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Qos of Network Using Advanced Hybrid Routing in WMN

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Abstract* - Maximizing the network throughput in a multichannel multiradio wireless mesh network various efforts have been devoted. The recent solutions are based on either static (or) dynamic approaches. In this approaches MMAC (MULTICHANNEL MAC) protocol is used which is optimized only for network throughput. A hybrid multichannel multiradio wireless mesh network is developed for channel allocation and routing. Here each mesh node has both static and dynamic interfaces. ADCA (ADAPTIVE DYNAMIC CHANNEL ALLOCATTION) protocol is used in hybrid multichannel WMN. In this ADCA optimizes for throughput and delay in the channel assignment, and also it results in reducing packet delay without degrading the network throughput. To balance the channel usage in the network ICAR (INTERFERENCE AND CONGESTION AWARE ROUTING PROTOCOL) is added. Simulation is done by NS2 (network simulator -2). The hybrid architecture achieves lower delay than the static and dynamic approaches and also it improves the QOS (quality of service) in the network architecture. Additionally we also compare with clustering approach is to improve the network throughput and QOS than the hybrid architecture.

Keywords **- WMN, hybrid channel allocation, clustering approach, routing.**

I. INTRODUCTION

WIRELESS mesh networking has fascinated grand look into attention freshly. WMN [7] has become a hopeful technology to facilitate that has the budding to smooth the progress of many useful applications. Capacity reduction problem is the one of the major problem facing in WMN due to wireless interference. Technology advances have made it probable to provide a wireless mesh router among multiple radios, which can be configured to dissimilar channels and therefore decrease network interference. The major challenge in multiradio multichannel WMN is the allocation of channel to interfaces with in mesh router as a result the network capacity can be maximized. The current two approaches of channel allocation are static and dynamic allocation. In static channel allocation, each one interface of all mesh routers is assign a channel permanently. In dynamic channel allocation, an interface is formal to change from one channel to another channel frequently. Both approaches have their merits and demerits. Static approach [4] do not require interfaces to change channels and have lower overhead. Dynamic approach [5] need frequent channel switching and thus have higher overhead than the static strategies.

Due to the inflexibility of static channel allocation and the purely dynamic channel allocation, in this paper we suggest hybrid architecture. Comparing to static and dynamic channel allocation it has several advantages. Here this architecture, has two interfaces, One interface from each router uses the dynamic channel allocation approach while the other interfaces use the static channel allocation approach. The working of links in static channels provide high throughput paths from end-users to the gateway while the dynamic channels links improve the network connectivity and the network’s adaptivity to the changing traffic. Hence, this hybrid architecture can achieve better adaptivity than the purely static architecture without much increase of overhead compared to the purely dynamic architecture. In this paper we converse several important issues in the hybrid wireless mesh network. 1) The system architecture: where each mesh node contains both static and dynamic interfaces, we converse on how to manage the channel assignment between both types of interfaces, so that the channel resources could be utilized efficiently. 2) The channel allocation for dynamic interfaces: Multichannel MAC protocol (MMAC) [6] is presently one of the most proficient dynamic channel allocations. The channel assignment in MMAC is obtained only for network throughput. We propose an Adaptive Dynamic Channel Allocation protocol (ADCA), which obtained for both throughput and delay in the channel assignment. Compared with MMAC, ADCA is better to reduce the packet delay without corrupting the network throughput. The rest of the paper is ordered as follows: We précis the previous work in II. In III, we introduce the network model. In IV protocol design in MMAC and V we present our dynamic channel allocation protocol and the routing algorithm in the hybrid wireless mesh network. We estimate our comparison result and clustering approach in VI, and at last we conclude our work in VII .

