Chapter 4
Classification of Channel Allocation Schemes in Wireless Mesh Network

Abira Banik
Tripura University, India

Abhishek Majumder
Tripura University, India

ABSTRACT

Wireless mesh network (WMN) is a widely accepted network topology due to its implementation convenience, low cost nature, and immense adaptability in real-time scenarios. The components of the network are gateways, mesh routers, access points, and end users. The components in mesh topology have a dedicated line of communication with a half-duplex radio. The wireless mesh network is basically implemented in IEEE 802.11 standard, and it is typically ad-hoc in nature. The advantageous nature of WMN leads to its extensive use in today's world. WMN's overall performance has been increased by incorporating the concept of multi-channel multi-radio. This gives rise to the problem of channel assignment for maximum utilization of the available bandwidth. In this chapter, the factors affecting the channel assignment process have been presented. Categorizations of the channel assignment techniques are also illustrated. Channel assignment techniques have also been compared.

INTRODUCTION

Wireless mesh networks (WMN) is a kind of network topology where every node is connected to the other node as that in mesh network topology. There is a dedicated line of communication of half duplex nature between the nodes. Here the nodes use wireless channel. The nodes are basically access points or mesh routers or both incorporated in a single node, which provide connection to the end users (Saini et al., 2016). The wireless mesh networks are widely used in deploying WLAN's. The advantageous nature of the deployment of WLAN and its working principle leads to extensive use of it in today's world. Basically IEEE 802.11 standard has three major protocols IEEE 802.11 a, b, g (Low et al., 2002)

DOI: 10.4018/978-1-5225-5693-0.ch004

which has different bandwidth and modulation. It is a typical network showing ad-hoc nature. The IEEE 802.11 has incorporated the ability of using multi channel and multi radio. Introduction of multiple radio interfaces on the device causes improvement in network capacities, latency and fault tolerance. But, this leads to the problem of assigning channels from the available channel bandwidth so that they perform the best irrespective of the design issues. An example of WMN is shown in Figure 1. Introduction of different channels over multiple radios on single mesh node compels to retrospect different issues such as interference, channel diversity, and channel switching (Islam et al., 2016). Table 1 shows the frequency, bandwidth and modulation used by the above mentioned protocols.

The IEEE802.11 WLAN standards allow multiple orthogonal frequency channels to be used simultaneously to have maximum frequency utilization. In the ad-hoc mode the nodes are connected in the network region in peer-to-peer basis. There is no as such infrastructure maintained for the communication. All the components of the network are immobile. The bandwidth aggregation is rarely used in the context of multi-hop 802.11-based LAN's that operate in the ad-hoc mode (Skalli et al., 2007). The chapter mainly focus on the multi radio multi channel (MRMC) model. In MRMC model the nodes are incorporated with multiple network cards or NIC's to operate in different radio channel. Channel assignment (Si et al., 2010) is the main tool for efficient utilization of MRMC. Channel assignment is the process of assigning separate orthogonal channel or partially over-lapped orthogonal channels to all the nodes in the communication range.

This chapter is regarding the various factors affecting the channel assignment process, the categorization of the channel assignment techniques. And the illustrative study of the channel assignment algorithm under the different heads of the category of the channel assignment techniques. The various factors that affect the channel assignment processes are: connectivity, interference, throughput, load balancing, dynamicity, distributiveness, stability, fault tolerance, convergence rate and fairness. The channel assignment strategies can be classified based on two schemes namely, point of decision and rigidness of the decision. Again they can further be subdivided into sub parts. Based on point of decision the schemes can be classified as centralized and distributed scheme. Again based on the rigidness of the decision the schemes can be sub divided into static, semi dynamic and dynamic schemes.

The entire chapter is organized as follows. The first section discusses the wireless mesh networks, channel assignment process, its need and the strategies in brief. The second section presents the factors affecting the channel assignment process. This section contains the various basic issues that should be dealt with and considered while designing the channel assignment technique. The following section is the preliminaries which discusses a few basic terms used in this chapter. The next section presents the classification of channel assignment strategies in wireless mesh network where the channel assignment strategies are divided depending upon two factors. The first factor is based on the point of decision which considers the node that takes the decision regarding the channel assignment. It has two subparts namely, centralized and distributed. On the other hand, the second factor is, rigidness of the channel

Table 1. Frequency, bandwidth and modulation used by different protocols of IEEE 802.11 standard

	IEEE 802.11 protocol	Frequency (in GHz)	Bandwidth (in MHz)	Modulation
1.	A	5/ 3.7	20	OFDM
2.	B	2.4	22	DSSS
3.	G	2.4	20	OFDM