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Enhanced Autonomous Reconfiguration of Link Failures in Grid Based Wireless Mesh Networks

Gokul Prasad. C*, Vinodh Kumar. B**
*II M.E (CS), **Assistant Professor (Sr).
Sri Shakthi Institute of Engineering and Technology, Coimbatore, Tamilnadu, India

Abstract:

Link failures is one of major issue in the networking area. So that wireless information communication is the most promising and complicated field. As wireless mesh networks are concerned these provides larger coverages and high data rate information transfer. Even though they provide lot of benefits to the users and several high range applications they still suffer from the occurrences of the link failure. These link failures will occur due to some interferences , different obstacles etc.. By this link failure the information transfer can be lost so the quality of communication cannot be achieved and also the performance of this Wireless Mesh Networks can low. So in order to recover from the link failures Autonomous Reconfiguration System is commonly used. This algorithm provides Autonomous reconfiguration to the links by employing group formation technique. Even though this algorithm provides the recovery for the link failure it provides limitations such as higher delay, low throughput etc. In order to over come the limitations of Autonomous Reconfiguration System (ARS) algorithm, a modified version of Enhanced Autonomous Reconfiguration (E-ARS) have been developed. This algorithm provides a different approach. So that the delay are made low, throughput are made higher and also several other parameters are also analyzed comparing to the ARS. These overall process are shown and simulated using the software called Network Simulator -2 (NS-2).

Key words: Wireless mesh networks, link failure, Enhanced Autonomous Reconfiguration System.

I. INTRODUCTION

Wireless mesh networks are boon to the wireless architecture[1]-[2]. It supports larger applications and it provides several benefits to users such as, no cabling cost, automatic connection to all nodes, network flexibility, ease of installation and it also discovers new routes automatically. These wireless mesh networks are not stand alone it is compatible and interoperable with other wireless networks. It provides greater range of data transfer rates. Wireless mesh networks are preferable compared to the adhoc networks for the easy of network maintanance , robustness etc. These wireless mesh networks consists of two types of devices: mesh routers and mesh clients. The mesh routers contains minimal mobility and this constitutes to form an backbone for the mesh clients. Mesh clients can be worked as router, but the hardware and the software platform may differ and it is much more simpler than the mesh routers. So that the protocols used for communication can be used at lesser amount. So the chance of packet loss and link failure are more. Information transmission are generally started from the source node to their specified destination. These transmission strategies will be mostly similar while considering several kinds of networks. But the difference in the transmission of information in several networks will mostly vary in terms of different data rates, some networks employ low data rate transfer where as others provide high data rate transfer. The information transmitted should not eaves drop before reaching the specified destination but these are not met in several kinds of networks.Though these wireless mesh networks provide many advantages there may also some disadvantages , multimedia related traffics based on real time delivery are not supported. Because these will be supported only by employing basic schemes which supports those traffic scenarios. If the routing capability are added then there will be energy constraints in the devices, due to this there will be shorter operating life time. Security related schemes are not developed entirely where multi hopping communication took place. Finally, wireless mesh networks does not provide centralized trusted architecture too, to distribute the public keys [3]. If these architecture are provided means there will be some improvement tasks may be there in terms of security. Here in the wireless mesh network, mesh clients should contain power efficient protocols. Mesh routers in the wireless mesh networks perform dedicated routing and configurations.

In this paper, the link failure occurring at the wireless mesh networks have been considered. Generally link failure is one of the major issue which took place in the networking arena. So, different kinds of approaches or algorithms are used to recover this problems. The main task which is carried out in this paper is to recover from link failure is based on the group formation of nodes from the failure occurred node. These group formation based approach will tend to some problems high delay , lesser throughput etc. In order to overcome the limitations of the ARS another approach is used which is called as Enhanced Autonomous Reconfiguration Algorithm (E-ARS) have been used. According to wireless mesh networks the coverage can be increased so that the in formations capacity are higher. In these cases if link failures occurred during transmission means efficient algorithms are used. In this paper E-ARS results are compared with Autonomous Reconfiguration System (ARS) [4] algorithm results these link failures.

II. EXISTING TECHNIQUES

By employing this resource allocation algorithm algorithm optimal reconfiguration plan has been generated but these requires global configuration changes which is an difficult one while considering the frequent link failures[5]-[7]. There is some drawback in above mentioned algorithm so in order to recover from these drawbacks greedy channel assignment algorithm [8] is used. In this algorithm network changes requirement is reduced to some extent by employing the changes in the settings only to the failure links. This algorithm also provides some drawbacks, it cannot provide higher improvements in the network. The higher improvement can only be achieved while considering the neighbouring nodes additional to the failure links. Finally the fault tolerant routing protocols is used. These protocols use local rerouting [9] or multipath routing [10] so that the failure links are avoided by path diversity. In the multipath routing scheme the ticket based probing is employed. These ticket based probing provides a ticket which is used to search one path. . These tickets are given by the source node. It is based on the state informations only. Suppose if there is tighter requirements in connection , then more number of tickets will be given. Then the probing , it is also considered as routing messages. These routing messages are being transmitted from the source node to the destination in order to find the least cost path . These routing messages should atleast carry one ticket regularly. This ticket based probing provides some advantages, routing overhead is controlled based on number of tickets, there is no need for any node to contain topology related informations, and also it uses stationary links when there is any requirement so by using these stationary links the path will be more stable.This approach is not best suited to achieve better improvements. So an algorithm called as Autonomous Reconfiguration System (ARS) is used. By employing this algorithm the failures links are recovered. In this algorithm, first it checks all the links. It is based on the link measurement technique. Then if the link failure is detected then the group formation will be made from the failure occurred node which are at distances less than 250 ms. Then the energy is calculated for the group formed nodes, for 4 nodes excluding failure occurred node. Then based on highest energy the links are recovered. The highest energy node is elected as leader, it send request message to failure node and it will generate reconfiguration plan and it sends to the leader node. Then in reconfiguration period the changes to node are made so the links are changed. There are different types of overheads occurred by this ARS algorithm such as high drop, low throughput etc.

