Implementation of Autonomous Network Reconfiguration System in Wireless Networks

K.R.Arjunadhityaa, G.Murugaboopathi, T.K.S.Rathish Babu

Abstract: - Wireless Mesh Networks (WMNs) experience frequent link failures caused by channel interference. These link failures cause severe performance degradation in WMNs .This project is aimed towards developing an Autonomous Network Reconfiguration System (ANRS) that enables a multiradio wireless mesh networks to autonomously recover from local link failures to preserve network performance. Further we carry out simulation using Network Simulator NS-2 to compare the performance of ANRS with the existing link failure recovery methods. The metrics used for the performance evaluation are throughput, efficiency and Delay.

Keywords: Autonomous Network Reconfiguration System (ANRS), multiradio wireless Mesh Networks (mr-WMNs), Wireless link failures.

I. INTRODUCTION

Wireless Mesh Networks (WMNs) are being developed actively and deployed widely for a variety of applications, such as public safety, environment monitoring, and citywide wireless Internet services. For example, environment monitoring 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 data cannot reach to the destination within time due to link failures. Resource-Allocation Algorithm when the link failure occur the entire network configuration settings have to change to recover from these local link failures. Drawback of this method is when the local link failure occur we have to change the entire configuration settings time is inefficient in this method. Greedy Channel-Assignment Algorithm when the link failure occurs the acknowledgment will be send to the source. Source will transmit the data again in another path. Drawback of this method is when the link failure occurs the data have to be retransmitted from the source. Time is inefficient by using greedy method. Local rerouting or multipath routing can be adopted to use network-level path diversity for avoiding the faulty links. However, they rely on detour paths or redundant transmissions, which may require more network resources than link-level network reconfiguration. To overcome the above limitations ANRS is proposed. Throughput and efficiency is improved in this method. When the link failure occur it itself automatically change its channel, path and radio diversities among the faulty area and send the data to the destination without delay.

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By using ANRS when the link failure occur the entire data does not retransmitted from the source. Time is efficient by using ANRS method and delay is reduced in this method.

II. ANALYSIS NETWORK TOPOLOGY AND ALGORITHM

Each node sends messages to allow other nodes to detect it. Once a node detects messages from another node (neighbor), it maintains a contact record to store information about the neighbor. Using multicast socket all nodes are used to detect the neighbor nodes.

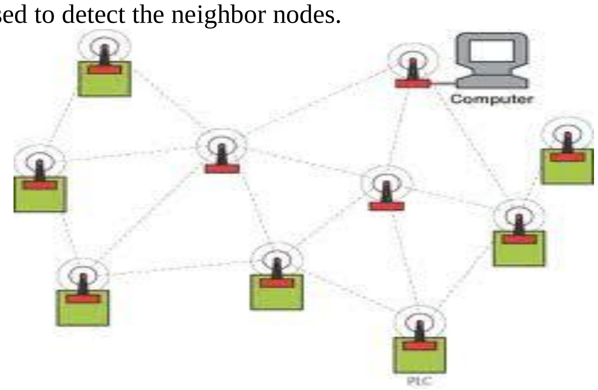

Figure 1: Multiradio WMN.A network often experiences wireless link failure and needs to reconfigure its settings.

The Greedy Channel-Assignment algorithm, which 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. 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.

III. AUTONOMOUS NETWORK RECONFIGURATION SYSTEM (ANRS) MODEL

ANRS in every mesh node monitors the quality of its outgoing wireless links at every node and reports the results to a gateway via a management message. Once it detects a link failure(s), ANRS in the detector node(s) triggers the formation of a group among local mesh routers that use a faulty channel, and one of the group members is elected as a leader. The leader node sends a planning-request message to a gateway. Then, the gateway synchronizes the planning requests, if there are multiple requests and generates a reconfiguration plan for the request. The gateway sends a reconfiguration plan to the leader node and the group members. Finally, all nodes in the group execute the corresponding configuration changes.

IV. PERFORMANCE ANALYSIS AND EVALUATION

The simulation topology is set up to analyze the performance of ANRS. The performance evaluation of ANRS is expected to produce a gain in throughput and the channel efficiency that is significantly greater than the existing greedy channel assignment algorithm and rerouting methods. It is also expected that the ANRS effectively reconfigures the network around a faulty link improving both network throughput and channel efficiency. By contrast local rerouting causes degradation in the channel efficiency due to the use of a detour path, and static channel assignment does not react to faults in a timely manner.
The performance parameters that can be obtained through the NS2 Trace Analyzer are as follows

- Throughput
- Delay

Throughput

Throughput is the rate at which a network sends and receives data. Throughput is rated in terms bits per second (bit/s).
Throughput, $T_p=P_a/P_f$,
P_a = packets received, P_f is the amount of forwarded over certain time interval

Delay

Delay refers to the time taken for a packet to be transmitted across a network from source to destination.

$$\text{Delay, } D = T_d - T_s$$

Td = packet received time at destination
Ts = packet time at source

V. ANRS ARCHITECTURE AND ALGORITHM

When the source node sends the data to the destination node, due to interference link failure occurs. By enabling the ANRS it automatically recover from the link failure by changing the channel, path and radio diversities among the faulty area and sends the data to the destination.

