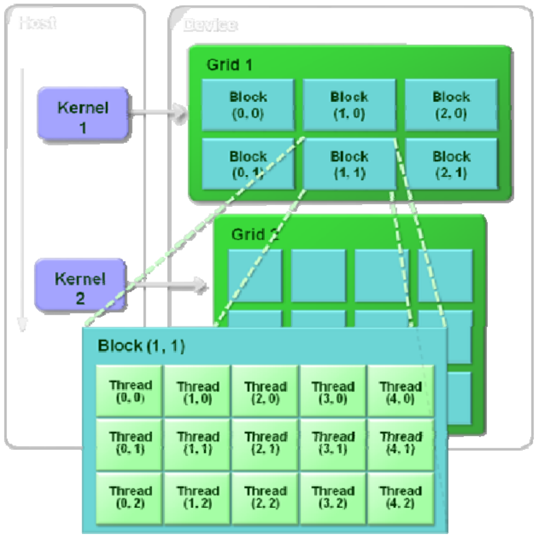
CUDA C Quick Reference

Kernels

kernel <<< dim3 Dg, dim3 Db, size_t Ns, cudaStream_t S >>> (arguments);

Dg.x*Dg.y = number of blocks, Dg.z = 1.
Db.x*Db.y*Db.z = number threads per block.
Ns = dynamically allocated shared memory, optional, default=0.
S = associated stream, optional, default=0.

Thread Hierarchy



Memory Hierarchy

Memory	Location	Cached	Access	Scope	Lifetime
Register	On-chip	N/A	R/W	Thread	Thread
Local	Off-chip	No	R/W	Thread	Thread
Shared	On-chip	N/A	R/W	Block	Block
Global	Off-chip	No	R/W	Global	Application
Constant	Off-chip	Yes	R	Global	Application
Texture	Off-chip	Yes	R	Global	Application

Device Memory

Linear Memory

cudaMalloc(void ** devptr, size_t size)

cudaFree(void * dptr)

cudaMemcpy(void *dst, const void *src, size_t size, enum cudaMemcpyKind kind)
kind = cudaMemcpyHostToHost or
cudaMemcpyHostToDevice or
cudaMemcpyDeviceToHost or
cudaMemcpyDeviceToDevice

CUDA Arrays

See Programming Guide for description of CUDA arrays and texture references.

Page-locked Host Memory

cudaMallocHost(void ** ptr, size_t size)

cudaFreeHost(void * ptr)

Shared Memory

Static allocation
__shared__ int a[128]

Dynamic allocation at kernel launch
extern __shared_ float b[]

Error Handling

cudaError_t cudaGetLastError(void)

const char * cudaGetErrorString(cudaError_t error)

CUDA Compilation

nvcc *flags* file.cu

A few common flags

-o	output file name
-g	host debugging information
-G	device debugging
-deviceemu	emulate on host
-use_fast_math	use fast math library
-arch	compile for specific GPU architecture
-X	pass option to host compiler

#pragma unroll *n* unroll loop *n* times.

Language Extensions

Function Qualifiers

__global__	call host, execute device.
__device__	call device, execute device.
__host__	call host, execute host (default).
__noinline__	if possible, do not inline

__host__ and __device__ may be combined to generate code for both host and device.

Variable Qualifiers

__device__	variable on device
__constant__	variable in constant memory
__shared__	variable in shared memory

Vector Types

[u]char1, [u]char2, [u]char3, [u]char4
[u]short1, [u]short2, [u]short3, [u]short4
[u]int1, [u]int2, [u]int3, [u]int4
[u]long1, [u]long2, [u]long3, [u]long4
longlong1, longlong2
float1, float2, float3, float4
double1, double2

Execution configuration

kernel <<< dim3 Dg, dim3 Db, size_t Ns, cudaStream_t S >>> (arguments)

Grids are 1D or 2D so Dg.z = 1 always
Ns optional, default 0
S optional, default 0

Built-in Variables

dim3 gridDim	size of grid (1D, 2D).
dim3 blockDim	size of block (1D, 2D, 3D).
dim3 blockIdx	location in grid.
dim3 threadIdx	location in block.
int warpSize	threads in warp.

Memory Fence Functions

__threadfence(), __threadfence_block()

Synchronisation Function

__syncthreads()

Fast Mathematical Functions

__fdividef(x,y), __sinf(x), __cosf(x), __tanf(x), __sincosf(x,sinptr,cosptr), __logf(x), __log2f(x), __log10f(x), __expf(x), __exp10f(x), __powf(x,y)

Texture Functions

tex1Dfetch(), tex1D(), tex2D(), tex3D()

Timing

clock_t clock(void)

Atomic Operations

atomicAdd(), atomicSub(), atomicExch(), atomicMin(), atomicMax(), atomicInc,(), atomicDec(), atomicCAS(), atomicAnd(), atomicOr(), atomicXor().

Warp Voting Functions

int __all(int predicate)
int __any(int predicate)