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Comparative Study between Self Reconfigurable and Non Reconfigurable System in WMN

Preeti Gill Bains,
M.Tech , Department of Information Technology
Chandigarh Engineering College,Landran ,
Punjab, India
preeti_gill88@yahoo.com

Dr.Parminder Singh,
Assistant Professor,
Department of Information Technology
Chandigarh Engineering College,Landran,
Punjab, India
singh.parminder06@gmail.com

Abstract: **The wireless Mesh Networks provide an approach to extend the networks and communicates with single (1-LAN) or different LANS (Local Area Networks). This paper uses the self reconfigurable system that able to reconfigure the channel or repair the channel/path automatically. This paper uses the ARS (Autonomous Network reconfiguration system) Methodology which deployed on each node with the use of AODV (Ad Hoc On demand Distance Vector) [1] routing Protocol. The ARS [2] locally repaired the channels as well as proper assignment of the channels with using Route discovery process that establish the shortest path in between source node and destination node. In this paper we implemented ARS methodology with IEEE 802.11 standard and evaluated the results using NS2 [6] simulator. Our results show that 92% channel efficiency gain by ARS as compared to non reconfigurable systems (rerouting). This shows that ARS methodology has ability to perform better that Rerouting schemes.**

I. INTRODUCTION

A Wireless Mesh Networks provide communication between routers mesh and mesh clients and also worldwide if the internet connection provided. Basically Mesh clients in the WMNs consist of Wi-Fi phone, WiFi device that are able to connect with Mesh Router for exchanging packets and these routers are static in the case and to form wired cum wireless connection. In this paper we show a Network model (in figure1) that forms a Multi Hop communication and this communication being extended with an Internet gateway for communicating worldwide.

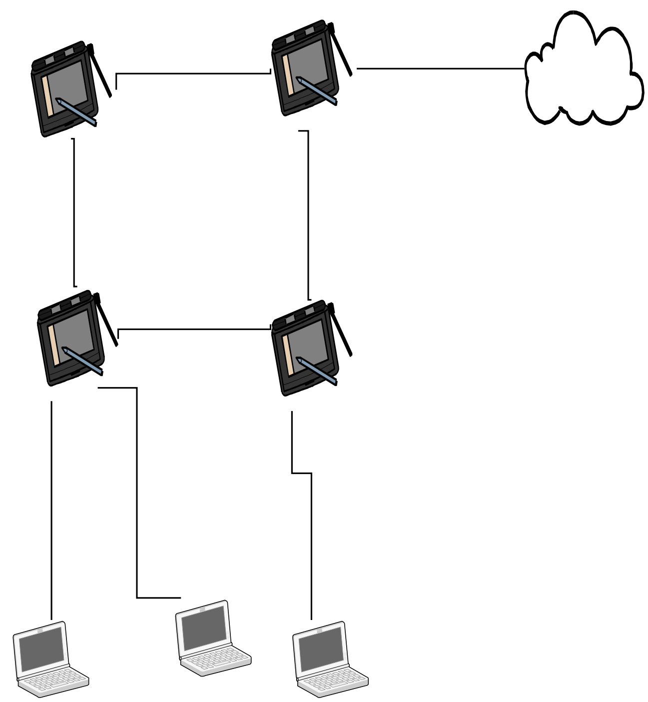

Figure 1: Network Model of Wireless Mesh Networks

The each Mesh clients worked on the MAC Layer for exchanging data and acknowledgments. For this purpose we use an AODV (AdHoc on demand distance vector) Routing protocol [1]. This protocol are basically exchanging the packets in between the Mesh clients and Mesh Routers and also sending acknowledgments using RREP (Route Reply). Why we use the AODV protocol in this paper if the question was arise in many of peoples? Because the AODV is one of the protocol that sends a fresh copy of the routing table information in each node means it uses Route discovery Process. This process explained with diagram in the coming subsection.

