

TABLE OF MEASURED EXECUTION TIMES:

Matrix Size	Reference Implementation (Single thread)	OpenCL on CPU			OpenCL on GPU		
		Normal kernel	Tiled kernel (tile_size= 8)	Tiled kernel (tile_size= 16)	Normal kernel	Tiled kernel (tile_size= 8)	Tiled kernel (tile_size= 16)
512x512	0.6938793	0.0067721	0.0183498	0.0169783	0.0106551	0.0116974	0.0189143
1024x1024	5.865238	0.123744	0.152639	0.135037	0.0911987	0.0936075	0.155972
2048x2048	241.8271	2.8781	1.61959	1.25388	0.937331	0.743679	1.24013

**Note : All the values in the above table refers to time in seconds.

- Below attached is the screenshot of model of the CPU and GPU of the machine on which you collect the measurement data:

```

vlinka2@en41193901:~/Downloads/CapsBasic$ make
g++ capsbasic.cpp -lOpenCL -lcapsbasic
vlinka2@en41193901:~/Downloads/CapsBasic$ ./capsbasic
Number of available platforms: 2
Platform names:
[0] Intel(R) OpenCL HD Graphics [Selected]
[1] Intel(R) CPU Runtime for OpenCL(TM) Applications
Number of devices available for each type:
CL_DEVICE_TYPE_CPU: 0
CL_DEVICE_TYPE_GPU: 1
CL_DEVICE_TYPE_ACCELERATOR: 0
*** Detailed information for each device ***
CL_DEVICE_TYPE_GPU[0]
CL_DEVICE_NAME: Intel(R) Gen9 HD Graphics NEO
CL_DEVICE_AVAILABLE: 1
CL_DEVICE_VENDOR: Intel(R) Corporation
CL_DEVICE_PROFILE: FULL_PROFILE
CL_DEVICE_VERSION: OpenCL 2.1 NEO
CL_DRIVER_VERSION: 19.13.12717
CL_DEVICE_OPENCL_C_VERSION: OpenCL C 2.0
CL_DEVICE_MAX_COMPUTE_UNITS: 24
CL_DEVICE_MAX_CLOCK_FREQUENCY: 1150
CL_DEVICE_MAX_WORK_GROUP_SIZE: 256
CL_DEVICE_ADDRESS_BITS: 64
CL_DEVICE_MEM_BASE_ADDR_ALIGN: 1624
CL_DEVICE_MAX_MEM_ALLOC_SIZE: 4294959104
CL_DEVICE_GLOBAL_MEM_SIZE: 26885742592
CL_DEVICE_MAX_CONSTANT_BUFFER_SIZE: 4294959104
CL_DEVICE_GLOBAL_MEM_CACHE_SIZE: 524288
CL_DEVICE_GLOBAL_MEM_CACHELINE_SIZE: 64
CL_DEVICE_LOCAL_MEM_SIZE: 65536
CL_DEVICE_PROFILING_TIMER_RESOLUTION: 83
CL_DEVICE_IMAGE_SUPPORT: 1
CL_DEVICE_ERROR_CORRECTION_SUPPORT: 0
CL_DEVICE_HOST_UNIFIED_MEMORY: 1
CL_DEVICE_EXTENSIONS: cl_khr_3d_image_writes cl_khr_byte_addressable_store cl_khr_fp16 cl_khr_depth_images cl_khr_global_int32_base_atomics cl_khr_global_int32_extended_atomics cl_khr_idc cl_khr_image_2d_from_buffer cl_khr_local_int32_base_atomics cl_khr_local_int32_extended_atomics cl_khr_priority_hints cl_khr_required_subgroup_size cl_khr_subgroups cl_khr_subgroups_short cl_khr_spir cl_khr_accelerator cl_khr_media_block_to_cl_intel_spirv_device_side_ava_motion_estimation cl_khr_spirv_media_block_to_cl_intel_spirv_subgroups cl_khr_spirv_no_integer_wrap_decoration cl_khr_mipmap_image cl_khr_mipmap_image_writes cl_khr_planar_yuv cl_khr_packed_yuv cl_khr_motion_estimation cl_khr_advanced_motion_estimation
CL_DEVICE_PREFERRED_VECTOR_WIDTH_INT: 4
CL_DEVICE_PREFERRED_VECTOR_WIDTH_LONG: 1
CL_DEVICE_PREFERRED_VECTOR_WIDTH_FLOAT: 1
CL_DEVICE_PREFERRED_VECTOR_WIDTH_DOUBLE: 1
CL_DEVICE_NATIVE_VECTOR_WIDTH_INT: 4
CL_DEVICE_NATIVE_VECTOR_WIDTH_LONG: 1
CL_DEVICE_NATIVE_VECTOR_WIDTH_FLOAT: 1
CL_DEVICE_NATIVE_VECTOR_WIDTH_DOUBLE: 1
vlinka2@en41193901:~/Downloads/CapsBasic$

