The alpaka SYCL back-end

Patatrack Students Meeting // 18 October 2022

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(Short) Introduction to alpaka

Introduction to alpaka

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alpaka – Abstraction Library for Parallel Kernel Acceleration

alpaka is…

- A parallel programming library: Accelerate your code by exploiting your hardware‘s parallelism!
- An abstraction library: Create portable code that runs on CPUs and GPUs!
- Free & open-source software

Introduction to alpaka

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Programming with alpaka

- C++ only!
- Header-only library: No additional runtime dependency introduced
- Modern library: alpaka is written entirely in C++17
- Supports a wide range of modern C++ compilers (g++, clang++, Apple LLVM, MS Visual Studio)
- Portable across operating systems: Linux, macOS, Windows are supported

Introduction to alpaka

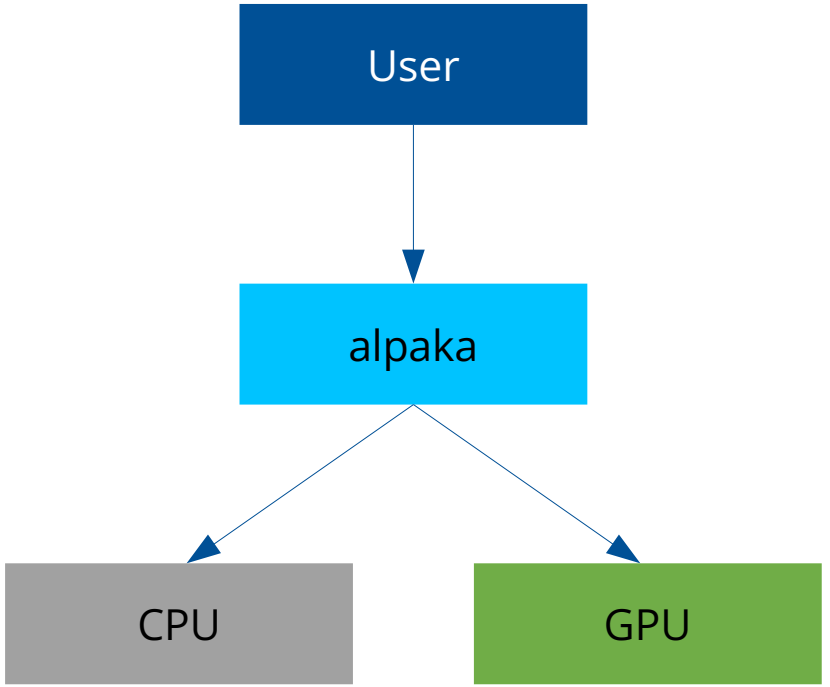
alpaka's purpose

Without alpaka

- Multiple hardware types commonly used (CPUs, GPUs, ...)
- Increasingly heterogeneous hardware configurations available
- Platforms not inter-operable → parallel programs not easily portable

alpaka: one API to rule them all

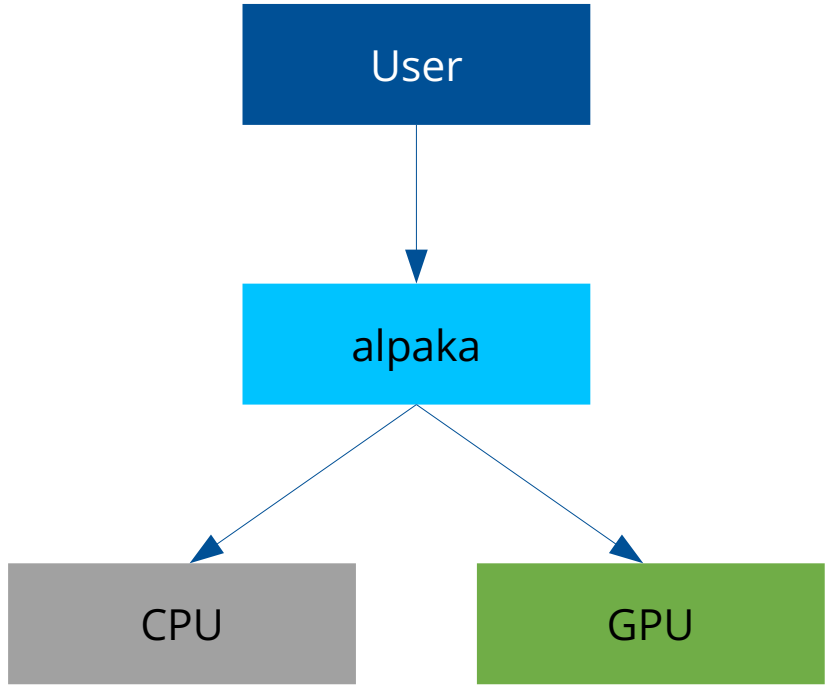
- Abstraction (not hiding!) of the underlying hardware & software platforms
- Code needs only minor adjustments to support different accelerators



Portable Heterogeneous Parallel Programming

alpaka enables portability!

- Idea: Write algorithms once…
  - … independently of target architecture
  - … independently of available programming models
- Decision on target platform made during compilation
  - Choosing another platform just requires another compilation pass
- alpaka defines an abstract programming model
- alpaka utilizes C++17 to support many architectures
  - CUDA, HIP, OpenMP, TBB, …



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The SYCL back-end

Initial Goals

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- Started as student project (diploma thesis) in late 2019
- Main interest: alpaka-based programs for FPGAs
- Available vendor at Helmholtz-Zentrum Dresden-Rossendorf: Xilinx

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- **Experimental** SYCL back-end merged in February 2022
- Supports Intel oneAPI and AMD/Xilinx SYCL implementations

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- Some smaller functionality is missing
  - Lack of functionality in SYCL

Current State

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Active Work

- Add pointer support for Intel oneAPI targets
- Require `alpaka::experimetal::accessor`s only for AMD/Xilinx targets

Short-term Goal

- Add CI support for Intel oneAPI

Long-term Goals

- Improve FPGA support / performance
- Make use of vendor-specific SYCL extensions

Help Wanted

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Contributors welcome!

- Find us on **https://github.com/alpaka-group/alpaka**
- Go to the issue tracker and filter for the “Backend:SYCL” flair

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