A. AODV Route discovery process

The Route discovery process of AODV triggers RREQ (Routing Request) that use Source node communicates with the destination node when routing path was established. Each node in the network maintains the routing table (in Table1) which contains following information.

Each node maintains two counters sequence number and broadcast id (in figure1).

TABLE 1: RREQ (ROUTING REQUEST)

Entries	Abbreviation	Description
Source Address	src_addr	Contains the address of source Node
Sequence Number	src_seq_no	Contains the Unique sequence of the packet sent by source Node
Broadcast ID	broadcast_id	Sending the broadcast request by source Node heard by each node in the network
Destination address	dst_addr	Contains the address of source Node

RREQ works as [1]:

1. If it has already received an RREQ packet with same (src_addr, broadcast_id), the RREQ is dropped.

2. If it is the destination node, or it has a routing entry for that destination and the destination nodes' sequence number in its routing entry is greater or equal to the one in the RREQ packet, it will reply with a RREP packet back to the source, indicating that a routing path has been found.

3. Else, it rebroadcasts the RREQ after increasing the hop_cnt, and sets up a "reverse path" pointed to the node from which the RREQ came (in Table 2).

TABLE 2: RREQ (REVERSE PATH)

Entries	Abbreviation	Description
Destination Sequence Number	dst_seq_no	Latest sequence Number
Hop Count	hop_cnt	Number of Hops reach to its Neighbor

II. METHODOLOGY USED

In this paper we are implementing ARS i.e. Autonomous Network Reconfiguration System [2] apply in various multi radio WMN system that automatically reconfigured the systems. The ARS searches the local system/LAN (Local Area Network), based on this system it reconfigure the faulty area based on current channel and radio association.

For this ARS used the Algorithm that operated on a Mesh Nodes[2].

a) for every link j (in figure 2) do
To measured the link quality (lq) using passive monitoring.
End for
Send monitoring results to a gateway g (see figure 3)

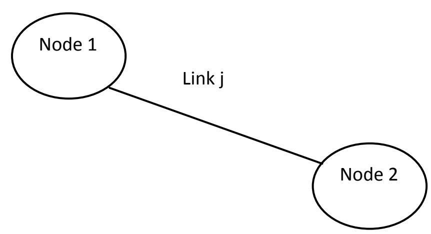

Figure 2: Communication between two nodes with link j

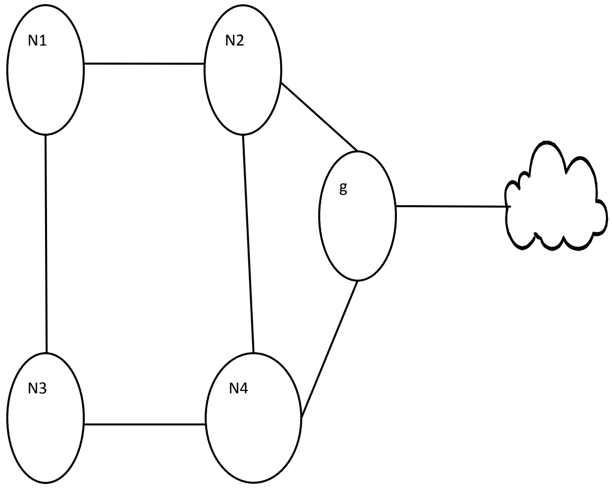

Figure 3: Communication between nodes and gateway

b) For Falure detection
If link l violates link requirement r then
Request a group formation on channel c of the link l
End if