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II. ROUTING AND PREVIOUS WORK

A. Routing decision in the network

In the hybrid structure, have static links and dynamic links, both can be used to transmit data. We added an (ICAR) Interference and Congestion Aware Routing protocol. Which provides and balancing the channel usage over the network and to improve the network throughput. Many studies have been devoted on how to allocate channel in multichannel WMN and how to minimize interference and maximize throughput. Two fundamental channel allocation strategies have been considered: 1) Static channel allocation, where the interfaces are assigning channels permanently (2).Dynamic channel allocation, where interfaces are authorized to change to different channels. The Raniwala et al [1] wished-for an iterative approach to work out the joint routing and channel assignment problem, each mesh router changes from time to time. Alicherry et al [2] and Kodialam , they proposed an approximation algorithm for getting joint routing and channel assignment. The learning algorithm needs time to meet to a good channel assignment each time the traffic pattern changes. In this paper, link level channel allocation algorithms on dynamic interfaces were spot lighted. Unlike previous approaches, we suggest hybrid architecture in this paper, which uses dynamic channel allocation strategy on one way and static channel allocation strategy on the other way of each node. In our comparison, the hybrid wireless mesh network is capable to obtain the advantages of both channel allocation methodologies. The hybrid multichannel allocation protocol (HMCP) has been proposed in [11]. For each node, it assigns some channel interface as fixed channels, where as letting the remaining interfaces to switch channels. Data transmission occurs between two nodes only when the dynamic interface of one node change to the same channel with the static interface of the another node. The data transmission on each hop needs a channel switch, due to this HMCP causes high delay for multihop data transmission. In distinguish, our hybrid architecture enables static interface to send out data among each other. As a result, our hybrid approach achieves lower delay than HMCP.

III. NETWORK MODEL

In this model, we suggest to use the hybrid architecture for achieving high throughput and network adaptivity to changing traffic and low channel switching overhead. Let G(V,E) be the network topology, Here represents a set of mesh routers and E represents a pairs of mesh routers that are within radio communication range. Imagine that each mesh router has multiple interfaces. In the hybrid architecture, one interface of each mesh router be able to switch channel repeatedly, and let the other interfaces work on permanent channels.

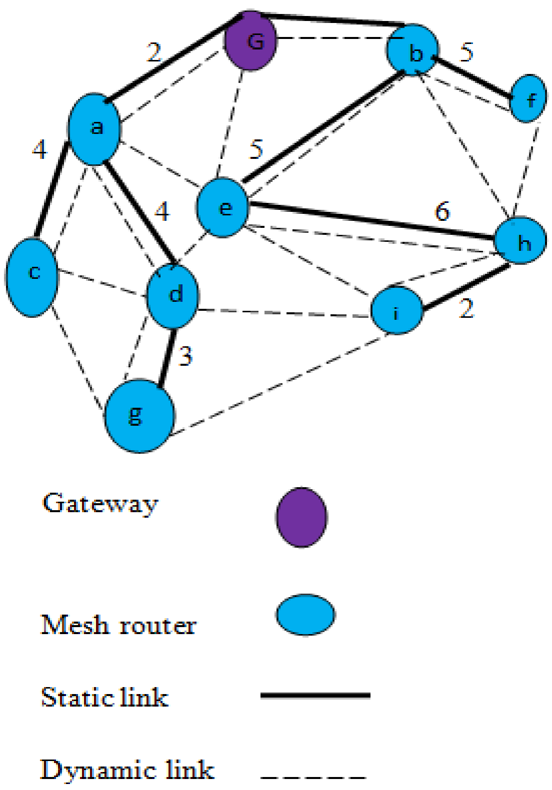

Fig I: Hybrid WMN Architecture

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In the rest of this paper, we describe the former interface as dynamic interface, and the latter as static interface. FIGURE I, describes a hybrid multichannel multiradio wireless mesh network. Most mesh nodes including the gateway have 3 interfaces, and a few boundary nodes(c,g,i.f)have 2 interfaces. For each mesh node, one interface works as dynamic interface, and the others work as static interfaces. After the network topology has been constructed, each link can then be assigned channels. The links nearer to the gateways are specified superior priority to be allocated with less overcrowded channels. In FIGURE I, the link is shown in bold lines, are called as static link. Dynamic interfaces work in an on-demand fashion. Two dynamic interfaces that are within radio transmission range of each other are able to discuss a common channel and communicate when they have data to transmit. We call these links as dynamic links. Here we use TDMA-style dynamic multichannel MAC protocols such as MMAC [6]. In this the time is divided into fixed-length intervals, each one consists of control interval and data interval. In the control interval, all nodes communicate on a default channel (or control channel) to discuss the channels to use in the data interval. In the data interval, nodes transmit and receive data on the negotiated channels (or data channel). As we are considering a hybrid architecture, the dynamic channel location should be aware of the interference from the static interfaces, So it requires some additional considerations in the protocol design.

