INTRODUCTION

- Wireless mesh networks (WMNs) are dynamically self-organized and self-configured[1] , with the nodes in the network automatically establishing an ad hoc network and maintaining the mesh connection.
- A mesh network can be designed using a flooding technique or a routing technique. When using a routing technique, the message is propagated along a path, by hopping from node to node until the destination is reached.

Channel Assignment scheme

- In wireless mesh network ,channel can be allocated between source to destination and in between source and destination each router is connected to its neighbor router in peer to peer manner, whole channel consists of number of routers some of them use static routing and others use dynamic routing scheme.

Types of channel allocation scheme:

1.Static channel allocation

2. Dynamic channel allocation

3.Hybrid channel allocation

Static Allocation

- In Static channel allocation, each interface of every mesh router is assigned a channel permanently.
- Static strategies do not require interfaces to switch channels and thus have lower overhead.
- They depend on stable and predictable traffic patterns in the network.

Mestic

It stands for mesh-based traffic and interference aware channel assignment. In Fixed channel assignment scheme need for channel switching, it cause more delay so to remove these delay. we use the MESTIC a rank based technique[4] which assign a rank to each node by finding aggregate traffic and based on the rank prioritized all the nodes and forward the data on the basis of rank.

Rank=Aggregate Traffic/min hops from gateway*no of radios

Dynamic Allocation

- In dynamic channel allocation, an interface is allowed to switch from one channel to another channel frequently.
- Dynamic strategies require frequent channel switching and thus have higher overhead than static strategies.
- The channel allocation can be changed with the changing traffic.

Routing Tree construction

- The basic tree construction process uses the metric by each WMN node to determine a parent to achieve better load balancing, and load-aware channel assignment.
- Gateway is used as central node which pass maximum traffic and it pass the information to its directly connected node by sending advertisement message and this advertisement message consists of cost of directly connected node.
- Other node which can receive the advertisement message can join or leave the node. If the new node has less cost the old node then it can join the new node and leave the old node. In this way shortest path is selected from source to destination

Hybrid Channel Allocation

Both static and dynamic allocation have their own advantages and disadvantages so we use hybrid architecture which is combination of both ,to can achieve better adaptively compared to the pure static architecture without much increase of overhead compared to the pure dynamic architecture.

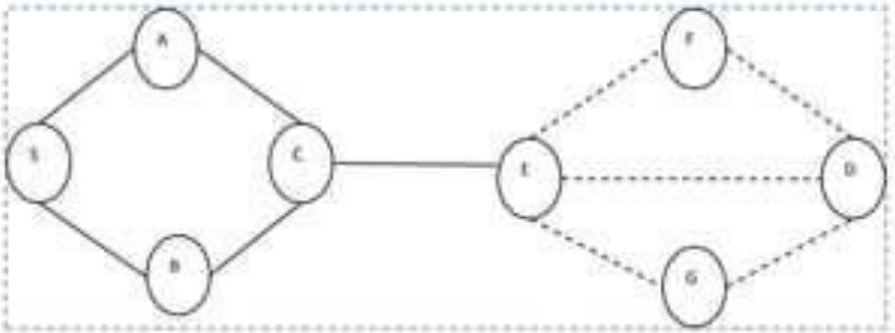


Fig:1 Hybrid Channel allocation Scheme

BFS-CA(Breadth First Search Channel Assignment)

This scheme is based on interference-aware channel assignment algorithm improved the capacity of wireless mesh network by making use of all available non-overlapping channels. This algorithm is based on an extension to the conflict graph called the multi radio conflict graph (MCG), where the vertices in the MCG represent edges between mesh radios instead of edges between mesh routers which overcome the problem of both the fixed and dynamic channel allocation scheme.

Multi Radio

- Mesh routers can be equipped with multiple radios to perform routing and access functionalities. This enables separation of two main types of traffic in the wireless domain.
- Mesh Routers improves the capacity of the network.
- Mesh Radios help to mesh routers to send data to other nodes by using different frequency.

Multi-channel

- In WMNs multi-channel concept is used with multi-radio to improve the capacity of network.
- By using multi radios every radio can be connected with number of different channels.
- In this way number of non overlapping channel increases and reduce the channel interference. Data can be send on different channels without overlapping.

Routing Protocols

A routing protocol specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network. Routing algorithms determine the specific choice of route. Each router has a prior knowledge only of networks attached to it directly.

