Hardware/Software Codesign

SS 2009

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Overview

• Introduction and motivation
• Course synopsis
• Lecture organization
What is Hw/Sw Codesign?

... integrated design of systems that consist of Hw- and Sw-components

- Analysis of Hw/Sw boundaries
- Evaluation of design alternatives
Hardware/Software Boundaries

• General purpose systems (PC, workstation)
  – processor design:
    processor $\leftrightarrow$ compiler, operating system

• Embedded systems (cell phone, automotive electronics)
  – design of specialized processors:
    processor $\leftrightarrow$ compiler
  – system design:
    processors $\leftrightarrow$ dedicated hardware devices
Why Codesign? (1)

• Modern embedded systems require “design” optimization
  – many functions, great variability, high flexibility
  – heterogeneous target systems
    ▪ processors, ASICs, FPGAs, systems-on-chip, …
  – many design goals
    ▪ performance, cost, power consumption, reliability, …

• Advances in formal / automated design methods
  – automation on the system level becomes possible
  – reduction of cost and time-to-market
Why Codesign? (2)

- Optimization of the “design process”

Diagram:
- Classic design:
  - hw
  - sw
- Co-design:
  - hw
  - sw
  - hw
  - sw
Word Game: CO-design

CO - complex

- complex

- korrekt

- koordiniert

- gemeinsam

- nebenläufig

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Course Synopsis

• System design – models and methods
• Target architectures for Hw/Sw systems
• Compiler and code generation
• Architectural synthesis
• System partitioning
• Estimation of design parameters

• Further codesign topics
  – Interface- and communication synthesis
  – Emulation and rapid prototyping
  – Hw/Sw co-simulation
Preview: Target Architectures

- general-purpose processors
- microcontrollers
- digital signal processors
- systems on a chip

- field-programmable gate arrays
x := a*b - (c+d)*e

- register selection
- instruction selection
- instruction ordering

DSP TMS320C25
i705 (Palm)

Preview: System Partitioning
Benefits? Learn about …

- ... challenges and approaches in modern system design
- ... target architectures – device zoo
- ... useful optimization methods
- ... a current research area
Lecture Organization

• Lecture Wednesday, 11:15 -12:45, D2

• Exercises Wednesday, 14:15 -15:00, D2
  – download the exercise sheets and try to solve the problems
  – discussion of the problems in the class

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• Web page
  http://homepages.uni-paderborn.de/plessl/lectures/2009-Codesign

• Course Materials on the web
  – slide copies, exercise sheets
  – script, papers