PATH DIVERSITY ALGORITHM FOR PACKET ROUTING IN WIRELESS NETWORK

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ABSTRACT

The development in wireless communication technology gives more scope for integrating one or more Radio Access Technologies (RATs) in single wireless node and it can be used to increase the throughput for improving the quality of service (QOS). In this paper, node with the two radios are deployed and data traffic has been forwarded by splitting the data over both the radios, the term split coefficient is defined as how much percentage of data traffic has to be sent on individual radio. This paper will explain about fault occurring in a network due to fluctuation in radio operation. A fault has been created randomly in a network by turning off the radio and path diversity algorithm is used to handle fault with a minimum delay. OPNET tool is used for network simulation.

Keywords: Radio Access Technology (RAT), Split coefficient, Path diversity, Traffic Splitting

I. INTRODUCTION

In modern era of wireless communication technologies, there are several wireless standards are introduced among which WiMAX (Worldwide Interoperability for Microwave access) and WiFi (Wireless Fidelity) [1],[2],[3] are the front runner in last mile achievement. IEEE 802.16 commonly known as WiMAX is a wireless MAN standard which is used for long distance broadband connectivity and promises a wide range of throughput. WiFi is based on IEEE 802.11 standard for wireless LAN and it has become very popular. Hence, the WiFi radios are available in almost all mobile devices. In this paper we consider a network which consists of
nodes where two radio technologies are deployed [4] and the data traffic has been forwarded over both available networks instead of using only one. This motivates to think about traffic splitting [5] as a best method of using available network resources effectively.

We define a term split coefficient at the source node which states the percentage of data traffic split over the radio channels. In this proposed work the split coefficients are varied over the range of [0, 1]. Depending upon the split coefficient value the data traffic is divided and transmitted over two different paths on two different channels till it reaches to destination where the data packets are recombined.

Traffic splitting will get complicated, when any one of the radio channel get failed due to fluctuation in radio hardware. Most of existing routing protocols are used in a scenario with single radio network. We propose a path diversity algorithm to overcome the radio failure scenario with a better throughput and less delay.

The paper is divided into three sections, in section II, We describe the problem statement for a proposed work and path diversity algorithm is defined for a faulty scenario. Section III, We present a simulation result. And concluded in section IV, with the results and analysis of the simulation and the work planned for future.

II PROBLEM STATEMENT

We work on the problem which causes due to radio hardware failure in a network which employs traffic splitting mechanism [6] for data transmission.

![Figure 1 Faulty Network Scenario](image-url)
Figure 1 shows a network scenario with faulty radio nodes which affect the overall performance of the network that is, throughput and delay. In figure 1, two paths for data transmission is shown. The route from X to Y goes through node N1, node N1 has a hardware fault in WiFi radio channel. To solve this problem, node N1’s WiFi data packets will be transferred through WiMAX radio section. Since, node N1’s WiMAX channel is already having the route to destination in its routing table.

A similar case is observed in figure 1, a route between X1 and Y1 through a faulty node N2, but in this case N2 does not have route to Y1 through the WiFi radio path. In this situation the faulty node beacons error message to its neighbors, this helps in finding the route to Y1 on non faulty node N5 as in figure 1. So that, data traffic switches to other non faulty radio path.

**Algorithm:**

Path diversity algorithm is illustrated below:

**Step 1:** On receiving interrupt from radio, Mac layer will initiate the procedure to obtain RADIO state and inform network and transport layers.

**Step 2:** If RADIO state is OFF then, Mac layer and network layer will send all packets waiting for transmission to transport layer so that they can be transmitted from other side whose RADIO is ON.

**Step 3:** Network layer on side where RADIO is ON, It will generate REM1 (Route Error Message) packet and send to all neighbors to inform neighbors that RADIO is OFF.

**Step 4:** Any node on receiving REM1 will transfer that packet to the other radio module of the node. It will make the node in Routing table unreachable by setting valid=0 and retransmit the REM1 packet to its neighbors for informing that a node has gone down and ask those nodes to find alternate paths.

**Step 5:** The source node on receiving the REM1 message initialize the route finding process with route request and route reply message.

**Step 6:** If RADIO RECOVERS FROM FAULT then, network layer will generate and send RRM2 (Route Recovered Message) packet stating that radio fault is recovered. When RRM2 is received by any neighbor node, It will update the routing table that the node is reachable by
setting valid=1 and transmit the packet to inform its neighbors for informing that the node has recovered.

### III IMPLEMENTATION RESULTS:

In this work we used OPNET tool for network simulation. 17 hybrid nodes are used and arranged in mesh network as shown in figure 2. Internal architecture of hybrid node is shown in figure 3 in which IEEE 802.11n and IEEE 802.16e radio channels are used with the raw data rate of 54Mbps and 70Mbps respectively. Figure 4 shows the packet format used in this work with 1024bits of data. Fault has been created by turning off the radio randomly.

In order to compare the measure of the algorithm efficiency we simulate a scenario where the node has no fault. The throughput and end to end delay graphs for different split coefficient is shown in figure 5 and 6 respectively. As seen from the graphs the split coefficient tend to alter the throughput curves at the start of the simulation and then normalizes to some steady value for all different values of split coefficient.
In the next test scenario faults has been created by turning off the radio for random duration. These faults are then repaired using path diversity algorithm and graph for throughput
and end to end delay with split coefficient 0.7 is shown in figure 7 and 8 respectively. From the comparison of these graphs it is seen that the reduction of throughput in the scenario where faults were introduced to the nodes does not decrease by a great amount and also does not allow greater delays in resuming the data transmission in the network.

IV CONCLUSION AND FUTURE WORK

As seen from the results presented in the previous section, Path diversity algorithm is implemented in wireless network with traffic splitting mechanism. Results explain that, path diversity algorithm allows uninterrupted data transmission and fault recovery mechanism.
algorithm efficiency is measured in the graphs which show that the reduction in throughput is not significant and does not hamper network operation. In future we can look further into interoperability between different wireless technologies. And to work on self organizing networks that deal with automatic assignment of split coefficients for splitting data traffic.

REFERENCES


