15th JLESC Workshop



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CharmTyles: Large-scale interactive Charm++ with Python

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Python is emerging as a high-productivity language favored by many application scientists and engineers in simulation/modeling, data analytics, and machine learning. Interactive parallel computing is another related trend, especially for analyzing graphs in addition to the above. The CharmTyles project is aimed at addressing these needs while providing a highly efficient and adaptive parallel runtime.

CharmTyles provides abstractions based on a client-server model with a python frontend running in a Jupyter Notebook on the user's machine and a Charm++ backend server running on a parallel machine. The broad view is that of multiple collections of *tyles*, spread over an elastic parallel machine, either in the cloud, a cluster, or a supercomputer, orchestrated from the frontend and assisted by the Charm++ runtime system in the backend. In this work-in-progress talk, we introduce CharmTyles and describe preliminary implementations of the abstractions it supports: a NumPy-based dense linear algebra library, and a stencil library for structured grid computations. We discuss lazy evaluation and message coalescing, optimizations to reduce the communication cost between the frontend and backend. We use JIT compilation on the backend to enable standard compiler optimizations such as vectorization and loop fusion.

The broad vision of this project is highly ambitious, and we seek collaborations to fulfill it.

JLESC topic

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