

# alpaka Parallel Programming – Online Tutorial

## Lecture 30 – Portability with alpaka

### Lesson 33: The Device Concept



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# 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



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