IV.PROTOCOL DESIGN IN MMAC

In FIGURE II, consider A has some data to send to C. According to MMAC, in the interval t1 the packets are transmitted from A to B and then in the second interval t2, the packets are transmitted from B to C. Although the packets can be transmitted from A to C through B in one interval, MMAC actually requires two intervals. Because of this, B has to wait till the second interval to discuss a common channel with C in order to continue transmitting the data.

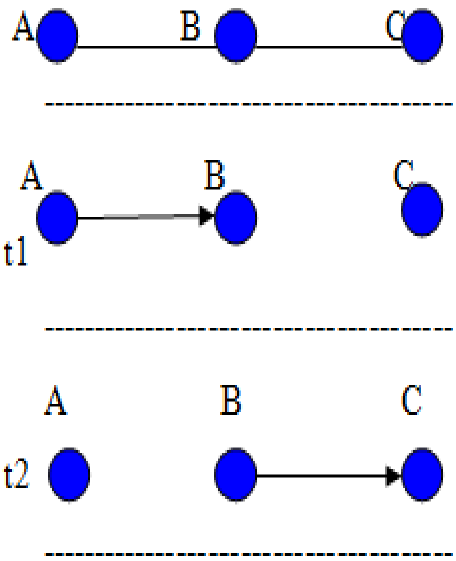

Fig II: Unnessesary Delay Of MMAC

V. ADAPTIVE DYNAMIC CHANNEL ALLOCATION

ADCA uses the similar to frame work with MMAC. Yong ding et al [11] proposed about ADCA. It divides time into fixed length intervals. Each interval is additional split into control interval and data interval. Let T be the interval length.**Tc** be the control interval length, and **Td** be the data interval. In the control interval, all nodes switch to the same default channel and negotiate channels. In the data interval, the nodes working on the same channel transmit and receive data among each other. In this MMAC protocol, interval length T is set to 100 ms, and control interval Tc is set to 20 ms, which is long enough for nodes to negotiate channels when network traffic is saturated. Our protocol uses the same parameter settings (T and Tc), but is different in the channel allocation scheme during control interval.

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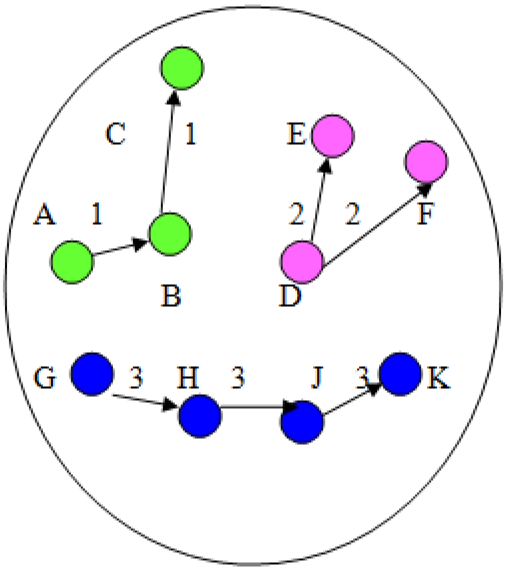

Fig III: Adaptive Dynamic Channel Allocation

In ADCA, dynamic interface maintain many queues in the link layer with one queue for each neighbor. The data to be sent to each neighbor are uffered in the corresponding queue. The first step of channel negotiation in ADCA is similar with MMAC. For each dynamic interface, if it has data to transmit, it chooses a neighbor that it wants to communicate and try to negotiate a common channel with the neighbor. There are many methods for selecting neighbors. If throughput is the only consideration, we may select the neighbor with the longest queue. However, this approach may cause malnourishment therefore, For that we supplement it with some justice consideration. Here we evaluate a neighbor's priority by considering both its queue length and how long the queue has not been served. As a result, during this step, pairs of nodes have discussed common channels with each other. Such as the example in FIGURE III.Different from MMAC, ADCA enables further channel cooperation among nodes.