Types Of Routing Protocols

1 DSR

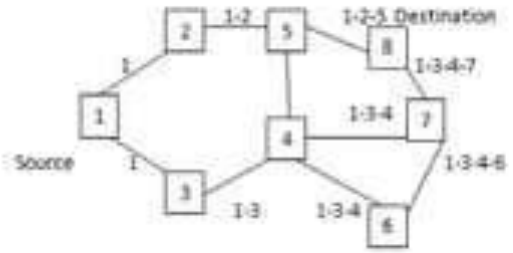
2AODV

3 MR-LQSR

DSR-Dynamic Source Routing Protocol

This protocol is based on the concept of source routing. The mobile nodes are required to maintain caches that contain source routes of which it is aware. The entries in the route cache are continually updated as new routes are learned.

It consists of two major phases: route discovery and route maintenance.

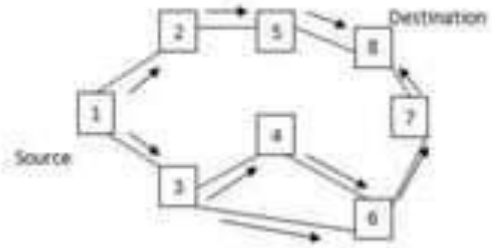


AODV-**Ad hoc on Demand Distance Vector**

Routes are set up on demand, and only active routes are maintained.

This reduces the routing overhead, but introduces some initial latency due to the on demand route setup.

It uses a simple request-reply mechanism for route discovery very similar to that of DSR.



MR-LQSR: Multi Radio-Link Quality Source Routing

It is based on using a metric called Multi-radio (MR) with LQSR. It use the WCETT metric and node has multiple radios, they are turned to different, non-interfering channels. The protocol uses the link weights to find a good path for a given destination.

Performance Metrics

Hop Count: is the most used metric in wireless multi hop networks. To avoid a looping in Wireless network hop count is assigned to each node. Every time when packets passes from one node to other hop count is decremented until it become zero.

Expected Transmission Count: ETX is the transmission count for delivering a packet over a wireless link successfully. ETX of a path is the sum of ETXs of all links of this path.

$$ETX = \sum_{k=1}^{\infty} K * s(K) = 1/1-P$$

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Expected Transmission Time (ETT): We define the ETT of a link as "bandwidth-adjusted ETX". In other words we start with ETX and multiply by link bandwidth to obtain the time spent in transmitting the packet. let S denote the size of packet and B bandwidth of link.

$$ETT=ETX *S/B$$

Weighted Cumulative Expected Transmission Time: This time depends on the loss rate and bandwidth. In WCETT is sum of expected time to successfully transmit a packet on the route.

$$WCETT = \sum_{k=1}^{n} ETT$$

802.11 Standards

There are several specifications in the 802.11 family:

- **802.11**-applies to wireless LANs and provides 1 or 2 Mbps transmission in the 2.4 GHz band using either frequency hopping spread spectrum (FHSS) or direct sequence spread spectrum (DSSS).
- 802.11a- an extension to 802.11 that applies to wireless LANs and provides up to 54-Mbps in the 5GHz band. 802.11a uses an orthogonal frequency division multiplexing encoding scheme rather than FHSS or DSSS

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- 802.11b- an extension to 802.11 that applies to wireless LANS and provides 11 Mbps transmission in the 2.4 GHz band. 802.11b uses only DSSS. 802.11b was a 1999 ratification to the original 802.11 standard, allowing wireless functionality comparable to Ethernet.
- 802.11e- a wireless draft standard that defines the Quality of Services support for LANs, and is an enhancement to the 802.11a and 802.11b wireless LAN (WLAN) specifications. 802.11e adds QoS features and multimedia support to the existing IEEE 802.11b and IEEE 802.11a wireless standards, while maintaining full backward compatibility with these standards.

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- 802.11g- applies to wireless LANs and is used for transmission over short distances at up to 54-Mbps in the 2.4 GHz bands.
- 802.11n-802.11n builds upon previous 802.11 standards by adding multiple input multiple output(MIMO). The additional transmitter and receiver antennas allow for increased data throughput through spatial multiplexing.

Comparisons of all Standards

802.11 protocols-> Parameters	802.11 a	802.11b	802.11g	802.11 n
Frequency(GHz)	5	2.4	2.4	2.4/5
Data rate(Mbps)	54	11	54	700
Range(feet)	50	100	100	50
Bandwidth(MHz)	20	20	20	40
Modulation	OFDM	DSSS	OFDM,DSSS	OFDM
No of overlapping channels	4(indoor/outdoor)	3(indoor/outdoor)	3(indoor/outdoor)	4(indoor/outdoor)
compatibility	Wifi 5	Wifi	Wifi at 11mbps	Wireless Ethernet compatibility alliance
MIMO streams	1	1	1	4

Conclusions

It can be concluded that Multi-Radio, Multi-Channel wireless mesh topology is best over all other topologies which helps us to improve the network performance by increasing network throughput and decreasing the delay in the network.

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Thank You