

# Vanguard: Maturing the ARM Software Ecosystem for U.S. DOE Supercomputing

Sandia National Laboratories

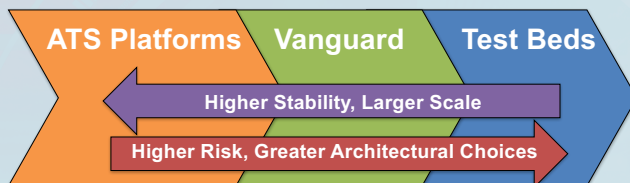
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## VANGUARD

### Problem

- **Contraction of HPC ecosystem**
  - Fewer choices available for large-scale Advanced Technology System (ATS) platforms
- **Emerging 64-bit ARM processors promise to be competitive with existing HPC processors**
  - Gaps identified in the software ecosystem
- **Vendor software stacks for ATS-class systems have become increasingly proprietary**
  - Limits ability of the laboratories and HPC community to influence and impact

### Vanguard Approach



- **Accelerate maturity of emerging technologies for U.S. DOE NNSA supercomputing**
  - Appropriate scale experimental systems
    - *Large enough to serve as proof of concept for future ATS platforms*
  - Appropriate level of investment
    - *Gain and maintain vendor and collaborator attention*
  - Appropriate level of risk
    - *Goals target mission workloads but not turn-key production support*
- **ARM 2019 platform requirements**
  - 64-bit ARM processor
  - On-package high-bandwidth memory
  - Advanced HPC interconnect
  - Analyze and address gaps in software ecosystem

### ARM Systems

- **Early 64-bit ARM investigations started in 2014 with HPE Moonshoot testbed**
- **Early access Cavium Thunder X2 May 2017**
- **Software Readiness Testbed 2018**
- **Large-scale ARM64 system 2019**

### ARM Software Stack Effort

- **Harden compilers, math libs, and tools**
  - SVE support and optimizations
  - Track performance improvements over time
- **Pursue new usage models with a more open and modular system software stack**
  - Target HPC and emerging AI + ML workloads
  - Flexibility to deploy alternative software stacks
    - *OpenHPC, TOSS and Lightweight Kernel operating systems*
  - Containers and virtualization support
- **Tri-lab (Sandia, Los Alamos, and Livermore) team working closely with vendor, ARM and HPC communities**

### Significance

- **Vanguard allows the DOE to take necessary risks to ensure a healthy HPC ecosystem for future production mission platforms**
  - Increase technology choices
- **Prove viability of ARM as candidate for large-scale HPC platforms**
  - Specifically for future ATS platforms and U.S. DOE NNSA supercomputing workloads



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