Translating Dataflow Programs to Efficient Hardware: an MPEG-4 Simple Profile Decoder Case Study

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Highly parallel computing platform

Dataflow programming

Example:
Xilinx Virtex-4
- 142k logic cells
- 552 RAMs
- 18k bits each
- 192 DSP ALUs
- 2 PowerPC 405
- 4 Ethernet MACs

Programming model:
dataflow with actors

- FIFO connections
- encapsulated state
- atomic state transitions

Actors, big and small
CAL actor language
ParserHeaders 1200 lines (without header comments)

Range of actors
• small compute kernels
• large control-dominated actors

Hardware Synthesis - Quality of Result

Smaller, faster, and earlier than VHDL reference.

Conclusion

- Parallel platforms require parallel programming models.
- Dataflow is a general and portable way to describe highly parallel computational systems.
- MPEG-4: an at-size, real world application, with a broad spectrum of computational elements.
- All actors built in the CAL actor language, and composed using the NL network language.
- Our tools generate implementations that actually beat the VHDL reference in terms of QoR.
- Any abstraction cost was dwarfed by the ability to quickly iterate over multiple versions of the design.