For a pair of nodes that have previously negotiated a channel specify the node that initiated the channel cooperation as sending node, and the other node as receiving node. The node that has not achieved something in negotiating a channel with any other node is denoted as pending node. The channel negotiation process is described in Algorithm. In this algorithm, a queue length threshold QT is used on each node to decide whether to execute further channel cooperation If the queue length is over the threshold, the traffic load may become saturated, and it will not transport any benefit with further channel negotiation. We will discuss how to determine queue length in Algorithm Channel cooperation.

Pending Node:

1: Televise PNODE REQ message to inform its neighbors to facilitate it is a pending node.
2: if receiving SWITCH CHANNEL then
3: Switch to some other channel indicated in the message.
4: end if

Sending Node:

1: if the queue length for the receiving node < QT then
2: Televise SENDING NODE REQUEST message to inform its neighbors that it is a sending node.
3: end if
4: if receiving SWITCH CHANNEL then
5: if its receiving node (r) is not discuss with any other sending nodes then
6: Switch tosome other channel indicated in the message.
7: end if

Receiving node:

1: if the queue length of its sending node < QT then
2: if receiving PNODE REQUEST then
3: Send SWITCH CHANNEL message to the pending node including its personal channel .
4: end if
5: if receiving SNODE REQ UEST then
6: Send SWITCH CHANNEL message to the sending node including its own channel

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7: end if
8: end if

VI.COMPARISION RESULT AND CLUSTERING APPROACH

The results of the different simulation are summarized in the list that follows:

- Throughput vs ratio skewed
- Packet delay vs data rates
- Packet jitter vs data rates
- Total throughput vs ratio skewed

THROUGHPUT: Throughput or network throughput is the average rate of successful message delivery over a communication channel

PACKET DELAY: Packet delay variation (PDV) is the difference in end-to-end one-way delay between selected packets. The effect is sometimes referred to as jitter.

AODV: (Ad hoc On-Demand Distance Vector) is a routing protocol for mobile ad hoc networks (MANETs) and other wireless ad hoc networks. It is jointly developed in Nokia Research Center, University of California, Santa Barbara and University of Cincinnati by C. Perkins, E. Belding-Royer and S. Das.

