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Load Aware Channel Assignment for Multi Interface Wireless Mesh Network

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ABSTRACT:- The aggregate capacity of wireless mesh networks can be improved significantly by equipping each node with multiple interfaces and by using multiple channel in order to reduce the effect of interfaces .Wireless Mesh Networks (WMNs) have the potential for improving network capacity by employing multiple radios and multiple channels (MRMC).Several efforts have been made to increase capacity. One such effort is by utilization of multiple radios and multiple channels for data transmission which improves network throughput. Research is in progress to offer optimal network throughput by efficiently utilizing multiple channels in multi-hop networks. This paper focuses on the channel assignment algorithm for multi-interface multi-channel wireless mesh networks based on the traffic flow of the link, which equitably distribute equalization for the business flow between nodes so that the distribution through the link on the flow is equal. The channel assignment improves network capacity by setting the value to reduce interference with the overall network interference.

Keyword : Channel Assignment, Interference, Wireless Mesh Networks.

I. INTRODUCTION

Research in WMNs is gaining momentum in recent past due to their low cost solution for broadband internet access. Some application areas of WMNs include community networks, campus networks, and enterprise networks.

WMN consists of the Mesh nodes and Mesh router. Mesh router become the Mesh Wireless backbone net and Mesh routing provide multi-hop connection to Mesh terminal through interaction with cable Network. WMN is different from traditional wireless networks and it is not only compatible with existing wireless networks but also support multiple types of Network access, which represents the next generation development direction of network.

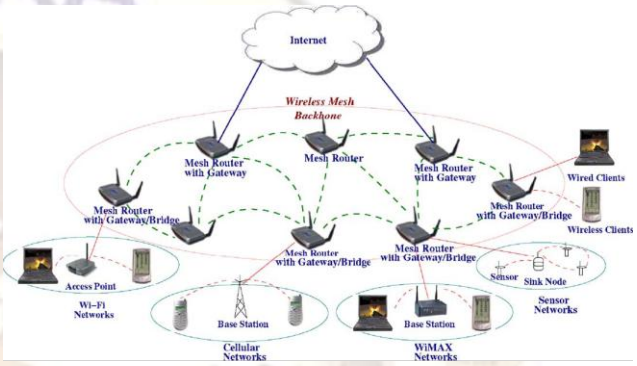

Fig 1. Wireless Mesh Network Architecture

In WMN radio channel is shared channel, there is competition between the communication nodes, the same channel exist interference in its neighborhood presence. Therefore, while making channel allocation, it's necessary to consider the interaction between the radio links. Centralized algorithm for channel allocation does not take into account the order of nodes and different nodes in order to channel a significant impact on the distribution of result, at the same time when switching the channel focus which cannot reliably ensure network connectivity, so channel allocation is likely to fail. Therefore channel allocation must consider how to improve the robustness of the network topology, a large number of business balance the load on link to reduce the redundant connection between nodes, thereby improve network performance.

Channel Assignment (CA) is a key issue that plays vital role in defining WMN throughput by efficient utilization of available multiple radios and channels thereby minimizing network interference. The two important issues that are needed to be addressed by Channel Assignment algorithm are Connectivity and Interference.

Channel Assignment algorithms may be categorized as Centralized or Distributed. Centralized CA has a gateway node or CA server that collects the network topology information and network traffic information

and offers CA to interfaces available on the nodes. Centralized algorithms have the advantage of performing optimal channel assignment decisions. Centralized CA is suitable for relatively static topologies and stable traffic patterns. Distributed CA algorithms take CA decisions at mesh nodes considering traffic information available in the neighborhood. CA decisions taken by Distributed CA algorithm may not be optimal globally but they efficiently adapt to the changes in the topology and traffic patterns.

In this paper we attempt to proposed load balancing channel assignment method, with the objective of minimizing aggregate interference and offering connectivity.

