Contribution ID: **42** Type: **Short talk**

Optimizing iterative applications using a data-flow programming model

Thursday 23 March 2023 16:20 (10 minutes)

Many HPC applications display iterative patterns, where a series of computations and communications are repeated a specific number of times. This pattern happens, for example, in multi-step simulations, iterative mathematical methods and machine learning training. When these applications are coded using data-flow programming models, much time is spent creating tasks and processing dependencies which are then repeated in regular patterns. This may cause scalability problems or excessive overheads when using very small tasks.

To tackle this issue, we present a new construct for the OmpSs-2 programming model, the *taskiter*, allowing users to annotate loops where the same task DAG is generated for every iteration. This task DAG is then processed and transformed into a cyclic format, allowing the reuse of the first iteration's tasks and dependencies, drastically reducing runtime overhead for successive iterations. Moreover, this cyclic transformation considers the fine-grained dependencies between tasks from each iteration, allowing the overlapped execution of tasks from multiple iterations.

The taskiter construct has already obtained significant performance benefits on OmpSs-2 benchmarks, especially when combined with the runtime's optimized scheduling features. This short talk aims to find collaboration opportunities to port real-world or proxy applications that can benefit from the low-overhead OmpSs-2 dataflow model.

JLESC topic

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Session Classification: Short Talks on Workflows, I/O and Frameworks

Track Classification: Programming languages and runtimes