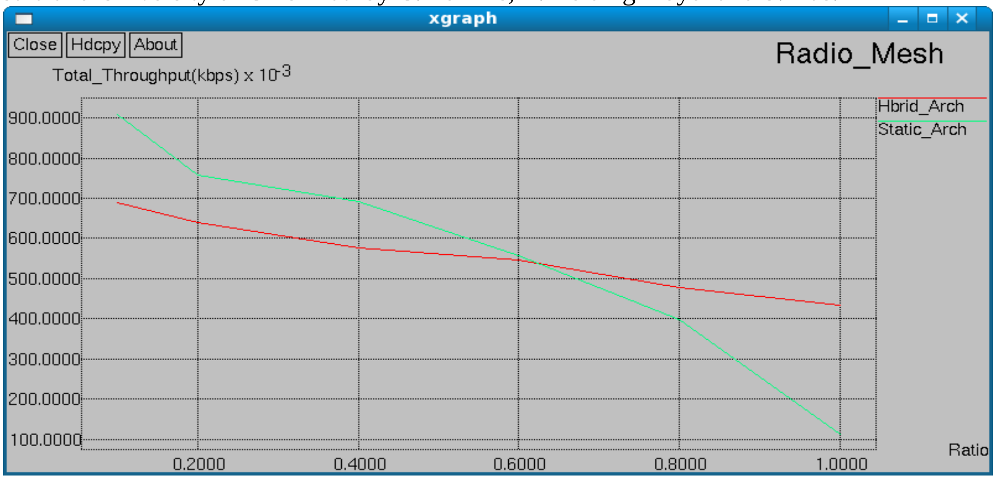

Fig IV: Presents the hybrid architecture compared with the static architecture. In this throughput of hybrid architecture is higher than the static architecture. Here x axis denotes the ratio skewed and y axis denotes the throughput. Green colour curve denotes static architecture results and red color curve denotes hybrid architecture results.

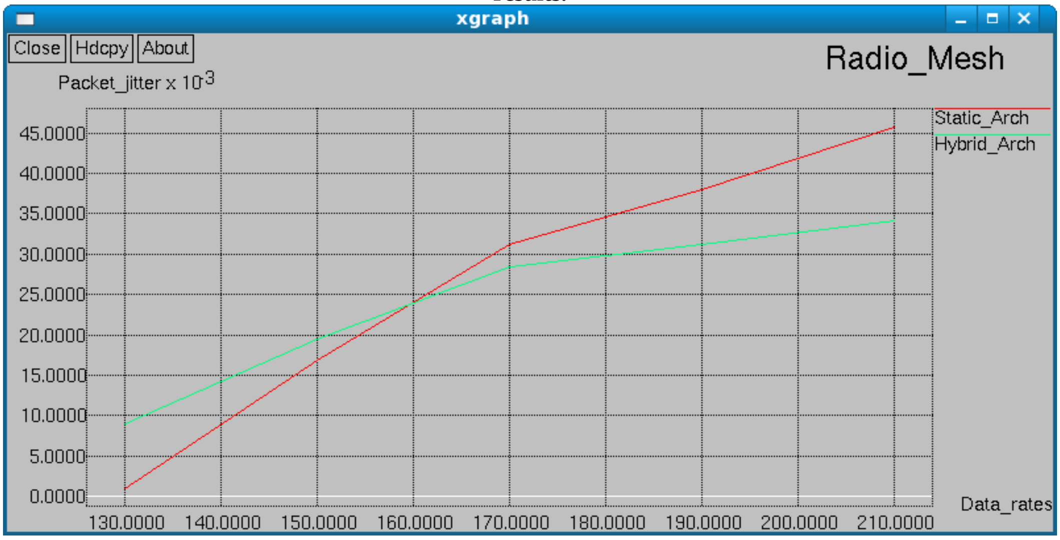

Fig V: Demonstrates the hybrid architecture compared with the static architecture. In this packet jitter of hybrid architecture is lower than the static architecture. Here x axis denotes the data rates and y axis denotes the packet jitter. Green colour curve denotes hybrid architecture results and red color curve denotes static architecture result.

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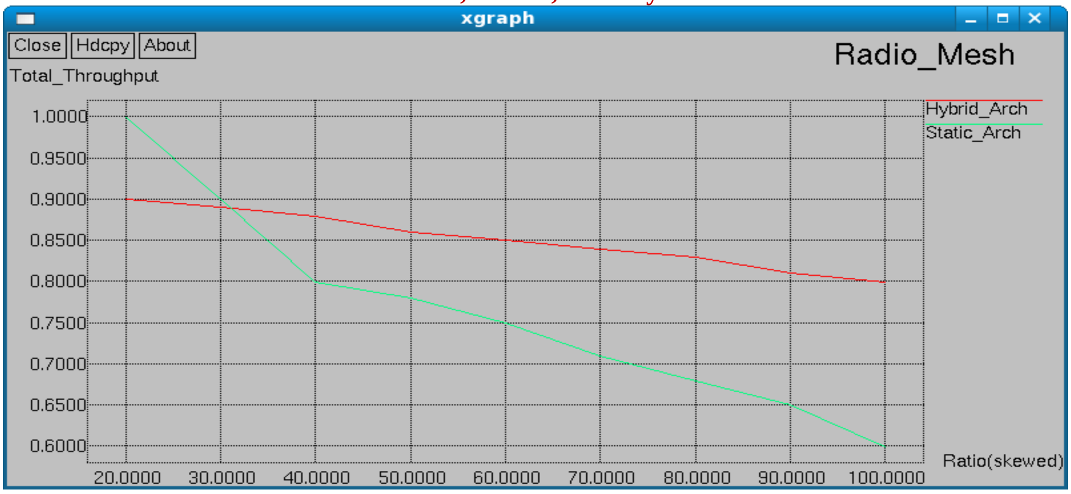

