Plumbing by Compilation

Marcel Beemster
ACE Associated Compiler Experts
marcel@ace.nl
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- Small company in Amsterdam, about 30 people
- Makers of the CoSy Compiler Development System
- Customers around the globe, mainly in the world of Embedded Systems, DSP processing

- Future may be about homogeneous microgrids
- Today is about heterogeneous System on a Chip systems
This Morning’s Reality: OMAP2
Heterogeneous Multi-Processor Systems for Embedded Computing

- Typically consist of a number of independent processors specializing in a task - control, video, graphics, sound, …
- Each core may be designed by a different company, with no knowledge of the other cores
- The SoC designer designs a communication structure with no control over the individual cores
- Each specialized task dictates its own specialized data model

- Thereby creating a software developer’s nightmare
What Can the Compiler Do?

- Compiler can significantly reduce the overhead that follows from partitioning decisions in the global software design process
  
  ➤ Ease the plumbing

- Thus:
  - Provide more flexibility in partitioning and faster turn around time
  - Allow the developers to exercise many different scenarios
  - Create a better application, in a shorter time to market, using less power and other resources, that is easier to maintain
Bridge Data Models

• The compiler has a highly accurate understanding of the data model of its target architectures
• It can emulate arithmetic in one model on the other
• It can translate data from one model to the other
Provide a More Uniform Programming Platform

• DSP processors support fixed point arithmetic, control processors do not
  ➔ Compiler can create emulation code for the exact data model used in the DSP to run on the control processor

• As a result, code can run on more than one processor, allowing more freedom in code allocation
Optimize Communication Protocols

- SoCs have a static layout: memory and connections are fixed by design
- So, the full dynamics of an OS are not necessary
- Whole program optimization can absorb and optimize run time system code right into the application
- Static memory allocation techniques can be used to avoid data copying between producer and consumer
- The compiler can translate from one data model to the other
The CoSy Compiler Development System
CoSy IR

- Keeps accurate track of the type of every object and expression
- Has an explicit representation of the data model of the target processor
- Separates the storage model from the arithmetic model
- Can be programmed to the bit
- And a lot more but that is not relevant today…
Demo: Arithmetic Emulation with CoSy
And so,
Superman and CoSy save the world