


Chapter 15

Sustainable Digital Transformation Through Energy-Efficient Edge and Fog Computing


Venkata Ramana Kaneti

VNR Vignana Jyothi Institute of Engineering and Technology, India

T. Nithya

 <https://orcid.org/0009-0006-8784-1305>
Rajalakshmi Institute of Technology, India

B. Senthilkumaran

 <https://orcid.org/0000-0002-7111-1950>
Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, India


B. Yuvasri

R.M.K. College of Engineering and Technology, India

K. Dhivya

SRM Institute of Science and Technology, India

V. Arunkumar

 <https://orcid.org/0009-0003-7296-145X>
Mallareddy College of Engineering, India

B. Chitra

Panimalar Engineering College, India

ABSTRACT

With the demand for realtime data processing and effective management of resources, edge and fog computing have become the key solutions for sustainable development issues in the digital world. This survey paper provides an overview of edge and fog computing and their application in enabling sustainable practices across sectors with less energy consumption and carbon footprint than cloud computing. In this context, we explore the structures and main elements of edge and fog computing,

DOI: 10.4018/979-8-3373-0766-4.ch015

focusing on energy-related approaches, local data processing benefits, and green hardware solutions. Moreover, we look at other application areas like smart cities, health care, industrial IoT, and agriculture where real-life successful cases with sustainable impact are also illustrated. The paper also discusses issues and drawbacks of the solutions such as security issue and the issue of compatibility between different solutions. This survey has underlined the importance of edge and fog computing to support the sustainable development in the world that becomes more interconnected.

1.INTRODUCTION

The terms Edge and Fog computing are recent trends developed to overcome the shortcomings of cloud computing by providing computational resources nearer to the end user and the data. The two models are designed for minimizing latency, increasing bandwidth utilization, and increasing processing power at the network periphery(Ometov et al 2022). These technologies have the potential of enhancing sustainability in a world that is rapidly going digital through the provision of better resource efficiency and minimized energy consumption, reduced carbon emissions.

1.1 Definition of Edge and Fog Computing

Edge computing is a distributed computing paradigm in which computing and data processing are done near the source of data such as on the IoT devices, the gateway or local servers(Kumar et al 2019). This means that there is little need for large amounts of information to be sent to centralized cloud data centers, which can be a very slow and resource consuming process. In edge computing, edge nodes are responsible for computing, decision making and real time analysis so that response time is faster and dependency on cloud is reduced. In contrast to the fog computing, which is an extension of the edge computing, an additional layer is introduced between the edge devices and cloud. Fog nodes are actually in the middle of the hierarchy, they collect data from edge devices, process it locally and then provide other necessary information to the cloud or other higher tier resources(Jain et al 2016). This intermediate layer is somewhat useful in decisions about load distribution within the network and can assist in preventing overloading of both edge and cloud infrastructures. Combined, edge and fog computing enable the effective distribution of data processing tasks across networks, making it possible to meet the ever increasing demand for IoT gadgets and real time data processing.

24 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/sustainable-digital-transformation-through-energy-efficient-edge-and-fog-computing/375648

Related Content

Quality of Service (QoS) Optimization in a Multicast Routing: A Hybrid Solution

Mohammed Mahseur and Abdelmajid Boukra (2019). *International Journal of Applied Metaheuristic Computing* (pp. 27-54).

www.irma-international.org/article/quality-of-service-qos-optimization-in-a-multicast-routing/223442

Coronary Artery Disease Classification Using Deep Neural Network and Ensemble Models Optimized by Particle Swarm Optimization

Pratibha Verma, Vineet Kumar Awasthi, Sanat Kumar Sahu and Akhilesh Kumar Shrivastava (2022). *International Journal of Applied Metaheuristic Computing* (pp. 1-25).

www.irma-international.org/article/coronary-artery-disease-classification-using-deep-neural-network-and-ensemble-models-optimized-by-particle-swarm-optimization/292504

A Hybrid Algorithm Based on Monte-Carlo Simulation for the Vehicle Routing Problem with Route Length Restrictions

Angel A. Juan, Javier Faulin, Tolga Bektas and Scott E. Grasman (2012). *Hybrid Algorithms for Service, Computing and Manufacturing Systems: Routing and Scheduling Solutions* (pp. 122-135).

www.irma-international.org/chapter/hybrid-algorithm-based-monte-carlo/58519

SODAC: A Simulation-Based Tool for the Optimal Design of Analog Circuits

Amin Sallem, Mourad Fakhfakh, Esteban Tlelo-Cuautle and Mourad Loulou (2012). *International Journal of Applied Metaheuristic Computing* (pp. 64-83).

www.irma-international.org/article/sodac-simulation-based-tool-optimal/74739

Optimization of Correlated and Conflicting Responses of ECM Process Using Flower Pollination Algorithm

Bappa Acherjee, Debanjan Maity and Arunanshu S. Kuar (2020). *International Journal of Applied Metaheuristic Computing* (pp. 1-15).

www.irma-international.org/article/optimization-of-correlated-and-conflicting-responses-of-ecm-process-using-flower-pollination-algorithm/262127