

Re-Organizable Wireless Mesh Network Using ARS

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ABSTRACT: In recent year wireless communication is most widely used, but there is also traffic in surrounding environment, while transferring the data from source to destination. This can be possible due to channel interference, various obstacles, which result in link failure causes poor performance, require expensive network management for their recovery. To maintain the network performance Autonomous network reconfiguration system (ARS) is used which autonomously reconfigure and recover from local link failure. ARS has been implemented and evaluated. ARS improves the channel efficiency better than other recovery methods for example reroute and greedy channel.

KEYWORDS: Failure detection, route recovery, reconfiguration, enhancement of the channel efficiency, IEEE 802.11.

I. INTRODUCTION

The wireless mesh network(WMN) is widely used in various application such as security, internet services, environment monitoring system[I]-[3].WMN has some important characteristics which includes without sacrificing channel capacity multi-hop wireless network extend the coverage range, without line of sight improves the connectivity among user, support ADHOC networking, capability of self-forming, self-organizing, self-healing. Mesh client can be mobile or stationary node; mesh routers usually have minimal mobility. It has multiple type of network access. Power consumption constraint depends on mesh node. The WMN improve the ability of user to connect directly with each other and enable distributed network in frastructure that provi de multiple paths to the network for communication and centrally located towers are not required. By using different signal path they can bypass different obstacle such as building, trees, hills, have no any failure and can easily pullout. With existing tools, the mesh network constructed with set of hardware from high end carrier class equipment consists of shelf in home router, laptop, computer, mobile devices. This result in device of infrastructure network support end to end communication and avoiding dependency of path and vendor lock in. The WMN has challenging problem to meet required performance of system [4]. Due to channel interference some link of the WMN get affected or damaged. Some part of wireless networks does not meet the bandwidth requirement from other user. In certain area links are unable to use frequency channel because of frequency regulation [5]. Reconfiguration methods such as rerouting method and greedy channel method are used to recover from the local link failure, but these methods have limitation, the rerouting methods adopted to use network level route diversitfor minimizing the faulty links, they depend onredundant transmission having more networks resources. Greedy channel method unable to consider the full improvement achieved by considering the configuration of adjacent mesh router along with faulty link.

To overcome this requirements autonomous network reconfiguration system (ARS) is used to enhance the performance of network. ARS recover from local link failure related to the channel, radio, route assignment. ARS does reconfiguration plans needs minimum changes for suitable network setting. ARS identifies link failure and creates most identified quality of system reconfiguration plans after identification of link failure [11]. Using NS2 based simulation as well as IEEE 802.11-based WMN test bed, ARS is experimentally evaluated. IEEE 802.11 is group of standard of evaluating wireless local area network communicate in frequency bands of

2.4,3.6,5 and 60 GHz. IEEE LAN/MAN standard committee creates and maintains IEEE 802.11. In 1997 the base version of the standard was released. It provides the base for wireless network product using Wi-Fi brand [6]. In WMN transmission of signal is done by using TCP and UDP. From one computer to another computer, TCP provide ordered delivery of stream of octet. By the different internet application such as file transfer, remote administration, World Wide Web, email TCP protocol is used. The end to end connectivity is provided by TCP/IP describing how data should be transmitted, formatted, addressed, routed and received at the destination. Autonomous reconfiguration system improves local network throughput and channel efficiency over the other rerouting method and greedy channel meth

II. RELATED WORK

On the various problems in wireless mesh network, up till now lots of work has been done. By the use of planning algorithm which helps to the local changes as possible instead of changing the entire network arrangement. The algorithm often requires global changes in network, the QoS on each link must have to satisfy as possible. The approximately maximum network configuration can be provided by scheduling algorithm, bandwidth constraint and channel assignment. To maximize the chance of getting QoS demand configuration algorithm requires only local changes. Among multiple network layer network setting can be consider by network configuration. The local rerouting allow for flow reconfiguration to get QoS constraint by exploiting path diversity, more network resources consume by them than link reconfiguration because of redundant transmission.

III. ARS ARCHITECTURE

ARS support re-configurability because of following specific features:

QoS aware planning: 1) ARS recognizes the QoSatisfiability of organized reconfiguration plans. 2) In channel utilization generating their expected profits.

Link quality monitoring: In the distributed manner autonomous reconfiguration system examines quality of each node. Depending on link's QoS constraint and calculation, autonomously reconfiguration system identifies local link failure and initiates the network reconfiguration autonomously.

Link layer interaction: For the purpose of planning autonomously reconfigurable system interact within the network and link layer; it causes to include rerouting in addition to link layer configuration.

Contained Reconfiguration: By generating recon-figuration plan ARS permits for changes of reconfiguration of network where link failure occurred maintaining configuration in space away from failure location.

