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Cutting Edge of High Performance Computing
- HPC Cloud and Exa-scale Programming -

高性能計算最前線
― 高性能計算クラウドとエクサスケールプログラミング ―

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In this seminar, I'll talk about two hot topics on High Performance Computing, High Performance Computing Cloud (HPC Cloud) and Programming for Exa-scale applications.

(1) Cloud is well known as its advantages such as the ability to provide customized software environment for each user, the elasticity by scale out, and energy efficiency. However, the overhead of virtualization had been too large for HPC. We are building an HPC Cloud on supercomputers at AIST, utilizing the latest research results on virtualization and resource managements. On our HPC Cloud, Virtual Machine Monitor (VMM)-bypass I/O technologies significantly reduce the overhead caused by virtualization, by which Cloud becomes a feasible platform for HPC. In addition, automated translation of virtual machines (e.g., between different hypervisors) and network virtualization realize the scale out of Cloud infrastructure by federated use of supercomputers provided by research institutions, universities, and commercial cloud providers.

(2) Forthcoming exa-scale computers consist of a huge number of components, and failures among the components are no longer a rare event.　Because of the unstable environment, exa-scale applications are required to be not only scalable, but also fault resilient. To reduce the programming effort required by exa-scale applications, we are developing Falanx, a middleware suite for fault resilient programming. This middleware insulates program execution from system failures, by means of a resource manager for task scheduling and a data store for data protection.　The middleware is built on top of MPI with User-Level Failure Mitigation (ULFM-MPI), allowing easy migration from the traditional MPI programming model.

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