Assignment 3. Improving Access to Global Memory

CUDA Device Specification

```
C:\masterhpc\hpcheterogeneousprog>deviceinfo
->CUDA Platform & Capabilities
Name: GeForce GTX 750 Ti
totalGlobalMem: 4096.00 MB
sharedMemPerBlock: 48.00 KB
regsPerBlock (32 bits): 65536
warpSize: 32
memPitch: 2097152.00 KB
maxThreadsPerBlock: 1024
maxThreadsDim: 1024 x 1024 x 64
maxGridSize: 2147483647 x 65535
totalConstMem: 64.00 KB
major.minor: 5.0
clockRate: 1110.35 MHz
textureAlignment: 512
deviceOverlap: 1
multiProcessorCount: 5

C:\masterhpc\hpcheterogeneousprog>_
```

Problem 1 - Monolithic Kernel

https://github.com/mahsanchez/masterhpc/blob/master/sqArrSkel.cu

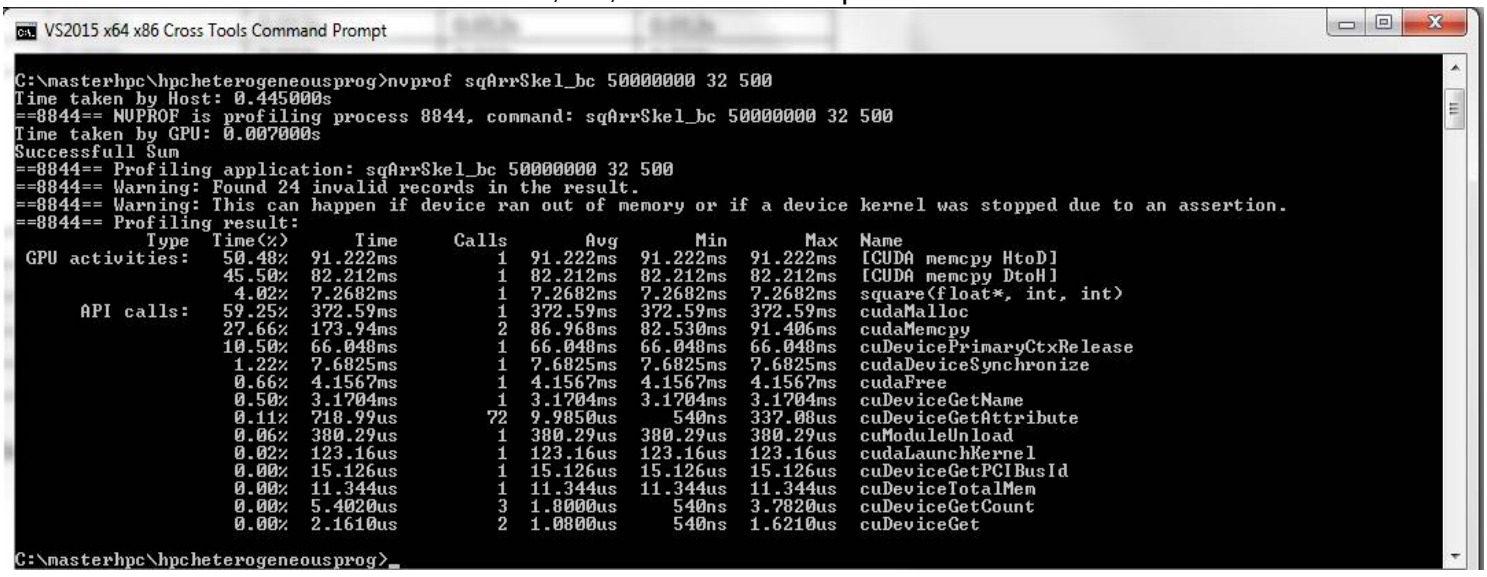
	Block				
N	**32**	**64**	**128**	**256**	**512**
50,000000	0.011s	0.006s	0.007s	0.006s	0.006s
100,000000	0.020s	0.012s	0.013s	0.012s	0.012s
200,000000	0.037s	0.024s	0.024s	0.023s	0.024s

