An Even Easier Introduction to CUDA

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DSCI-560
Data Science Professional Practicum

Introduction to CUDA

- __global__: kernel functions callable from the host
- __device__: kernel functions callable from the kernel (__device__ or __global__)
- __host__: host functions callable from the host

- cudaMallocManaged(void** dptr, size_t size, unsinged int flags=cudaMemAttachGlobal): allocates memory (manged by the unified memory system)
- cudaMalloc(void** dptr, size_t size): allocate memory on the device(GPU)
- cudaMemPrefetchAsync(const void* dptr, size_t count, cudaMemLocation, unsigned int, cudaStream_t): prefetch memory to the specified destination location
- cudaFree(void* dptr): frees memory on the device (GPU)

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global function call:

function_name<<<gridDim, blockDim, sharedMemBytes, stream>>>(argument1, argument2);

cuda synchronize:

cudaDeviceSynchronize(): wait for compute device to finish

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Cuda Kernel Built-in functions and variables:

__syncthreads(): all threads in the block sync

threadIdx.x, threadIdx.y, threadIdx.z

blockDim.x, blockDim.y, blockDim.z

(0 <= threadIdx.x < blockDim.x)

blockIdx.x, blockIdx.y blockIdx.z

warpSize: size of warp

Kernel Keywords:

__shared__: shared memory (block share memory)

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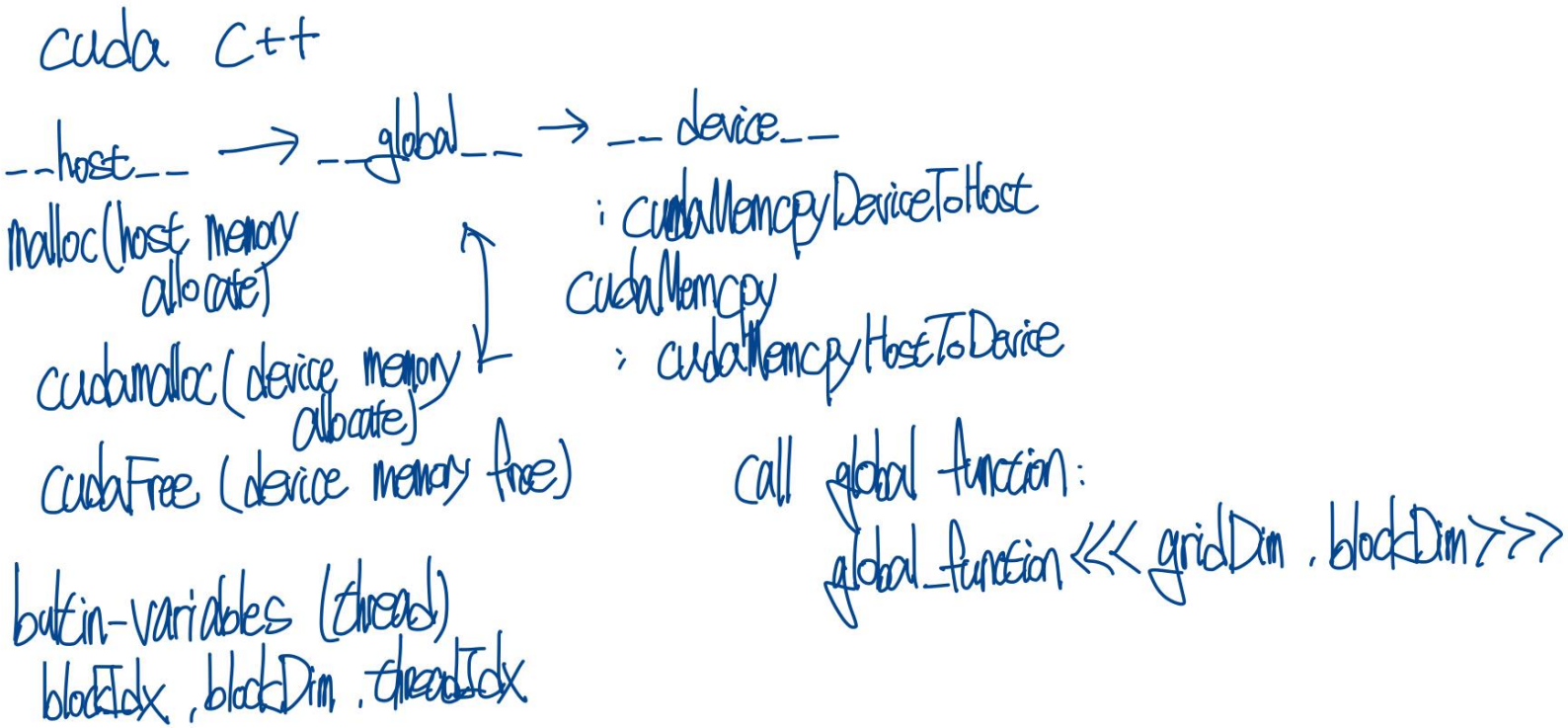

Question: Explain function of CUDA memory hierarchy and its scope

Answer:

http://thebeardsage.com/cuda-memory-hierarchy/

Global Memory: all threads and CPU, cudaMalloc, cudaFree

Constant Memory: all threads and CPU (RO), __constant__ int const_data;

Shared Memory: per block, __shared__ int shared_data[64];

Local Memory: per thread, int local_data[64]; (decide by compiler)

Register: per thread, int register_data; (decide by compiler)