By monitoring link quality Autonomous reconfiguration: In distributed manner ARS check the quality of every node, depending on link's QoS constraints and measurement, ARS identifies failure and network reconfiguration autonomously

ARS FLOW CHART

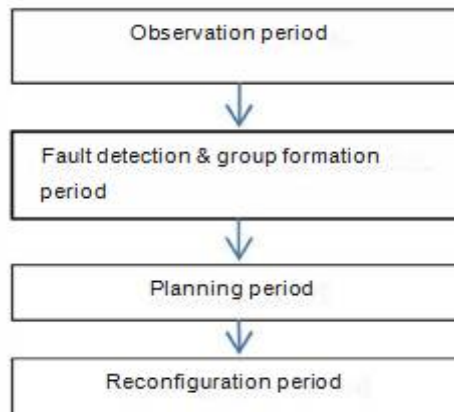


Fig. 1. Flowchart of ARS

The above flow chart describe the operation of autonomously reconfigurable system, first it at every time i.e. at 10 s observe the quality of wireless link and via management message, send result to gateway, after detecting the link failure trigger the formation of group, one of the group member selected as leader. The planning request is sent by leader node to gateway, then gateway generate reconfiguration plan for request, if there are multiple request. Reconfiguration plan send to the group member and leader node by gateway. All nodes in group execute the changes. Routing protocols send all the messages during formation and reconfiguration.

NETWORK RECONFIGURATION PLANNING

ARS generate reconfiguration plan for every failure of link, different network configuration can be caused due to changes in link requirements, ARS applies connectivity constraint to create group of feasible reconfiguration plan to enumerate link, channel, route changes around the faulty region, given link failure constraint and connectivity. To identify plan of reconfiguration, this satisfies QoS demand and improves network utilization.

Plan Generation: To avoid local link failure and maintain existing network connectivity ARS identifies some changes, but doing this ARS has to address the following challenges.

Removing faulty channel: ARS identifies three main link changes for fix faulty link. ARS can use both the end radios of link XY can simultaneously change their tuned channel i.e. channel switch S. 2) A radio switch R where one radio in node X can switch its channel and associate with another radio in node y. 3) A route switch L, instead of using faulty link all traffic over faulty link use detour path.

Network connectivity maintenance and utilization: To avoid the use of faulty channel, it is necessary for ARS to maintain connectivity with radio resources full utilization. With multiple neighboring nodes, each radio is associated, so change in one link causes neighboring link to change their settings. ARS takes two-step approaches 1) ARS combines set of feasible changes that enable a network to maintain its own connectivity. The usages of network resources are maximized by ARS by making each radio of a mesh node, avoiding the use of same channel among radios in one node. **Maintaining the scope of reconfiguration changes:** As local as possible, ARS has to limit local changes, at the same time by considering more network changes or scope it need to find locally optimal solution. ARS uses k-hop reconfiguration parameter. ARS assumes in first k hop some link changes and creates feasible plan. ARS cannot find local solution, it increases quantity of hop so that,

it may explore broad range of link changes. On the basis of existing reconfiguration for the faulty and value of total reconfiguration is defined.

IV. IMPLIMENTATION OF SYSTEM ANDEXPERIMENTATION

ARS IMPLEMENTATION DETAIL

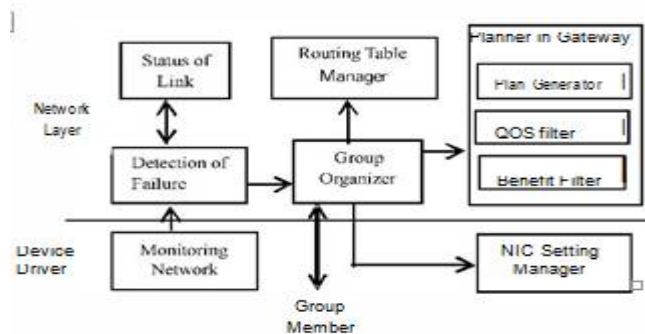


Fig.2 ARS software architecture

Fig. 2 shows ARS software architecture. In the network layer using netfilter, inside the Linux kernel netfilter is set of hook which permits the kernel modules to register the function of callback with the stack network. For every packet that traverses the respective hook within the network stack a registered callback function is then called back. For the definition of rule sets IP table is generic table structure. Within an IP table each rule consists of one connected action (IP table's target), connection tracking, number of classifiers, ip_tables. The major part of framework is built by the NAT subsystem together [9].

ARS is implemented which provides ARS with hook to detect and send formation of group messages. This module include in network layer

Link Status:which identify the status of link, whether link failed to send data or working properly.

Failure detector: It detect the failure if occurs while sending data.

Group Organizer: This generates group between different mesh routers.