Problem 2 – Block Cyclic Version

https://github.com/mahsanchez/masterhpc/blob/master/sqArrSkel_bc.cu

	Block				
N	**32**	**64**	**128**	**256**	**512**
50,000000	0.007000s	0.007000s	0.007000s	0.007000s	0.007000s
100,000000	0.015000s	0.014000s	0.015000s	0.015000s	0.014000s
200,000000	0.030000s	0.028000s	0.028000s	0.028000s	0.028000s

Screenshot of the case of execution for 50,000,000 and 32 tasks per block and k 500

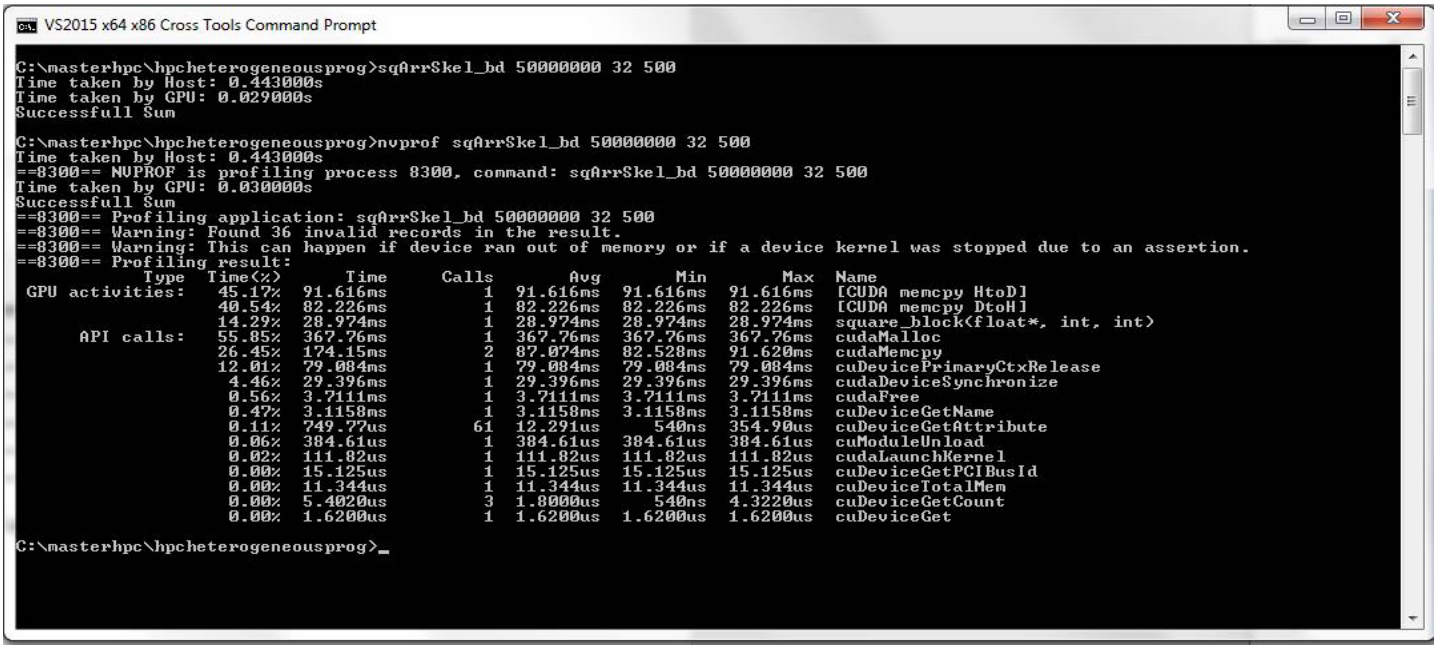


Problem 3 – Block Distribution

https://github.com/mahsanchez/masterhpc/blob/master/sqArrSkel_bd.cu

	Block				
N	**32**	**64**	**128**	**256**	**512**
50,000000	0.030000s	0.034000s	0.034000s	0.034000s	0.034000s
100,000000	0.059000s	0.065000s	0.064000s	0.064000s	0.065000s
200,000000	0.102000s	0.127000s	0.122000s	0.121000s	0.127000s

