

A high-level C++ approach to asynchrony and faults in MPI

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Exa-scale application pose many new challenges for developers. Two particular problems are the growing communication overhead and the increased probability of faults.

A common approach to leverage the impact of communication is to introduce asynchronicity and overlap communication and computation. In order to properly handle faults MPI extensions (in particular ULFM) were proposed to detect faults using a low-level API.

In high-level C++ simulation codes implementing these techniques increases the code complexity significantly and often the low-level APIs don't play well with modern C++ programming paradigms. We present an approach that adds extends the concepts of error propagation via exceptions and asynchronous operations of future-promise to MPI.

We discuss how these techniques are used to improve performance and reliability of our simulation code in the EXA-DUNE project. A particular use-case are asynchronous local failure local recovery resilience approaches.