Goals

The methods addressed by VISION focus on challenges in the design of distributed microelectronic systems above the level of SoCs and NoCs. In this way, focal points are new specification methods for distributed systems, approaches for the derivation of optimized interconnection topologies for given application, techniques for communication and performance analysis and mechanisms for an automated dimensioning and parameterization of the interconnect structure. This includes methods for the derivation of executable virtual prototypes from abstract system models. In addition new approaches to the verification of models across domain and abstraction boundaries are addressed. This will clearly facilitate the integration of systems in their networked environment and therefore significantly simplify the process of system engineering in the future.

The shortcomings addressed in the project and scientific / technical goals derived from this can be divided into the following areas of emphasis:

- Modeling approaches which provides a holistic view on the networked systems in early phases of the system design process.
- Analysis approaches of the communication and performance behavior of distributed microelectronic systems. This supports an early evaluation and exploration of communication topologies and network architectures.
- Verification methods in order to integrate subsystem models into their embedding system environment. This allows for an early detection of integration errors already at specification level.
- Application-specific customization of the developed methods, which results in highly applicable design flows for distributed microelectronic system design in automotive and mobile communication.

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The VISION project (FKZ: 01 M 3078) is supported in accordance with the BMBF „Nanoelectronics" sponsorship scheme within the scope of the Ekompass sponsorship complex of the Federal Ministry of Education and Research (BMBF).

VISION

Distributed Systems and Communication in Automotive, Mobile, and Multi-Computing

a public funded EDA research project

Runtime: 05/2006 - 04/2009

Abstract

Today's and - more dramatically - tomorrow's microelectronic systems migrate towards highly interconnected "systems of systems" resulting in a growing degree of complexity and interaction. An increasing number of subsystems are involved in providing a specific system function, and more and more system functions are sharing a hetero-geneous network of distributed resources. In this context, interaction becomes the most critical challenge of the design process: With today's system design methods and tools, a design of distributed systems with highest demands on flexibility, reliability, fault tolerance and real-time behavior cannot be done in an economical way, which will limit innovation in the near future. VISION faces these challenges and addresses the design of distributed microelectronic systems using a holistic view of the system and its embedding environment. This is supported by a global modeling concept which provides early model-based system integration, automated determination of an appropriate communication topology and network architecture as well as seamless integration into verification and implementation processes for highly interconnected systems. Thus, VISION provides enabler solutions for the design of tomorrow's advanced distributed systems in automotive, mobile communication and multi-computing.

Structure

Project Structure

The VISION project is divided into four work packages:

A1: "Topologies and Architectures for Distributed Systems"
A2: "Analysis and Evaluation"
A3: "Verification-Driven System Integration"
A4: "Applications and Flow Integration"

A2: "Analysis and Evaluation"

A2.1 "Performance and Communication Analysis"

A2.2 "Application Requirements Checking"

