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About the Queue Organization in the Multiprocessor Computing Systems

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The development of distributed and parallel computing systems is caused by the tasks of information search, multi-agent intelligent systems, and storage of large amounts of data and research on various scientific directions. Many tasks of modeling in science and technology require more and more accuracy and timeliness of their calculation, i.e. fast computational resources.

Before these similar tasks could be solved within the common powerful computers, today there are already tasks requiring decisions within large supercomputing facilities.

The development of scientific research in e-infrastructure can be implemented on a combination of computational resources within the Grid-system.

The implementation of Grid technologies allows building management systems of distributed computing resources in which it is not important for the user at what particular node of network his task is executed. Grid is different from services of Internet ([1]) which supports not only work with the distributed information, but also uses the services of distributed computing capacities for performance of users' applications.

In the base of Grid-system there are powerful computing clusters consisting of many multiprocessor nodes. As a rule, clusters solve the problems in which the interaction between separate computing nodes is organized by means of transferring messages.

Grid-systems are not intended for decision of parallel tasks, but are intended for the solution of batch tasks, when each separate parallel task is executed entirely on one node. The queue system of tasks manages different tasks.

The operational performance of task in Grid-environments requires organizing the dynamic distribution and the management of resources. For that new models and methods are required. One of the most important aspects of computing systems is the availability of a flexible system of queuing. It should be noted that the parameters of running tasks contain information about the number of required processors, the quantity of required memory and disk memory with input and output data, as well as may contain temporary parameters such as duration and the terms of running tasks.

In this case, there are some tasks of optimum use of computing resources, by means of redistributing tasks between queues inside the Grid-system. These tasks also include the process of stopping the running tasks, transferring them to a new turn and restart to continuation.

The optimal use of processor time in multiprocessor systems of cluster type depends from many factors, such as the method of receptions and productions tasks in queue, the definition of order performance, the opportunities of computing resources dynamic distributions ([2, 3]), the opportunities of transferring task on various performance phases into minimally necessary environment or performance stop with opportunity of continuation, etc.

Reception tasks in the system for service plays important role in organization of its process. The opportunity of distributed processes interactions in determined intervals of time requires the synchronization and simultaneous performance as in one so in different computing systems. Therefore, the acceptance of tasks from queue for the service imposes the responsibility on scheduler for supplying its duly performance.

Let a computing system consisting from N processors (N≥1) act with flow tasks. Every task is characterized by three parameters (v, τ, ω), where v -the number of processors, necessary for performance tasks, τ - maximal time, required for performance, ω - admitted time for holding tasks in queue before performance beginning.

In received moment, the task can be accepted for service only on condition of its performance opportunities in term. In opposite case it receives failure in service.

The algorithm of checking conditions for opportunities is described for various restrictions on order performance.

References

1. Ian Foster, Carl Kesselman, Steven Tuecke, The Anatomy of the Grid: Enabling Scalable Virtual Organizations, Journal International Journal of High Performance Computing Applications, Volume 15 Issue 3, August 2001
2. T.Grigoryan ,V.Sahakyan Dynamic Resource Manager for Clusters, Proceedings of Conference. Computer Science and Information Technolgies, 2005
3. Astsatryan H., Yu.Shoukouryan, V.Sahakyan, M. Daydé, A.Hurault, M.Pantel, E.Caron, A Grid-Aware Web Interface with Advanced Service Trading for Linear Algebra Calculations, High Performance Computing for Computational Science, VECPAR2008, Lecture Notes in Computer Science 5336 Springer 2008, pp. 150-159, Toulouse, France, June 24-28, 2008.