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Channel Allocation and Routing For Throughput Optimization in Wireless Mesh Networks

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ABSTRACT: Various approaches have dedicated to maximizing the network throughput in a multichannel multi radio wireless mesh network. Recent solutions are based on either purely static or dynamic channel allocation approaches. One major problem facing wireless mesh network is the capacity reduction due wireless interference. The major challenge in multiradio multichannel wireless mesh network is the allocation of channels to interfaces of mesh routers so that network capacity can be maximized. Currently two approaches of channel allocation, that is, static approach and dynamic approach. In static channel allocation, each interface of every mesh router is assigned a channel permanently. In dynamic channel allocation, an interface is allowed to switch from one channel to another frequently. In proposed hybrid architecture which combines the advantages of both approaches that is one interface from each uses the dynamic channel allocation strategy, while other interfaces use the static channel allocation strategy. The links working on dynamic channels provide high throughput paths from end-users to the gateway while the links working on dynamic enhance the network's adaptability to change the traffic. Therefore, hybrid architecture can achieve better adaptability compared to the purely static architecture without much increase of overhead compared to the purely dynamic architecture.

Index Terms—Wireless mesh network, hybrid channel allocation, multichannel and multi radio, routing.

I. INTRODUCTION

Wireless mesh networking has attracted great research interest recently. It has become a promising technology that has the potential to enable many useful applications. One major problem facing Wireless Mesh Networks (WMN) is the capacity reduction due to wireless interference. Technologies advances have made it possible to equip a wireless mesh router with multiple radios, which can be configured to different channels, and thus reduce network interference. Therefore, a major challenge in multiradio multichannel wireless mesh networks is the allocation of channels to interfaces of mesh routers so that the network capacity can be maximized.

Currently two approaches of channel allocation, that is, static approach and dynamic approach. In static channel allocation, each interface of every mesh router is assigned a channel permanently. In dynamic channel allocation, an interface is allowed to switch from one channel to another channel frequently. Both strategies have their advantages and disadvantages.

Static strategies do not require interfaces to switch channels, and thus have lower overhead. However, they depend on the stable and predictable traffic patterns in the network. Require that the exact traffic profile is known ahead, assume known statistical traffic patterns. Dynamic strategies, such as require frequent channel switching, and thus have higher overhead than static strategies. However, as the channel allocation can be changed with the changing traffic, dynamic strategies are more appropriate when the network traffic changes frequently and is unpredictable.

In the real environment, the overall traffic profile is usually complex. It not only contains some predictable traffic, e.g., a large amount of traffic from end-users to the Internet through gateways, but also contains a considerable amount of unpredictable peer-to-peer traffic between end-users due to the emerging new applications within the community. Due to the inflexibility of purely static channel allocation and the high overhead of purely dynamic channel allocation, in proposed a hybrid architecture which

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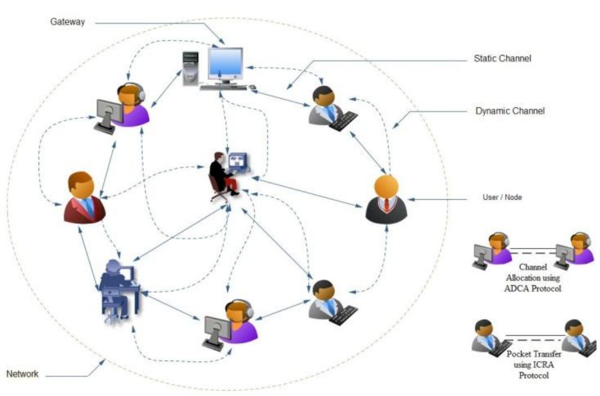
combines the advantages of both approaches. The architecture, one interface from each router uses the dynamic channel allocation strategy, while the other interfaces use the static channel allocation strategy**.**

II WIRELESS MESH NETWORKS

Mesh network (topology) is a type of network topology where each node must not only capture and disseminate its own data, but also serve as a relay for other nodes, that is, it must collaborate to propagate the data in the network. 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. To ensure all its paths' availability, a routing network must allow for continuous connections and reconfiguration around broken or blocked paths, using self-healing algorithms.