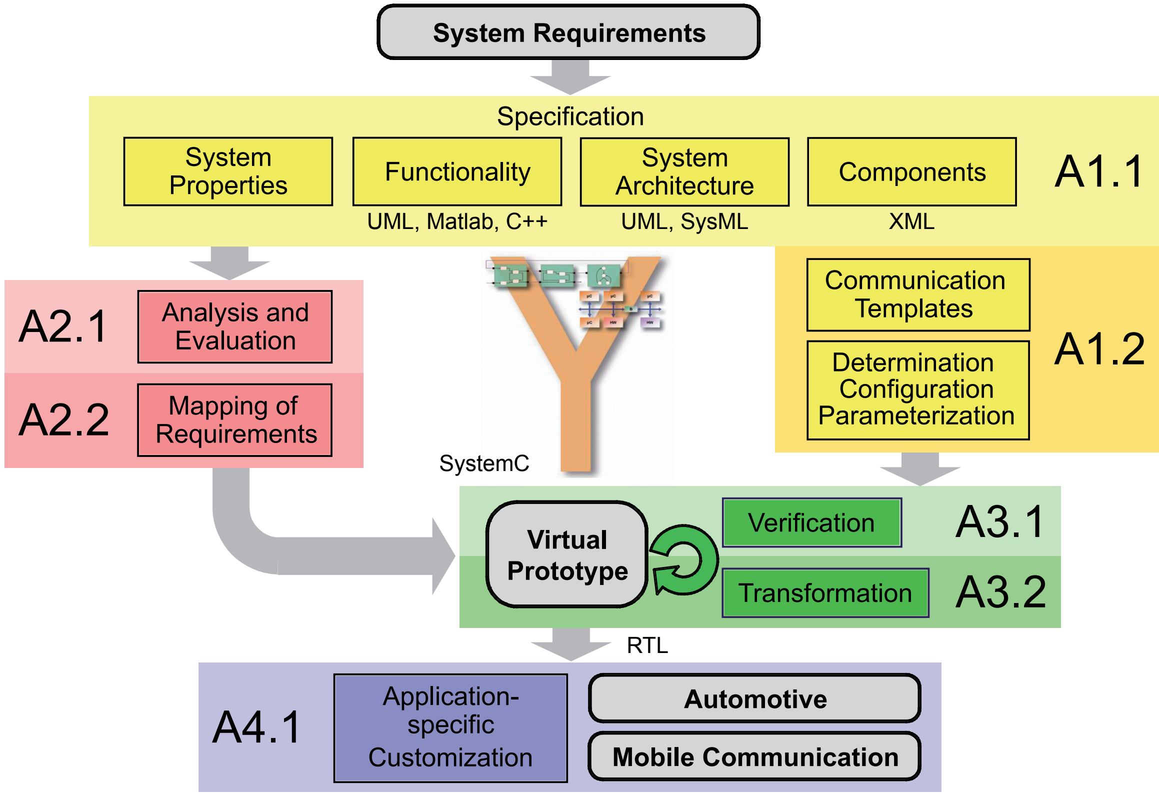
In the iterative design flow work package A2 is positioned as the assessment process to validate (intermediate) design steps in terms of performance, quality and consistency. The work package addresses the analysis of performance and intrinsic qualities using both dynamic and static techniques based on analytical models. System requirements defined by the embedding environment are integrated in the model, which allows for capturing and processing complex system requirements like reliability, fault tolerance and real-time behavior in an early stage of the design process.

A1: "Topologies and Architectures for Distributed Systems"

A1.1 "High-Level Modeling and Refinement"

A1.2 "Derivation of Communication Topology and Network Architecture"

Work package A1 addresses the specification and interconnection topology of distributed microelectronic systems. Working areas of A1 focus on building up modeling techniques that provide a holistic view of an interconnected system and its embedding environment and on deriving an appropriate communication topology and network architecture from that abstract system model. The derivation process is guided by performance and communication analysis techniques of work package A2 and includes an adequate parameterization of communication templates as well as a generation of abstract executable models of the inter-connected system scenario.



A3: "Verification-Driven System Integration"

A3.1 "Verification of System Integration"

A3.2 "Seamless Integration of Implementation Processes"

The result of the work packages A1 and A2 is a distributed system model, where a given application including its environmental constraints has been mapped onto a specific network topology and system architecture in an optimized way. Based on this abstract system model, work package A3 addresses mechanisms that allow for a verification across abstraction level and design domain boundaries targeting on verified system integration. Model transformations for a target-oriented manipulation of system characteristics form another focal point of work packages A3 and provide the interface for a seamless integration into underlying implementation processes.

A4: "Applications and Flow Integration"

A4.1 "Application-Specific Customization of Design Methods"

Work package 4 addresses aspects of specific application areas, which all share new design challenges caused by the need to consider interconnected system behavior. The domain-independent design methods that are developed in work packages A1 to A3 provide an universal methodology for distributed microelectronic system design. Within a customization step, highly applicable design flows for specific European key application domains are derived from that universal methodology.