```

```
vlanka2@en4119390L:~/vamsi/matrix_mul$ ./test_all_configs.sh
*****TESTING THE TILED KERNEL FOR MATRIX SIZE 512 *****
Number of available platforms: 2
CL_DEVICE_TYPE_GPU[0]
Reference C matrix multiplication: 0.69065 sec
OpenCL matrix multiplication: 0.0106551 sec
CL_DEVICE_TYPE_CPU[0]
Reference C matrix multiplication: 0.668988 sec
OpenCL matrix multiplication: 0.00677212 sec
*****TESTING THE TILED KERNEL FOR MATRIX SIZE 512 WITH TILE SIZE 8*****
Number of available platforms: 2
CL_DEVICE_TYPE_GPU[0]
Reference C matrix multiplication: 0.701602 sec
OpenCL matrix multiplication: 0.0110974 sec
CL_DEVICE_TYPE_CPU[0]
Reference C matrix multiplication: 0.668941 sec
OpenCL matrix multiplication: 0.0183498 sec
*****TESTING THE TILED KERNEL FOR MATRIX SIZE 512 WITH TILE SIZE 16*****
Number of available platforms: 2
CL_DEVICE_TYPE_GPU[0]
Reference C matrix multiplication: 0.689386 sec
OpenCL matrix multiplication: 0.0189143 sec
CL_DEVICE_TYPE_CPU[0]
Reference C matrix multiplication: 0.669628 sec
OpenCL matrix multiplication: 0.0169781 sec
*****TESTING THE TILED KERNEL FOR MATRIX SIZE 1024 *****
Number of available platforms: 2
CL_DEVICE_TYPE_GPU[0]
Reference C matrix multiplication: 6.8914 sec
OpenCL matrix multiplication: 0.0911987 sec
CL_DEVICE_TYPE_CPU[0]
Reference C matrix multiplication: 6.39351 sec
OpenCL matrix multiplication: 0.123744 sec
*****TESTING THE TILED KERNEL FOR MATRIX SIZE 1024 WITH TILE SIZE 8*****
Number of available platforms: 2
CL_DEVICE_TYPE_GPU[0]
Reference C matrix multiplication: 5.81367 sec
OpenCL matrix multiplication: 0.0936075 sec
CL_DEVICE_TYPE_CPU[0]
Reference C matrix multiplication: 5.56524 sec
OpenCL matrix multiplication: 0.152639 sec
```

```
*****TESTING THE TILED KERNEL FOR MATRIX SIZE 1024 WITH TILE SIZE 8*****
Number of available platforms: 2
CL_DEVICE_TYPE_GPU[0]
Reference C matrix multiplication: 5.81367 sec
OpenCL matrix multiplication: 0.0936075 sec
CL_DEVICE_TYPE_CPU[0]
Reference C matrix multiplication: 5.56524 sec
OpenCL matrix multiplication: 0.152639 sec
*****TESTING THE TILED KERNEL FOR MATRIX SIZE 1024 WITH TILE SIZE 16*****
Number of available platforms: 2
CL_DEVICE_TYPE_GPU[0]
Reference C matrix multiplication: 5.74149 sec
OpenCL matrix multiplication: 0.155972 sec
CL_DEVICE_TYPE_CPU[0]
Reference C matrix multiplication: 5.58612 sec
OpenCL matrix multiplication: 0.135837 sec
*****TESTING THE TILED KERNEL FOR MATRIX SIZE 2048 *****
Number of available platforms: 2
CL_DEVICE_TYPE_GPU[0]
Reference C matrix multiplication: 221.452 sec
OpenCL matrix multiplication: 0.937331 sec
CL_DEVICE_TYPE_CPU[0]
Reference C matrix multiplication: 257.697 sec
OpenCL matrix multiplication: 2.8781 sec
*****TESTING THE TILED KERNEL FOR MATRIX SIZE 2048 WITH TILE SIZE 8*****
Number of available platforms: 2
CL_DEVICE_TYPE_GPU[0]
Reference C matrix multiplication: 230.802 sec
OpenCL matrix multiplication: 0.743679 sec
CL_DEVICE_TYPE_CPU[0]
Reference C matrix multiplication: 252.191 sec
OpenCL matrix multiplication: 1.61959 sec
*****TESTING THE TILED KERNEL FOR MATRIX SIZE 2048 WITH TILE SIZE 16*****
Number of available platforms: 2
CL_DEVICE_TYPE_GPU[0]
Reference C matrix multiplication: 228.944 sec
OpenCL matrix multiplication: 1.24013 sec
CL_DEVICE_TYPE_CPU[0]
Reference C matrix multiplication: 259.077 sec
OpenCL matrix multiplication: 1.25388 sec
vlanka2@en4119390L:~/vamsi/matrix_mul$
```

The above two are the screenshots while running the test script which runs the main.cpp and prints the outputs on the terminal for all the specified combinations.