II. RELATED WORK

In this section we review some of the important existing methods that describe Channel Assignment schemes for WMNs. The scheduling scheme for wireless mesh networks that are capable of multiple channel access and equipped with multiple radio interfaces [1]. This scheme is interference and traffic aware in that it increases the overall achievable throughput of the network by eliminating the interference between the wireless mesh routers and maximizes the satisfaction ratios of all active sessions by accounting for the sessions' data rate requirements.

A simple channel re-assignment algorithm proposed in [2] that takes the current channel assignment into account and attempts to cope with the new traffic pattern in the best manner possible while modifying the channel on a limited number of radios. In this paper Minimum Variation Channel Re-Assignment (MVCRA) algorithm is implemented, whose aim is to overcome some drawbacks with channel assignment algorithms being re computed upon every variation in the traffic pattern. The MVCRA algorithm takes the current channel assignment and the new set of pre computed flow rates into account and attempts to minimize the maximum total utilization over all the collision domains while constraining the number of radios that can be assigned a new channel.

Intra- and Inter-flow interferences are the principal causes of network utilization degradation in MR-MC (Multi- Radio Multi-Channel) wireless mesh networks. To minimize these interferences, the literature [4] is proposed a channel assignment algorithm and incorporate it in an on-demand routing protocol called the HCARP (Hybrid Channel Assignment Routing Protocol). In addition, HCARP uses load balancing in route discovery to avoid "hot-spots" with several interference and to find a route satisfying QoS requirements of the incoming flows. HCARP has the capability of circumventing congested areas in the network and enhancing the QoS support for bandwidth-intensive traffic.

Channel assignment is implemented, consider the network modularity and versatility, but this centralized algorithm for channel allocation does not take into account the order of nodes, and that different nodes in order to channel a significant impact on the distribution of results, At the same time when switching the channel focus which cannot reliably ensure network connectivity, so channel allocation is likely to fail [5].

Joint Radio and Channel Assignment (JRCA) scheme [7] , which is a novel technique of intelligently allocating radios and their respective channel assignments to wireless nodes in a mesh network with the intention of satisfying customer traffic demands. Previous work in the area of channel assignment in 802.11-based wireless networks work consider the number of interfaces available on wireless nodes as an input to their channel assignment algorithms.

Some existing literature convert the channel allocation problem into a goal to maximize the number of simultaneous transmission of the business flow, constraint is the network-wide connectivity and limited number of channels and the limited number of potential interference edge linear programming problems. This paper propose a link-based traffic to achieve channel allocation by analyzing the characteristics of multi-channel WMN based on existing research.

The review of some of the important existing methods that describe CA schemes for WMNs[9] [10] proposed a centralized, connectivity preserving traffic independent CA algorithm. The CA algorithm selects a node randomly and traverses other nodes in depth-first order assigning channels to the incident links of these nodes. Channels are picked in greedy manner to minimize interference. Though the algorithm preserves connectivity, but some radios are left unassigned.

Many literature proposed a number of multi-radio multi-channel allocation algorithm and implementation from the channel interference, topology control, link capacity, load balancing, and other aspects . But it has been observed that dynamic changes in network model and changes in topology which cannot be accepted. As Interference can be measured accurately by considering amount of traffic load carried in the neighborhood rather than merely counting number of neighbors.

III. PROPOSED WORK

The proposed algorithm use Load-aware interference estimation. The channel assignment algorithm takes the input about the location of the routers, transmission radius, interference radius, number of channels, number of radios on each node and outputs the channels assigned to the radios of each router.

This project is link-based traffic to achieve channel allocation by analyzing the characteristics of multi-channel WMN based on existing research. The primary objective of CA is maximizing network capacity while minimizing the interference and taking advantage of multiple paths in the underlying network topology. This approach that explicitly creates a separation between the topology construction and channel assignment functions, thus minimizing flow disruptions.

