Multi-node advanced performance and power analysis with Paraver

Filippo MANTOVANI [a] and Enrico CALORE [b,1],
[a] *Barcelona Supercomputing Center, Spain*
[b] *INFN and University of Ferrara, Italy*

Keywords. Performance, Power, Energy, Analysis, Paraver, Cluster

1. Introduction

Performance analysis tools allow application developers to identify and characterize the inefficiencies that cause performance degradation. Profiling and analysis is often the first step towards the optimization of an application. Also, being able to observe and measure the behaviour of parallel applications "at scale", or at least in a multi-node context, can show unexpected behaviours and insightful information about performance bottlenecks. The *Extrae* instrumentation library [1] is able to collect performance traces of parallel applications with minimal overhead, while *Paraver* [1] is a post-mortem advanced trace visualizer.

2. Contribution

One of the main contributions of this study is the Paraver plug-in, developed within the Mont-Blanc project [2], with which it is possible to visualize, navigate and correlate performance and power traces of multi-node parallel applications. This plug-in has been developed with the objective of correlating performance and power in order to highlight valuable information, exploitable by developers to better understand where energy is consumed in their applications. This knowledge allows to improve energy-awareness in general, but can also help developers to improve applications' energy-efficiency.

Figure 1 shows a typical Paraver view of the traces acquired while running a multi-node application. This allows to correlate a generic performance metric (e.g. Instruction Per Cycle, IPC), with the power drain. The trace reported in Figure 1 refers to a Lattice Boltzmann simulation, in which is easy to identify compute-bound (high IPC regions), memory-bound (low IPC regions) and synchronization phases. For each phase we can identify its length, its average power drain, and thus its energy consumption. In such situation, this tool can be useful to spot candidate phases where to apply power-saving

[1] Corresponding Author: Filippo Mantovani, Barcelona Supercomputing Center; C. Jordi Girona, 29 – 08034 Barcelona (Spain); E-mail: filippo.mantovani@bsc.es