SUPERCOMPUTING 2014

November 16-21, 2014

Session: Big Data Analysis

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EFFICIENT I/O AND STORAGE OF ADAPTIVE RESOLUTION DATA

Abstract

We present an efficient, flexible, adaptive-resolution I/O framework that is suitable for both uniform and Adaptive Mesh Resolution (AMR) simulations. In an AMR setting, current solutions typically represent each resolution level as independent girds which often results in inefficient storage and performance. Our technique coalesces domain data into a unified, multi-resolution representation with fast spatially aggregated I/O. Furthermore, our framework easily extends to importance-driven storage of uniform grids, for example, by storing regions of interest at full resolution and nonessential regions at lower resolution for visualization or analysis. Our framework, which is an extension of the PIDX framework, achieves state of the art disk usage and I/O performance regardless of resolution of the data, regions of interest, and the number of processes that generate the data. We demonstrate the scalability and efficiency of our framework using the Uintah and SCD large-scale combustion codes on machines Mira and Edison.