An Adaptive Framework for WCDMA System Analysis in the EGEE Grid Infrastructure

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Description of the activity: We plan to use the EGEE infrastructure in order to evaluate and analyze various techniques and scenarios for the design of mobile communication systems. Thus far, we have performed simulations of various scenarios for Wideband Code Division Multiple Access (WCDMA) systems. In the future, we intend to use EGEE resources for performing further simulations on other mobile communication techniques, such as OFDM, smart antennas and multiple-input multiple-output (MIMO) techniques.

Grid added value: The systems we are analyzing and evaluating are stochastic; Monte Carlo methods are used in order to perform system simulations. These Monte Carlo simulations may become extremely computationally demanding as the physical dimensions and the loading of the simulated system increase. Indicatively, a single simulation may last a day or even more in a standard desktop computer and for the convergence of the Monte Carlo to be satisfied, hundreds of simulations may be eventually needed. The EGEE infrastructure provides vast resources that may be exploited in order to efficiently reduce execution time. Use of these resources will enable the simulation and analysis of more complex systems that would be infeasible to perform in a desktop computer or a conventional small cluster. Monte Carlo methods are widely used in research fields (ray-tracing, molecular dynamics, finance, etc) and our proposed framework may be used under these contexts with minimal modifications.

Experience or proposed activity: In order to speedup the execution of the simulations, we have exploited the parallelizability of Monte Carlo methods and have developed a task-farming framework for their parallel execution. The framework is tailored to the gLite middleware and implements and manages a task-farming workflow for parallel Monte Carlo simulations. Briefly, once the initialization parameters are given, the application dispatches several jobs to the grid, assigning a number of single simulations to each job. Due to the heterogeneity of the infrastructure and the maximum CPU time available for each job, the number of simulations assigned to each job is dynamically determined by a simple heuristics that takes into consideration execution time and MaxCPUTime and that is incorporated to the job itself. Until now, we have executed several scenarios regarding a WCDMA system, for various base station configurations, physical dimensions and system loading.

Future evolution: A restraining factor to our approach is that in certain scenarios a single simulation may exceed the MaxCPUTime limit mentioned above. In order to surpass this problem, we plan to exploit any parallelization pattern may be applicable to a single simulation and develop MPI programs for concurrent execution at simulation level. This, however, restricts usable resources to those of an MPI

supporting site, as the support for MPI applications across different sites is still missing.

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