Julian Kunkel's Papers

Title and Abstract

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1 HDTrace - A Tracing and Simulation Environment of Application and System Interaction

HDTrace is an environment which allows to trace and simulate the behavior of MPI programs on a cluster. It explicitly includes support to trace internals of MPICH2 and the parallel file system PVFS. With this support it enables to localize inefficiencies, to conduct research on new algorithms and to evaluate future systems. Simulation provides upper bounds of expected performance and helps to assess observed performance as potential performance gains of optimizations can be approximated.

In this paper the environment is introduced and several examples depict how it assists to reveal internal behavior and spot bottlenecks. In an example with PVFS the inefficient write-out of a matrix diagonal could be either identified by inspecting the PVFS server behavior or by simulation. Additionally the simulation showed that in theory the operation should finish 20 times faster on our cluster - by applying correct MPI hints this potential could be exploited.

2 Towards an Energy-Aware Scientific I/O Interface

Intelligently switching energy saving modes of CPUs, NICs and disks is mandatory to reduce the energy consumption.

Hardware and operating system have a limited perspective of future performance demands, thus automatic control is suboptimal. However, it is tedious for a developer to control the hardware by himself.

In this paper we propose an extension of an existing I/O interface which on the one hand is easy to use and on the other hand could steer energy saving modes more efficiently. Furthermore, the proposed modifications are beneficial for performance analysis and provide even more information to the I/O library to improve performance.

When a user annotates the program with the proposed interface, I/O, communication and computation phases are labeled by the developer. Run-time behavior is then characterized for each phase, this knowledge could be then exploited by the new library.