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HPGMG: Benchmarking computers using multigrid

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HPGMG (https://hpgmg.org) is a geometric multigrid benchmark designed to measure the performance and versatility of computers. For a benchmark to be representative of applications, good performance on the benchmark should be sufficient to ensure good performance on most important applications and only those system features necessary for some important applications should be stressed by the benchmark. Moreover, the specification should be scale-free and the method should solve a globally-coupled problem. FMG with highly parallel smoothers and a matrix-free representation of the operator has most of the desirable attributes and we have developed benchmark implementations using finite volume and finite element methods. Both implementations stress the network similarly, and can clearly distinguish different network types, but have quite different on-node characteristics due to different arithmetic intensity, cache demands, and the fact that a non-overlapping partition of the data is not a partition of the work. In this talk, I will present the benchmark design, performance results on many top machines, and remaining challenges for this benchmarking effort.