The growth of High-Performance Computer (HPC) systems increases the complexity with respect to understanding resource utilization, system management, and performance issues. HPC performance monitoring tools need to collect information at both the application and system levels to yield a complete performance picture. Existing approaches do not allow the users to do meaningful analysis on an actionable timescale. Efficient infrastructures are required to support large-scale systems performance data analysis for both run-time troubleshooting and post-run processing modes. In this dissertation, we present methods to fill these gaps in the infrastructure for HPC performance monitoring and analysis.

First, we enhance the architecture of a monitoring system to integrate streaming analysis capabilities at arbitrary locations within its data collection, transport, and aggregation facilities. Next, we present an approach to streaming collection of application performance data. We integrate these methods with a monitoring system used on large-scale computational platforms. Finally, we present a new approach for constructing durable transactional linked data structures that takes advantage of byte-addressable non-volatile memory technologies. Transactional data structures are building blocks of in-memory databases that are used by HPC monitoring systems to store and retrieve data efficiently. We evaluate the presented approaches on a series of case studies. The experiment results demonstrate the impact of our tools, while keeping the overhead in an acceptable margin.

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The public is welcome to attend.