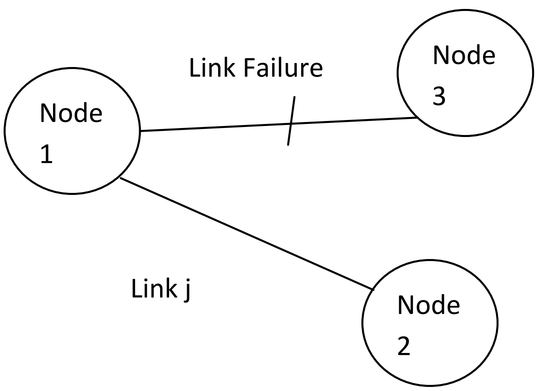

Figure 4: Link Failure

III. SIMULATION STUDIES

Simulation setup consisted of 20 wireless nodes, placed randomly in 800x500 flat space for 60 s of simulation time. In the first set of simulations, all the nodes were moveable. Background traffic was established through the use of a low network load with four routers connected to the two gateways, until a medium network load level with four Routers, of FTP/TCP type; the destination nodes were placed in the clustered manner where ten nodes working on one cluster and other ten belong to another cluster (in fig.5). Each data packet had 1000 bytes of size.

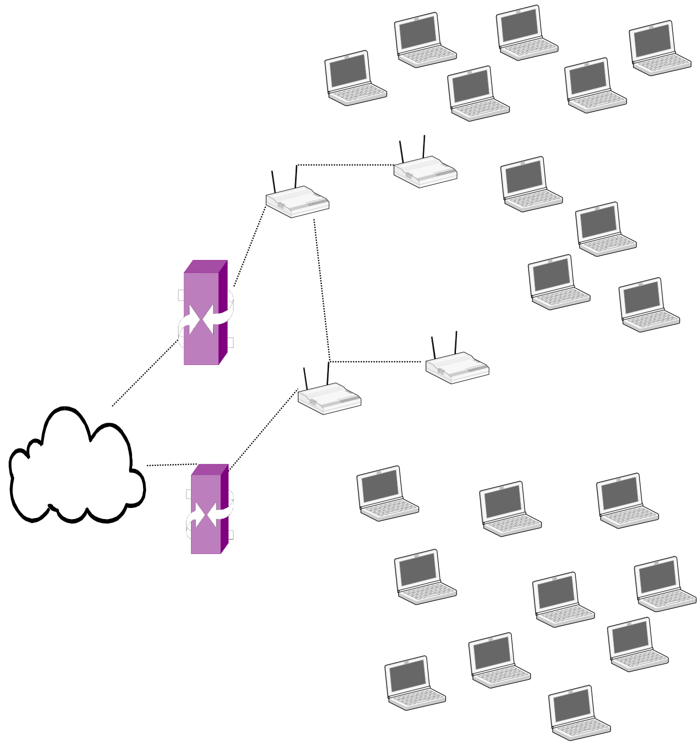

Figure 5: Simulation scenario using ARS

The figure 5 and figure 6 shows the scenarios that were used in this paper.

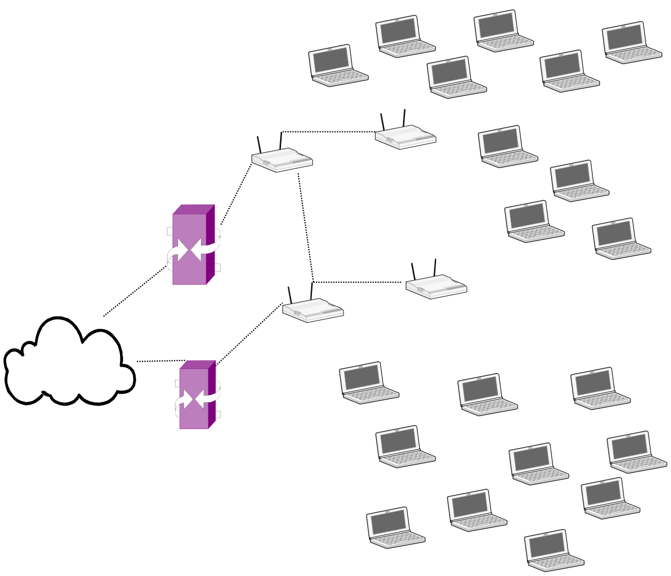

Figure 6: Simulation scenario Without ARS

We compare the extensive performance evaluations to determine the effectiveness of the proposed route quality metric [5] and the same parameters used in both figures (fig.5 and fig.6) listed in Table3.

