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Mathematical simulation for 3-Dimensional Temperature Visualization on Open Source-based Grid Computing Platform

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New Iterative Alternating Group Explicit (NAGE) is a powerful parallel numerical algorithm for multidimensional temperature prediction. The discretization is based on the finite difference method of partial differential equation (PDE) with parabolic type. The 3-Dimensional temperature visualization is critical since it's involves large scale of computational complexity. The three fundamental applied mathematics issues under consideration are as follows:
i. The accurate modeling of physical systems using finite differential methods.
ii. The investigation of discretization methods that retain constraint-preserving properties of mathematical modeling.
iii. The high performance measurements of parallel algorithms involving time and space.
This paper proposed the NAGE method as a straight forward transformation from sequential to parallel algorithm using domain decomposition and splitting strategies. The processes involving the scheduling of communication, algometric and mapping the subdomain into a number of processors.
This computational challenge encourages us to utilize the power of higher performance computing. By the means of higher performance computing, the computation cannot be relying on just one single set of cluster. Therefore, this research takes the advantage of utilizing multiple set of clusters from geographically different location which is known as grid computing. In realizing this concept, we consider the advantages of data passing between two web services which each are connected with one or multiple set of clusters. For this kind of relationship, we choose service-oriented architecture (SOA) style. Each web services are easily maintainable since there is loose coupling between interacting nodes. The development of this architecture is based on several programming language as it involves algorithm implementation on C, parallelization using Parallel Virtual Machine (PVM) and Java for web services development. The grid computing platform is an open source-based and will be develop under Linux environment. The platform development will increase the acceleration and scaled-out across a virtualized grid. The clusters of processors involved in this platform are developed on increasingly-larger computational hardware with inexpensive architecture. As the conclusions, this leading grid-based application platform has a bright potential in managing highly scalable and reliable temperature prediction visualization. The efficiency of this application will be measured based on the results of numerical analysis and parallel performance.

Primary authors: SATAM, Noriza (Department of Mathematics, Faculty of Science,Universiti Teknologi Malaysia); ALIAS, Norma (Institute of Ibnu Sina, Universiti Teknologi Malaysia,); MYDIN, Suhaimi (D'Synergy Sdn. Bhd.)

Presenters: SATAM, Noriza (Department of Mathematics, Faculty of Science,Universiti Teknologi Malaysia); ALIAS, Norma (Institute of Ibnu Sina, Universiti Teknologi Malaysia,)

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