Energy aware handoff management for cluster-based D2D communications

Poulomi Mukherjee*, Swarnabh Paul and Tanmay De

Department of Computer Science and Engineering,
National Institute of Technology,
Durgapur, 713209, India
Email: pm.20cs1105@phd.nitdgp.ac.in
Email: swarnabh38paul40@gmail.com
Email: tanmay.de@cse.nitdgp.ac.in
*Corresponding author

Abstract: In device-to-device (D2D) multicasting, network service continuity can be disrupted due to the mobility of multicasting users, potentially resulting in a lower multicasting rate and increased energy dissipation by the serving cluster heads (CHs). To ensure seamless communication for mobile multicasting users, this paper addresses an energy-efficient handoff strategy for 5G D2D multicasting. The proposed approach identifies victim users based on the energy dissipation of their current CH and determines the target destination accordingly. An integer programming-based mathematical model is presented, along with a suitable greedy algorithm. The proposed handoff technique demonstrates over 90% service coverage with a high fairness index, and achieves more than double the energy savings compared to other methods. A detailed quantitative and qualitative performance evaluation is provided, demonstrating that our approach results in minimal energy dissipation of 0.3 Joules and achieves a higher multicasting rate of 8 Mbps, even under conditions of high user density.

Keywords: 5G D2D; cluster head; energy efficiency; handoff management.

Reference to this paper should be made as follows: Mukherjee, P., Paul, S. and De, T. (xxxx) 'Energy aware handoff management for cluster-based D2D communications', *Int. J. Ad Hoc and Ubiquitous Computing*, Vol. x, No. x, pp.xxx–xxx.

Biographical notes: Poulomi Mukherjee is a Senior Research Fellow in the Department of Computer Science and Engineering of National Institute of Technology, Durgapur. Currently, she is working towards her PhD research work. Prior to that, she obtained her MTech in Computer Science and Engineering from the University of Calcutta, Kolkata, India. She has also worked as an Assistant Professor in the Department of Computer Science and Engineering at Dr. B.C. Roy Engineering College, Durgapur, India. Her research interests include wireless communications and mobile computing, 5G D2D communications, etc.

Swarnabh Paul is currently associated with the Technology Department, Wells Fargo, Hyderabad, India. He has been a student of BTech in Computer Science and Engineering at NIT Durgapur. His area of BTech project includes 5G D2D communications.

Tanmay De is currently working as a Professor and the Head of the Department of Computer Science and Engineering, National Institute of Technology, Durgapur, India. He obtained his PhD from the prestigious Indian Institute of Technology, Kharagpur, India. After completing his BTech from he Calcutta University, Kolkata, India, he received his ME from the Jadavpur University, Kolkata, India. His research interests are optical networks, delay tolerant networks, wireless sensor networks, 5G networks, D2D communications, and the like. He has more than a hundred research publications in reputed international journals, conferences, and book chapters in these areas.

1 Introduction

Device-to-device (D2D) communication has evolved as a promising communication paradigm of fifth-generation (5G) cellular network to facilitate high-speed direct communication among two user equipment (UEs) of close proximity. Effective D2D communications can also lead to a reduction in load on the base station (BS) of the existing cellular network. With the unprecedented growth in the number of wireless communication traffic the demand for high-speed network access, spectrum efficiency, energy-efficient communications, and service continuity