Course Title: Introduction to Building High Performance Computing Systems
Course Code: CS 74
Instructor: Steve Jones

Course Summary:

What are High Performance Computing Systems? In this course you will learn the answer to that question. They range from monolithic architectures with single purposes such as weather simulation and high-fidelity simulation of jet engines, to more complex workflows such as mining massive datasets and exploring, teaching, and training models within Artificial Intelligence.

In this course, students will remotely build their own high performance computing system using the open-source freely available cluster distribution OpenHPC. The OpenHPC framework can be used to build systems mentioned above in addition to systems for storage, container-based computing, computer labs, and web server farms. This involves the installation and configuration of CentOS, OpenHPC, and various third-party applications. Students will learn the basics of cluster composition including cluster topology, data interconnect, and processor and memory properties. Students will learn how to administer these systems through package, scheduling, and resource managers such as RPM and Slurm. Students will carry out their work using Linux.

Students will take away a skillset that is applicable beyond the specific field of high performance computing. For example, familiarity with Linux is useful and frequently necessary in many professional software domains. Configuring and managing cluster resources is necessary for generating intensive neural networks in machine learning. Moreover, the fields of artificial intelligence and high performance computing have by and large converged as the two go hand-in-hand in their software and hardware requirements.

Note About Live Attendance and Recording:

These class sessions will be recorded.

Our class is tentatively scheduling guest lectures from engineers at Intel Corporation and OpenHPC. You are encouraged to attend lectures live so that you may ask questions from us and our guest speakers.

See attendance requirements below if you are seeking credit or a grade.
Grade Options and Requirements:

- **No Grade Requested (NGR)**
  - This is the default option. No work will be required; no credit shall be received; no proof of attendance can be provided.

- **Credit/No Credit (CR/NC)**
  - Students must watch all seven class sessions.
  - At least five of the sessions must be watched live and up to two sessions may be watched recorded to receive credit.
  - If you live in a distant time zone or have other extenuating circumstances which makes this difficult, please be in touch with the course staff.

- **Letter Grade (A, B, C, D, No Pass)**
  - Students must complete 60% of available assignments and projects to earn a passing grade, in addition to the attendance requirements above.
  - Assignments are graded on a submission basis
    - A: 90-100%
    - B: 80-89%
    - C: 70-79%
    - D: 60-69%
  - Component 1: Weekly Assignments (70% of total grade):
    - Assignments consist of completing cluster buildouts, answering related questions, and answering questions on lecture material.
    - Due Mondays 5:00pm.
  - Component 2: Final Project (30% of total grade):
    - Written report due Monday 11/22 10:00pm.
    - Presentation slides due Sunday 11/28 10:00pm.
    - Presentation delivered in class Monday 11/29, live or pre-recorded.

*Please Note: If you require proof that you completed a Continuing Studies course for any reason (for example employer reimbursement), you must choose either the Letter Grade or Credit/No Credit option. Courses taken for NGR will not appear on official transcripts or grade reports.*

Tentative Weekly Outline:

Prior to Course

- Watch video:
  Yellowstone (supercomputer)
Week 1

- Monday 10/4: Course overview, Grading, Introduction to High Performance Computing

Week 2

- Monday 10/11: I’ve never used Linux, what do I do? ~ Introduction to Linux, Intro to SSH, the command line interface, OpenHPC, file systems

Week 3

- Monday 10/18: Making Applications and Data Move at High Speed ~ Installation and management of Infiniband and benchmarking your cluster.

Week 4

- Monday 10/25: How do we manage the Compute Nodes? ~ Installation of Slurm and Node Health Check

Week 5

- Monday 11/1: We have a cluster, how can we take advantage of it? ~ Application Installation and Management, example use-cases and how to submit simulations to execute on your cluster

Week 6

- Monday 11/8: Guest Lecture: Hyperscale Computing at Intel, Shesha Krishnapura, Intel Fellow and Intel IT CTO

Week 7


** No Class 11/22 **

Week 8

- Monday 11/29: Final presentations

Course Logistics:

Please contact the Stanford Continuing Studies office with any questions
365 Lasuen St., Stanford, CA 94305
continuingstudies@stanford.edu
650-725-2650
Canvas:
- Students should use Canvas to communicate with course staff, read announcements, find class materials, read assignment specifications, and submit assignments.
- Weekly discussion boards are posted on Canvas for students to ask questions and collaborate with each other. Students should feel free to post debugging questions and solutions to these boards. If you need to communicate with course staff about a very specific matter, please use the Canvas “inbox” feature. Select both “Teachers” and “Teaching Assistants” so your issue can be addressed promptly.
- Lecture recordings are posted to canvas.

Zoom:
- Live virtual lectures and non-recurring optional workshops will be held on Zoom.
- Please ensure that at least your first name is listed on your zoom profile.
- Plan to log into zoom a few minutes prior to lecture; students sometimes experience configuration and connection issues when starting zoom.
- Please ensure to mute your microphone after speaking.
- Feel free to have your video feed either on or off.
- Feel free to post questions to the zoom chat during lecture.