Routing table manager: Routing information is provided by routing table manager to all interested client such as management programs, routing programs, routing protocols. It passes best information to the entire interested client. Through routing table manager ARS can be obtained. For making accurate network monitoring in MAC layer the device driver allows for accessing management registers and various control. The device driver includes

Monitoring Network: Network monitor constantly the network for slow and failing components. In case of outages that notifies network administration. Monitor the network which includes different links and nodes.

SETUP OF EXPERIMENT

The test bed consist of several mesh node and in between there are multiple links. In order to receive and send strong signal from and to adjacent nodes, each node is placed on high level

rate and transmission. For wireless interfaces and implementation of ARS, all nodes run Linux OS, MADWiFi device driver [8]. For routing protocols weighted cumulative expected transmission time (WCETT) and ETX [10] routing matrices are implemented. The WCETT include assigning weight to every link given time in transmission linked out. WCETT has a routing metrics that take two things into account 1) Channel assignment diversity 2) Difference in the bandwidth of link. It has advantage to configure the best path for the variety of channel offered and bandwidth of link IGWs.

V. RESULT OF EXPERIMENT

ARS causes the improvement in quality of system satisfiability, efficiency of channel, and throughput, ripple effect reduction.

QoS gain satisfaction: QoS indicate differentiation of traffic and using multiple point to point communication service between two networks with significances and configuration adjusted to guarantee sufficient service quality of each user. Based on QoS classes identifiers network controlled simplified QoS profiler and network initiated bearer establishment are vital features of the evolved QoS concept. ARS generally is responsible for getting varying QoS demand. To show the gain considers the example as follows.

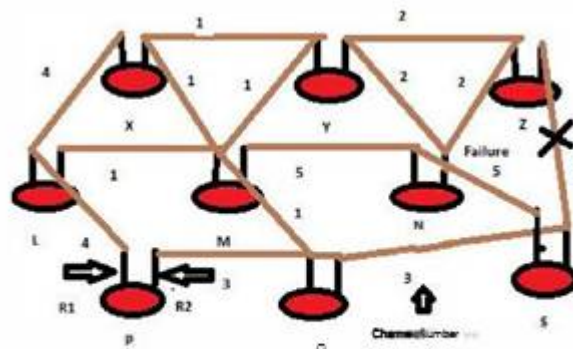


Fig.3. Multi radio Wireless Mesh Network undergoes wireless link failure and requires reconfiguring its setting.

Where the node X, Z and P are the gateway, a mesh router in the shop and mesh router in a control room respectively. During meeting through router Z mobile clients in the shop request video stream and after meeting return to the control room and connect to the router P. It can measure the total number of admitted stream after network reconfiguration, while number of video stream increases. ARS improves chance for wireless mesh network to meet varying QoS demand.

Rejection of ripple effect: ARS helps in rejecting ripple effect of network reconfiguration. To induce the failure on different link, run the same scenarios with two interference frequency (i.e. 5.28 and 5.2 GHz). For comparison the three failure recovery methods are used i.e. local rerouting, greedy, ARS. As shown in figure, with each of three recovery scheme the average throughput performance improves. But by using ARS reconfiguration methods throughput performance

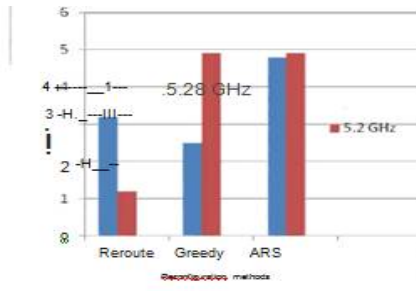
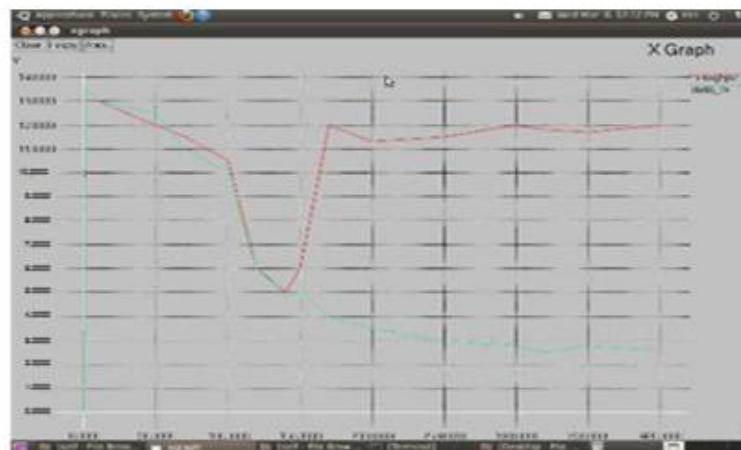


Fig. 4. By each reconfiguration methods improvement from the degraded throughput

increases more as compare to other methods. According to planning algorithm to another channel ARS switches the fault related channel link Local rerouting can causes interference of channel heavily for the detour path, slows down the neighborinflow's activity

Channel efficiency and Throughput gain: In this paper one UDP flows at maximum rate for selected link on the test board increasing the level of interference, as shown in graph static assignment causes the severe degradation of throughput, but ARS detect failure using completes network reconfiguration and link quality monitoring information. The delay is mainly to link quality information update and with gateway a communication delay and the delay can be adjusted. Actual channel switch is less than 3 ms. causes negligible flow disruption. The local rerouting improves the throughput using detour path, still suffers from throughput degradation because of along detour path an increased loss rate.