Load aware channel assignment works in four phases. The first phase involves network Formation. Second phase of the algorithm performs default Channel assignment. Third Phase involves Load balancing and last step performs channel assignment according to Load.

A. Mesh Network Creation Link Formation

Whenever a node has data to send, it senses the channel prior to transmitting the packet. If it senses signals that are greater than its carrier sense threshold it will defer from transmitting for a random interval of time. However, if the medium is free for a specific period of time called the Distributed Inter Frame Space (DIFS), the node will proceed with its transmission. Each node in a network has three basic ranges related to packet transmission:

a. *Transmission Range (TR)* is the range inside which a node can receive and decode packets correctly.

b. *Interference Range (IR)* is the range inside which any new transmission will interfere with packet reception

c. *Carrier Sensing Range (CS)* is the range within which a node can sense the signal and will defer from transmission

Usually, carrier sensing range and interference range are taken to be equal to each other (CS=IR) and transmission range has to be less than or equal to carrier sensing range (TR ≤ CS) If the CS range is too low (in other words, carrier sensing threshold is high), collisions will increase and if it is too high (or, carrier sensing threshold is low), the node will defer from transmission. Both cases will decrease throughput of the network. Since the carrier sensing range determines whether or not a node will go ahead with its transmission, it becomes imperative to set an appropriate value for it. In proposed project hop count 2 is used to create a network.

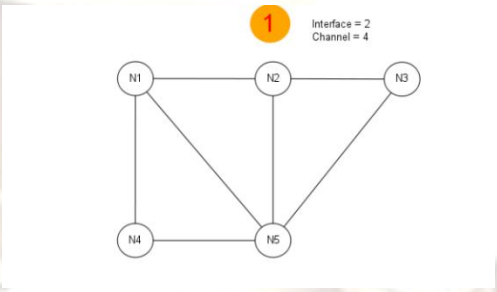

Fig 2: Mesh Network with 2 hop Count

B. Channel Assignment

In the second part of algorithm, default channel assignment is done. It measures the packet loss ratio by considering transmitted packets and received packets.

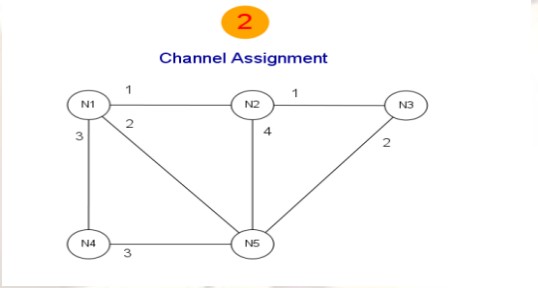

Fig 3 : Channel Assignment

C. Interface Checking

Interface checking performs binding of an interface on incident node to link. It verifies the network interfaces available with particular node and available number of channel. If the network is in balanced position then it transfers the data with allocated channel otherwise load balancing is performed. Number of channel should not be greater than NIC(Network Card Interface).

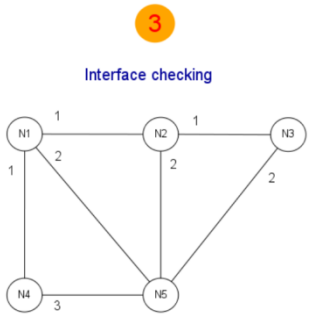

Fig 4 : Interface Checking

D. Load Balancing

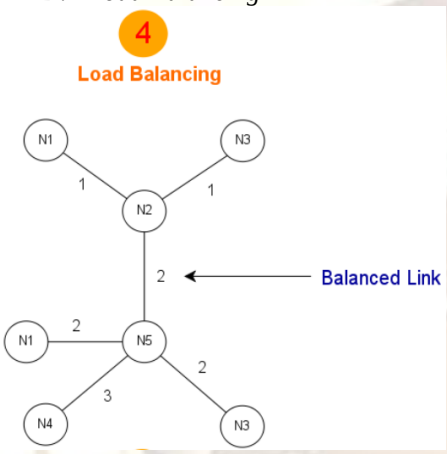

Fig 5 : Balanced Link

In load balancing phase load of every node is checked, according to that proper channel assignment is done. This procedure assigns least interfering channels in the neighborhood to the interfaces bounded to the link. Interface to ink binding is performed to ensure that every link in the network topology receives a communication channel. The channels are assign to interface by selecting least interfering channel in neighbourhood.

