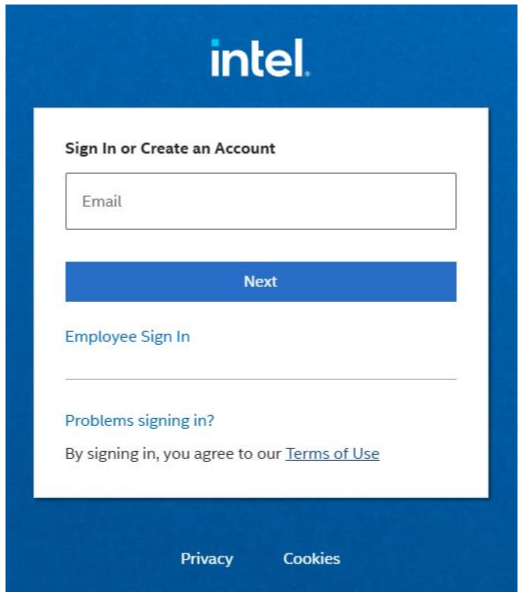
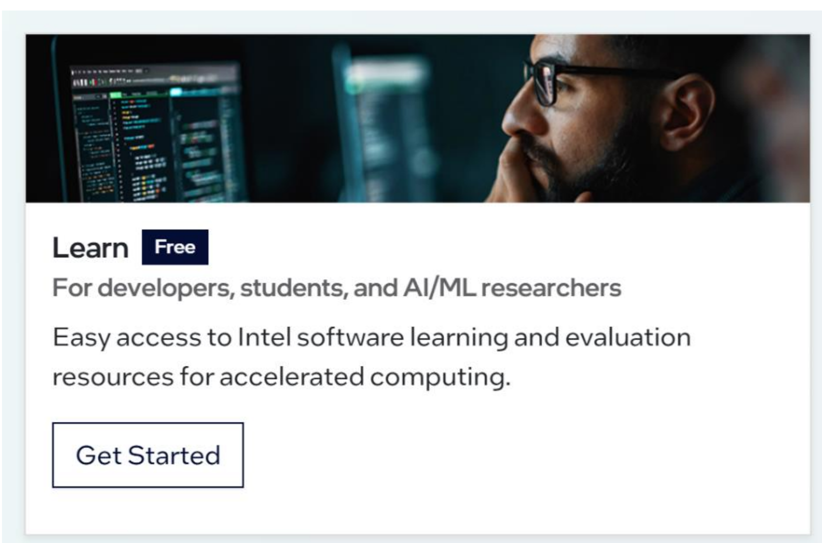
Migrating AI Applications to SYCL with SYCLomatic

How to Login to Intel® Tiber™ AI Cloud

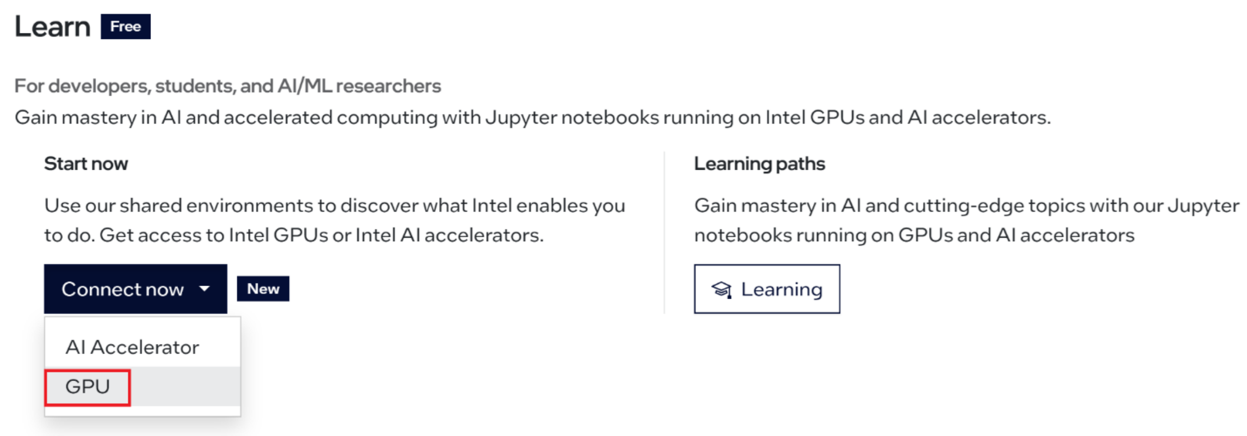
1) Sign in to https://console.cloud.intel.com/ (if you have an existing account) or create a new account



