Bulletin of Electrical Engineering and Informatics
Vol. 12, No. 4, August 2023, pp. 2313~2327
ISSN: 2302-9285, DOI: 10.11591/eei.v12i4.4977

New efficient fractal models for MapReduce in OpenMP parallel environment

Muslim Mohsin Khudhair[1,2], Furkan Rabee[2], Adil AL_Rammahi[3]
[1]Department of Computer Information System, College of Computer Science and Information Technology, University of Basrah, Basrah, Iraq
[2]Department of Computer Science, Faculty of Computer Science and Mathematics, University of Kufa, Najaf, Iraq
[3]Department of Mathematical Science, Faculty of Computer Science and Mathematics, University of Kufa, Najaf, Iraq

Article Info

Article history:

Received Oct 9, 2022
Revised Nov 9, 2022
Accepted Jan 7, 2023

Keywords:

Cloud computing
Fractal
MapReduce
OpenMP

ABSTRACT

Parallel data processing is one of the specific infrastructure applications categorized as a service provided by cloud computing. In cloud computing environments, data-intensive applications increasingly use the parallel processing paradigm known as MapReduce. MapReduce is based on a strategy called "divide and conquer," which uses ordinary computers, also called "nodes," to do processing in parallel. This paper looks at how open multiprocessing (OpenMP), the best shared-memory parallel programming model for high-performance computing, can be used in the MapReduce application using proposed fractal network models. Two fractal network models are offered, and their work is compared with a well-known network model, the hypercube. The first fractal network model achieved an average speedup of 3.239 times while an efficiency ranged from 73-95%. In the second model of the network, the speedup got to 3.236 times while keeping an efficiency of 70-92%. Furthermore, the path-finding algorithm employed in the recommended fractal network models remarkably identified all paths and calculated the shortest and longest routes.

Corresponding Author:

Muslim Mohsin Khudhair
Department of Computer Information System, College of Computer Science and Information Technology
University of Basrah
Basrah, Iraq
Email: muslim.khudhair@uobasrah.edu.iq or mos1970@yahoo.com

1. INTRODUCTION

The ability to offer computing resources and services on-demand has propelled the popularity of computational clouds. A collection of applications is arranged on virtual machines, which then execute on multiple server computers in data center networks (DCNs). These machines serve as the backbone for computational clouds. With the popularity of cloud computing and mobile cloud computing, DCN is the fundamental infrastructure and backbone supporting service delivery. The tree-based hierarchical structure is among the most famous architectural type [1], [2].

Big data is becoming an increasingly effective approach for a corporation to improve its value proposition or operations. Big data uses parallel computing to process large amounts of data quickly. Big data supports several specialized programming paradigms and runtime technologies [3]. Spark and Hadoop are map/reduce frameworks [4]. In GraphLab, Giraph, and GraphX, the Pregel model is implemented [5]. Storm [6] handles data streaming. Each system uses threads and simple methods to create a parallel and distributed computing environment. In contrast, the high-performance computing community developed programming