ArtistDesign Kickoff Meeting

Paris, January 29-30, 2008

Cluster presentation
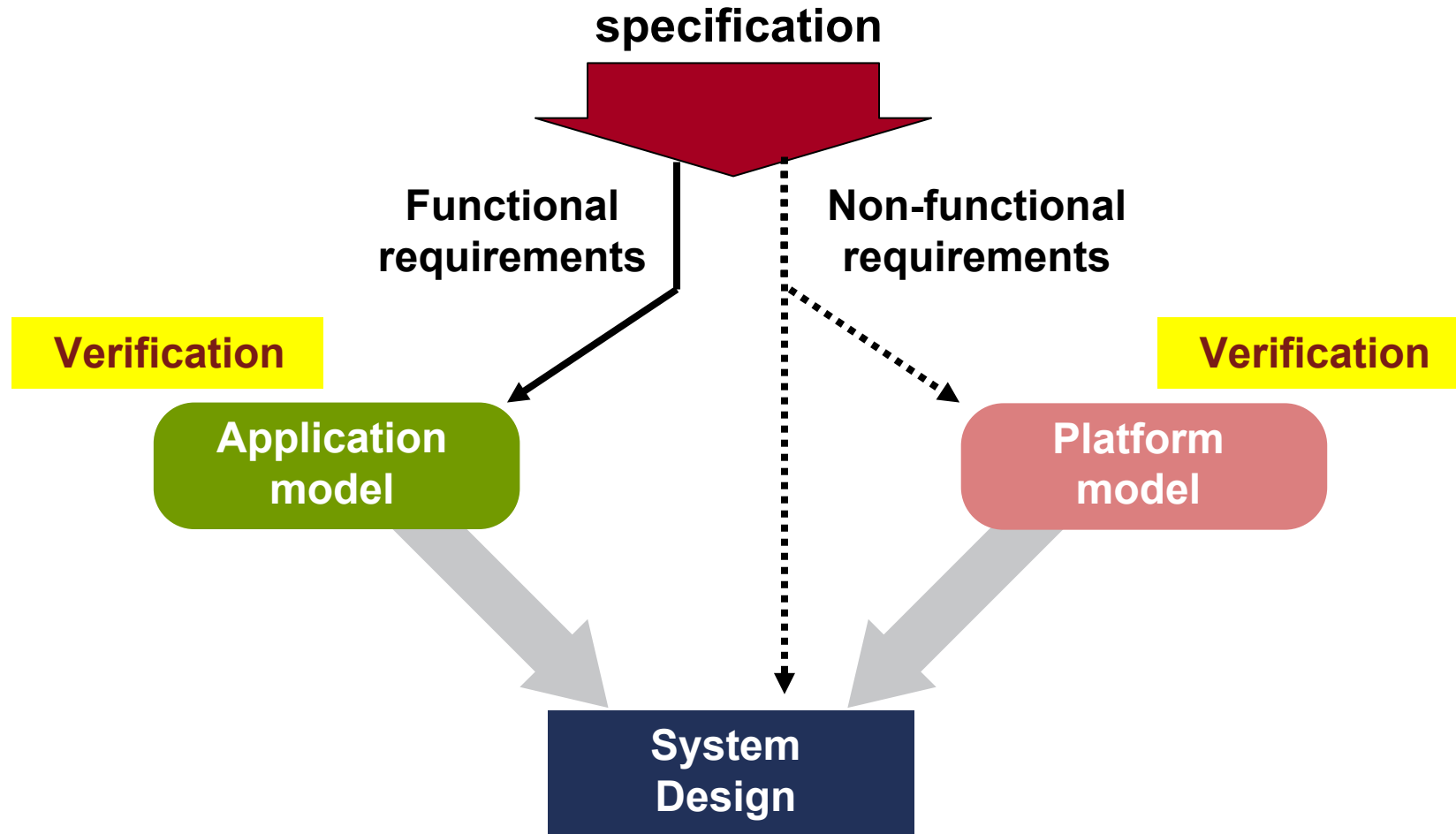
Hardware Platforms and

MPSoC Design

Cluster Leaders :

