HPC Subcommittee Proposal

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Purpose

- Discuss the need for a standing working group on HPC strategy to provide advice on the current and future directions in High Performance Computing important to the SAB.
Agenda

• Trends in High Performance Computing
• Proposed Working Group
• Products of the Working Group
• How will this Working Group complements existing advisory groups within NOAA
High Performance Computing Locations

Boulder, CO
Development HPC
• xJet (721 Tflops)
• *Jet (382 Tflops)

Oak Ridge, TN
Research HPC
• Gaea (4,020 Tflops)

Fairmont, WV
Development HPC
• Theia (3,000 Tflops)
• Zeus (383 Tflops)

Princeton, NJ
Climate Post-Processing & Analysis

Reston, VA
• Tide (776 Tflops)
• Luna (2,060 Tflops)

Orlando, FL
• Gyre (776 Tflops)
• Surge (2,060 Tflops)

Operational HPC Systems
Research and Development (R&D) HPC Systems
• The High Performance Computing Industry is presenting NOAA with many challenges in improving our science capacity
  • Traditional processors no longer provide large performance increases from generation to generation
  • Fine Grain/Many Core Architectures
    • Graphics Processing Units, Advanced RISC Machine, Xeon Phi
    • Optimized for a higher degree of parallelism
    • Large number of simple cores geared for high throughput
    • Higher latency and lower performance per process
  • Fine Grain/Many Core Processors are becoming larger competitors in the HPC market and will become even more common as we move into exascale architectures
Trends in HPC

- Fine Grain computing introduces increased complexity
  - Increased requirement for parallelism (1,000’s to 1,000,000,000’s processes)
  - Increasing size and complexity of HPC systems increases challenges for reliability

- 86 of the Top500 list now use fine grain computing
  - 10 use it primarily

- Other metrological agencies have already begun planning for, and adapting code to, these new architectures
SENA Project
Software Engineering for Novel Architectures

• Prepare codes for future production architecture
  • Must monitor the evolution of these architectures
• Maintain codes in a way that subject matter experts can still work with the code
• Codes should still be viable for current architectures
  • Performance is expected to increase on across new and old architectures
• Develop software engineering expertise within NOAA
• To ensure that NOAA is adequately preparing and planning for exascale architectures, the HPC program would like to seek advice from the SAB and a specialized subcommittee comprised of academic, industry, and government experts.

• This advice will build on the program’s existing roadmap and strategy, improving NOAA’s ability to provide increasingly reliable and accurate model results at finer resolution.
Working Group Description

• It is envisioned that the subcommittee will be comprised of 12-15 members who are recognized leaders within the HPC and scientific computing community
  • Membership could include:
    • University Partners
    • National Laboratory Staff
    • HPC program staff from other government agencies
    • Foreign government weather agencies
    • NGO
    • Industry

• Quarterly Meetings

• Yearly Face to Face Meeting
Working Group Deliverables

• A yearly report based on NOAA’s existing HPC Roadmap
  • Yearly recommendations on technologies that NOAA should be investigating
  • Feedback on NOAA’s 5 - 10 year HPC roadmap
  • Yearly advice to the SAB regarding the OCIO’s HPC strategic plan
Existing Advisory Groups

- The working group will complement existing modeling advisory committees within NOAA (e.g., UMTF, SAB-CWG, UMAC).
  - The subcommittee will take modeling requirements from these advisory groups to shape the technical and roadmap recommendations to the SAB
  - The SAB’s recommendations can be used by the modeling committees to plan for potential future capabilities and capacity
  - The SAB’s recommendations can also be used by the NOAA HPC Board to provide more accurate planning for NOAA’s scientific HPC capacity
Thank You

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