Scheduling for atomic broadcast operation in heterogeneous networks with one port model

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Abstract

With the emergence of the network technologies, heterogeneous computing has become a wide accept paradigm for distributed and network computing. In this paper, we present different algorithms aiming to efficiently perform atomic one-to-all broadcast in a heterogeneous network with a one port model. The proposed algorithms are divided into graph-based and tree-based ones. In graph-based algorithms, we present Nearest Neighbor First and Maximum Degree Neighbor First schemes. A prescheduling strategy with constructing a message forwarding table for avoiding redundant transmissions is applied as runtime support. In the tree- based approaches, there are five heuristic algorithms: Nearest Neighbor First, Maximum Degree Neighbor First, Maximum Height Subtree First, Maximum Subtree First, and Maximum Weighted Subtree First, proposed based on different network characteristics. To evaluate the performance of the proposed techniques, we have developed a simulator that contains a parametric graph generator for generating network graphs with various characteristics. We have implemented all of the proposed scheduling algorithms on the simulator. The performance results show that the Maximum Weighted Subtree First performs best in high degree heterogeneous environments. On the contrary, with homogeneous-like environments, the graph-based Nearest Neighbor First will be the best choice. In summary, contribution of this study relies on informing significant suggestions for adapting proper broadcasting mechanism in different heterogeneous platforms.

Keyword：Atomic broadcast - Heterogeneous computing - Grid scheduling - Parallel algorithm - Message forwarding table - Nearest neighbor first - Maximum weighted subtree first - One-port communication model