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REVIEW ARTICLE

Mesh Networks with Fault Tolerant Routing Technique – A Review

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Abstract- *Wireless mesh networks (WMNs) typically consist of a set of mesh routers that communicate with each other via wireless links and form a mesh topology. The basic functionalities of these mesh routers are providing the backhaul connection for Wireless LANs (WLANs) and routing the traffic in the backhaul. Routing becomes a challenging issue when routers with multiple directorial antennas and intermittent failures are common. To avoid these failures an autonomous network reconfiguration is done that enables a WMN to autonomously recover from local link failures to preserve network performance. By using channel and radio diversities in WMNs, ARS generates necessary changes in local radio and channel assignments in order to recover from failures. Next, based on the thus-generated configuration changes, the system cooperatively reconfigures network settings among local mesh routers. It addresses both the problems and propose an effective geometric routing scheme which avoids loops in the network, improves scalability and efficiency and self-heals against failures*

Keywords: *Reconfiguration, Self-healing, Advanced Greedy Forwarding*

I. INTRODUCTION

Wireless mesh networks(WMNs) typically consist of a set of mesh routers that communicate with each other via wireless links and form a mesh topology[1] . The basic functionalities of these mesh routers are:

(1) Providing the backhaul connection for Wireless LANs (WLANs)

(2) Routing the traffic in the backhaul.

Aim is to improve their performance in the backhaul by routing and Wireless mesh networks have also been evolving in various forms to meet the increasing capacity demands by the different emerging applications. However, due to heterogeneous and fluctuating wireless link conditions, preserving the required performance of such WMNs is still a challenging problem [1]. For example, some links of a WMN may experience significant channel interference from other coexisting wireless networks. Some parts of networks might not be able to meet increasing bandwidth demands from new mobile users and applications. Links in a certain area (e.g., a hospital or police station) might not be able. (WMNs) experience frequent link failures caused by channel interference, dynamic obstacles, and/or applications' bandwidth demands. These failures cause severe performance degradation in WMNs or require expensive manual network management for their real-time recovery. An Autonomous Network Re-configuration System (ARS) that enables a multiradio WMN to autonomously recover from local link failures to preserve network performance[2]d. By using channel and radio diversities in WMNs, ARS generates necessary changes in local radio and channel assignment in order to recover from failures

Why Is Self-Reconfiguration Necessary?

Maintaining the performance of WMNs in the face of dynamic link failures remains a challenging problem. However, such failures can be withstood (hence maintaining the required performance) by enabling mr-WMNs to autonomously reconfigure channels and radio[1] assignments, as in the following examples.

(1) **Recovering from link-quality degradation**: The quality of wireless links in WMNs can degrade (i.e., link-quality failure) due to severe interference from other colocated wireless networks. For example, Bluetooth, cordless phones, and other coexisting wireless networks operating on the same or adjacent channels cause significant and varying degrees of losses or collisions in packet transmissions by switching the tuned channel of a link to other interference-free channels, local links can recover from such a link failure.

(2) **Satisfying QoS demands dynamic**: Links in some areas may not be able to accommodate increasing QoS demands from end-users depending on spatial or temporal locality [20]. For example, links around a conference room may have to relay too much data/video traffic during the session. Likewise, relay links outside the room may fail to support all attendees' voice-over-IP calls during a session break. By re-associating their radios/channels with underutilized radios/channels available nearby, links can avoid communication failures.

(3) **Coping with heterogeneous channel availability**: Links in some areas may not be able to access wireless channels during a certain time period (spectrum failures) For example, some links in a WMN need to vacate current channels if channels are being used for emergency response near the wireless links (e.g., hospital, public safety). Such links can seek and identify alternative channels available in the same area.

Motivated by these three and other possible benefits of using reconfigurable mr-WMNs, we would like to develop a system that allows mr-WMNs to autonomously change channel and radio assignments (i.e., self-reconfigurable) to recover from the channel-related link failures mentioned

II. Literature Review

Given the above system models, we now discuss the pros and cons of using existing approaches for self-reconfigurable WMNs

Localized Reconfiguration: Network reconfiguration needs a planning algorithm that keeps necessary network changes (to recover from link failures) as local as possible, as opposed to changing the entire network settings. Existing channel assignment and scheduling algorithms provide holistic guidelines such as throughput bounds and scheduleability for channel assignment during a network deployment stage [5][6]. However, the algorithms do not consider the degree of configuration changes from previous network settings, and hence they often require global network changes to meet all the constraints, akin to edge coloring problems. Even though these algorithms are suitable for static or periodic network planning, they may cause network service disruption, and thus are unsuitable for dynamic network reconfiguration that has to deal with frequent local link failures.

Greedy channel-assignment: It considers only local areas in channel assignments might do better in reducing the scope of network changes than the above-mentioned assignment algorithms. However, this approach still suffers from the ripple effect, in which one local change triggers the change of additional network settings at neighboring nodes due to association dependency among neighboring radios[7]. This undesired effect might be avoided by transforming a mesh topology into a tree topology, but this transformation reduces network connectivity as well as path diversity among mesh nodes.

Greedy routing algorithm: It follows the problem solving heuristic of making the locally optimal choice at each stage with the hope of finding a global optimum.[3] In many problems, a greedy strategy does not in general produce an optimal solution, but nonetheless a greedy heuristic may yield locally optimal solutions that approximate a global optimal solution in a reasonable time despite using different kinds of graphs, most of these approaches have the following common characteristics.

First, the wireless network environment is modelled by the unit disk graph (UDG), in which all network nodes use omnidirectional antennas with an identical transmission range and two nodes have a link between them if their distance is no more than the transmission range [1]. Thus, there exists significant interference among links that are near each other, which makes the routing protocols solely based on position information not appealing.

Second, the geometric graphs used as the network topology needs to be established and maintained by exchanging control messages among the nodes, which incurs significant overhead.

Finally, in routing a packet to the destination, if the processing node does not have a neighbor closer to the destination than itself, face routing is used to overcome this communication void phenomenon and to guarantee the packet delivery. Though face routing cannot generate loops in static networks, it can do so in dynamic networks.

The consideration here is the interaction between channel assignments and distributed scheduling in multi-channel multi radio Wireless Mesh Networks (WMNs)[4]. Recently, a number of distributed scheduling algorithms for wireless networks have emerged. Due to their distributed operation, these algorithms can achieve only a fraction of the maximum possible throughput. As an alternative to increasing the throughput fraction by designing new algorithms, the idea here is a novel approach that takes advantage of the inherent multi-radio capability of WMNs. Thus this capability can enable partitioning of the network into sub networks in which simple distributed scheduling algorithms can achieve 100% throughput. The partitioning is based on the recently introduced notion of Local Pooling. Using this notion, we characterize topologies in which 100% throughput can be achieved distributedly. These algorithms partition a network in a manner that not only expands the capacity regions of the sub networks but also allows distributed algorithms to achieve these capacity regions.

III. Conclusion

By using routing protocol based on the greedy forwarding algorithm and the self-reconfiguration scheme WMNs makes routing easier where WMNs recover from link-quality degradation in short amount of time, satisfy dynamic QoS demands and Coping with heterogeneous channel availability thus increasing scalability and channel efficiency by removing loops in the network

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