Fig VI: Shows the hybrid architecture compared with the static architecture. In this total throughput of hybrid architecture is higher than the static architecture. Here x axis denotes the ratio skewed and y axis denotes the throughput. Green colour curve denotes static architecture results and red colour curve denotes hybrid architecture results.

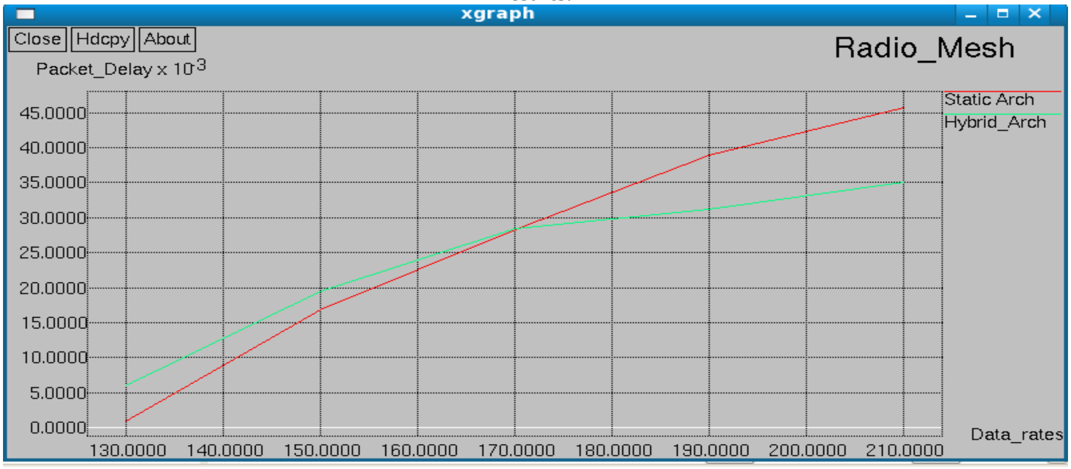

Fig VII: Shows the hybrid architecture compared with the static architecture. In this packet delay of hybrid architecture is lower than the static architecture Here x axis denotes the data rates and y axis denotes the packet delay. Green colour curve denotes hybrid architecture results and red color curve denotes static architecture results.

CLUSTERING APPROACH

Clustering approach to increase the number of nodes in network. Channel selection is based on dynamic (based on highest energy level in every node). To reduce the routing distance and increase the QOS through the clustering approaches packets transfer from CH to Sink node(receiver node) Throughput can be increased compare to the hybrid architecture and packet delay can be reduced compared to the hybrid architecture.

VII CONCLUSION

The hybrid wireless mesh network architecture achieves high throughput and reduce packet delay than the static and dynamic interfaces. Have made two contributions. First, proposed an adaptive dynamic channel allocation protocol to be used on dynamic interfaces. Compared with MMAC, ADCA reduces the packet delivery delay without degrading the network throughput. In addition, proposed an interference and congestion aware routing algorithm in the hybrid network, which balances the channel usage in the network and therefore increases the network throughput. The simulation results have shown that, hybrid architecture achieves better results compared to the purely static architecture. Hybrid approach is more adaptive to the changing traffic without significant increase in overhead. And additionally by comparing with the clustering approaches, throughput can be increased than the hybrid method. Finally we can improve our QOS of network in these clustering approaches.

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