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COMET What is next?

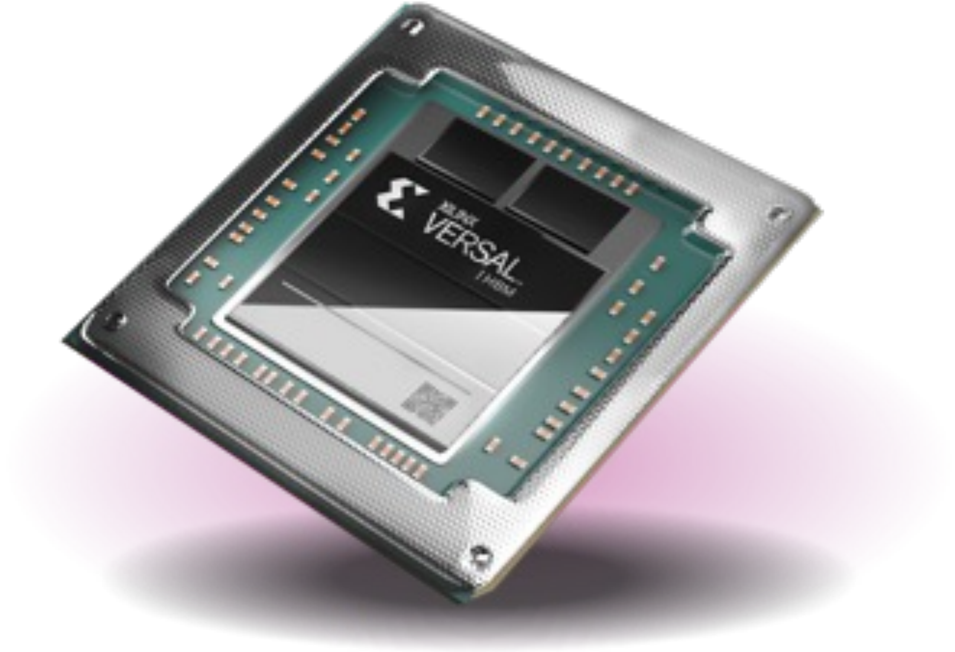
April 4th, 2022

Support for Emerging Dataflow Architectures

- Novel compiler technologies are fundamental to generate efficient computational graph for emerging dataflow architectures
- We are working on adding support to COMET to generate optimized code for emerging dataflow architectures

SambaNova SN10

Xilinx Versal



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Other Features

- **Sparse Transpose**
- Initial design to support code generation on **Xilix Versal AI engine** and **Sambanova**
- Multiple frontends (**CometPy** and Rust **eDSL**)
- Integration with other tools:
  - **MCL** for execution on extremely heterogeneous systems
  - **Lamellar** for execution non distributed systems
- **HW/SW Co-Design**
  - COMET automatically inserts calls to novel hardware accelerators, real code of simulators (e.g., Aladdin)

Conclusions

- Explosion of programming framework and heterogeneous architectures challenge traditional compiler development
- COMET is a compiler and support various frontend (NumPy and Rust) targeting computational chemistry and graph analytics domains
  - Based on MLIR
  - Support sparse and dense tensor algebra computation
- COMET employs high-level, domain specific optimizations and low-level, architecture specific optimization to generate efficient code for target architectures
- COMET targets various architecture, including parallel CPUs, GPUs, and FPGAs.
- Open source: https://github.com/pnnl/COMET

References

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- ReACT: Redundancy-Aware Code Generation for Tensor Expressions. Tong Zhou, Ruiqin Tian, Rizwan A Ashraf, Roberto Gioiosa, Gokcen Kestor, Vivek Sarkar. 2022 31st International Conference on Parallel Architectures and Compilation Techniques (PACT). October 2022
- Guo L., R.A. Ashraf, R.D. Friese, and G. Kestor. 10/10/2022. "Towards Supporting Semiring in MLIR-based COMET Compiler." Presented by G. Kestor at the 31st International Conference on Parallel Architectures and Compilation Techniques (PACT), Chicago, Illinois.

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- **Open source:** https://github.com/pnnl/COMET
- **Activities at PACT’22:**
  - Our paper and poster presentations

Thank you

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