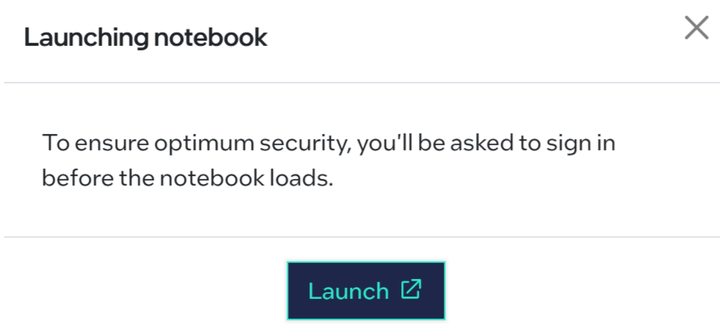
2) Please note that you will need a mobile phone number to complete the registration. Two-factor authentication will be used to log in. Click on Get Started under Learn tab



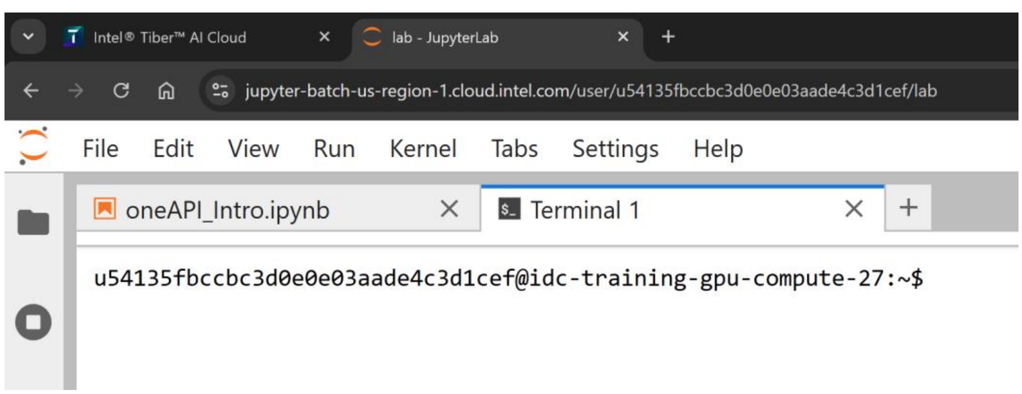
3) Select 'Connect Now' and GPU



4) Launch the Jupyter Notebook:



5) Note that you will be asked to enter your credentials one more time (including verification via SMS).
   The terminal windows look like this:



6) If, for some reason, it is not opened for you, please select File -> New -> Terminal.

CMake-based Project Migration: DL-MNIST

Prepare the environment for the migration

Download the set_env.tgz package, it contains scripts to set the env for DL-MNIST migration.

1) *wget https://github.com/ivorobts/IWOCL2025/raw/refs/heads/main/set_env.tgz*
2) *tar -zxvf set_env.tgz*

The script will download Velocity-Bench (which includes DL-MNIST code) and install required dependencies via conda for original code compilation (~ 5 mins).

