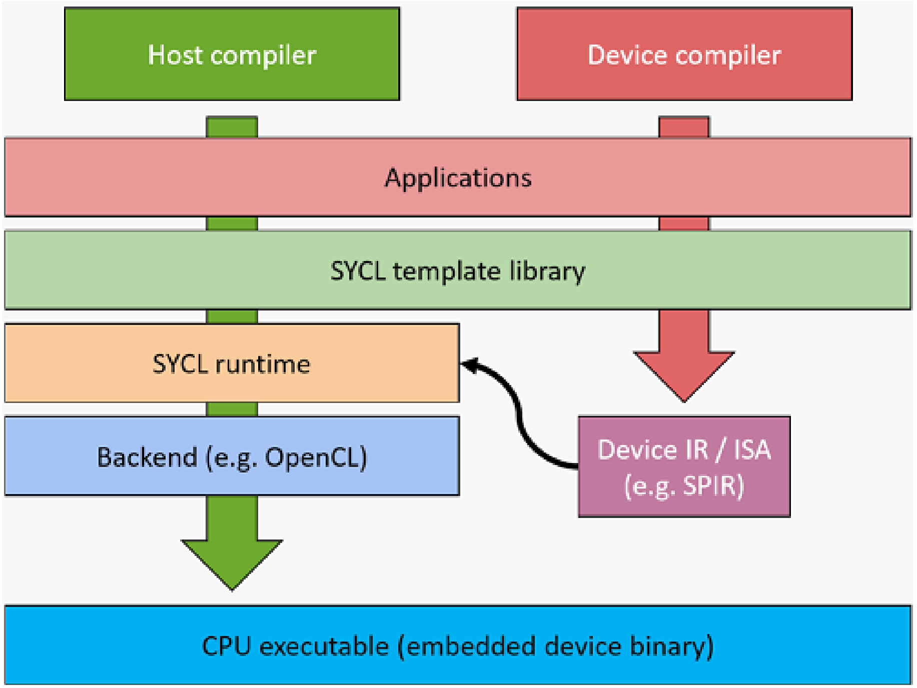
SUMMARY

1. WHAT IS SYCL?



- Single source, high-level, standard C++ programming model, that can target a range of heterogeneous platforms
- Provides high-level abstractions over common boilerplate code

2. ENQUEUEING A KERNEL

```
class my_kernel;

queue deviceQueue;
deviceQueue.submit([&](handler& cgh){

  auto os = sycl::stream(1024, 128, cgh);

  cgh.single_task<my_kernel>([=]() {
    os << "Hello world!\n";
  });
}).wait();
```

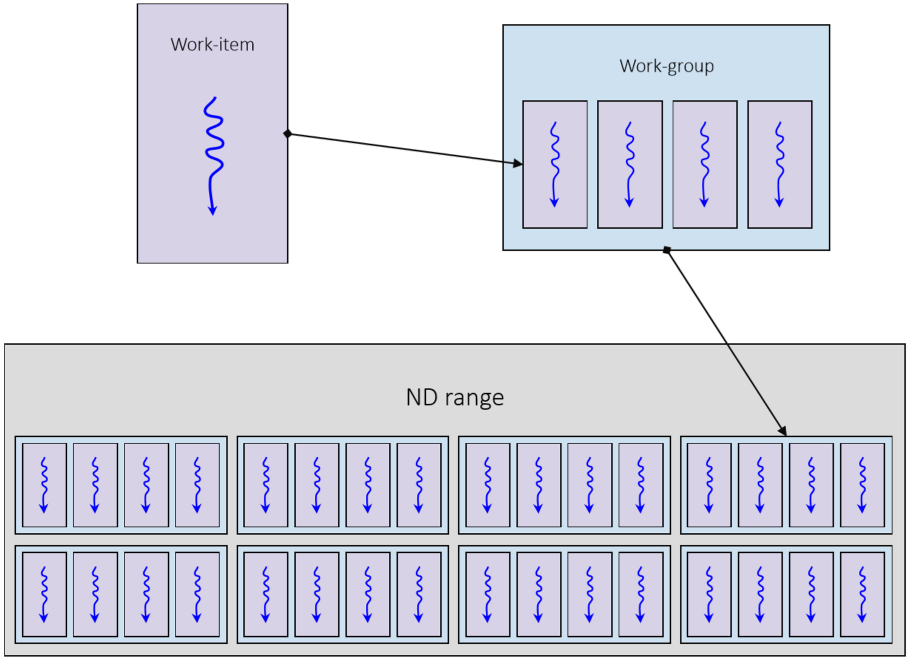
- Series of commands are enqueued via command groups
  - Performed via `sycl::queue::submit`
- Commands are scheduled for execution on a device
- Kernels submitted as kernel functions, either as C++ lambdas or function objects
- There are restrictions on kernel code because of device limitations
- Can use a `sycl::stream` to write text on device

3. MANAGING DATA

```
class my_kernel;
queue deviceQueue;

// Create a buffer and allocate USM memory
buffer<int> user_buffer{range{128}};
int* usm_ptr = malloc_device<int>(128, deviceQueue

deviceQueue.submit([&](handler& cgh){
  // Request access to buffer
  accessor user_acc{user_buffer, cgh, write_only};

  // USM pointer doesn't need to request access

  cgh.single_task<my_kernel>([=]() {
    user_acc[0] = 1;
    usm_ptr[0] = 2;
  });
}).wait();
```

- Two models for managing data: Buffer/accessor model and Unified Shared Memory
- SYCL separates the storage (buffer) and access of data (accessor)
- Different types of accessor provide different ways to access data
- In buffer/accessor model the scheduler takes care of data movement
- Access modes specify how to access data (read/write/no_init)
- USM memory can be allocated as host, device, or shared
- USM requires manual operations

4. DATA PARALLELISM AND ND-RANGE KERNELS



- Task parallelism: Executes separate tasks simultaneously
- Data parallelism: Performs the same task on multiple data elements
- Work-items perform computation, execute independently (threads)
- Work-items grouped into work-groups. Work-groups invoked within an ND-range. Work-items within a group can synchronize
- Each work-item has private memory, can't access others'

FURTHER RESOURCES

- The SYCL Academy "main" branch contains many more materials to learn from
- You can follow the guides to install SYCL on your own machine or cluster
- There is a free SYCL book that can be downloaded
- The sycl.tech website has a SYCL playground and lots of videos and resources
- You can find information about SYCL libraries for math and DNN to use alongside your SYCL code (see uxlfoundation.org or Google oneAPI)
- Search for oneAPI to find Jupyter notebook exercises in SYCL and using the oneAPI libraries