CHAPTER 2

Related Work

The IEEE 802.16 technology is the standard for broadband wireless metropolitan area networks (WMAN). Access and bandwidth allocation algorithms of this technology must accommodate hundreds of terminals per channel, with terminals that may be shared by multiple end users. The PHY layer supports single carrier, OFDM and OFDMA works in frequencies between 2-11 GHz and 10-66 GHz. MAC layer supports two kinds of modes, namely PMP mode and mesh mode. Mesh networks are able to reduce costs as these networks are easy installable and can be extended fast, simple by adding new mesh nodes.

2.1. Behavior Studies about 802.16 Mesh mode

In 2002, Dave Beyer, Nico van Waes and Carl EKlund have detailed introduction as a tutorial document to make us have an 802.16 MAC layer mesh extensions overview [5]. Not only the MAC frame structures are introduced, but also mesh distributed election-based scheduling concept is depicted, as Figure 2.1.

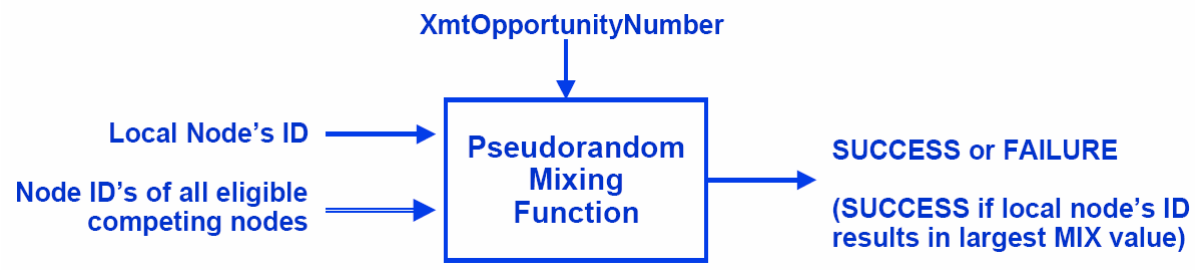

Figure 2.1: Mesh distributed election-based scheduling concept depicted by [5]

Nico Bayer, Dmitry Sivchenko, Bangnan Xu, Veselin Rakocevic and Joachim Habermann describe the election based transmission timing mechanism defined in the IEEE 802.16 standard [6]. This paper presents the influence of this mechanism on the overall network performance. It shows that in dense networks the interval between subsequent distributed scheduling messages (MSH-DSCH) is very large and thus causes significant delay on data packets. This interval is a special holdoff time defined in the IEEE 802.16 mesh mode, namely Transmission Holdoff Time. They propose a concept that reduces the constant 4 to 0 in following formula to lessen the transmission delay and enhance the performance.

$$H = 2^{exp+4}$$

Scheduling IE, Request IE, Availability IE and Grants IE are messages to determine the available channel resource. The MSH-DSCH is the key component in the whole scheduling process and includes these messages. Within the MSH-DSCH transmission, available minislots are requested by the sender to ask its data transmission resource. Fuqiang LIU, Zhihui ZENG, Jian TAO, Qing LI, and Zhangxi LIN propose an algorithm to look up certain continuous available minislots at the same position of the continuous frames [7]. This paper

proposes a slot allocation algorithm based on prioritization for IEEE 802.16 in the Mesh mode to achieve QoS with a low delay and low packet drop rate for high prioritized data flows.

2.2. Performance Studies about 802.16 Mesh mode

Some of papers are researched the performance between MAC and PHY, because 802.16 provides various PHY modulations [8]. They evaluate maximum theoretical throughput per OFDM symbol.

To the best of our knowledge, there are fewer papers, emphasized the MAC layer issue, devoted to model distributed scheduling of IEEE 802.16 mesh mode, except [9]. Min Cao, Wenchao Ma, Qian Zhang, Xiaodong Wang and Wenwu Zhu propose a geometric distribution to model the distributed scheduling of IEEE 802.16 mesh mode. They consider the modeling and analysis of the control sub-channel, which is characterized by the distributed election algorithm. [9] uses the following conclusion to evaluate the delay time.

$$E[S] = (N-1)\frac{V + E[S]}{H + E[S]} + 1 = (N-1)\frac{2^x + E[S]}{2^{x+4} + E[S]} + 1$$