Introducing High Performance Computing (HPC) in the Baton Rouge Community College (BRCC) Computer Science Curriculum

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Overview

- Baton Rouge Community College
- Introducing High Performance Computing
- HPC Goals and Expected Outcomes
- BRCC and Curriculum
- RET 2014 Trainings
- LittleFE Tool and Community Outreach
- Conclusion

Baton Rouge Community College

8 Campus Locations with Approximately 8,000+ Students

- Mid City
- Arcadian
- Frazier
- Westside
- Port Allen
- Hooper Road
- Donmoor
- New Roads

Why High Performance Computing ?

- HPC has become a major focus for Academics and Researchers.
- The advancement of computer technology used for research is creating the need to change the way classes are taught in higher education.

High Performance Computing

High Performance Computing is considered to include machines with a good balance among the following major elements:

- Multistage (pipelined) functional units.
- Multiple central processing units (CPUs) (parallel machines).
- Multiple cores.
- Fast central registers.
- Very large, fast memories.
- Very fast communication among functional units.
- Vector, video, or array processors.
- Software and memory system that will integrate each element effectively.

High Performance Computing Continued

- By definition, supercomputers are the fastest and most powerful computers available, and at present the term refers to machines with hundreds of thousands of processors. They are the "super-stars" of the high performance class of computers.
- Additionally, Personal Computers (PCs) small enough in size and cost to be used by an individual, yet powerful enough for advanced scientific and engineering applications, can also be high performance computers.

