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Planning in FARS by dynamic multipath Reconfiguration system failure recovery in Wireless Mesh Network

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ABSTRACT: Mesh Network has the advantages of fast implementation, easy maintenance and low direct investment while comparing with the existing networks. Wireless mesh networks are implemented as wireless anchors, but they are not stabilized. WMN experience frequent link failures caused by channel interference, dynamic obstacles and/or applications bandwidth demands. These failures cause severe performance degradation in WMNs. This paper presents the fast autonomous network reconfiguration system which provides the multi radio Wireless Mesh Networks to recover from link failure automatically to maintain the network performance. Fast autonomous network reconfiguration system gives the necessary changes in local radio and channel allocations to rescue from fails. The cooperative networks reconfigure network protocol for routers. FARS widely used in Wireless Mesh Networks test. The Implementation results Shows Fast Autonomous Network Reconfiguration System failure recovery by more than 97%. Recover Mechanism have been introduced in order to increase the network performance while failure occurs. The infrastructure will be implemented to create disjoint paths in those frameworks.

KEYWORDS: Multi-Radio WMNs, Wireless Link Failures, Self-Reconfigurable Networks, IEEE 802.11.

I. INTRODUCTION

WIRELESS mesh networks (WMNs) are being developed actively and deployed for a variety of applications, such as public safety, environment monitoring and citywide wireless Internet services [1]-[2]. Extending high-speed IP connectivity to the last mile is an open and on-going research with no satisfactory solution. Many existing technology lack many fundamental basis to satisfy to the problem. First, resource-allocation algorithms [12]-[14] can provide theoretical solution for initial network resource planning. That approach gives a comprehensive and optimal network configuration plan, they often require "global" configuration. Greedy channel-assignment algorithm (e.g., [15]) provides solution by changing settings of only the faulty link(s). However, this greedy change might not be able to realize full improvements, which can only be achieved by considering configurations of neighboring mesh routers in addition to the faulty link(s). Third, fault-tolerant routing protocols, such as local re-routing [16] or multi-path routing [17], can 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. Next is the Autonomous Network Reconfiguration System that allows a multi-radio WMN (mr-WMN) to autonomously reconfigure its local network settings. ARS identifies reconfiguration plans that require the minimum number of changes for the healthy network settings. ARS also includes a monitoring protocol that enables a WMN to perform real-time failure recovery in conjunction with the planning algorithm. But it does not satisfy the QoS requirements. To Overcome this we propose a solution to reduce delay in self reconfiguration.

The idea of using multiple paths has existed for some time and it has been explored in different areas of networking. In the



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traditional circuit-switching network, alternate path routing was used to decrease the probability of call blocking. In this scheme, the shortest path between two exchanges is used until it fails or reaches its capacity, when calls are routed through a longer, alternate path². In data network the idea of using multiple paths for end-to-end transport. Based on the assumption of stationary input traffic and unchanging network, the computation framework converges to minimize the overall delay in the network. Self-reconfigurable protocol can provide fault tolerance by having redundant information routed to the destination via alternative paths. This reduces the probability that communication is disrupted in case of link failure. More sophisticated algorithms employ source coding to reduce the traffic overhead caused by too much redundancy, while maintaining the same degree of reliability. This increase in route resiliency is largely depended on metrics such as the diversity, or disjointness, of the available paths. We delay the discussion on disjoint routes until the next section. When a link becomes over-utilized and causes congestion, Self-reconfigurable protocol can choose to divert traffic through alternate paths to ease the burden of the congested link. Bandwidth aggregation – By splitting data to the same destination into multiple streams, each routed through a different path, the effective bandwidth can be aggregated. This strategy is particular beneficial when a node has multiple low bandwidth links but requires a bandwidth greater than an individual link can provide. End-to-end delay may also be reduced as a direct result of larger bandwidth. Reduced delay– For wireless networks employing single path on-demand routing protocols, a route failure means that a new path discovery process needs to be initiated to find a new route. This results in a route discovery delay

II. RELATED WORKS

ARS algorithm [3] focus on Autonomous network Reconfiguration System that enables a multi-radio 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.

EAR algorithm [2]focus on maximizes the measurement accuracy, and its opportunistic use of the unicast application traffic present in the network minimizes the measurement overhead by three complementary measurement schemes: passive, cooperative, and active monitoring.EAR effectively identifies the existence of wireless link asymmetry by measuring the quality of each link in both directions of the link. its cross-layer architecture across both the network layer and the IEEE 802.11-based device driver makes EAR easily deployable in existing multi-hop wireless mesh networks without system recompilation or MAC firmware modification.