3) *source ~/set_env/dl-mnist/set_env.sh*

Migrate the project to SYCL

We prepare a Makefile via CMake and then intercept compilation commands via the intercept-build tool:

4) *mkdir build && cd build*
5) *cmake ..*
6) *intercept-build make -B*

Once the compilation database file is generated compile_commands.json, we may proceed with the project migration to SYCL:

7) *cd ~/Velocity-Bench/dl-mnist*
8) *dpct --in-root .. -p ./CUDA/build --out-root out --migrate-build-script=CMake*

Build and run the SYCL code project

Need to prepare a data file required to run the DL-MNIST workload Once the compilation

9) *cd out/dl-mnist; mkdir datasets; cp ~/set_env/dl-mnist/train-images.idx3-ubyte datasets/*
10) *cd CUDA; mkdir build && cd build; cmake -DCMAKE_CXX_COMPILER=icpx ..*
11) *Some minor code modifications are required before the compilation, e.g.*
    - *vi ../CMakeLists.txt (comment out line 82: #add_compile_options(-DUSE_CUDA))*
    - *vi ../main.cudnn.cpp.dp.cpp (comment out line 68: //Utility::QueryCUDADevice();)*
12) *make -j*
13) *SYCL_UR_TRACE=1 ./dl-mnist-cuda -conv_algo CUDNN_FIND_BEST_ALGO*

PyTorch-based Project Migration: Stylegan3

Prepare the environment for the migration

Download the set_env.tgz package (if not done earlier). It contains scripts to set the env for stylegan3 migration.

1) *wget https://github.com/ivorobts/IWOCL2025/raw/refs/heads/main/set_env.tgz*
2) *tar -zxvf set_env.tgz*

The script will download the stylegan3 code, required CUDA header files used during the migration, modify and copy compilation database file compile_commands.json. Usually it should be generated/intercepted while compiling the original CUDA code. This file is prepared to be used on Intel® Tiber™ AI Cloud since the env/hw to build the CUDA version of sytlegan3 is not available.

3) *source ~/set_env/stylegan3/set_env.sh*

Migrate the project to SYCL

The two custom migration rule files contain required code changes for the Python build scripts and source code migration. Each fix is root-caused after the code migration step and identified during the code build stage. For this tutorial, each change is organized in a YAML file to demonstrate that the manual code changes can be organized in the user-defined migration rules files.

Note that the step 1 is optional; you also can fix the migrated SYCL code/Python scripts during the build step.

1) *cp ~/set_env/stylegan3/stylegan3_specific_migration_rule_v0.yaml .*
   cp ~/set_env/stylegan3/stylegan3_specific_python_build_script_migration_rule.yaml .

Run the SYCLomatic command to migrate the source code. The CUDA source files listed in compile_commands.json will be migrated into SYCL code. After migration, all SYCL code will be available in the **out** folder.

2)
```
dpct -p . --in-root . --out-root out --use-experimental-features=free-function-queries,local-memory-kernel-scope-allocation \
--rule-file ~/syclomatic_package/extensions/pytorch_api_rules/pytorch_api.yaml \
--analysis-scope-path ~/.conda/envs/stylegan3/lib/python3.9/site-packages/torch/include \
--analysis-scope-path . --rule-file ./stylegan3_specific_migration_rule_v0.yaml \
--cuda-include-path=$HOME/cudaheaders
```

Run the SYCLomatic command to migrate Python build scripts. After migration, SYCL-capable Python build scripts will be available in the **out** folder.

3)
```
dpct -p . --in-root . --out-root out \
 --rule-file ~/syclomatic_package/extensions/python_rules/python_build_script_migration_rule_pytorch.yaml \
 --migrate-build-script=Python --migrate-build-script-only \
 --rule-file ./stylegan3_specific_python_build_script_migration_rule.yaml \
--cuda-include-path=$HOME/cudaheaders
```

Build and run the SYCL code project

Set the environment to build the migrated code. It includes the creation of stylegan3_sycl Conda environment, removing default PyTorch with no Intel XPU support and installation of a new version of PyTorch which has Intel XPU support (via https://download.pytorch.org/whl/test/xpu).

1) *source ~/set_env/stylegan3/env_to_run.sh*

Run the migrated version of application:

2) *python **gen_video.py** --output=lerp.mp4 --trunc=1 --seeds=0-31 --grid=4x2 \
--network=https://api.ngc.nvidia.com/v2/models/nvidia/research/stylegan3/versions/1/files/stylegan3-r-afhqv2-512x512.pkl*