

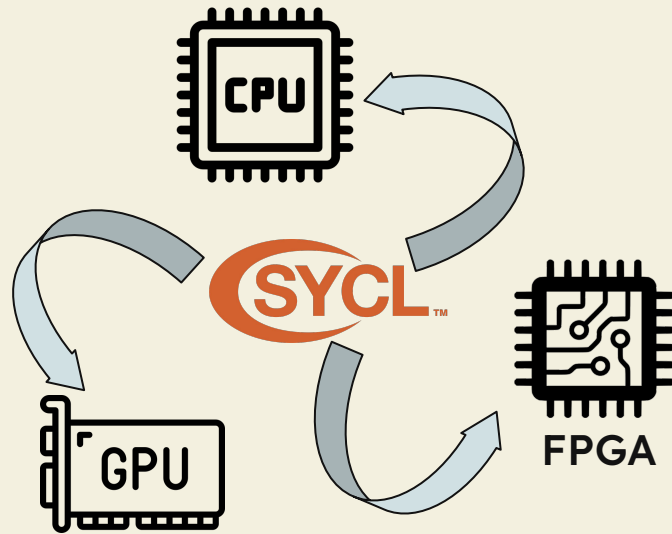
# Empowering HPC Education with SYCL: Open-Source Modules for Modern Supercomputers

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# Why SYCL for HPC Education?

- **Motivation:**
  - Modern supercomputers are increasingly diverse with GPUs, FPGAs, etc.
  - Need for **portable code** across diverse hardware platforms.
- **Goal:**
  - Develop **open-source, accessible** educational modules for HPC, focusing on underserved communities.



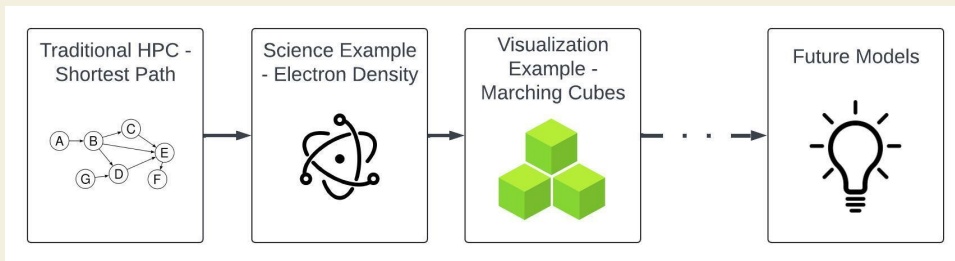
# SYCL and UnoAPI Overview

		
CPU	✓	✓
FPGA	✓	✗
NVIDIA GPU	✓	✓
AMD GPU	✓	✗
Intel GPU	✓	✗

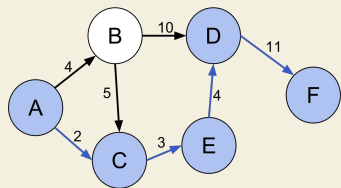
- **SYCL:**
  - Vendor-neutral alternative to CUDA.
  - **Write once, run anywhere:** CPUs, GPUs, and beyond.
- **UnoAPI:**
  - UnoAPI serves as the foundation for creating **educational modules** for HPC learners.

# Three Modules for SYCL Education

- **Modules:**
  - **Module 1:** Shortest Path in Graph
  - **Module 2:** Particle Electron Density Computation
  - **Module 3:** Marching Cubes Visualization



# Diving into the Modules

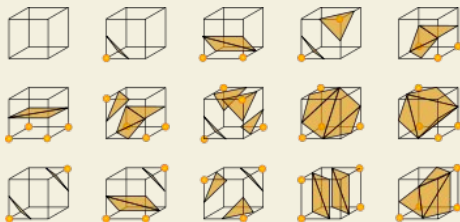
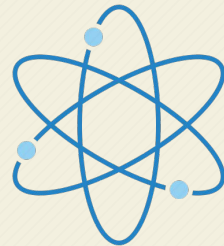


- **Module 1: Shortest Path (Graph Problem):**

- Entry-level example to demonstrate **parallelism**.
- Uses basic SYCL constructs to introduce the SYCL programming model.

- **Module 2: Particle Electron Density:**

- **Scientific computing:** Generate volumetric electron density data.
- Memory management and data access with SYCL.



- **Module 3: Marching Cubes Algorithm:**

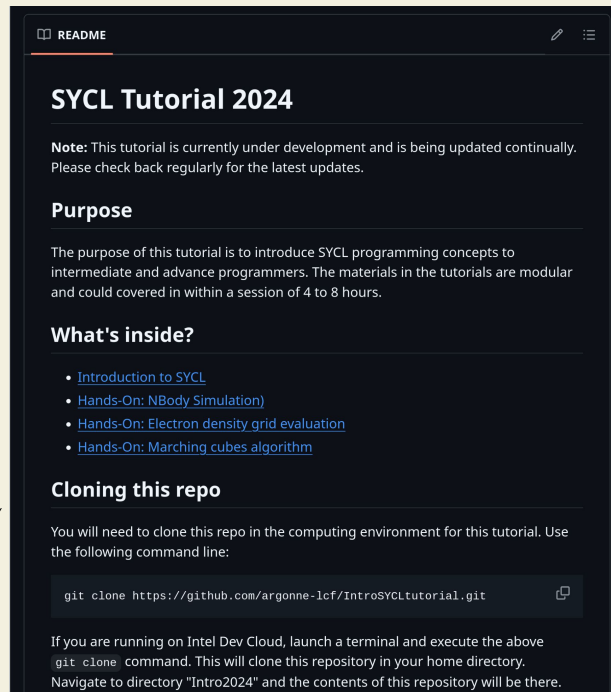
- Ported from CUDA to SYCL with **SYCLomatic**.
- Challenges included adjusting ND-Range kernels, switching namespaces, and refactoring to simplify.

# Portability & Accessibility

- **Portability:**
  - Platform-agnostic modules usable across various hardware setups.
  - Suitable for use in workshops, classrooms, and supercomputers.
- **Open-Source Access:**
  - Repository available for educators and students.



<https://github.com/argonne-lcf/IntroSYCLtutorial>



# Empowering HPC Education

- Our modules provide **real-world applications** in scientific computation and visualization.
- Visit our **GitHub repository** to explore tutorials.

**Join us in bringing HPC to everyone, especially underserved communities!**



**Thank you!**

# Acknowledgment

- This research used resources of the Argonne Leadership Computing Facility.
- Supported by the U.S. Department of Energy, Contract No. DE-AC02-06CH11357.