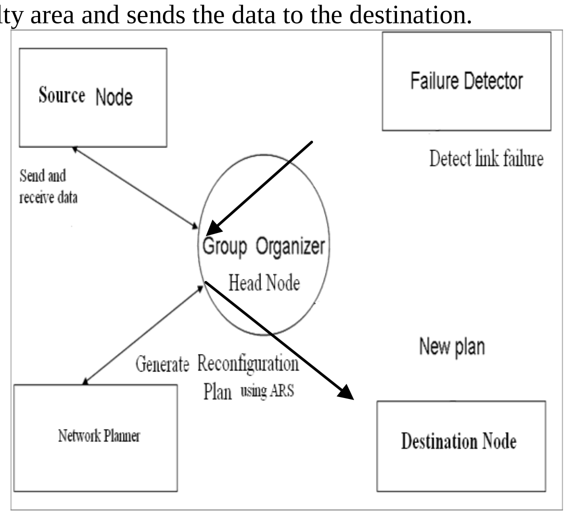

Figure 2: ANRS Architecture

Failure Detector detects the link failure and the link failure information is send to the head node and its group members. Network planner generates the reconfiguration plan and the new plan is implemented in the network settings and data are sent to the destination.

ANRS in every mesh node monitors the quality of its outgoing wireless links at every node and reports the results to a gateway via a management message. Once it detects a link failure(s), ANRS in the detector node(s) triggers the formation of a group among local mesh routers that use a faulty channel, and one of the group members is elected as a leader using the well-known bully algorithm for coordinating the reconfiguration. The leader node sends a planning-request message to a gateway. Then, the gateway synchronizes the planning requests, if there are multiple requests and generates a reconfiguration plan for the request. Fourth, the gateway sends a reconfiguration plan to the leader node and the group members. Finally, all nodes in the group execute the corresponding configuration changes, if any, and resolve the group.

VI. RESULTS

Experimental Results we evaluated the improvements achieved by ANRS, including throughput, channel efficiency and Delay.

i). Throughput

ANRS performance is high compared to the existing failure recovery methods such as greedy and rerouting.

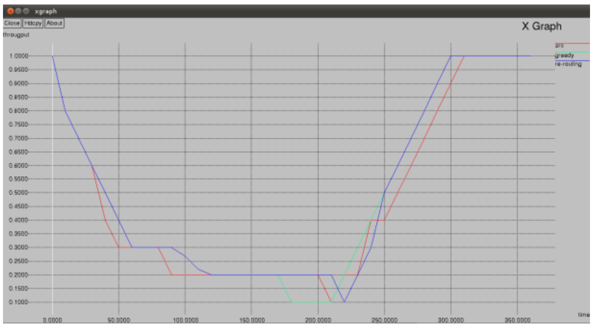

Figure 3: Throughput Vs Time

ii). Channel-Efficiency Gains

The efficiency of ANRS performance is high compared to the existing failure recovery methods as shown in figure 4.

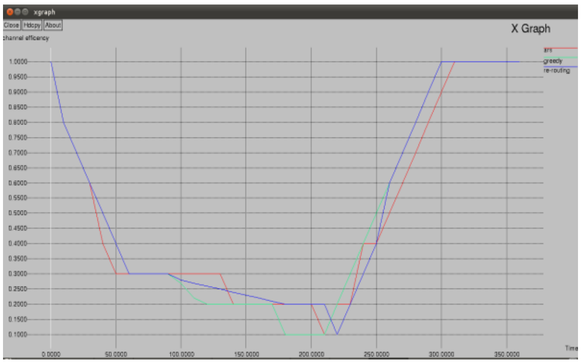

Figure 4: Efficiency Vs time

iii). Delay

The delay of ANRS is reduced compared to the existing failure recovery methods.

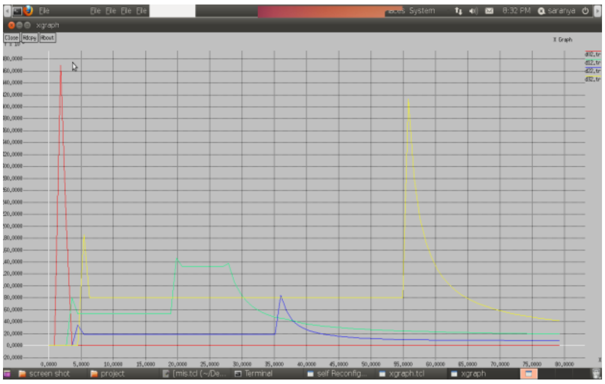

Figure 5: Delay Vs time

VII. CONCLUSION

ANRS performance is high compared to the existing methods. Thus by using ANRS it autonomously recovers from wireless link failures that require only minimum network configuration changes and thus improving the channel efficiency, throughput and satisfying the new application bandwidth demands. The ANRS average throughput and efficiency is high compared to the existing recovery methods. The average delay for ANRS is reduced compared to the existing recovery methods. So the packets are transmitted without delay to the destination when the link failure occurs.

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