# Channel Assignment Schemes for Multi-Radio Multi Channel in Wireless Mesh Network

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***Abstract*—In Wireless Mesh Network Multi channel used to improve the performance and the network capacity multi radio environment. In this network each router has multiple radio and multiple channel for the communication. We are focusing on the how to assignment of the channel for each router to achieve the minimum load on the network. So for the channel assignment there are some algorithm that we are using. These channel maintain the communication between the nodes that are available in the network. The result of this getting the minimum interference between the channel and improved the capacity of the network.**

***Keywords—Wireless Mesh Network; Multi Radio; Multi Channe; Interference;***

## I. INRODUCTION

### *A. Wireless Mesh Networks*

(WMNs)[1] is the fast growing technology in the field of wireless networking. These networks are dynamic and self – healing. There are two types of node classification Mesh Router and Mesh clients. Mesh router provide the service to the mesh clients and also the other mesh router. In the mesh router we have the multi radio to connect the channel and have the different channel to distribute the load of the network.

Now wireless mesh network used in different areas: As the security purpose it is used in military field also. Here in Fig.1 we see the general architecture of WMN.

### *B .Channel Interference in wireless networks*

There are many factors at which we can judge the performance of a wireless mesh network. It depends on the end-to-end delay, throughput etc. Interference[2] is can be main factor for any network. It can be degrade the performance of any network. Interference that occurs between the nodes of the prescribed network. The main objective of the channel assignment is to minimize the overall network performance. The assignment of the channels should be aware about the interference constraint[3] in which number of the channels assigned to the links incident on a node is maximum the number of interfaces on that node. Thus there are different kind of algorithm that are enable on the different channel assignment scheme. Theses algorithm run fast and give the quality solution.

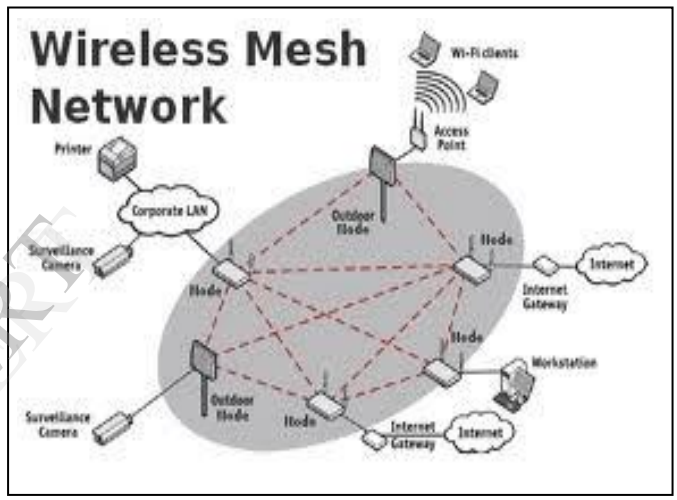


Fig. 1 Wireless Mesh Network

Although many research [4] have been devoted to the problem of channel assignment in multi-channel WMNs, there are network topology of channel assignment algorithms on the network performance. We explore the this problem in multi-radio multi – channel WMNs. In this paper we compare the performance of the different that are used in the channel assignment in the multi channel environment [5]. In which nodes can communicate each other at different data rates.

Therefore, channel assignment schemes predominantly employ heuristic techniques to assign channels to nodes in the network. There are various channel assignment algorithm to make a quality network.

Every transmission between wireless mesh routers creates interference in its neighbourhood[6], which is a major issue challenging the performance of WMNs. Certain high power level for transmission is necessary for successful reception at the receiver.

It is well understood among researchers that the above mentioned problems are highly interrelated. For example, it may happen that link scheduling does not yield a high throughput schedule because of the existence of high interference links in the network[7].

This may require the traffic of such links to be re-routed on shorter and lower interference links.

## II. MOTIVATION

Wireless mesh networks are emerging as a popular communication media due to its cost effective and deployment potentials. Various interactive application are now facilitate users that require high bandwidth and low handoff delay like Video conference, online radio, television.

To ensure a better quality of interactive application suitable scheme of mobility management is essential. In general, a node in WMN is mobile but in many application node can be stationary. So, a node can change the state of being mobile and stationary. In this situation, a hybrid mobility management system with both proactive and reactive routing ability can highly improve performance. If the mobility can be predicted from previous behaviour , we can reduce scanning overhead thus the handoff delay.

Mobility prediction can provide almost accurate prediction based on four factors, location, group, time of date, duration. Location utilizing in routing avoids the overhead of implementing explicit location update message with pointer forwarding. Location based routing integrate a routing based location update that locate the mesh client location by its uploading and downloading position.

But it fails when the mesh client is highly mobile. That requires pointer forwarding to keep trace of mobile node regularly. Implementing both of these strategies can reduce the handoff delay [7]. In handoff process channel scanning process causes the large handoff delay. Optimizing the channel scanning process can dramatically reduce handoff delay and provide seamless communication. Split channel strategy [8] split each channel into two channel, data channel and control channel. Data channel use to transmit data while control channel maintain control packets. A well designed split channel can reduce handoff latency without causing congestion.

