

Compiler Optimization for Heterogeneous Locality and Homogeneous Parallelism in OpenCL and LLVM

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Abstract:

Heterogeneous platforms may include accelerators such as Digital Signal Processors (DSP's) that employ SW-controlled scratch-pad memories instead of, or in addition to standard HW-cached memory. Controlling scratch-pads efficiently typically requires tiling and pipelining loops, thereby optimizing for memory locality rather than parallelism as a primary objective. On the other hand, achieving high performance on CPU's and GPU's typically requires optimizing for data-level parallelism as a primary objective, compromising locality. In this lightning talk we show how OpenCL and LLVM can be used to achieve both target-dependent locality and target-independent parallelism. Such an approach facilitates the development of optimized software for DSP accelerators while enabling its efficient execution on standard servers. Following the work of Tian et al. [1], our approach leverages automatic compiler optimization and relies purely on OpenCL, including its device-side enqueue capability [2] and SPIR-V format [3,6].

References:

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2. *GPU-Quicksort in OpenCL 2.0: Nested Parallelism and Work-Group Scan Functions*, Robert Ioffe, 2014. <https://software.intel.com/en-us/articles/gpu-quicksort-in-opengl-20-using-nested-parallelism-and-work-group-scan-functions>
3. *SPIR-V is a better SPIR with Intel® OpenCL™ Code Builder*, Robert Ioffe, 2016. <https://software.intel.com/en-us/articles/spir-v-is-a-better-spir-with-intel-opengl-code-builder>
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5. *Extending Halide to Improve Software Development for Imaging DSPs*, Sander Vocke, Henk Corporaal, Roel Jordans, Rosilde Corvino and Rick Nas, TACO 14(3), Sept 2017
6. *Compiling and Optimizing OpenMP 4.X Programs to OpenCL and SPIR*, Marcio M Pereira, Rafael C F Sousa and Guido Araujo, IWOMP 2017. <https://omp2ocl.github.io/aclang/>