The software and user interface challenge: Getting from “OK, we’ll try it” to production runs

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Agenda

• What are the issues and challenges?

• What kinds of support do these users need to get to the point where they are doing productive work?

• Is there sufficient expertise within HPC centers, or do engineering professors need to be brought in for engagement?
Using an HPC Center as a Contractor

• Business expects
  – Prepackaged solutions
  – One stop shop
  – Lots of support
  – Guaranteed delivery
  – Privacy and discretion

• Traditional model
  – Per-user customization
  – BYO (experts, apps)
  – Investigative users
  – Best effort delivery
  – Openness
Industrial support requirements

• Early engagement
  – Scaling runs to identify technical problems
  – If it’s not going to work, client wants to know ASAP

• Project management
  – Well understood internal workflow
  – Follow up and scheduled delivery with client

• “Out the door” costs
  – Hardware and software

• Usable interface
Total execution costs

- Software billed by calendar
- Hardware billed by usage
- 1 core, 2 weeks
  - HW cost: $33
  - SW cost: $1,100
- But, at reasonable scale (128 cores) and time, HW and SW costs level
Composite Materials Collaboration

• FTi produces TCON®, an alumina/silicon carbide composite material
• Variations to TCON manufacturing process induce different mechanical properties (e.g., stiffness, strength) and thermal conductivity
• For example, DoE tests in 2007 estimated that the reduced thermal conductivity of TCON will save over 0.55 trillion BTU per year for the aluminum industry
• New goal: expand range of applications
  • Processing of liquid aluminum
  • Lightweight vehicle braking systems
  • Conformal body armor

Faculty Collaboration Role

- TCON material properties now found through trial and error
- Eventual goal: predict microstructural features and macroscopic property performance given details for a specific TCON manufacturing process
- Computational modeling requires a combination of:
  - FEA (Algor) for final macro-property prediction
  - CFD (ANSYS Fluent) for porous medium flow prediction
  - Computation Chemistry (LAMMPS) for displacement chemical
    – reaction prediction at the metal-ceramic interface

Proof of concept models for FEA of TCON material

Interpenetrating Metallic Component

Ceramic with Metallic Component Enclosed
Thank You!

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