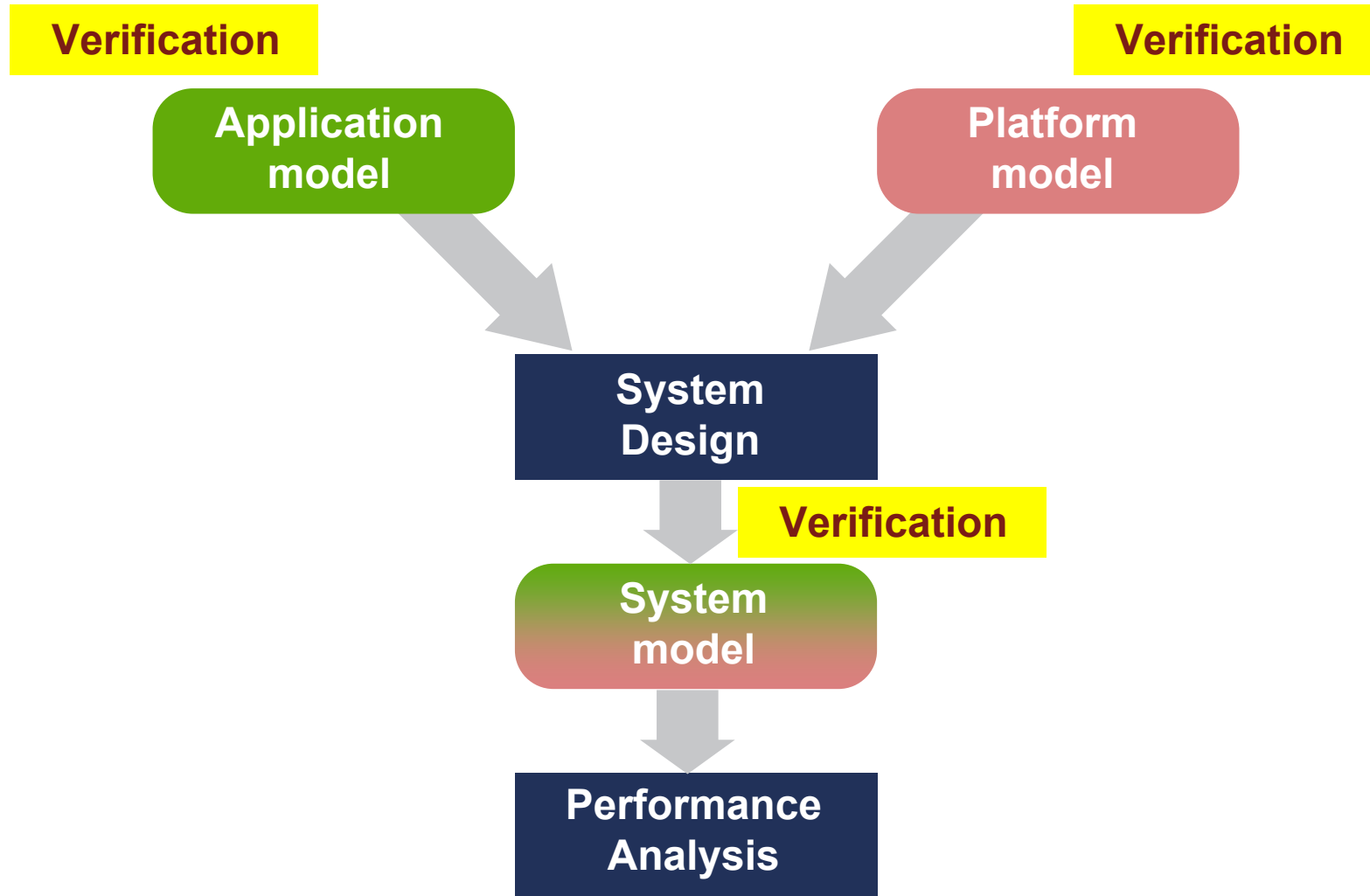Luca Benini, UNIBO

Jan Madsen, DTU

Main Research Trends in the Area

- Distributed, communication-centric embedded systems

    - Multi-core System-on-Chip (MPSoC)

    - Networked embedded systems (Automotive)

    - Wireless sensor networks

- Hardware platforms for embedded applications will continue to be multi-core

    - Less hardware platform design

    - More hardware platform configuration

- Programming models, design-time and run-time application environments are less clear

- Growing maturity of scalable performance analysis algorithms and tools

- New challenges, platform robustness and adaptability

Embedded systems design

specification

Functional requirements

Non-functional requirements

Verification

Application model

Verification

Platform model

System Design

Embedded systems design

Verification

Verification

Application model

Platform model

System Design

Verification

System model

Performance Analysis

High-Level Objectives

- Focus on Design and Analysis

- Hardware architecture and software components in their interaction

  – Less hardware platform design

  – More hardware platform configuration

  } Focus on ressource management

- Tools for accurate estimation

- Design space exploration and optimization

  – Task mapping (design-time and run-time)

