ISSN: 2321-7782 (Online)
Volume 1, Issue 7, December 2013
International Journal of Advance Research in Computer Science and Management Studies
Research Paper
Available online at: www.ijarcsms.com

Flow Based Assignments and Routing Techniques for Automatic Reconfigurable Wireless Mesh Network

Puja J. Mande[1]
B.E.Comp
Department of Computer Engineering
Jaihind College of Engineering, Kuran
Pune - India

Shital S. Khaire[2]
B.E.Comp
Department of Computer Engineering
Jaihind College of Engineering, Kuran
Pune - India

Priyanka S. Khemnar[3]
B.E.Comp
Department of Computer Engineering
Jaihind College of Engineering, Kuran
Pune - India

Abstract: A Wireless Mesh Network (WMN) has emerged as a wireless backbone for internet access for next-generation wireless network. During their lifetime, multi-hop wireless mesh network experience frequent link failures caused by channel interference, dynamic obstacles, and application's bandwidth demands. Because of these link failures the throughput of wireless mesh network severely decreases which is expensive and manual management is required. The autonomous reconfiguration system presented over this paper helps a multi radio WMN to recover from link failure in an autonomous way.ARS monitors and generates the necessary changes in the network. Based on the changes generated the network is reconfigured and helps in improving channel efficiency and meeting application's bandwidth demands.

Keywords: Multi-hop Wireless Mesh Network, Autonomous Reconfiguration System, Wireless Link Failure.

I. INTRODUCTION

A. Wireless Mesh Networks

WMN is a communication network made up of radio nodes organized in a mesh topology.WMN consists of mesh clients, gateways and mesh routers. The mesh client can be laptops, cell phones and other wireless devices. Also mesh client can work as a router. It supports larger applications and also it provides some benefits to users such as no caballing cost, automatic connection to all nodes, network flexibility, ease of installation and it also discovers the new routes automatically. WMNs 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. In WMN protocols are used for communication at small cost. So that there is more chances of packet losses and link failures .Information transmission are generally started from source node to their specified destination node. The transmission strategies can be similar for different kinds of networks.

B. Need for self- reconfiguration

WMNs are being developed for variety of applications such as internet, public safety, environment monitoring. But in WMN link failure occurs because of increase in the application's bandwidth demand or channel interference and dynamic obstacles.

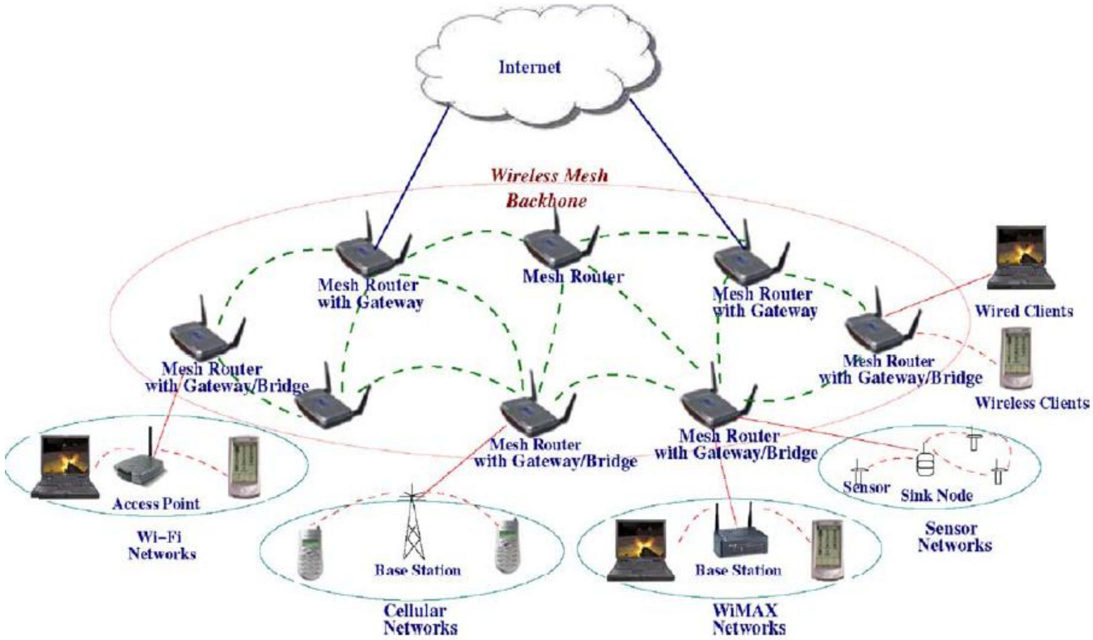

Fig.1.1: Multi-hop Wireless Mesh Network

The following examples illustrates why self-reconfiguration is necessary:

a) *Satisfying dynamic quality QoS requirements*: If there is situation when the QoS demand from end users will increase then links in some areas may not be able to accommodate that increment. So in this case the self-reconfiguration is required.

