

Fitting the statistical module of the adaptive grid scheduler to the data of the NIIF

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Distributed computer systems are becoming prominent in various application areas. An important requirement is to create such large, geographically distributed systems (grids) whose elements are connected by a wide-area network, heterogeneous in every aspect, yet provide a traditional desktop environment for users. These systems must support various tasks, such as execution of computation intensive and data intensive applications, supporting distributed collaboration and providing problem solving environments, whose resource demand and execution characteristics are very different.

There are many unsolved problems in large distributed heterogeneous environments. One of the most important ones is grid scheduling. It is not enough to know the hardware parameters of the resources for the best scheduling; we also need to estimate the overall run-time (waiting + wallclock time) of a job of a given queue. Job execution is a stochastic process; therefore the grid scheduler needs to be an adaptive system. The data processing module of the adaptive grid scheduler estimates the distribution of the typical run-time of the system as a random variable, after this it identifies the parameters of the given distribution. As the procedure requires a large database, for being efficient the purpose is to solve this part of the task with process migration and to send the output parameters towards the statistical module with minimal network overload. Another input parameter of the statistical module is the length of the queue. The overall run time as a random variable is the sum of independent random variables with the same distribution and parameters. ($\eta_k = \xi_1 + \xi_2 + \dots + \xi_k$, where k is the length of the queue) Calculating the distribution of η_k in some particular cases - e.g. when the distribution of ξ_i -s being exponential - is not so difficult. In case of more complicated distributions the statistical module can only identify some characteristic values of the distribution. The expected value is for example $E(\eta_k) = k \cdot E(\xi_1)$. The estimation of the quintiles will be done by simulations.

In the presentation we will provide an overview of the architecture and the operating mechanism of the planned grid scheduler. We will present the distribution and parameters that fit the best the run-time as a random variable calculated from the job logs of the NIIF supercomputer. Then we characterize the calculated lengths of the job queues. Using the results we compare the calculated values of our model with the real run-times.