  – Energy minimization / management

- Adaptability

  – Robustness

  – Life-time management

  – Resilience

Overview of the Cluster's Activities

- **Design**:
  Leader: Luca Benini, UNIBO

- *Main scientific challenges are focused on*

  – *how to map complex applications onto communication-centric execution platforms.*

- *This includes addressing design of*

  – *Run-time management layers,*

  – *Resource allocation and scheduling.*

- *Focusing on issues like:*

  – *scalability,*

  – *flexibility,*

  – *composability,*

  – *predictability,*

  – *design-time reduction*

  – *and increased dynamism.*

Overview of the Cluster's Activities

- **Analysis**
  Leader: Jan Madsen, DTU

- The major focus of the activity on platform analysis is to establish a set of models and analysis methods that:

  - Scales to highly parallel and heterogeneous multiprocessor architectures,

  - Is applicable to distributed embedded systems as well,

  - Allows for the analysis of global predictability and efficiency system properties

  - Takes the available hardware resources and the corresponding sharing strategies into account.

- Focusing on:

  - design-time analysis

  - run-time analysis

  - hybrid analysis approaches

Cluster Participants

Core Partners:

- Jan Madsen (DTU - Denmark)

- Luca Benini (UNIBO - Italy)

- Lothar Thiele (ETHZ - Switzerland)

- Rolf Ernst (TUBS – Germany)

- Petru Eles (LiU - Sweden)

- Stylianos Mamagkakis (IMEC - Belgium)

- Hannu Tenhunen (KTH - Sweden)

- Thierry Collette (CEA LIST - France)

Cluster Participants

Affiliated Partners (Industry):

- Roberto Zafalon (**STMicroelectronics** – Italy)
  Energy-efficient platforms for nomadic and multimedia computing. Power optimization techniques, low power design.

- Henrik Lönn (**Volvo Technology Corporation** - Sweden)
  Electronic automotive systems; industrial input, evaluation of results, hosting interns.

- Antonello Mangogna (**Galileo Avionica** - Italy)
  Multi-core platforms for avionics

- Kai Richter (**Symtavision** – Germany)
  will investigate the applicability in automotive electronics.

- Rune Domsteen (**Prevas** – Denmark)
  Platforms for embedded systems. System level modeling and exploration.

- Karsten Nielsen (**ICEpower Bang & Olufson** – Denmark)
  Intelligent audio systems. Power optimization. Design methods.

- Poul Jessen (**PAJ Systemteknik** - Denmark)
  Platform based design.

- Tiberiu Seceleanu (**ABB** – Sweden)
  MPSoC design

- **Simens**

Cluster Participants

Affiliated Partners (Academia):

- Lilius (TUCS – Finland)
  Embedded software.

- Dimitrios Soudris (DUTH - Greece)
  Adaptive middleware for efficient resource managment

- Salvatore Carta (UNICA – Italy)
  Task migration technologies for multi-core processors

- Sharon HU (Uni. Notredam - US)

- Andrea Acquaviva (Uni. Verona - italy)

JPRA: Design (1st year)

- Predictable communication infrastructure for MPSoC [UNIBO -> LiU]

- Design optimization for fault-tolerant real-time systems [LiU -> DTU, TUBS -> LiU]

- Adaptive energy management in sensor networks with energy harvesting [UNIBO -> ETHZ]

- Combination of tools and methods for compositional analysis and optimization [ETHZ <-> TUBS]

- Modeling for on-chip networks [IMEC -> DTU]

- Dimensioning of NoC [KTH -> IMEC]

- Dynamic and temperature aware energy optimization [LiU, UNIBO]

JPRA: Analysis (1st year)

- Join forces to understand better the performance analysis of adaptive systems [ETHZ, TUBS, DTU, IMEC, LiU].

- Combination of tools and methods for compositional analysis and optimization [ETHZ <-> TUBS]

- Execution time analysis for multi-core systems [LiU -> TUBS]

- Adaptive resource management [DUTH -> IMEC]

- Performance analysis of communication network based on Network Calculus [KTH]

Meetings and Interaction in Year 1

- Workshops (organization)

  – "6th IEEE Workshop on Embedded Systems for Real-Time Multimedia", ESTMEDIA 2008

- Interaction with industry

  – Industry seminar, May 2008

- Education and Training

  – PhD course on "Advanced topics in Embedded Systems", DTU, June 2008 (ARTSIT2 ?)

- Seminars and special sessions

  – "Synthesis of Dependable Embedded Systems", DATE 2008 Special Session

- Industrial Liaison

- International Collaboration

  – Sharon Hu, Uni. Notre Dame, US

- Meetings

  – Cluster meeting at DATE 2008 in Munich

  – Cluster meeting, Copenhagen, May 2008