

## **Information for researchers responding to the National Science Foundation's Petascale Computing Resource Allocations solicitation**

The design and implementation of computing codes that can fully exploit Blue Waters, a powerful next-generation computing system capable of delivering sustained performance in excess of one petaflop on a broad range of complex science and engineering problems, may require extensive revision for some science and engineering applications. The National Science Foundation recently released a [solicitation](#) to identify groups who among other things:

- Plan to use petascale computing for ground-breaking science and engineering research.
- Have the need for a unique resource like Blue Waters.
- Are likely to be ready to use Blue Waters effectively when it comes online in 2011.

Those groups who successfully respond to this solicitation will be granted a pre-allocation of Blue Waters resources and a small amount of funding to support travel costs. The Blue Waters project team will provide consulting support for these projects. According to the solicitation, “In the months prior to Blue Waters entering production in mid-2011, groups receiving awards under the current competition will be asked to submit a request for a final allocation. Reviewers of the final allocation requests will be asked to review progress and readiness.”

This document outlines additional information about Blue Waters for those responding to the NSF solicitation. No further information will be released on Blue Waters for the 2008 submissions. Those who successfully respond to the solicitation may request more detailed information from IBM under a non-disclosure agreement.

### *System hardware*

Blue Waters will be based on IBM's Power7 architecture:

- The Power7 is based on advanced multicore processor technology.
- More than 200,000 cores will be available to applications running on the system.
- Blue Waters will be capable of optimized simultaneous multithreading (SMT) and has vector multimedia extension (VMX) capability.
- The cache architecture will feature multiple levels of cache (private L1 and L2 caches for each core and an L3 shared cache).
- There will be 32 or more gigabytes of memory per SMP.
- There will be more than 10 petabytes of user disk available.
- The interconnect fabric will feature significantly reduced latency and increased bandwidth. It will be able to overlap computation with I/O and node communication through RDMA technology.

### *System software*

Blue Waters software will include Fortran, Co-Array Fortran, C/C++, and UPC compilers. It will use a GPFS file system.

### *Applications software*

Blue Waters will support the MASS, ESSL, and Parallel ESSL math libraries. It will also support MPI I/O.

### *Programming models and environments*

Blue Waters will support:

- MPI and MPI2.
- OpenMP for shared memory.
- Partitioned Global Address Space languages.
- Low-level active messaging layer.
- Eclipse-based application framework to support development.
- Debugging tools.
- Tuning, including the use of the HPC and HPCS Toolkits.
- The Cactus framework.
- The Charm++ infrastructure.

### *Operation*

Blue Waters will support:

- Debugging at scale.
- Batch and interactive access.
- Application checkpointing, with data compression where appropriate.
- Block time allocation.

### *Interim systems*

Other platforms will be available for application development and code testing before Blue Waters becomes available in 2011. These include:

- Power 575+ system at NCSA with 120 16-way nodes (1,920 cores).
- A small Power6 system at NCSA.
- Multicore systems that are available through the TeraGrid allocations process, including an AMD Cray system at Oak Ridge National Laboratory, an AMD Sun cluster at the Texas Advanced Computing Center, and NCSA's Intel-based Abe cluster.

### *Applications support*

NCSA has established a Blue Waters Consulting Office to provide assistance to prospective users of the Blue Waters system to enable them to port and optimize their applications for this extraordinary resource. The consulting staff have expertise in application porting and optimization, multicore technology, approaches to scalability and fault tolerance, compilers, debugging and performance tools, I/O, visualization, algorithms, libraries, and code development environments. The Consulting Office will be staffed from 8:30 a.m. to 5 p.m. Central, Monday through Friday, to provide in-person, phone, and email assistance.

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