## III. RELATED WORK

### *A. Channel Assignment Schemes*

#### *1) Fixed Channel Assignment Schemes:*

*a) Common Channel Assignment(CCA):*

In CCA [4] the radio interfaces of each node are all assigned the same set of channels. The main benefit is that the connectivity of the network is the same as that of a single-channel approach, while the use of multiple channels increases network throughput. Thus, although this scheme presents a simple CA . it fails for the various factors affecting channel assignment in a WMN.

*b) Varying Channel Assignment (VCA):*

In this scheme, interfaces of different nodes may be assigned different sets of channels [7]. However, the assignment of channels may lead to network partitions that may increase the length of routes between the mesh nodes. Therefore, in this scheme, assignment needs to be carried out carefully.

#### *2) Dynamic Channel Assignment Schemes:*

This scheme allow any interface to be assigned any channel, and interfaces can frequently switch from one channel to another. Therefore, when nodes need to communicate with each other, a coordination mechanism has to ensure they are on a common channel. In the Slotted Seeded Channel Hopping (SSCH) mechanism [3], each node switches channels synchronously in a random sequence so that all neighbours meet periodically in the same channel.

The benefit of dynamic assignment is the ability to switch an interface to any channel, thereby offering the potential to use many channels with few interfaces. However, the key challenges involve channel switching delays, and the need for coordination mechanisms for channel switching between nodes.

#### *3) Hybrid Channel Assignment Schemes:*

Hybrid channel assignment strategies combine both static and dynamic assignment properties by applying a fixed assignment for some interfaces and a dynamic assignment for other interfaces [8]. Hybrid strategies can be further classified based on whether the fixed interfaces use a common channel or varying channel approach.

The fixed interfaces can be assigned a dedicated control channel or a data and control channel , while the other interfaces can be switched dynamically among channels. Hybrid assignment strategies are attractive because, as with fixed assignment, they allow for simple coordination algorithms, while still retaining the flexibility of dynamic channel assignment.

There are two hybrid schemes for CA:

- Link Layer Protocols for Interface Assignment[8]
- Interference-Aware Channel Assignment[7]

Wireless mesh networks suffer from the degradation of capacity due to interference problem. An effective approach to relieve this problem is using the technology of Multi-Channel Multi-Radio (MCMR) [3-8]. In this way, every mesh router is equipped with multiple Network Interface Cards (NICs) .

Multiple channels[9] leads to efficient spectrum utilization and increases the capacity of network. The nodes can transmit packets simultaneously on distinct channels without causing collisions and interference. However, since the number of available channels is limited, some links interfere with each other and cannot be active at the same time[13].

## IV. PROBLEM FORMULATION

*a)* In a single-channel mesh network, nodes sharing the same channel and provide intra-flow interference in multi hop transmissions and inter- flow interference .

*b)* frequency multiplexing approach, which uses multiple radios[3] to carry packets in separate channels[9], can be used to avoid this interference.

*c)* Therefore, the mesh system applies a low-cost solution that uses fewer radios switching between multiple channels[6,7] for data transmission. Several channel switching problems must be solved.

*d)* The first problem is that switching between channels without coordination can result in packet loss. To avoid this, a notification mechanism that notifies neighbours to buffer data before channel switching is necessary.

*e)* Second, frequent switches cause a heavy switch overhead, while infrequent switches may result in pro- longed latency and buffer overflow [12]. Hence, a policy that manipulates radios to switch between multiple channels at suitable switch intervals must be decided.

*f)* Packet level algorithms are highly dynamic[14], where channels are assigned for every packet or every few packets . Channel switching overhead is the major drawback of these algorithms.

## V. CHANEEL ASSIGNMENT ALGORITHM

*A) Centralized Greedy Solution* [11]
*Input:* Expected load on each link.
*Output:* Assignment of channels to the network interfaces
*Algorithm:*
*1)* All the links are sorted
*2)* Visited all the links as per load according to its decreasing order.
*3)* When a link is visited, it is assigned to a channel with the lowest degree of interference.
*a)* If the interfaces of the incident nodes are all used out, we may need to change one interface to a used channel.
*b)* If the interfaces of the incident nodes are all used out but they have a common channel, then assign the link to the common channel.
*B) Distributed Algorithm*
*1)* Initially, each node chooses a random channel as its fixed interface.
*2)* Periodically, each node broadcasts on every channel its current fixed channel.
*3)* On receiving a packet, a node updates its Neighbor Table and Channel Usage List.
*4)* Each node periodically consults its CUL (relatively long period).
If its fixed channel is detected to be too crowded, it has a probability to change its fixed channel to a less crowded channel.

## VI. COMPARISON OF CHANNEL ASSIGNMENT SCHEME

| ***PROPERTY*** | **FIXED CA** | **DYNAMIC CA** |
|---|---|---|
| Interference | Not Available | Trace Driven |
| Switching Time | No Switching Required | Infrequent Switching |
| Topology Control | Fixed | No, topology is defined by the routing tree |
| Traffic Pattern | Not Considered | Considered |

## VII. CONCLUSION

In this paper, we have provided a comparative study on various channel assignment scheme in wireless mesh networks. Our aim is to focus on channel assignment that are aware of interference mainly and to introduce a new interference aware al in this field .Now, as a first step , we have provided a survey report on various algorithm scheme that accounts interference . Each one of these metrics is having limitations in certain factors. In future, we will be analysing all these metrics quantitatively and finding a new routing metric overcoming those limitations.

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