Consider an Applications-First Approach for PDC

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EduHPC Lightning Talk at SC24
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Problem

We aren't educating enough HPC users and developers

Are PDC course prerequisites really needed?

- Do students really need to know OS concepts?
- How about parallel architecture?

How much do students learn by writing parallel programs from scratch?

- Getting to the point where parallelism can be observed can take too long
- The process can be unnecessarily discouraging

Applications-First Approach

Introduce students to PDC concepts through lens of practical applications

Can we use/develop parallel applications on day 1?

- See the performance and scaling advantages they provide
- Observe those advantages on applications that students care/know about

Can we adjust key outcomes of PDC courses?

- How to extend and maintain existing parallel codes
  - including performance and scalability analysis
- How to port their Python/R/MATLAB etc codes for HPC

Real-World Experiences

CHAMPS: A 3D, Unstructured-Grid CFD Solver for Aerodynamics: >100k lines of Chapel code

- Developed at Polytechnique Montreal, led by Eric Laurendeau

We ask students … to do stuff that would take 2 years, and they do it in 3 months. … So, if you want to take a summer internship and you say: 'program a new turbulence model', well they manage.

Eric's CHIUW '21 Keynote:

youtube.com/watch?v=wD-a_KyB8aI

Chapel enables undergraduate students to contribute to CHAMPS' development, something almost impossible to think of when using very complex software.

Eric's Interview on Chapel Blog:

chapel-lang.org/blog/posts/7qs-laurendeau/

Eric's Distinguished Talk at PAW-ATM

A Case Study for using Chapel within the Global Aerospace Industry

Sunday, 2:00 PM, B306

Real-World Experiences

Arachne: Graph analytics extension for Arkouda

- Arkouda: a Python frontend for HPC
- Arachne is developed by David Bader's group at NJIT

Students in my group, without prior experience in parallel programming, were able to write and implement scalable graph algorithms in Chapel within just a few weeks.

David's Interview on Chapel Blog:

chapel-lang.org/blog/posts/7qs-bader/

RapidQ: Satellite image analysis for coral reefs

- 100s of lines of code, developed by Scott Bachman

I was able to speed it up by a factor of 10,000. I would say some of that was algorithmic… but again, Chapel had the features in the language that allowed me to do it pretty succinctly.

Scott's Interview on Chapel Blog:

chapel-lang.org/blog/posts/7qs-bachman/

Closing Thoughts

5. What would an ”Applications variant” of student cluster competitions specifically for non-CS students look like?

Meet us at the HPE Booth (2219)

Join us at CHUG

Chapel Users Group

Happy hour, Sunday 6:30PM

Der Biergarten

Chapel Educator Meetup

2nd Wednesday of Every Month

Noon, PT

Check out the Community Calendar in the Events page

chapel-lang.org/events.html


Thank you
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