The Hybrid WMN Architecture

A mesh network whose nodes are all connected to each other is a fully connected network. Mesh networks can be seen as one type of ad hoc network. Mobile ad hoc networks (MANET) and mesh networks are therefore closely related, but MANET also have to deal with the problems introduced by the mobility of the nodes. The self-healing capability enables a routing based network to operate when one node breaks down or a connection goes bad. As a result, the network is typically quite reliable, as there is often more than one path between a source and a destination in the network. Although mostly used in wireless situations, this concept is also applicable to wired networks and software interaction.

III LITERATURE SURVEY

"Joint Multi-Channel Link Layer and Multi-Path Routing Design for Wireless Mesh Networks," It combines multichannel link layer with multi-path routing, and dividing time into slots. JMM coordinates channel usage among slots and schedule traffic flows on dual paths. This scheme efficiently decomposes traffics over different channels, different time and different paths.

"Practical Distributed channel Assignment and Routing in Dual-Radio Mesh Networks," Distributed routing and channel assignment protocol that achieves high end –to-end performance for paths in mesh network. It reduces inter-path interference gateways try to use different channel in their channel sequences although perform joint channel assignment and routing. To avoid intra-path interference.

"Characterizing the Capacity Region in Multi-Radio Multi-Channel Wireless Mesh Networks" Model multiple heterogeneous wireless standards with inherent rate diversity inter-operating with each other as multi-radio multi-channel mesh network. Due to hardness of the join routing and scheduling problem for linear program that give necessary conditions. Two link channel assignment algorithms, balanced static and packing dynamic channel assignment.

"Interference-Aware Topology Control and QoS Routing in Multi-Channel Wireless Mesh Networks" Co-channel interference capture the interference, it based on fully considering both interference and connectivity. Define minimum interference survivable topology control problem which seeks a channel assignment for given network among all K-connected topologies. Fully exploit the influence of inter flow and intra flow connections of multi-hop Qos routing algorithm.

"Centralized Channel Assignment and Routing Algorithms for Multi-Channel Wireless Mesh Networks" Wireless LAN standards allow multiple non-overlapping frequency channels to used simultaneously to increase the aggregate bandwidth to end-users. It evaluate multi-channel multi-hop wireless network built using standard 802.11 hardware equipping each node with multiple network interface cards. Set of centralized channel assignment, bandwidth allocation and routing algorithms for multichannel is critical.

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IV BACK GROUND

One major problem facing Wireless Mesh Networks (WMN) is the capacity reduction due to wireless interference. The major challenge in multi radio multichannel wireless mesh networks is the allocation of channels to interfaces of mesh routers so that the network capacity can be maximized. It based on two approaches of channel allocation, that is, static approach and dynamic approach. In static channel allocation, each interface of every mesh router is assigned a channel permanently. In dynamic channel allocation, an interface is allowed to switch from one channel to another channel frequently. Static strategies depend on the stable and predictable traffic patterns in the network. Static channel allocation is inflexibility. Dynamic strategies have higher overhead than static strategies. Dynamic strategies are more appropriate when the network traffic changes frequently and is unpredictable.

V CHANNEL ALLOCATION

Various channel allocation schemes for mesh networks are divided into three main categories fixed, dynamic, and hybrid it depending on the frequency with which the channel allocation scheme is modified. In a fixed scheme the channel allocation is almost constant, while in a dynamic scheme it is continuously updated to improve performance. A hybrid scheme applies a fixed scheme for some interfaces and a dynamic one for others.

