TITLE:

High Performance Geometric Multigrid (HPGMG): an HPC performance benchmark

100-word abstract:

This meeting facilitates community participation in the HPGMG project. HPGMG is a compact benchmark designed as a design tool for emerging architectures and a ranking metric. HPGMG is well balanced with respect to modern HPC applications and algorithms. We compile the HPGMG list of the world’s largest supercomputers with the metric, a multigrid solve of a fourth order accurate finite volume discretization of the Laplacian. Our first SC BoF was in 2014 and we released our first list at ISC16, and continue with our next biannual release at SC17. We encourage community participation with submissions to the HPGMG list, and contributed talks and discussion in the BoF.

500-word abstract:

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. HPGMG is designed to have machine sensitivities that correlate well with the sensitivities of HPC applications.

Our first SC BoF for the HPGMG project was at SC14. We presented the first official HPGMG list at ISC16 and present the next list in this BoF. We provide analysis to gain insights regarding the architecture and performance characteristics of top500 machines.

This year we have several interesting new machines to discuss. We have the first entry for the full *Cori* KNL machine at NERSC, which was our No. 1 machine in the June 2017 list. In a close second place the [Sunway *TaihuLight*](https://en.wikipedia.org/wiki/Sunway_TaihuLight) machine used 131,072 processes with 65 cores each to solve the largest Lapalcian ever explicitly solved with 4.4 trillion equations, and required a new implementation of the kernels in the preferred programming model/language of *TaihuLight*. We will also present the early HPGMG data from the *summitdev* machine with 32 nodes and 128 GPUs. We thus have three new machines to present data on:

1. *Cori*/KNL with 8K nodes (#1 rank)
2. Sunway *TaihuLight* with 131,072 processes (#2 rank)
3. The new IBM-Nvidia development machine *summitdev* with 32 nodes and 128 Pascal GPUs

We aim for stimulating a discussion of benchmarking issues with speakers from the HPGMG team, 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 interested in speaking are encouraged to contact us. Centers interested in submitting results are encouraged to visit our web page (<http://crd.lbl.gov/projects/hpgmg>) and the repository (<https://bitbucket.org/hpgmg/hpgmg>).

We will begin with short talks from the HPGMG developers, who discuss the HPGMG metric, and provide performance data and analysis. 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 conclude with an open forum and discussion with the audience and speakers.