Channel Assignment [3]is focus on addressing the problem of quasistatic assignment of channels to links in the context of networks with multi-radio nodes. Channel assignment is done as some variation of a graph coloring problem. The assignment of channels to links must obey the interface constraint that the number of different channels assigned to the links incident on a node is at most the number of interfaces on that node. Our approach is “topology preserving,” i.e., all links that can exist in a single channel network also exist in the multichannel network after channel assignment.

Optimization Algorithm [12]focus on optimal buffer management policy based on global knowledge about the network state. They have introduced a distributed algorithm that uses statistical learning to approximate the required global knowledge of the optimal algorithm. Using simulations based on a synthetic mobility model and two real mobility traces shows that our buffer management policy based on statistical learning successfully approximates the performance of the optimal algorithm.



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Delay tolerant network protocol [5] focus on a novel Look-Ahead Routing and Message Scheduling scheme in which the ferry nodes inform the gateway nodes about their travel schedule so that the gateway nodes can decide which ferry to use for each message in advance and schedule the message in the queue accordingly. When a ferry arrives at a region, it contacts the gateway node, and during the contact time it will unload to the gateway the messages that are destined to this region, and load from the gateway the messages that this region wants to send to other regions. To reduce the latency, multiple ferries can be deployed in the network.

Joint channel assignment routing and scheduling problem [6] that can model the interference and fairness constraints and is also able to account for the number of radios at each of the wireless nodes. A novel flow transformation technique to design an efficient channel assignment algorithm that can assign channels to node radios while ensuring that maximum data can be transmitted on specified traffic routes.

ETX algorithm [13] focus on ETX finds paths with the fewest expected number of transmissions required to deliver a packet all the way to its destination. The metric predicts the number of retransmissions required using per-link measurements of packet loss ratios in both directions of each wireless link. The primary goal of the ETX design is to find paths with high throughput, despite losses.

Link channel assignment algorithm [8] focus on algorithm that computes the optimal routes for a given objective of meeting a set of demands in the network using a set of necessary conditions as constraints. Two link channel assignment algorithms, one static and the other dynamic, which allow us to schedule flows on the links in the network. Link channel assignment and scheduling algorithms are able to characterize network capacity and achieve a performance that is close to optimal.

Interference channel assignment [9] focus on model Dynamic channel assignment interference between the routers. Interference-aware channel assignment algorithm and a corresponding channel assignment protocol aimed at improving the capacity of wireless mesh networks by making use of all available non-overlapping channels.

III. PROPOSED WORK

The proposed work has the following Strategies

A. Localized Reconfiguration

Based on multiple channels and radio associations available, ARS generates reconfiguration plans that allow for changes of network configurations only in the vicinity where link failures occurred while retaining configurations in areas remote from failure locations.

B. Qos-Aware Planning

ARS effectively identifies QoS-satisfiable reconfiguration plans by

1) estimating the QoS satisfiability of generated reconfiguration plans

2) deriving their expected benefits in channel utilization. Algorithm 1: FARS Operation at mesh node

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(1) Monitoring period for every link measure link-quality using passive monitoring. send monitoring results to a gateway.

(2) Failure detection and group formation period if link violates link requirements then request a group formation on channel of link participate in a leader election if a request is received.

(3) Planning period if node is elected as a leader then send a planning request message to a Gateway else if node is a gateway then synchronize requests from reconfiguration groups generate a reconfiguration plan send a reconfiguration plan to a leader end if

(4) Reconfiguration period if includes changes of node then find the transmission at the reduced delay apply the changes to links.

C. FARS Scenario

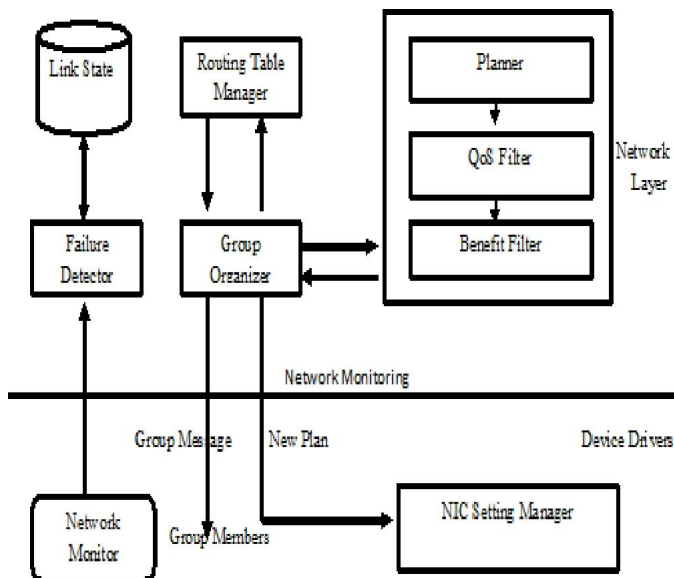


Fig.-3.1 Software Scenario at each node.

Network planner:Generates reconfiguration plans only in a gateway node.

