Blelloch Scan

Blelloch scan performs an exclusive scan of the elements of a vector.

Consider the example vector:

1	2	3	4

First we reduce all the elements, while keeping the middle values within the vector itself.

					Notes
Initial	1	2	3	4	
Reduce 1	1	3	3	7	sum (0,1) & (2,3)
Reduce 2	1	3	3	10	sum (1,3)

Then we substitute the last element with the identity value 0. Then we do the downsweep, which is applying the downsweep over the elements, in the same fashion as the reduce, but in an inverse order (that is, from (1,3) to (0,1)&(2,3)).

The downsweep operator is:

initial	a1	a2
downsweep	0	a1 + a2

Now, placing the identity value and doing the downsweep steps gives us:

					Notes
initial	1	3	3	0	
downsweep (ds)	1	0	3	3	ds (1,3)
downsweep	0	1	3	6	ds (0,1) & (2,3)

Which led to the exclusive scan of the initial vector.

Implementation

- Each step in the reduce is dependent of the previous step
- The same applies for the downsweep part

Therefore, we implemented kernels that execute **only one single step** of each operation. Each kernel receives a 'step' argument that tells it what step to execute.

By doing this, we can call kernels sequentially, executing each step, and the CUDA environment guarantees that each kernel call finishes before the next kernel is executed, guaranteeing the dependence fulfillment that we

needed.