Fragmented Programming System LuNA. Short review

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LuNA Fragmented Programming System is under development now in the Institute of the Computational Mathematics and Mathematical Geophysics, Russian Academy of Sciences. LuNA is intended for automatic construction of parallel programs, implementing large-scale numerical models, to be executed on peta- and exa-flops distributed supercomputers. The project is based on the theory of parallel program synthesis on the computational models [1]. The LuNA development project is mostly concentrated on solution of technological problems of parallel program synthesis practically nothing saying on fundamental basis of the project. The objective of the project is the elimination of parallel programming from the process of large-scale numerical models implementation. LuNA properties are demonstrated on the example of an implementation of a PIC (Particle-In-Cell method) application in astrophysics. The LuNA possibilities and restrictions are demonstrated and explained. Automatically generated algorithm of the problem solution is assembled out of ready-made fragments of computation (sequential modules) and data, which should be prepared by a user in advance. Algorithm is represented as a recursively countable set of functional terms. In order to transform the algorithm into a program, the control and resources allocation are added to the algorithm. Algorithm of dynamic distributed distribution of distributed multicomputer resources is constructed as imitation of some distributed natural phenomena. In particular, data redistribution in the course of workload balancing is done by an algorithm, which imitate a liquid flow in a system of communicating vessels. For this reason, any LuNA generated program doesnâĂŹt contain any plan how to communicate. Merely, the fragments of computation and data migrate from overloaded nodes to under loaded nodes.

[1] V.A.Valkovskii, V.E.Malyshkin. Synthesis of Parallel Programs and Systems on the Basis of Computational Models// Nauka, Novosibirsk, 1988, 128pp. (In Russian).

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