Group organizer:Forms a local group among mesh routers. Failure detector: Periodically interacts with a network

monitor in the device driver and maintains an up-to-date link-state table.



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Routing table manager: FARS obtains or updates states of a system routing table. The device driver is designed for chipset-based 802.11 NICs and allows for accessing various control and management registers (e.g., longretry, txrate) in the MAC layer, making network monitoring accurate. The module in this driver includes:

- 1) Network monitor: Efficiently monitors link-quality and is extensible to support as many multiple radios as possible.
- 2) NIC manager: Effectively reconfigures NIC's settings based on a reconfiguration plan from the group organizer.

D. Feasible Plan Generation

Generating feasible plans is essentially to search all legitimate changes in links' configurations and their combinations around the faulty area. Given multiple radios, channels, and routes, FARS identifies feasible changes that help avoid a local link failure but maintain existing network connectivity as much as possible.

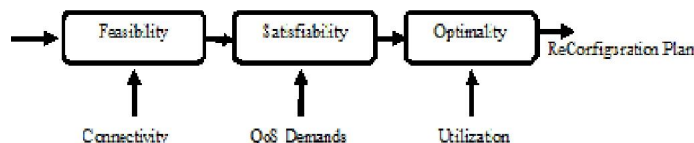


Fig-3.2 Localized reconfiguration planning in FARS.

FARS generates a reconfiguration plan by breaking down the planning process into three processes with different constraints.

E. Avoiding a Faulty Channel

FARS first has to ensure that the faulty link needs to be fixed via reconfiguration. Specifically, to fix a faulty link(s), FARS can use: 1) a channel-switch where both end-radios of link AB can simultaneously change their tuned channel; 2) a radio-switch where one radio in node A can switch its channel and associate with another radio in node B;



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TABLE 1
DEFINITION OF LINK CHANGES IN FARS

Primitive changes	Description
Channel switch $(S(A_i, B_j))$	Radios A_i and B_j of link AB switch their channel $(_)$ to other channel $(_)$.
Radio switch $(R(A_i, B_j))$	Radio A_i in node A re-associates with radio B_j in node B , tuned in channel $(_)$.
Detouring $(D(A_i, B_j))$	Both radios A_i and B_j of link AB remove their associations and use a detour path, if exists

F. Maintaining Network Connectivity and Utilization

FARS needs to maintain connectivity with the full utilization of radio resources. Because each radio can associate itself with multiple neighboring nodes, a change in one link triggers other neighboring links to change their settings. To coordinate such propagation, FARS takes a two-step approach. FARS first generates feasible changes of each link using the primitives, and then combines a set of feasible changes that enable a network to maintain its own connectivity. Furthermore, for the combination, FARS maximizes the usage of network resources by making each radio of a mesh node associate itself with at least one link and by avoiding the use of same (redundant) channel among radios in one node.

IV. PERFORMANCE ANALYSIS

We have doing FARS in large-scale network settings via simulation. We first describe our simulation methodology and then present the expected evaluation results on FARS.

A. The Simulation Model

ns-2 is used in our simulation study. Throughout the simulation, we are use 50 nodes in an area of routing protocol of network failures. First, to generate users traffic, multiple flows between nodes is randomly-chosen. Second, to create



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network failures, channel faults are injected at a random time point. Random bit-error is used to emulate channel-related link failures and lasts for a given failure period.

B. Evaluation Results

1) Effectiveness of QoS-aware planning:

FARS enhances chance to meet the varying QoS demands. We assume that mobile clients in the conference room request video streams through the router A during a meeting, and after the meeting, they return to the office room and connect to the router C. We use static, WCETT routing metric that finds a path with diverse channels and FARS for reconfiguration. We expect the effectiveness of FARS in meeting the varying QoS requirements in a mr-WMN. We initially assign symmetric link capacity. Then, while changing the QoS constraints in different times (i.e., T_1, \dots

, T_5), we are trying to evaluate the improvement of available capacity that FARS can generate via reconfiguration. FARS reconfigures a wireless mesh network to meet different QoS requirements.

2) Impact of the reconfiguration range:

We are evaluating the impact of the reconfiguration range. We are doing the same experiment settings as the previous one and focused on reconfiguration requests. When we increase the hop count from a faulty link, we able to measure the capacity improvement achieved by the reconfiguration plans. In addition, we are trying to calculate the capacity gain per change as the cost-effectiveness of reconfiguration planning with different values.

FARS can improve the available links capacity by increasing the reconfiguration range. This saturation results mainly from the fixed number of radios of each node. In other words, the improvement is essentially bounded by the total capacity of physical radios. Furthermore, because reconfiguration plans with a larger range are required to incur more changes in network settings, the bandwidth gain per change significantly degrades .so we are trying to reduce the delay between the transmissions by choosing the new path.

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