b) *Recovering from link quality failures*: In WMN the quality of wireless links can be degrade (i.e. link quality failure) due to severe interference from other co-existing wireless networks. e.g. Bluetooth, wireless phones and other co-existing wireless network operating on same or adjacent channels can cause significant losses or collision in packet transmission.

c) *Copying with heterogeneous channel availability*: In some areas links may not be able to access the wireless channels during a certain time period due to spectrum regulation. If the channel is being used for high priority response then some links in WMN need to vacate the current channels.

II. LITERATURE REVIEW

A. *Existing System*

To recover from wireless link failures different approaches have been proposed like Resource Allocation Algorithm, Greedy channel assignment algorithm, Interference Channel Assignment Algorithm, Fault tolerant routing protocols, etc.

a) Resource Allocation Algorithm: This algorithm allocates the resources initially and it provides only the theoretical guidelines for initial network planning. The disadvantage of this algorithm is to provide optimal solution but it requires global configuration changes and those changes are not suitable when there occurs frequent link failures.

b) Greedy Channel Assignment Algorithm: This algorithm can change only the configuration of faulty links. But the drawback of this algorithm is that we need to consider the configuration of neighbour nodes in mesh along with the faulty link.

c) Interference Channel Assignment Algorithm: It can minimize the interference. This algorithm can improve overall network capacity by using additional channels. This algorithm may require global network configuration changes from changing local QoS demands and causes the network disruption.

d) Fault Tolerant Routing Protocols: Fault-tolerant routing protocols, such as local re-routing or multi-path routing, can be adopted to use network-level path diversity for avoiding the faulty links. But they rely on redundant transmissions, which may require more network resources than link-level network reconfiguration.

B. Proposed System

Even though many approaches have been proposed for recovering the link failures they still have limitations. So, to overcome from such limitations we proposed ARS (Autonomous Network reconfiguration System) algorithm. ARS enables the WMN to autonomously recover from local link failure to preserve the network performance.

For failure recovery ARS makes the necessary changes in channel assignment and next based on this generated configuration changes the system will co-operatively reconfigures network setting among the local mesh routers.

III. ARS Architecture

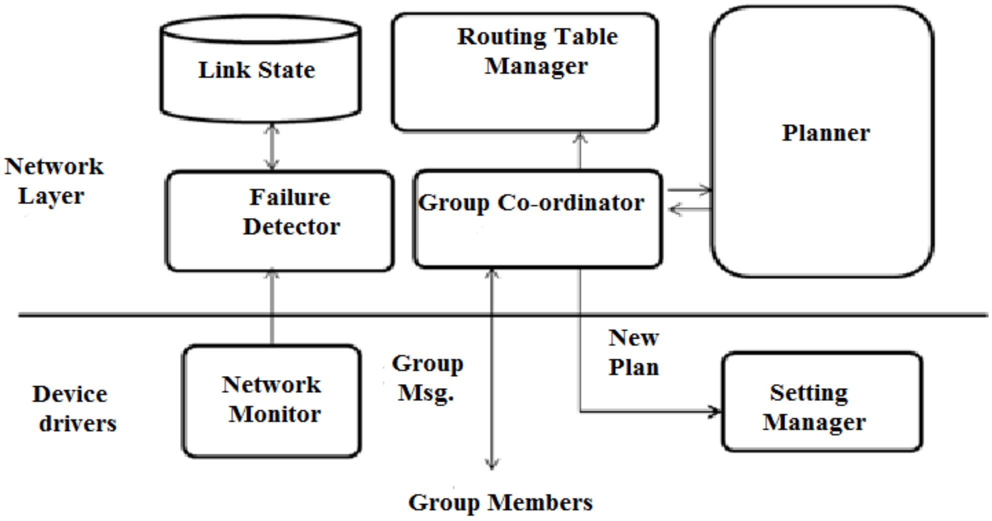

Fig. 2.1: ARS Software Architecture

Fig. shows the software architecture of ARS. ARS in the network layer implemented using net filter which provides ARS with a hook to capture and send ARS related packets such as group formation messages. This module includes several important algorithms and protocols of ARS.

a) Link State: Each node in WMN monitors the quality of its outgoing wireless links. The node contains information about incoming and outgoing traffic and it also maintains information about neighboring nodes.

b) Failure detector: It interacts with a network monitor in device driver and maintain an up-to-date link state table.

c) Group Co-ordinator: It forms a local group among mesh routers. Each router has a specific set of locations from which it can accept data and to which it can send data.

