## BOG 7 Compilers, Libraries, Runtime Contributors

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**BOGists:**

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Prog Env Capability Targets for Extreme Heterogeneity

BOG X brainstorming and discussion of capabilities that will be needed in the 2025-2035 timeframe to make increasingly heterogeneous hardware technologies useful and productive for science applications.
BOG X Targets for 2030

Target 1:

Target 2:
BOG X Current Status

BOG X survey describing the current status of science, technology, or practice related to this theme (starting with material directly from the FSD).
BOG X Current Capability

Capability 1:

Capability 2:
BOG 7: Compilers, Libraries, Runtime Challenge Assessment

- Enormous space of possible mappings of computation and data
  - Accelerators want data organized in different ways than each other and CPUs
  - Difficult for the application developer to reason about and manage all the data movement
- Lack of knowledge of HW either because IP or being planned
  - How to expose specialized functional unit capabilities to compiler?
  - How to do basic and HPC compilation for new, “exotic” architectures?
- Performance models like the Roofline need to be re-thought to include more possible performance bottlenecks
- Need more options for providing information to the compiler and runtime
- How do we get architecture-specific optimizations into compiler infrastructures
- How do you coordinate between different compilers for heterogeneous and hierarchical components in the system?
BOG X: list of key research challenges

Challenge X.1

Challenge X.2
BOG 7: Compilers, Libraries, Runtime: Possible Research Directions Summary

PRD 7.1 - Orthogonal program storage and scheduling strategies at compile time and runtime, potentially with the aid of machine learning

PRD 7.2 - HPC HW abstractions between ISA and BLAS, layer of coordination between the vendors. Interconnect capability for PGAS as an example.

PRD 7.3 - New compiler optimizations, especially for data locality, and somehow make those more immediately accessible in vendor compilers
PRD X.n: Short title of possible research direction

- One paragraph description (3 sentence/bullet)
- Research challenges
  - Metrics for progress
- Potential research approaches and research directions
- How and when will success impact technology?