TABLE 3: SIMULATION PARAMETERS

Parameter Used	**Value**
Node Queue Length	50
Protocol used	AODV
Data Packet Size	1000 bytes
Traffic generation	Exponential
Transmitter Antenna Gain	0 dB
Transmit Power	20 dB
Propagation Model	Two way ground
Receiver Antenna Gain	0 dB

The mesh routers dynamically form multi-hop routes between the mobile users (mesh clients) and the gateways. Mesh routers have two interfaces, one for communicating with the mesh clients and another for communicating with other mesh routers. We focus on routing within the mesh routers only, i.e. the mesh clients do not participate in multi-hop routing. Only single channel operation is assumed, i.e. all mesh nodes operate on the same channel for transmitting mesh traffic. Although the use of multiple radios per node operating on multiple orthogonal channels would reduce interference effects, we focus on the quality of single channel networks in this work. It is assumed that the gateway is aware of the locations of the mesh routers, and keeps track of all active nodes and neighborhood information [5].

The simulated scenario run with using NS2 Simulator and observed value shown in Table4.

TABLE 4: ANALYSIS THE STATISTICS FROM THE SIMULATED SCENARIO (in Fig.5)

Node	**Route Changes**	**Link Changes**
0	178	103
1	164	102
2	318	85
3	190	76
4	200	82
5	238	127
6	250	119
7	220	110
8	210	70
9	198	90
10	190	120
11	178	101
12	190	100
13	200	130
14	201	120
15	220	98
16	221	70
17	223	78
18	224	89
19	225	67
20	221	57

IV. SIMULATION RESULT

Number of used paths represents the total number of routes that are used to transmit traffic between each pair of source-destination nodes.

A. Channel Efficiency gains

The ARS configured in each node and calculated the channel efficiency. For local repair the nodes, it improves 92% over the local rerouting scheme (in figure7). The static rerouting scheme suffers unnecessary retransmissions and rerouting this way poor utilization of channel.

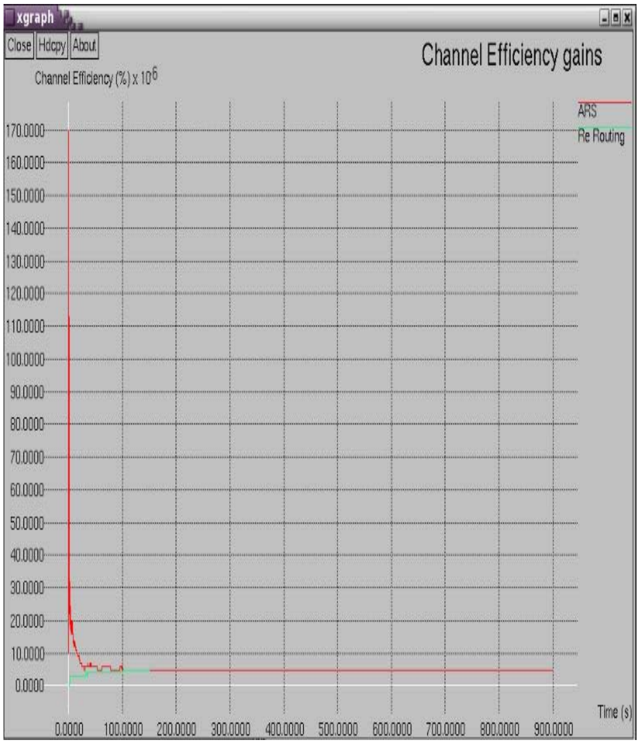

Figure 7: Channel Efficiency gains

V. CONCLUSION

This paper addresses the common link failure in between the networks therefore a number of packets has retransmitted. The work related to this paper has to assignment the channel to the Mesh clients and Mesh routers; providing QOS support in between the Wireless Mesh Networks. We use a Methodology of ARS that automatically reconfigured the local system and improved the channel efficiency [2] when using two scenarios i.e. static routing and ARS.

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