

alpaka Parallel Programming – Online Tutorial

Lecture 30 – Portability with alpaka

Lesson 33: The Device Concept



CASUS

CENTER FOR ADVANCED
SYSTEMS UNDERSTANDING

www.casus.science



Lesson 33: The Device Concept

Recap

- Accelerator concept is an important part of alpaka's tool shed
- Key to abstraction of hardware-dependent aspects
- Contains thread state and device-side API
 - Grid navigation
 - Shared memory
 - Block-level synchronization
 - Math functions
 - Atomics
 - Random-number generation
 - Time

Lesson 33: The Device Concept

alpaka Devices

- alpaka Devices represent physical devices
- Determined by programmer's Accelerator choice
- Easy management of physical devices

```
/* Chosen by programmer */  
using Acc = acc::AccGpuHipRt<Dim, Idx>;  
  
/* Return number of HIP GPU devices */  
auto const numDevs = pltf::getDevCount<Acc>();  
  
/* Return the first entry from vector of HIP GPU devices */  
auto myDev = pltf::getDevByIdx<Acc>(0u);  
  
/* Return list of all HIP GPU devices */  
auto devs = pltf::getDevs<Acc>();
```

Lesson 33: The Device Concept

Devices and hardware

- Each alpaka Device represents a single physical device
- Contains device information:

```
auto const name = dev::getName(myDev); // Back-end-defined device name
auto const bytes = dev::getMemBytes(myDev); // Size of device memory
auto const free = dev::getFreeMemBytes(myDev); // Size of available device memory
```

- Provides the means for device management:

```
dev::reset(myDev); // Reset GPU device state
```

- Encapsulates back-end device:

```
auto nativeDevice = dev::getDev(myDev); // nativeDevice is not portable!
```

Lesson 33: The Device Concept

alpaka Devices and the Accelerator concept

- Device and Accelerator are different concepts!
- An alpaka Accelerator is an abstract view of all physical devices (for the chosen back-end)
 - Kernel POV: thread state, device functions, memory management, synchronization
 - Host POV: meta-parameter for overall abstraction
- An alpaka Device is a representation of exactly one physical device
 - Device information
 - Device management

Lesson 33: The Device Concept

Summary

- alpaka Devices enable physical device handling
- 1:1 relation between alpaka Devices and physical devices
- Direct representation of physical devices
- Not to be confused with alpaka Accelerators



CASUS

CENTER FOR ADVANCED
SYSTEMS UNDERSTANDING

www.casus.science