ONEAPI MATH KERNEL LIBRARY (ONEMKL) INTERFACES

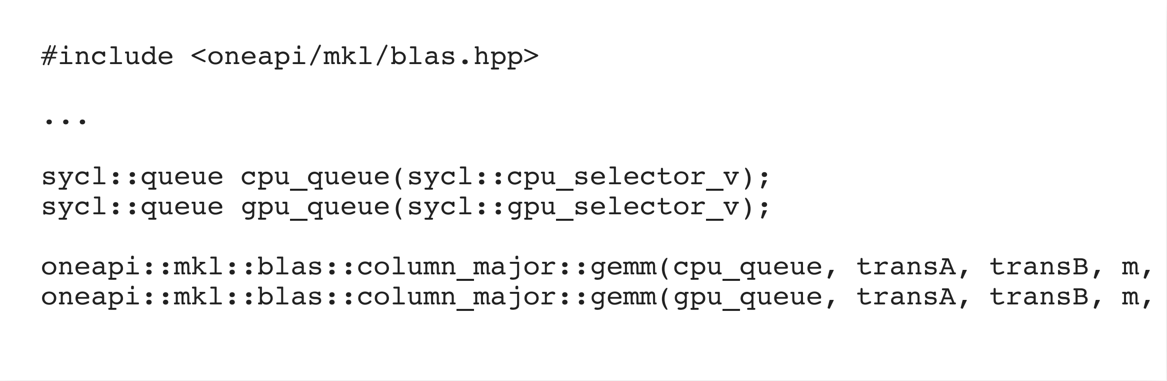
LEARNING OBJECTIVES

- Learn about oneMKL library, more specifically oneMKL Interfaces project
- Learn about how to use GEMM APIs from oneMKL with both USM and buffer memory models

RESOURCES

- oneMKL Interfaces: **https://github.com/oneapi-src/oneMKL**
- oneMKL specification: **https://spec.oneapi.io/versions/latest/elements/oneMKL/source/index.html#**
- Important: What is the difference between the following oneMKL terms: (1) oneAPI Specification for oneMKL (2) oneAPI's oneMKL Interfaces Project (3) Intel(R) oneAPI's oneMKL Product **https://github.com/oneapi-src/oneMKL?tab=readme-ov-file#onemkl**

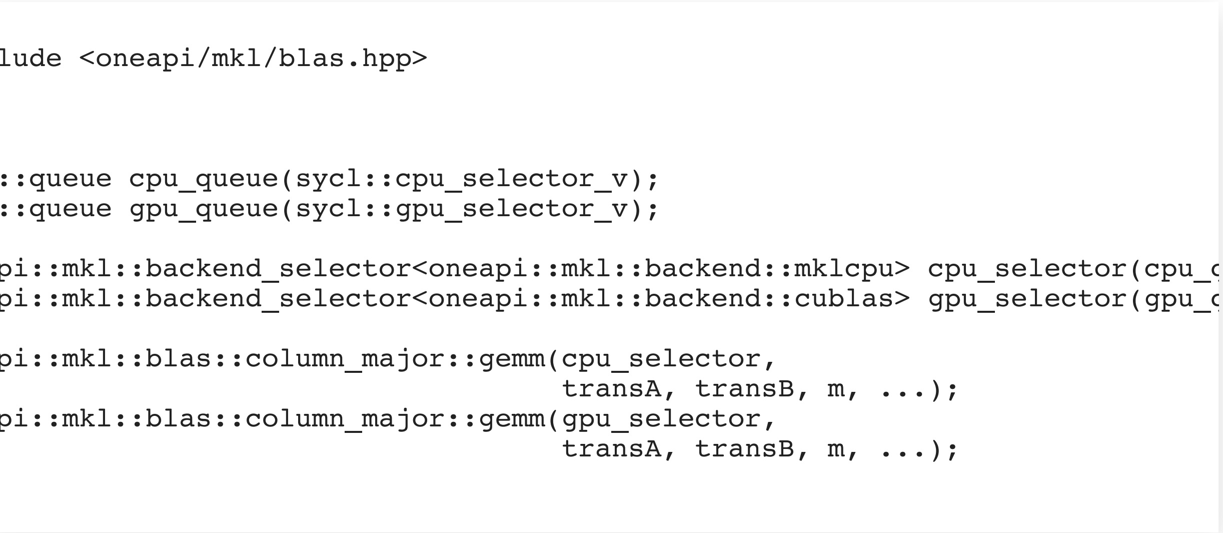
RUN-TIME DISPATCHING



```
#include <oneapi/mkl/blas.hpp>

...

sycl::queue cpu_queue(sycl::cpu_selector_v);
sycl::queue gpu_queue(sycl::gpu_selector_v);

oneapi::mkl::blas::column_major::gemm(cpu_queue, transA, transB, m,
oneapi::mkl::blas::column_major::gemm(gpu_queue, transA, transB, m,
```

- Backend is loaded at run-time based on device-vendor
- $> icpx –fsycl –I$ONEMKL/include app.cpp
- $> icpx –fsycl app.o –L$ONEMKL/lib –lonemkl

COMPILE-TIME DISPATCHING



```
lude <oneapi/mkl/blas.hpp>


::queue cpu_queue(sycl::cpu_selector_v);
::queue gpu_queue(sycl::gpu_selector_v);

pi::mkl::backend_selector<oneapi::mkl::backend::mklcpu> cpu_selector(cpu_q
pi::mkl::backend_selector<oneapi::mkl::backend::cublas> gpu_selector(gpu_q

pi::mkl::blas::column_major::gemm(cpu_selector,
                                  transA, transB, m, ...);
pi::mkl::blas::column_major::gemm(gpu_selector,
                                  transA, transB, m, ...);
```

- Uses a templated back selector APIs, where th template parameters specify the backends
- Application is linked w the required oneMKL backend wrapper libra
- `$> clang++ -fsyc I$ONEMKL/include app.cpp`
- `$> clang++ -fsyc app.o –L$ONEMKL/ – lonemkl_blas_mkl – lonemkl_blas_cub`

EXERCISE

- Objectives: Learn to use oneMKL GEMM buffer, USM APIs
- What is provided:
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  - Boiler plate-code provided (a) to perform GEMM on CPU, (b) Helper function to verify results from oneMKL APIs and CPU
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  - Please complete the TODO tasks marked in the `source_*.cpp`.
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  - Refer to the solutions at `solution_*.cpp`