Parameter:

Parameters	Values
Simulation Time	100 Seconds
Simulation Area	600m *400m
Transmission range	80 – 100 Meter
Traffic Type	UDP
Packet Size	1024 bytes
Data Rates	1Mbps
Number of nodes	5 & 7 nodes
Number of radios	3,4 ,5

IV. SIMULATION RESULT

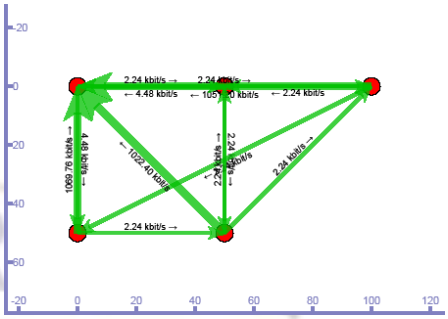

Fig 6 : Simultaneous Data Transfer with 5 Nodes

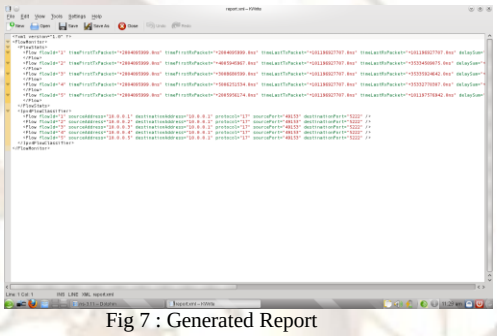

Fig 7 : Generated Report

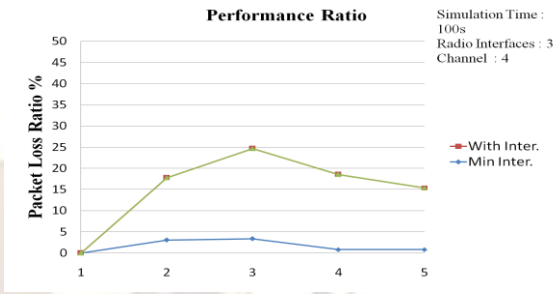

Fig 8 :Packet Loss Ratio Vs Flow With 4 Channels

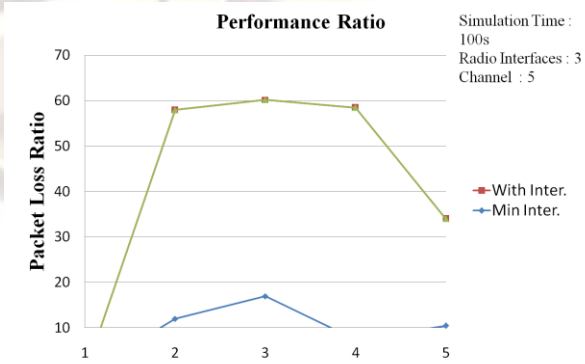

Fig 9 : Packet Loss ratio Vs Flow (5 Channels)

V. CONCLUSIONS

Load Aware Channel Assignment algorithm helps to minimizing network aggregate interference and assuring connectivity. The simulation will run on different sizes of Channels and Interfaces. Load based Traffic aware channel assignment will shows considerably lesser aggregate interference. As expected interference is seem to increase with the number of nodes increases Load aware Channel Assignment is best in controlling interference. This is due to fact that the proposed channel assignment algorithm utilizes radio interfaces effectively in order to reduce interference in carrier sense range.

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