Distributed Computing and High-Speed Networks

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Distributed computing is becoming an alternative to traditional high-performance computing based on central supercomputers. In this case, computing resources of many distributed low performance computers can be bundled to clusters, in which many computers collaborate in order to solve a given problem by parallel processing. Nevertheless, supercomputers are still needed for certain problems and users need access to those high-performance computing resources. For both scenarios, powerful communication infrastructures such as high-speed networks and interfaces are needed in order to interconnect high-performance computers and allowing users to access computing resources. In particular, the Internet has already or will become an enabling technology for distributed / high-performance computing and will play a more important role for interconnecting computing resources and users over the wide area in the future. High-speed Internetworking technologies will enable applications such as distance learning, remote device control, virtual reality, and DNA analysis. The 29th SPEEDUP workshop on "Distributed Computing and High-Speed Networks" has addressed several issues on high-speed networks and communications, distributed systems and applications, as well as latest trends in distributed high-performance computing. The workshop provided an excellent opportunity to bring together members of academic institutions, private enterprises and government who are interested in obtaining an overview of the state-of-the-art of these areas.

This issue of the Electronic Notes on Future Generation Computer Systems consists of a selected set of papers presented at the 29th SPEEDUP workshop.

A basic requirement for GRID computing are high-speed networks operating at least with Gigabit/s or even Terabit/s speeds. While several developments in that area have already been deployed in academic and commercial networks, several issues are still in a research phase. In particular, charging and

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accounting belong to those. Stiller et al. describe in their paper an extremely innovative approach to support charging value-added services in high-speed networks. The fact that charging on a per-packet basis is not feasible in networks with such speeds is very challenging. The Cumulus Pricing scheme seems to be a promising step to solve this problem. It remains an open but interesting question whether charging high performance computing services can benefit from similar concepts.

High-Speed networks are the basis for high-performance computer clusters. Gruber reports on the activities performed within the Swiss-Tx project. Up to 70 processor are integrated into such a cluster. The paper provides a comprehensive description of the system design and discusses several design choices.

More classical applications of parallel computer systems are solving optimization problems. Schneider presents an algorithm tailored for solving combinatorial optimization problems on parallel systems. The algorithms makes use of the fact that many solutions are based on similar parts, so-called backbones.

More recent applications of high performance networks and computers are virtual reality and distance learning. Joslin et al. present a distributed virtual reality system capable to animate bodies in real-time. The virtual scenes consisting of avatars representing the users are computed on a multi-threaded server system based on sensor signals.

Guggisberg presents a virtual laboratory for experiments in nanoscience. The projects belongs to a series of projects within the framework of the Swiss Virtual Campus. The projects target is to provide an infrastructure for simulating virtual nanoscience experiments and for controlling real experiments from remote workstations. The overall system architecture relies on a client/server model. Powerful server systems and high-performance networks are crucial for satisfying the user's requirements.

Finally, Baumgartner brings the topics of high-speed networks and distributed / parallel computing together again. He presents a system capable to emulate large IP networks for the purpose of performance evaluation on a small set of computers. The approach benefits from powerful computing resources and is able to run on parallel computers or distributed computer clusters. Emulated parts of a network can be integrated with "real" IP networks. The system targets to evaluate novel communication system components, e.g. packet scheduling, but is also promising to support computer network training.

Finally, I want to thank all authors for their papers, the speakers for their stimulating and encouraging talks during the workshop, the numerous participants for attending and discussions, the SPEEDUP committee for helping to set up the program and my colleagues at University of Berne for the workshop organization.