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Autonomously-Reconfigurable Wireless Mesh Networks

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Abstract: *Multi-hop wireless mesh network experience link-failure due to channel interference, dynamic obstacles etc. which causes performance degradation of the network in Wireless Mesh Networks. The paper proposes "Autonomously Reconfigurable Wireless Mesh Networks system based upon IEEE 802.11" for mr-WMN to recover autonomously in case the network failure occurs, to improve the network performance. The paper presents an autonomously network reconfiguration system (ARS) that allows a multiradio WMN to self-recover from local link failure to maintain network performance. By using channels and radio variability in WMNs, ARS generates needful changes in local radio and channel assignments in order to recover from failures. Next, based on the generated configuration changes, in which the system cooperatively reconfigures network setting among local mesh routers.*

Keywords: *IEEE 802.11, multi-radio wireless mesh networks (mr-WMNs), Autonomous-Reconfigurable Network, Wireless Link Failures.*

I. INTRODUCTION

A wireless mesh networks: (WMN) is a communications network made up of radio nodes organized in a mesh topology. Wireless mesh networks consist of mesh clients, Gateways and mesh routers. The mesh clients like laptops, cell phones and other wireless devices also mesh clients can work as router. The mesh routers send network traffic and the gateways which may connect to the Internet [1]. It supports larger applications and also it provides some benefits to users such as no cabling cost, automatic connection to all nodes, network flexibility, ease of installation and it also discovers new routes automatically.

Wireless mesh networks are not stand alone they are connected with other wireless networks through mesh routers. It provides greater range of data transfer rates in the networks. Wireless mesh networks in which protocols are used for communication at small cost. So that here is more chances of packet losses and link failures. Information transmission are generally started from the source node to their specified destination node [3].

The transmission strategies can be similar for different kinds of networks. In wireless mesh networks in which link failures occurs because of increase the application bandwidth demand, channel interference and dynamic obstacles. Even though various solution for WMNs to recover from wireless link failures have been proposed such as resource-allocation algorithm, greedy channel assignment algorithm and fault-tolerant routing protocols [2].

First is resource-allocation algorithm it allocates the resources initially, also can used only theoretical guidelines for initial network planning. The disadvantages is that they provide optimal solution they require the global configuration changes, which is not suitable for the frequently link failures occurs. Next, a greedy channel assignment algorithm can change the settings of only the faulty link(s the drawback is that we need to consider configurations of neighbor nodes in mesh along with the faulty link(s). Third, fault-tolerant routing protocols, it can be used for avoiding the faulty links in routing protocol for local rerouting, multipath routing This fault-tolerant routing protocol depends on repetition transmission, used for more amounts of network resources than the reconfiguration in link-level network [2][5].

This paper presents an autonomous network reconfiguration system (ARS) to overcome the above mentioned limitations that allows multiradio WMN (mr-WMN) autonomously reconfigure local network settings. To maintain the healthy networks using autonomous network reconfiguration system (ARS). ARS consists of reconfiguration planning algorithm that will find the configuration changes in local network for recovery, thus reducing the changes in healthy network. It means ARS initially search for local reconfiguration changes that are available faulty area.

Autonomously reconfiguration system also supervising the protocol that enables a WMN to perform real-time recovery form failures It also prevents the ripple effects. The protocol run in each mesh node and simultaneously measure wireless link conditions. For measuring the information of ARS calculate the failure of link and generates the reconfiguration plan. The rest of this is arrange as follows, Section II related work Section III describe ARS Architecture, IV Concludes the paper.

II. RELATED WORK

A considerable amount of work has been done for solving the problem in WMNs and maintains the healthy networks. And Networks reconfiguration used a planning algorithm that keeps necessary network changes (to recover from link failures) as local as possible as opposed to change in entire network settings. Scheduling algorithms and existing channel assignment provide guidelines such as throughput bounds and schedule ability for channel assignment during a network deployment stage. The paper by A. Brzezinski, G. Zussman, and E. Modiano, [2] provides brief study to develop practical algorithms to solve problems of wireless mesh networks also they have discussed various theories to solve these problems.

A survey paper by IAN F. Akyildiz, Georgia [3] gives a brief survey of wireless mesh networks. The authors of this paper give emphasis on architectural design of WMNs, layered communication in network and security.

