LLLA: New Efficient Channel Assignment Method in Wireless Mesh Networks

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Abstract. Wireless mesh networks (WMNs) have emerged as a promising technology for providing ubiquitous access to mobile users, and quick and easy extension of local area networks into a wide area. Channel assignment problem is proven to be an NP-complete problem in WMNs. This paper aims proposing a new method to solve channel assignment problem in multi-radio, multichannel wireless mesh networks for improving the quality of communications in the network. Here, a new hybrid state channel assignment method is employed. This paper proposes a Link-Layard Protocol and Learning Automata (LLLA) to achieve a smart method for suitable assignment. Simulation results show that the proposed algorithm has better results compared to AODV method. E.g., it reduces the packet drop considerably without degrading.

Keywords: Wireless mesh network (WMN); Channel Assignment (CA); Learning Automata (LA); Network Throughput.

1 Introduction

Recent improvements in Micro-Electro-Mechanical-Systems (MEMS), wireless telecommunication and also digital electronic have made possible manufacturing small, low energy consuming and cost effective nodes that are able to have wireless connection [1]. Generally networks are classified as wired and wireless. Wireless networks include infrastructure based wireless networks and infrastructure less wireless networks. The first class of wireless networks have central controller and service providers called access points that have the same duty as routers in wired networks and nodes connect to each other through access points. But in infrastructure-less wireless networks there is no central controller and access point and every node

A. Abraham et al. (eds.), *Innovations in Bio-inspired Computing and Applications*,
Advances in Intelligent Systems and Computing 237,
DOI: 10.1007/978-3-319-01781-5_14,

acts as final node and router for other nodes in the network. Infrastructure-less wireless networks include mobile ad-hoc networks (MANET), wireless sensor network (WSN) and wireless mesh network (WMN). WMNs are of connection systems that their connection to clients is high speed and wide band. These networks are completely wireless and self-organized and guide traffic to internet or from internet in multi-hop and ad-hoc method. Wireless mesh networks consist of some nodes that are stable and static. These nodes usually have one or more radio or network interface. These networks use available channels that are supported by 802.11 protocols to reach to maximum capacity. In these networks every node connects to its neighboring nodes or nodes in its transmission range if these two nodes have at least one radio that uses a common channel. It is necessary that each of these two nodes has a radio and these radios be adjusted to a common channel. Because nodes can have connection to each other only if this connection is made through a common channel [2, 3].

One of the problems in wireless mesh networks is optimum Channel Assignment (CA) for nodes and interference. In order to decrease interference, channels may be dedicated in such a way that nodes have the least number of common channels. This means decreasing nodes connections. Therefore, high level of connection in the network and low interference are not possible simultaneously. In other words, there is a trade-off between connection in network and network interference. Interference in these networks is inevitable and is the factor that limits capacity. So CA in WMN methods tries to decrease interference. So in this paper, we want to propose a new method to improve CA and decrease interference in multi-channel wireless mesh networks [4, 5].

The purpose of this study is proposing a new method for solving CA problem with better performance than mentioned methods. We compare our algorithm with AODV [6, 18] method based on interference of channels and simultaneous connection of network nodes and will show that our proposed method yields better result. In section 2 related works in CA and routing in WMN will be mentioned. In section 3 the proposed idea that is based on learning automata is presented in details. Section 4 includes tables and graphs of simulation and efficiency estimation of the proposed idea and other methods. Finally, conclusion and future works are presented in the last section.

2 Related Research

In this section studies on recent channel assignment protocols and reliable multi-section protocols are reviewed. Prior work on channel assignment schemes can be broadly classified into three categories: static assignment, dynamic assignment and hybrid assignment. *Static assignment or Constant* strategies assign a channel to each interface for permanent use. *Dynamic assignment* forces nodes to switch their interfaces from one channel to another between successive data transmission dynamically and *Hybrid approaches* apply a static or semi-dynamic assignment to the fixed interfaces and a dynamic assignment to the switching interfaces [7].