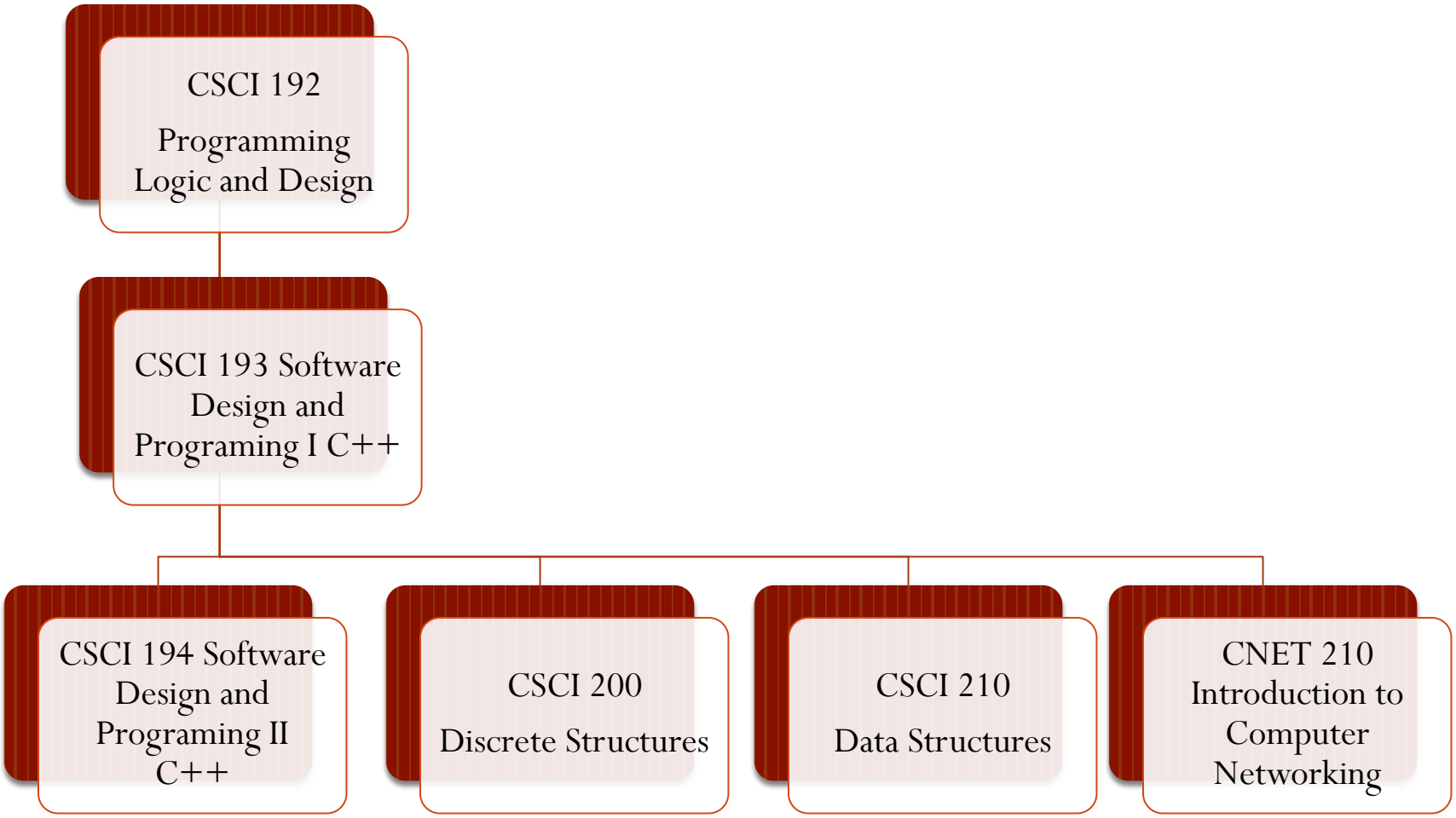
Goals for using HPC at BRCC

- Present the general ideas and basic principles of High Performance Computing
- Enhance critical thinking skills
- Cultivate interest in research
- Develop concrete programing techniques

BRCC HPC Expected Instructional Outcomes

- Understand in a general sense the architecture of high performance computers.
- Understand how the architecture of high performance computers affects the speed of programs run on HPCs.
- Understand some of the general concepts of parallel computing and the different types of parallel computers.
- Understand memory access of HPC programs (shared vs. distributed memory).
- Understand the importance of communication overhead in high performance computing.
- Understand how different types of problems are best suited for different types of parallel computers.

BRCC Computer Science Courses Considered for HPC Curriculum



Proposed BRCC HPC Curriculum Modules

Introduction to Unix/Linux

- Basic Concepts / Commands
- Working with files and folders
- Text Editors
- I/O Redirection and Pipes
- Bash Shell and Scripts

Proposed BRCC HPC Curriculum Modules Continued

LittleFE

- Hardware Components
- Basic BCCD OS Install
- Booting Diskless Nodes
- Basic BCCD Commands
- Introduction to Parallel Computing
- Programming Examples
  - Hello World
  - GalaxSee

    (simulates a galaxy using Newton's Laws of Physics)

