Programming for 1.6 Million cores: Early experiences with IBM’s BG/Q SMP architecture\(^1\)

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With the stall in clock cycle improvements a decade ago, the drive for computational performance has continues along a path of increasing core counts on a processor. The multi-core evolution has been expressed in both a symmetric multi processor (SMP) architecture and cpu/GPU architecture. Debates rage in the high performance computing (HPC) community which architecture best serves HPC. In this talk I will not attempt to resolve that debate but perhaps fuel it. I will discuss the experience of exploiting Sequoia, a 98304 node IBM Blue Gene/Q SMP at Lawrence Livermore National Laboratory. The advantages and challenges of leveraging the computational power BG/Q will be detailed through the discussion of two applications. The first application is a Molecular Dynamics code called ddcMD. This is a code developed over the last decade at LLNL and ported to BG/Q. The second application is a cardiac modeling code called Cardioid. This is a code that was recently designed and developed at LLNL to exploit the fine scale parallelism of BG/Q’s SMP architecture. Through the lenses of these efforts I’ll illustrate the need to rethink how we express and implement our computational approaches.

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