TITLE:

High Performance Geometric Multigrid (HPGMG): an HPC Benchmark for Modern Architectures and Metric for Machine Ranking

100-word abstract:

This meeting facilitates community participation with the HPGMG project. HPGMG is a compact benchmark to both provide architects with a tool for driving new architectures and a metric for extreme scale systems with generality comparable to High Performance Linpack (HPL). HPGMG is sensitive to multiple aspects of architectures that inhibit performance of HPC applications. We encourage community participation with contributed talks and will host an open discussion of issues relevant to extremes scale benchmarking. We present a biannual release of HPGMG metric data with analysis to provide insights into the efficacy of TOP500 machines for modern applications.

500-word abstract:

This is the second BoF for the HPGMG extreme scale architecture benchmark and metric. The first BoF at SC14 drew approximately 100 attendees and resulted in the desired exchange of ideas for a new extreme scale benchmark and metric. In this past year the number of visitors to our repository has increased to about 1000 per month.

This year we aim for similar success in stimulating a discussion of benchmarking issues with speakers from the HPGMG team, metric users and submitters to the HPGMG database, and researchers on topics relevant to HPGMG, followed by an open discussion with the audience and speakers. Users of HPGMG, and researchers in benchmarking and advance programming models, that are interested in speaking, are encouraged to contact us. Centers interested in submitting results are encouraged to visit our web page (https://hpgmg.org) or the repository (<https://bitbucket.org/hpgmg/hpgmg>) for instructions.

We announce a biannual release of the HPGMG measurements and, like the TOP500, the next release will be announced at ISC. While the precise specification of the metric is still evolving, the high level design - full geometric multigrid solve of a high order discretization of the Laplacian - is stable. We augment the TOP500 listing with HPGMG results and provide additional analysis to gain insights regarding the architecture and performance characteristics of TOP500 machines.

This project is motivated by the loss of effectiveness of the HPL benchmark as a proxy for a wide variety of application relevant to the HPC community, although HPL continues to be an effective proxy for applications based on dense linear algebra.

HPL benchmark is the most widely recognized metric for ranking high-performance computing systems. When HPL gained prominence in the early 1990s there was a strong correlation between its predicted ranking of a system and the efficacy of the system for full-scale applications. Computer system vendors pursued designs that would increase HPL performance, which would in turn improve overall application performance. This has ceased to be the case and in fact the opposite is now true. HPL rankings of computer systems are no longer well correlated to real application performance, which use more work optimal algorithms with high bandwidth and low latency requirements.

We will begin with short talks from the HPGMG developers, who will introduce the 4th order HPGMG-FV implementation, provide high-level performance challenges compared to the 2nd order implementation, and discuss performance observations on various DOE HPC platforms including the observation of attaining up to 28% of peak on a Cray XC30 (Ivy Bridge). We will discuss general benchmarking issues for extreme-scale computers and provide a quantitative performance model, with validation, of HPGMG-FV.

We will continue with talks from users of HPGMG and researchers in the benchmarking community. Interested speakers are invited to contact us about giving a short presentation. We will conclude with a half hour discussion session where the public is invited to ask questions of the developers and speakers.