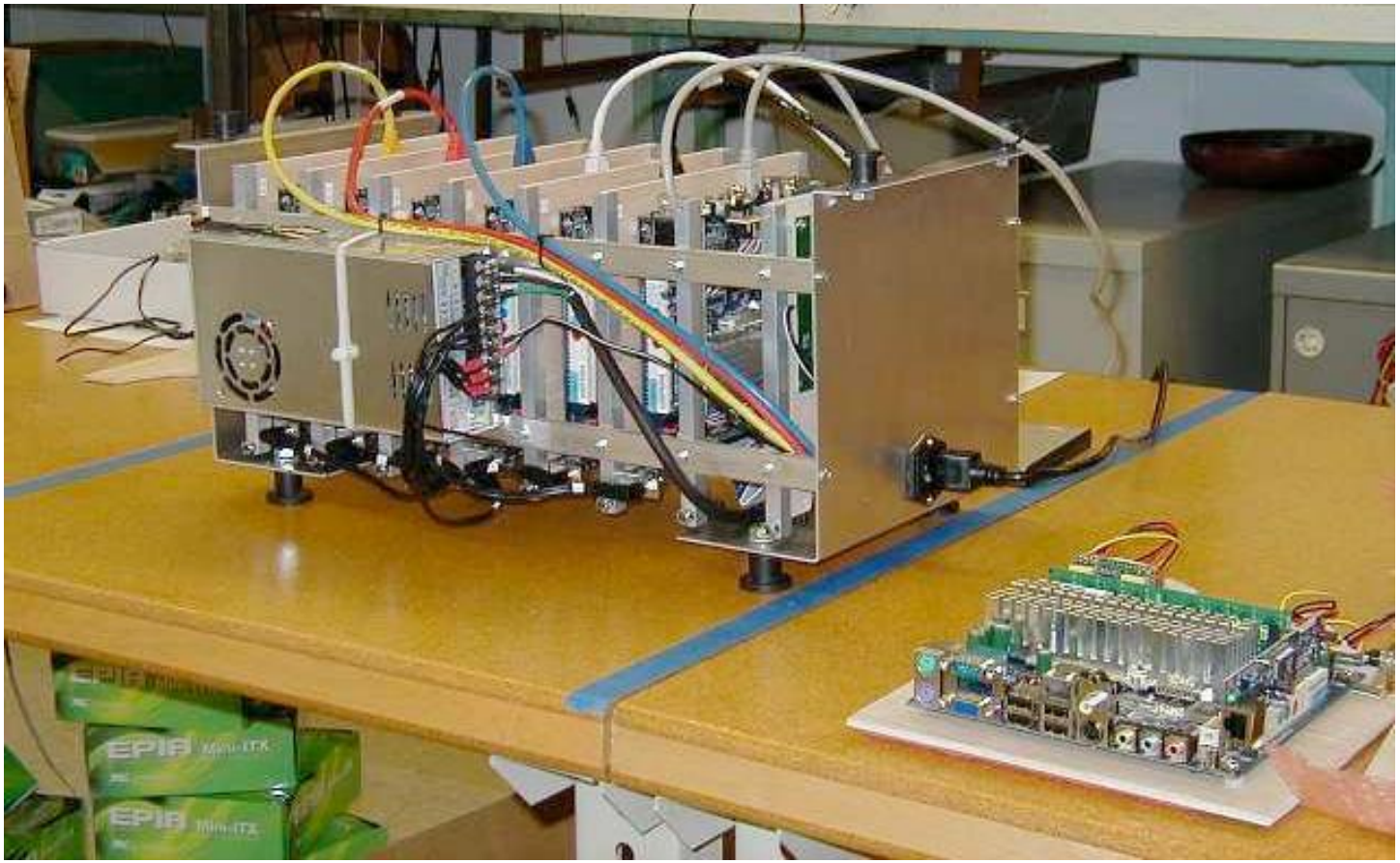
RET 2014 HPC and Other Trainings

- 3rd Annual LONI HPC Parallel Programming Workshop June 2 - 4, 2014
- GPU Workshop Friday, June 6, 2014
- Beowulf Bootcamp July 7 – 11, 2014
- Shell Energy Camp July 28 – August 1, 2014
- LittleFE Research Summer 2014
- C++ Programming Summer 2014
- Python Programming Sumer 2014
- The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC14), November, 2014 in New Orleans, LA

Summer 2014 Beowulf Boot Camp

7 BRCC Students Experienced Hands-on HPC Simulations

LittleFE HPC Award



About LittleFE

- LittleFE is a complete multi-node Beowulf-style [Brown, 2008] portable computational cluster designed as an "educational appliance" for significantly reducing the resistance associated with teaching high performance computing (HPC) and computational science in a variety of settings.
- The entire package weighs less than 50 pounds, easily travels via checked baggage, and sets-up quickly.

LittleFE Specs

Demonstrate ideas of cluster computing

- 6 node
- 12 processors
- 6 GPU's

- OpenMP, MPI, and CUDA
- Cost with set up approximately $3,000.00

BRCC HPC Outreach

East Baton Rouge Parish School System (EBRPSS)

Participated in Glasgow Middle STEM Night

- Introduced parallel thinking
- Skills for scientific computing

Future site Buchanan Elementary

- Plans to start a robotics club
- Introduce HPC Concepts

Conclusion

- The goal of this summer research is to enhance the BRCC Computer Science curriculum implementing HPC concepts.
- Provide the LittleFE HPC tool such that it is easily accessible to BRCC students, faculty, and EBRPSS.
- Our mission is to promote HPC concepts in the classroom and create a path for unscripted discovery.

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Questions?