d) Routing table manager: It updates the system routing table.

e) Network monitor: It effectively monitors the link quality and is extensible to support as many multiple radios as possible.

f) Setting manager: It effectively reconfigures the NIC setting based on a reconfiguration plan from the group coordinator.

g) Planner: It generates needed reconfiguration plans only in a gateway node. For generating new reconfiguration plans it uses following phases:

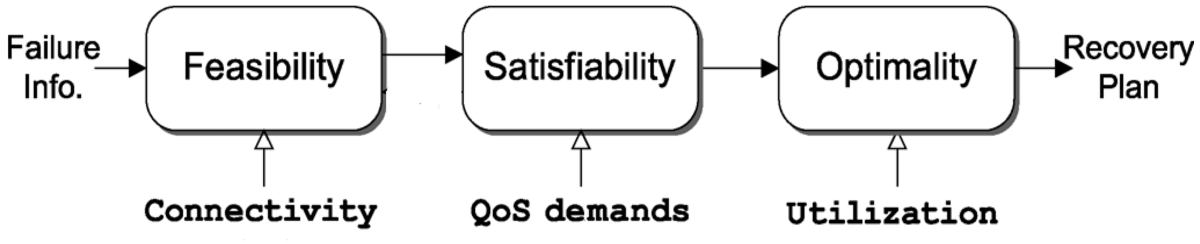

Fig.2.2: Reconfiguration planning in ARS.

Feasibility: In this phase it takes the failure information from failure detector and based on the current network setting i.e. connectivity constraints the set of feasible plans are generated.

Satisfiability: In this phase the process takes the set of feasible plans and applies QoS constraints on it and according to that it will select those reconfiguration plans that satisfy the QoS constraints.

Optimality: In this phase process checks the reconfiguration plan for network utilization i.e. the benefit filter selects best plan to reach the destination.

IV. ALGORITHM

Algorithm shows the operation of the Autonomous Reconfiguration System.

(1) *Monitoring period*

1: for every link do

2: measure link-quality using passive monitoring

3: end for

4: send monitoring results to a gateway

(2) *Failure detection and group formation period*

5: if link violates link requirements then

6: request a group formation on channel of link

7: end if

8: participate in a leader election if a request is received

(3) *Planning period*

9: if node is elected as a leader then

10: send a planning request message to a gateway

11: else if node is a gateway then

12: synchronize requests from reconfiguration groups

13: generate a reconfiguration plan for

14: send a reconfiguration plan to a leader of

15: end if

(4) *Reconfiguration period*

16: if includes changes of node then

17: apply the changes to links at

18: end if

19: relay to neighbouring members, if any.

Algorithm has four important phases:

a) *Monitoring Period:* This phase checks the quality of link by passively monitoring the nodes and the result is forwarded to the controlling gateway.

b) *Failure Detection and Group Formation*: Once the result is obtained by the control gateway, the gateway checks for the link failure. In case of failure the group is formed and a leader is elected.

c) *Planning Period:* After electing a leader the reconfiguration plan is generated. There can be more than one plan for same link failure. Then gateway selects the feasible plan to reach the destination.

d) *Reconfiguration Period*: In reconfiguration port whatever changes are necessary for reconfiguration are made and the reconfiguration plan is relayed to the neighboring node.

V. METHODOLOGY

Our system is broadly divided into four phases

a) At every time period tm ARS monitors the quality of outgoing wireless links and then sends the result to the control gateway via management message.

b) Once the control gateway has detected a failure, ARS that is allocated in the detected node causes the group formation among the local mesh routers that are using a faulty channel then one of the group member is elected as a leader by using bully algorithm for coordinating the reconfiguration.

c) After electing the leader the planning request is send to the control gateway by the leader and gateway synchronizes the planning requests and generates a reconfiguration plan for the request.

d) The gateway sends the reconfiguration plan to the leader and the group member and necessary changes are done for reconfigure the network.

