Lesson 1.3
Portability and Scalability in Heterogeneous Parallel Computing
Objectives

- To understand the importance and nature of scalability and portability in parallel programming
Software Dominates System Cost

- SW lines per chip increases at 2x/10 months
- HW gates per chip increases at 2x/18 months
- Future system must minimize software redevelopment
Keys to Software Cost Control

- Scalability
Keys to Software Cost Control

- Scalability
  - The same application runs efficiently on new generations of cores
Keys to Software Cost Control

- Scalability
  - The same application runs efficiently on new generations of cores
  - The same application runs efficiently on more of the same cores
More on Scalability

- Performance growth with HW generations
  - Increasing number of compute units
  - Increasing number of threads
  - Increasing vector length
  - Increasing pipeline depth
  - Increasing DRAM burst size
  - Increasing number of DRAM channels
  - Increasing data movement latency

The programming style we use in this course supports scalability through fine-grained problem decomposition and dynamic thread scheduling.
Keys to Software Cost Control

- Scalability
- Portability
  - The same application runs efficiently on different types of cores
Keys to Software Cost Control

- Scalability
- Portability
  - The same application runs efficiently on different types of cores
  - The same application runs efficiently on systems with different organizations and interfaces
More on Portability

- Portability across many different HW types
  - X86 vs. ARM, etc.
  - Latency oriented CPUs vs. throughput oriented GPUs
  - VLIW vs. SIMD vs. threading
  - Shared memory vs. distributed memory

Emerging standards such as OpenCL and Heterogeneous System Architecture help address portability
To Learn More, Read Chapter 1