Integrating Parallel Distributed Computing Topics Throughout Undergraduate CS Curriculum: A Work in Progress

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Tennessee Tech. University

- TTU is a medium size public engineering college – about 12,000 students
- The CS department:
  - offers BS (ABET accredited), MS, and Ph.D. degrees
  - has approximately 400 undergraduate and 30 graduate students
  - employs 9 faculty

Motivation

- Multi-core and GPU based machine are becoming ubiquitous
- CS undergraduates are typically trained to think and program sequentially
- Most undergraduate CS programs do not teach Parallel and Distributed Computing (PDC) concepts
- ACM/IEEE-CS Computer Science Curriculum 2013 identified PDC as a new knowledge area
- Need to address the rapidly widening gap between emerging highly parallel computer architectures and the sequential programming approach taught in traditional CS courses

Project Goals

- Integrate PDC topics throughout undergraduate curriculum following TCPP guidelines
- Develop/adopt self contained PDC modules
- Share modules and implementation results by disseminating them to the community

Plan

- Introduce an upper division elective parallel programming course
- Integrate PDC topics into the following courses
  - CS0 - Principles of Computing
  - CS1 - Intro to Programming
  - CS2 - Data Structures
  - Operating Systems
  - Computer Architecture
  - Computer Networks

Current Status

- An upper division Parallel Programming course has been added in the curriculum and offered in fall 14
  - 30 students
  - will be offered every fall
  - Pthreads, OpenMP, MPI, CUDA
- PDC topics have been integrated in CS0 and is being offered every semester
  - 3 lecture hours
  - PDC, parallelism vs concurrency, speedup, and race conditions
- CS1, CS2 will be implemented in fall 15
- OS, Networks, and architecture will be implemented in spring 16

Assessment

- Upper division parallel programming class
  - Quiz/test, programming assignments
  - A popular core elective
- CS0
  - Subjective assessment through pre/post survey
  - Objective assessment – quiz and homework

Knowledge gain in PDC topics in CS0 class

Sorting example in SNAP!