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Guest Editorial on Cluster Computing in the Internet

The growing popularity of the Internet along with the availability of powerful computers and high-speed networks is changing the traditional way of computing. The Internet technologies facilitate the coupling of a wide variety of geographically distributed resources such as computers, clusters, and storage systems, and allow them to be used as a single unified resource. This new computing paradigm, cluster computing in the Internet, is making researchers and developers rethink the way of designing and implementing applications. However, real cluster computing will not come until the software infrastructure that controls individual units and provides a framework for cooperative operations is fully developed.

The infrastructure based on message passing paradigm that was built decades ago has made great impact on the parallel execution across the networks. However, more and more application developers come to realize that cluster computing is the concept that suits better to many applications. For this purpose, far more work is required and serious challenges must be addressed for resource management, scheduling, and administration in cluster systems. New algorithms are needed for complex applications such as web servers, e-commerce applications, parallel computing, and distributed systems. This special issue addresses some of the technology challenges faced by researchers and presents their latest findings in design for the next generation of Internet technologies and applications.

The 8 papers in this special issue are organized as follows. The first paper by Adreolini et al., proposed a new architecture of web servers consisting of a front-end node called web-switch and a cluster of data-servers. The web server can differentiate user's expectations with multi-class *Service Level Agreements* and provide QoS-enhanced services. The paper by Sit et al., introduced a cluster-based web server system, *Cyclone*, which uses a novel network support mechanism called socket cloning, together with the technologies of clustering of server nodes and replication of data objects at multiple server nodes. Grid computing systems are emerging as a computing infrastructure that facilitates the use of computing resources over the Internet as a huge computing system. Azzedin et al. presented a resource allocation mechanism for Grid computing systems, which can assure quality of service (QoS) and maximize resource utilization. Another fundamental issue for performance improvement in cluster computing is load distribution. Lu et al. proposed a load distribution algorithm based on the concept of *anti-tasks* (a kind of mobile agents). To reduce the network cost incurred by those *anti-tasks*, an algorithm was developed to limit the number nodes an *anti-task* may travel within $\sqrt{N}$. The paper by Nomoto et al. presented a parallel programming environment called "distributed shared array", which provides an abstraction of globally shared array across different machines connected by the Internet. This mechanism would make parallel programming for cluster systems much easier. Satoh presented a framework for migrating mobile agents over the Internet. The frame work enables dynamic change and deployment of network protocols for agent migration. It is an important mechanism for resource management and collaborative computing in cluster systems. The next paper by Leung et al. presented an application of agent technology in e-marketplaces. It proposed a mechanism to control the agent population to reduce both the communication and computing cost incurred by agents. The last paper of this special issue, by Cardei et al., introduces a resource management infrastructure for mobile ad hoc networks. The scheme is particularly target for the network where nodes are clustered into groups.

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