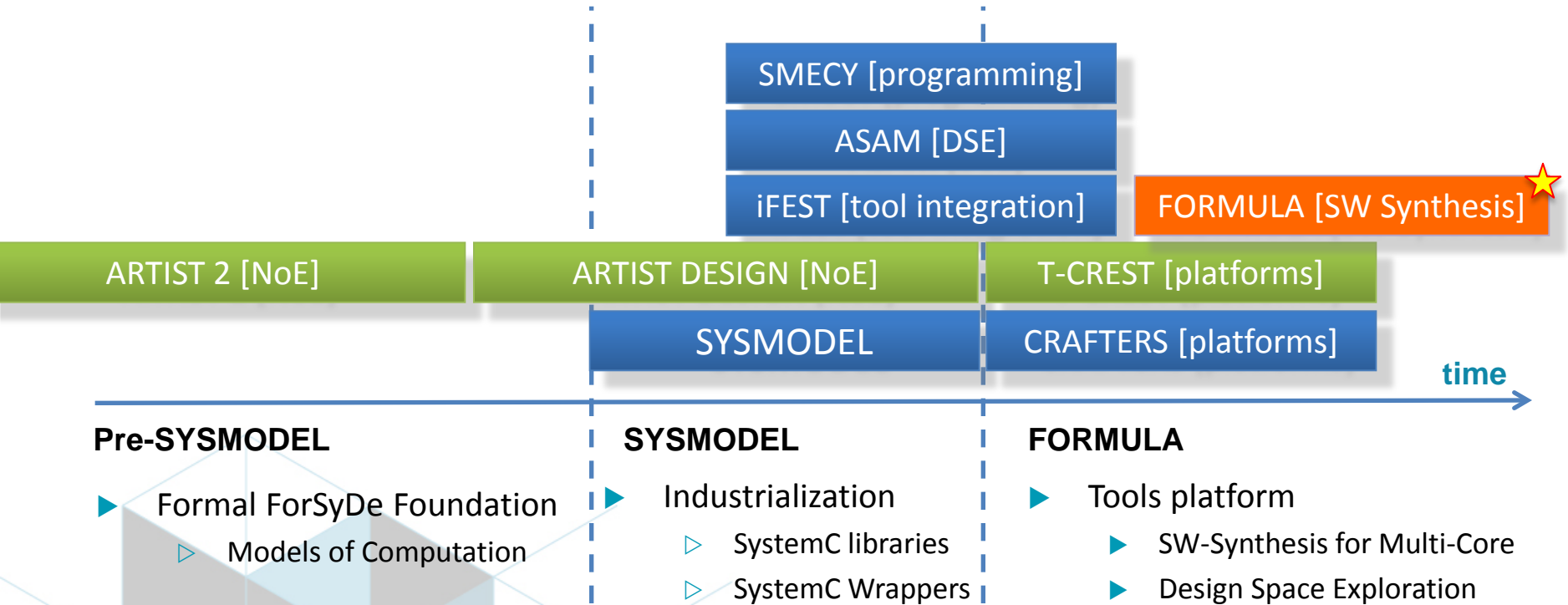




FORmal software synthesis for embedded **MU**ltiprocessor **pLA**tforms

FORMULA

SYSMODEL Timeline



Towards Predictable Software



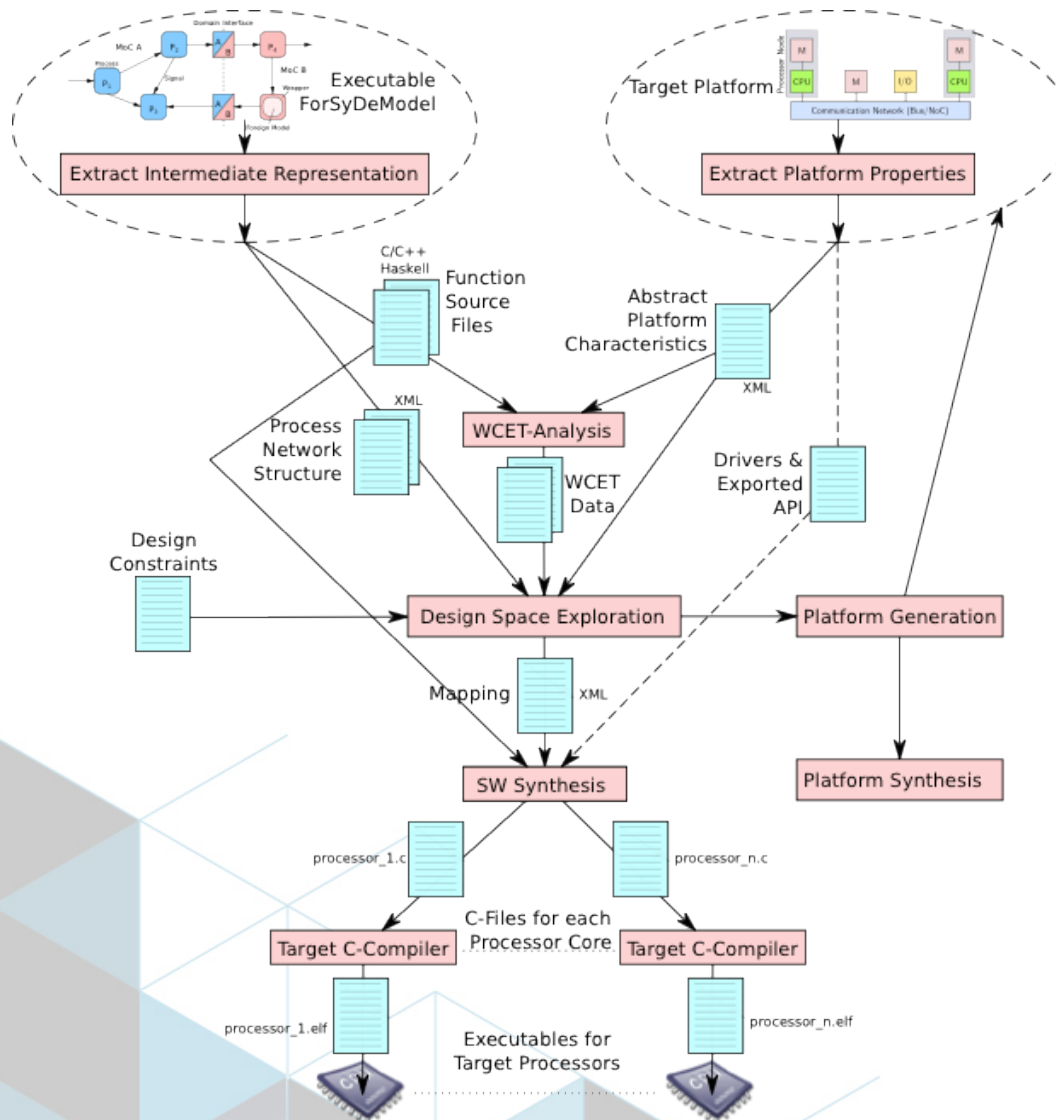
- ▶ Software design needs to be based on formal foundation
- ▶ Software architecture needs to provide predictability
- ▶ Libraries need to be offered to the designer, so that models created comply to the formal framework
- ▶ Tools need to be developed that exploit the formal basis (Performance Analysis, Verification, Synthesis)

Software Design Flow



- ▶ Designer models executable system model
- ▶ Abstract analyzable models are extracted
- ▶ MoC theory is used for design space exploration and synthesis => **efficient mapping**
- ▶ Code is generated for each individual processor

FORMULA Design Flow





Thank you for your attention!

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