STUDENT CLUSTER COMPETITION

A MULTI-DISCIPLINARY UNDERGRADUATE HPC EDUCATIONAL TOOL

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THE NEED

• Undergraduate programs don’t provide for the interdisciplinary nature of HPC

• Computational science is, at best, offered as an elective

• Exposure to parallel computing is only attained through a computer science degree program.

• SCC created as an educational tool to immerse undergraduates in HPC

• The SCC can complement a strong parallel and distributed computing (PDC) curriculum through multi-disciplinary experiential learning and engagement

• The SCC is designed so that teams are aware of the interconnections between system architecture and applications
HPC WORKFORCE NEEDS

MULTI-DISCIPLINARY WORKFORCE

• Science application developers are typically not trained to develop massively parallel applications.

• Design choices are heavily impacted by HPC architecture complexity

• Many different kinds of staff are required for a functioning HPC center
  • Data Scientists
  • Computational Scientists
  • System Engineers
  • System Administrators
  • User Assistance Specialists

• These staff have a direct impact on the quantity and indirect impact on the quality of research done.

• Both researchers and staff benefit greatly from understanding both the science and the technology
HPC WORKFORCE NEEDS

WORKFORCE AVAILABILITY

- Whitehouse executive order for formation of National Strategic Computing Initiative

- 93% of HPC centers have difficulty hiring staff with the requisite skills.

- Current approaches to workforce development are inadequate to address today's needs.

- The pace of HPC growth in industry is outpacing government labs and academia.
The Details

- Teams of six undergraduates assemble small clusters at the conference and race to complete a real-world HPC workload.

- Teams also are scored on
  - Technical interviews
  - Posters
  - Presentations

- Teams can bring any architecture and hardware
  - Hardware must be able to execute the computation without going over the power limit
  - Power limit is 3120 watts

- Teams run HPL and 4 scientific and/or engineering applications
  - All applications are posted many months in advance save one
  - One mystery application is revealed at the start of the competition
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INTENDED IMPACT

• Students experience a microcosm of an HPC center in the competition

• Encourage breadth and multidisciplinary methodology in HPC/PDC education

• Show the impact of HPC to the world we live in and inspire students to pursue HPC as a career

• Students experience the HPC community
• Some comments from a survey sent to the teams after SC13:
  • “Our team concluded that SC12 itself was the BIG experience. That is, coming from a small liberal arts college setting […] It was the experience of being with the HPC community that made the big difference.”

  • “The Cluster Competition was a great way to learn skills that are not taught whatsoever at school.”

  • “The SCC is a great event for undergraduate students who never have HPC experiences during their undergraduate study... This event guides them into the HPC community.”

• Many SCC alumni go into HPC related jobs and there are a growing number of SCC alumni that participate in the SC conference every year
Trend is becoming more international
Good representation from US and Asia
Americas, Australia and Europe has room for growth

60% from returning academic institutions have adopted more formal coursework to prepare students for the HPC workforce and, by proxy, the competition.
Multi-disciplinary work is important in the HPC workforce

SCC give students their first glance at the inter-disciplinary nature of HPC

1/6\textsuperscript{th} of students have a non-computing major or an average of one person per team is from a domain science or other major.

Not only are some domain scientists being exposed to HPC but computing majors are being exposed to domain scientists and their tools.
• Continued interest in the competition is a measure of usefulness to the HPC community.

• 57% of teams apply two or more times

• Schools that get a rejection on their first application rarely apply twice
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SCHOOL SIZE DEMOGRAPHICS

- No schools under 5k accepted
- Weak correlation with underserved institutions
- Only 8% of applications have been from small schools
- Applications were not adequate, however, feedback and support system needed.
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WHAT WE CAN DO TO IMPROVE?

• Better advertisement to underserved groups
  • Gender ratio is very low

• Clearer expectations and feedback on judging team applications

• Better follow up with students after the competition. Reinforce key multidisciplinary themes.

• More team matchmaking for smaller schools with vendors and other mentor schools.

• More data: put in place a regular survey that quantifies the student impact long term
THANK YOU
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