New Autonomous System for WMN [4] the author have suggested a new Autonomous System for WMNs. He proposes this as for WMN to reduce manual configuration of network which solve failure recovery problems. He also fulfills the Quality of service (QoS) requirement of network.

As discussed above there are some problems in WMNs, a research by Kyu-Han kim and Kang G. shin [5] suggested a self- reconfigurable WMNs. The authors claim to solve the above discussed problems. We are extending our work from this paper.

2.1. ARS ARCHITECTURE

2.1.1 ARCHITECTURE.

The fig 1 Shows architecture of ARS. ARS is used for collect and sends the packets related to ARS similar to the group formation information. For this module in which it include algorithm and related protocols of ARS [4][5].

Link status information provides the information related to links in wireless mesh networks and network controller resides in device driver and interacts with failure finder in the algorithm [6].

1. Failure Finder, which is interact frequently with network monitor with device driver and maintain information about updated link state table.
2. Group organizer, designed for formation of local groups within mesh networks.
3. Planner Gateway- It is used for generating the network reconfiguration plan only for gateway nodes. The planner gateway includes plan producer, QoS filter and Benefit filter to generate plan.
4. NIC setting administrator receives new plan from group organizer and uses this new plan for further communication in the wireless mesh networks.

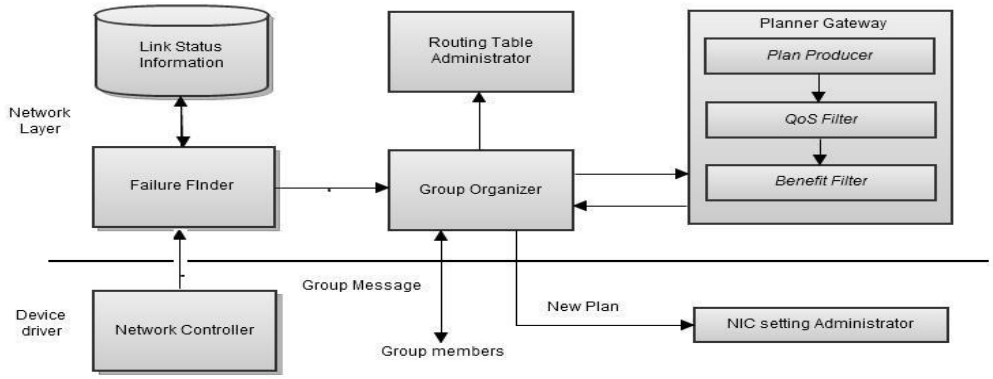

Fig 1. ARS Architecture

2.1.2. Ars Algorithm

1. Network controller time (*tc*)

1: For every link *l* do
2: calculate link quality (*lq*) using passive monitoring
3: end for
4: Send controlling result to a gateway *g*;

2. Failure Finder and group organization time (*to*)

5: if link *l* disconnect link requirement *r* then
6: request group organization on channel *c* of link *l*;
7: end if
8: start a leader election if it is receiver a request

3. Planning time (*C,tp*)

9: if node x is elected as leader then
10: send planning request message (*m,C*) to gateway
11: generate a reconfiguration plan (*p*) to *Cx*;
12: send a reconfig plan (*p*) to a leader of Cx;
13: end if

4. Reconfiguration Time (*p, tr*)

14: if p has changes of node *x* then
15: apply changes to link at *t*;
16: end if
17: relay p to neighboring members, if any

First, ARS in every mesh node checks the outgoing links quality and sends result to a gateway by sending message. Second, if it detects a link failure, ARS in the detector node trigger the group formation within local mesh routers and one group member becomes leader using election algorithm for coordinating reconfiguration. Third, leader sends a planning request message to a gateway then the gateway generate reconfiguration plan for the request. Forth, the gateway sends reconfiguration plan to leader node and the group members and Finally all nodes in group execute the new plan, if any, and resolve the group[5][7].

III. CONCLUSION

This paper presents Autonomous Reconfiguration System (ARS) that helps a WMN to reconfigure autonomously from link failure. Also ARS help in generating reconfiguration plan. ARS implements the reconfiguration plan that satisfies QoS constraint. User interface for application deployment.

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