Joint Optimal Channel Allocation, Interface Assignment and Routing in Multi-hop Wireless Networks

Jie Wu, Hongchun Li, Yi Xu and Jun Tian

Fujitsu Research and Development Center Co., Ltd, Beijing, P.R. China

wujie@cn.fujitsu.com, lihongchun@cn.fujitsu.com, xuyi@cn.fujitsu.com, tianjun@cn.fujitsu.com

Abstract—**Multi-hop wireless networks have advantages over the single-hop ones in terms of reliability and coverage range. Moreover, the capacity of multi-hop wireless network can be substantially increased via multiple radios tuned to non-overlapping channels. However, the channel allocation, network interface cards assignment and routing selecting remain challenging due to the interference of the neighboring transmissions. These three problems have proved to be a NP-hard problem. Previous studies separating the routing selecting from the channel allocation, instead of considering the three problems as a whole, cannot get the overall optimal solution. In this work, we employ an improved Multi-Objective Genetic Algorithm to optimize the channel allocation, interface assignment and the routing selection, so as to minimize the overall network interference. The proposed algorithm includes two parts: 1) dynamic genetic mutation based on diversity measure; and 2) elite preservation based on ideal points. In order to eliminate the impact of illegal solutions, a new individual encoding method is proposed. In addition, an interference model taking into account the effects of channel separation and the traffic of neighbor links is applied to evaluate the quality of the interference of the network. Finally, a fitness function is defined to obtain the best search results. Simulation results show that our improved Multi-Objective Genetic Algorithm can reduce the interference and cost of total network compared to the standard Genetic Algorithm.**

Keyword—**Channel allocation, interface assignment, multi-hop wireless network, multi-objective genetic algorithm, routing**

Jie Wu was born in Shanxi Province, China in 1984. He received the Ph.D. degree in wireless communication from the Tianjin University, Tianjin, China, in 2015. He joint Fujitsu Research and Development Center Co. Ltd. Beijing China as a researcher in 2015. His research interests include wireless sensor networks time synchronization and sensor node localization. Currently he is focusing on video transmission in wireless multi-hop network and deployment of wireless mesh network.

Hongchun Li received the Ph.D degree of control theory and control engineering from Institute of Automation, Chinese Academy of Sciences in 2012. He works in Fujitsu Research and Development Center since 2012.His research interests are wireless sensor network, IoT system, network design and deployment.

Yi Xu received the M.E degree in transport information engineering and control from Beihang University in 2012. She was researched in vehicular ad hoc network, urban sense and network coding. Since Apirl 2012, she has worked as researcher in Communication Technology Laboratory of Fujitsu Research and Development Center Co. Ltd. Her current research interests include network deployment and failure diagnosis for wireless sensor network.

Jun Tian received the M.E degree in communication from Beijing University of Posts and Telecommunications in 1999. He has been working in Fujitsu Research and Development Center Co. Ltd. Beijing China since 1999. His research interests include WCDMA, IEEE802.16e, LTE, smart grid etc. His current research interests include IOT front network planning, IOT standardization, network maintenance, resource management, video transmission in wireless multi-hop network, and indoor localization technology.