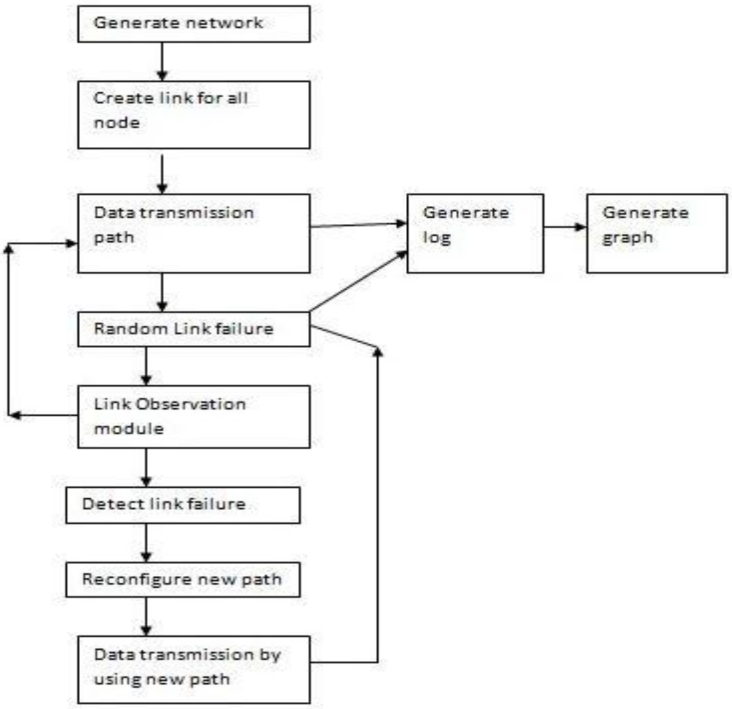

Fig. 3.1: Process model of ARS

VI. ADVANTAGES

a) Public Safety, Environment Monitoring.

b) City-wide Wireless Internet Services.

c) Throughput improvement.

VII. APPLICATIONS

a) In City-wide Wireless Internet Services.

b) In Environment Monitoring Applications.

VIII. CONCLUSION

A. Concluding Remarks

ARS technology helps in resolving problems with link failures and recovery. Link failure and link recovery is achieved with help of continuous monitoring. Furthermore, ARS effectively identifies reconfiguration plans that satisfy applications' QoS constraints, admitting up to two times more flows than static assignment, through QoS aware planning. Thus we will achieve recovery from local link failure which preserves network performance.

B. Future Work

Joint Optimization with Flow Assignment and Routing. ARS decouples network reconfiguration from flow assignment and routing. Reconfiguration might be able to achieve better performance if two problems are jointly considered. Even though there have been a couple of proposals to solve this problem, they only provide theoretical bounds without considering practical system issues.

References

1. K. Kim and Kang G. Shin, “Self-Reconfigurable Wireless Mesh Networks"(IEEE/ACM Transactions on Networking, April 2011).
2. Ghule S.J.,Jadhav H.B.,Dighe M.S. "Autonomous Reconfigurable Wireless Mesh Net-works" in IJETAE (ISSN 2250-2459, October 2012).
3. B.Sindhu,V.Bharathi, N. Karthikeyan."Autonomous Reconfiguration for Wireless Mesh Network" in IJERA (ISSN: 2248-9622 www.ijera.com Vol.3,Issue 3,May-Jun 2013).
4. M.A.Shabad,S.S.Apte "Routing Improvement in Wireless Mesh Networks" in IJEAT (ISSN: 22498958,October 2012).
5. M. Yambal, N. R. Nomulwar,"A Study on Effectiveness of Self Healing Wireless Mesh Network in Intelligent Transportation System to Reduce Congestion in Transportation" in IJEATE (ISSN 2250-2459,Feb. 2012).
6. Y. Huang, W. Gong and D. Gupta, "Architecture and Scheduling Algorithm for a Multi-Channel Wireless Infrastructure Network with Diversity Management Layer".
7. R. Draves, J. Padhye, and B. Zill, "Routing in multi-radio, multi-hop wireless mesh networks" Sep. 2004.
8. D. Aguayo, J. Bicket, S. Biswas, G. Judd, and R. Morris, "Link-level measurements from an 802.11b mesh network" Aug. 2004.
9. I. Akyildiz, X. Wang, and W. Wang, "Wireless mesh networks: A survey" Computer Networks, 2005.
10. M. Yambal, N. R. Nomulwar , "A Study on Effectiveness of Self Healing Wireless Mesh Network in Intelligent Transportation System to Reduce Congestion in Transportation" International Journal of Emerging Technology and Advanced Engineering ,Feb. 2012.

AUTHOR(S) PROFILE

Miss. Puja J. Mande, currently pursuing her B.E degree in Computer Engineering from Jaihind College of Engineering, Kuran (University of Pune). Also received the Diploma in Computer Engineering from Jaihind Polytechnic, Kuran(MSBTE) in 2011.

Miss. Shital S. Khaire, currently pursuing her B.E degree in Computer Engineering from Jaihind College of Engineering, Kuran (University of Pune). Also she received the Diploma in Computer Technology from B.V.J.N.I.O.T's Pune(MSBTE) in 2011.

Miss. Priyanka S. Khemnar, currently pursuing her B.E degree in Computer Engineering from Jaihind College of Engineering, Kuran (University of Pune). Also received the Diploma in Computer Technology from Vamanrao Ithape Polytechnic, Sangamner (MSBTE) in 2011.