Some Thoughts on Adaptive Grid-Enabled Optimisation Algorithms for Wireless Network Simulation and Planning

Zhihua Lai, Nik Bessis, Jie Zhang, Gordon Clapworthy

zhihua.lai@beds.ac.uk

CONTEXT

- Planning and optimization of 3G networks large amounts of data modeling, parameters adjusting until satisfied conditions are found. It often needs significant computation resources since a typical network is large.
- Grid, as an emerging technique, can aggregate resources from all over the world and benefit the wireless network simulator.

OBJECTIVES

- to improve the speed and accuracy of the planning and optimisation algorithm used in wireless network simulator
- to apply the algorithm in grid environment
- to develop a grid-enabled wireless network simulator
- to analyse and compare the efficiency with other existing distributed strategies

WHY GRID?

- interoperability among technology protocols
- resource discovery across virtual participants
- dynamic construction of a virtual organization
- a suitable platform for sharing of resources
- For radio network simulation, planning and optimization, it is very likely that the radio network system modeling, simulation engine (e.g., using Monte Carlo, dynamic or discrete event simulation methods), and optimization engine are in geographically dispersed areas.
- The use of grid middleware would allow individual PCs, centralized and distributed clusters working on a demand basis to implement the optimization algorithm.
- easily merged with web services
- The scalability and flexibility are guaranteed.
- Possibly parallelism can be applied.

GRID-ENABLED 3G NETWORK PLANNING TOOL SCHEMA

- The end-users obtain a copy of the client software, install it and log in to the grid environment.
- They next submit a wireless network model to a nearby agent, which will look up all available resources from the pool of users logged in.
- The agent will send specific computation tasks to each available PC and collect the result from them.
- The agent then sends the final result to the requester.
- The agent will act as the "master" node which will schedule and distribute computation tasks to processors in the "grid pool", which act as "worker" nodes.

'REFINED' MASTER-WORKER

- The master node estimates the task and divides the task into sub-tasks for workers. In this stage, the master node takes into account the processing power of each individual processor, because the grid environment contains heterogeneous PCs. In this case, each processor obtains different amount of works according to capability $w_i = w_{total}\frac{p_i}{\sum p_i}$

  w_i is the work amount distributed to processor i. w_{total} is the total work remaining and pi is the processing power of processor i (e.g. how many add calculations the processor can finish in unit time).
- The workers divide the sub-tasks received into two buffers, the second buffer is estimated to finish within average communication time. The worker finishes the first buffer, sends partial results along with a request to the master, and immediately continues with the second buffer.
- The master receives the partial results from workers, stores them and sends new sub-tasks back. Meantime, the worker is supposed to finish the second buffer and to pick up the new sub-task.
- The master collects all the partial results and determines the final results.

References

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University of Bedfordshire

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