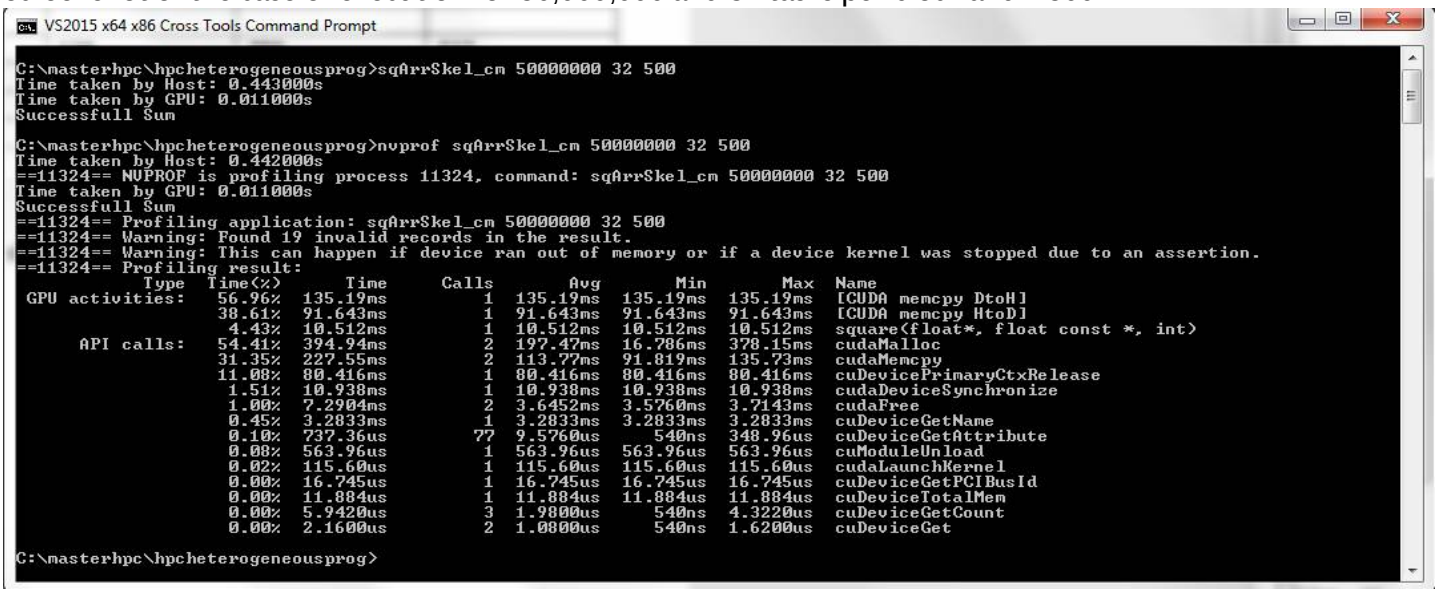
Screenshot of the case of execution for 50,000,000 and 32 tasks per block and k 500



Problem 4 - Read-only Data Cache
https://github.com/mahsanchez/masterhpc/blob/master/sqArrSkel_cm.cu

	Block				
N	**32**	**64**	**128**	**256**	**512**
50,000000	0.011000s	0.007000s	0.006000s	0.006000s	0.006000s
100,000000	0.020000s	0.012000s	0.013000s	0.012000s	0.012000s
200,000000	0.037000s	0.024000s	0.024000s	0.024000s	0.024000s

Screenshot of the case of execution for 50,000,000 and 32 tasks per block and k 500



Problem 5

Solution Block Cyclic registered the best performance due potentially to a better usage of global access memory. Increasing the number of threads on memory bound problem do not provides any improvement in performance or hardware usability. Monolithic Kernels implemented in Problem 1 and Problem 4 registered the second and third best response time but it shows that using wisely the cache lines is one of the best way to address performance whenever access to global memory.

Block Distribution memory access pattern registered the worst performance/response time.