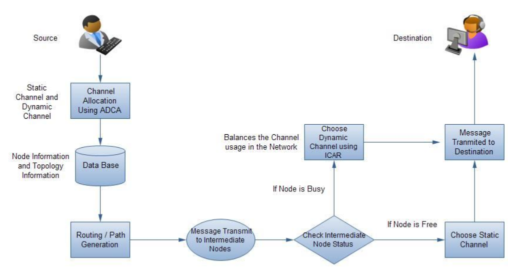
Adaptive dynamic channel allocation:

In ADCA, each dynamic interface maintains multiple queues in the link layer with one queue for each neighbor. The data to be sent to each neighbor are buffered in the corresponding queue. The first step of channel negotiation in ADCA is similar to MMAC. For each dynamic interface, if it has data to transmit, it selects a neighbor that it wants to communicate with and tries to negotiate a common channel with the neighbor. There are many criteria for selecting neighbors. If throughput is the only consideration, select the neighbor with the longest queue. However, this strategy may cause starvation. Therefore, augment it with some fairness considerations, that is, 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 negotiated common channels

Interference congestion aware routing protocol:

Determination of links states and interfering links. The link states can be inferred from the queue length. In the hybrid architecture, each static interface has one queue while each dynamic interface maintains multiple queues, one for each neighbor. The state of each link, whether static or dynamic, can be inferred from the corresponding queues of the two end interfaces. The longer the average queue length, the more likely is the link congested. Unlike the static link whose channel is fixed, a dynamic link may work on different channels at different intervals. Thus, if there is a dynamic link in a pair of links, it cannot deterministically say whether they will interfere with each other or not. An alternative way is to estimate their probability of interference.

VI SYSTEM ARCHITECTURE



The Hybrid WMN Architecture

First user will be create many number of nodes and for each node they allocate the channel, construct the path as well. The channel commonly has three types such as static channel, dynamic channel and hybrid channel. Static channel, each interface of every mesh router is assigned channel permanently. Dynamic channel, an interface is allowed to switch from one channel to another channel frequently. Hybrid channel, each mesh node contains both static and dynamic interfaces so that network capacity can be maximized. Each node store information about the neighbor.

A major challenge in multiradio multichannel wireless mesh networks is the allocation of channels to interfaces of mesh routers so that the network capacity can be maximized, high packet delay and degrading network throughput usage. Static

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Channel Allocation strategy depends on the stable and predictable traffic methods in the network.

Dynamic Channel Allocation strategy requires frequent channel switching in the network. Both Static Channel Allocation strategy and Dynamic Channel

Allocation strategy causes high packet delay and degrading network throughput usage. The protocol may used in the allocation of channels named as, Adaptive dynamic channel allocation protocol, which means that considers optimization for both throughput and delay in the channel assignment. Path may construct using Interference and Congestion Aware Routing protocol (ICAR) in the hybrid network with both static and dynamic links, which balances the channel usage in the network. And also ADCA reduce the packet delay without degrading the network throughput. After message transmission based on static, dynamic and hybrid links. Finally it reach the destination.

VII PROPOSED SYSTEM

The hybrid architecture, which combines the advantages of both approaches. In this architecture, one interface from each router uses the dynamic channel allocation strategy, while the other interfaces use the static channel allocation strategy. The links working on static channels provide high throughput paths from end-users to the gateway while the links working on dynamic channels enhance the network connectivity and the network's adaptivity to the changing traffic. Therefore, hybrid architecture can achieve better adaptivity compared to the purely static architecture without much increase of overhead compared to the purely dynamic architecture. As each mesh node contains both static and dynamic interfaces, to coordinate the channel assignment between both types of interfaces, so the channel resources could be utilized efficiently.

VIII CONCLUSION

Hybrid wireless mesh network architecture, where each mesh node has both static and dynamic interfaces. It has made two contributions. First, the proposed 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, compared to the purely static architecture, our approach is more adaptive to the changing traffic without significant increase in overhead. Moreover, compared to existing hybrid architecture, this approach achieves lower delay, while maintaining the adaptivity to the changing traffic.

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