Over the other recovery methods ARS also improves channel efficiency. The static channel assignment suffers very less channel utilization due to frame retransmission on failure channel. Static channel assignment has some limitation but by using ARS that limitation can overcome.



(b)

Fig. 5. Gain in throughput and channel efficiency (a) Channel-efficiency gains. (b) Throughput gains



Fig. 6. NAM Window showing data transfer

source node to destination node, it select shortest path, but if in case link or node failure occurs then radio switch and channel switch done by ARS, another alternative shortest path is selected. As shown in NAM window node 4 is failed, so that data reach to the destination by choosing another path which comes in broadcasting range node in network. Meanwhile ARS detect failure in the network, reconfigure it and recover it. After reconfiguration again the first shortest path is selected. By doing this it helps to reduce loss of packets transfer, enhance channel efficiency and throughput.

VI. CONCLUSION

CONCLUDING REMARKS

ARS autonomously reconfigure failure in the network by generating effective reconfiguration plan which satisfy application's constraints and admitting up to two times more flow than static assignment. Based on existing MAC, routing, and transport protocols, network performance is not scalable with either the number of nodes or the number of hops in the network.

FUTURE WORK

In this paper I have implemented the static ADHOC network, i.e. the nodes are immobile but in future I am going to implement mobile node. The nodes are free to move anywhere and communicate with other nodes which are in broadcasting range. Mobile nodes in ADHOC network increases the complexity as it is difficult to be in the broadcasting range of other nodes.

REFERENCES

- [1] Akyildiz, X. Wang, and W. Wang, "Wireless mesh networks: A survey," *Comput. Netw.* vol.47, no.4, pp.445-447, Mar.2005.
- [2] "MIT Roofnet," [Online]. Available: <http://www.pdos.lcs.mit.edu/roofnet>
- [3] Motorola, Inc., "Motorola, Inc., mesh broadband" Schaumburg, IL [Online]. Available: <http://www.motorola.com/mesh>.
- [4] P. Kyasanur and N. Vaidya, "capacity of multichannel wireless networks: Impact of number of channel and interferences," in *Proc. ACM Mobicom*, Cologne, Germany, Aug. 2005, pp.43-57.

- [5] MJ. Marcus, "Real time spectrum markets and interruptible spectrum: New concept of spectrum use enabled by cognitive radio," in proc. IEEE DySPAN, Baltimore, MD, Nov.2005, pp.512-517.
- [6] A. Raniwala and T. Chiueh, "Architecture and algorithms for an IEEE 802.11-based multi-channel wireless mesh network," in Proc. IEEE INFOCOM, Miami, FL, Mar 2005, vol.3,pp. 2223-2234.
- [7] A.S. Tanenbaum and M. V. Steen, Distributed system. Upper Saddle River, NJ: Person Education, 2002.
- [8] "MADWiFi,"Linux-Consulting, Reno, NV[Online]. Available: <http://www.madwifi.org>"MIT Roofnet," [Online]. Available: <http://www.pdos.lcs.mit.edu/roofnet>
- [9] Motorola, Inc., "Motorola, Inc., mesh broadband" Schaumburg, IL [Online]. Available: <http://www.motorola.com/mesh>.
- [10] P. Kyasanur and N. Vaidya,"capacity of multichannel wireless networks: Impact of number of channel and interferences," in Proc. ACM Mobicom, Cologne, Germany, Aug. 2005, pp.43-57.
- [11] MJ. Marcus, "Real time spectrum markets and interruptible spectrum: New concept of spectrum use enabled by cognitive radio," in proc. IEEE DySPAN, Baltimore, MD, Nov.2005, pp.512-517.
- [12] A. Raniwala and T. Chiueh, "Architecture and algorithms for an IEEE 802.11-based multi-channel wireless mesh network," in Proc. IEEE INFOCOM, Miami, FL, Mar 2005, vol.3,pp. 2223-2234.
- [13] A.S. Tanenbaum and M. V. Steen, Distributed system. Upper Saddle River, NJ: Person Education, 2002.
- [14] "MADWiFi,"Linux-Consulting, Reno, NV[Online]. Available: <http://www.madwifi.org>