III. PROPOSED SYSTEM

In the above mentioned Autonomous Reconfigurable System (ARS) algorithm the link failure are recovered but this also produces drawbacks such as, high drop, low throughput etc. In order to recover from these drawbacks, a enhanced form of algorithm called as Enhanced Autonomous Reconfigurable System (E-ARS) was used. The several operation performed in this EARS are,

- Link Monitoring
- Link Failure detection
- Checking energy
- Reconfiguration period

A. Link Monitoring:

Monitoring is an important phenomenon when we consider the link failure. Generally monitoring is the basic operation involved in many link recovery algorithms . Monitoring period is used to monitor the links from which the information is started to the end of that period. In mesh networks it is easier to choose the alternate path when the link failure occurs. Here, since the mesh networks are used there is some general criteria should be met , there should be connectivity between all nodes in the mesh network. These connectivity can be ensured by transmitting test messages to all the nodes from source node. The source node is selected and the information transmitted to destination. Finally the monitoring period is used to detect the link failure and to measure the quality of the links by using hybrid link measurement technique.

B. Link Failure Detection:

After this link monitoring, the failure links are detected. Due to this link failure the packet dropping occurs. These packet loss occurred not only for link failure even they occur if the traffic exhibits some congestion, due to some miscablings etc. then to recover from this failure here no group formation based approach is used because these produces drawbacks such as high drop, low throughput etc..

C. Checking Energy :

Energy is considered to be the important phenomenon.. Generally required energy will be more, when the distances became large and also if the high resources are used .In this paper, the energy is calculated for the neighbouring nodes from the link failure occurred node. Then the node with highest energy is elected as an leader. It will send the request to the failure occurred node and then that node will generate the reconfiguration plan, send to the leader node. Finally the link failures are recovered and transmission continues through the leader node to the destination.

D. Reconfiguration period:

In this period some modifications to links are included. If a failure occurs to a link then there will be loss of information. By using reconfiguration plan send to the leader node the changes to node are made. So that the changes are made to the links. The most important task carried out in this period is the changes must be made to link. In this proposed algorithm , the group formation is removed and also traffic has increased. Because by removing these group formation the overheads such as high drop, low throughput will be overcomed. Here the link recovery is based on the highest energy which is at the path in near by distance .Generally if the link failure occurred means the alternative path will be provided from the source node and also the failure information will be send to all the nodes where as in this E- ARS, the failure link information will be send to only the near by nodes based on near by path the information will be transferred. The selecting best path is based on distance . These are the operations involved in the planning period. Then finally, the information transfer took place via the near by nodes to the destination these transmission will be done at the reconfiguration period. So by employing this proposed

algorithm E- ARS , less drop, high throughput etc..can be produced.

IV. RESULTS AND DISCUSSION

Here, ns -2 [11] is used for this simulation environment. In this paper, to perform simulation 25 number of nodes are created and they are placed in the 5x5 grid based formation. These 25 nodes are separated at the distance of about 180 ms to the other nodes. Then routing protocol used here is Destination Sequence Distant Vector (DSDV). Here User Datagram Protocols (UDP) is used. Since the mesh networks is used, the connectivity should be ensured by transmitting test messages from each node to all other nodes. Then the routing path is set. These are set by assigning the traffic, CBR . Here by considering the 25 nodes the number of traffic is made as 6 to reach the destination. Then the information transmission starts from the source node to the destination node. While transmitting the link failures are occurred. Due to this link failure the packet dropping took place. This graph shows that the packet dropping occurred by the Autonomous Reconfigurable System (ARS) is about 21.These packet dropping can be reduced by employing the Enhanced Autonomous Reconfigurable System (EARS) algorithm. Here the packet dropping occurred is 7. It can be shown from the figure 1,

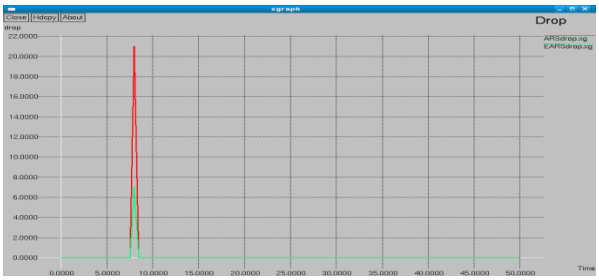

Figure 1: Packet Drop

Then the second parameter which is considered is the energy. These energy are described in terms of joules .Generally the energy consumption will be more when the resources are high. It may vary from node to node. This energy is considered mainly for the ARS algorithm because, based on the highest energy node only the failure recovery can be achieved. Where as in the EARS algorithm the failure recovery will be based on the shortest path from the failure occurred node. But in the both algorithm the energy has been considered, ARS consumes lesser energy when compared to EARS. The main reason for high energy consumption in case of EARS is due to the increased CBR traffic. This can be shown by this energy graph, Since the traffic is set for 12 m sec ,the graph shows higher energy consumption for EARS ,when compared to the ARS. These energy graph is plotted between time vs energy(joules).It can be shown from the figure 2,

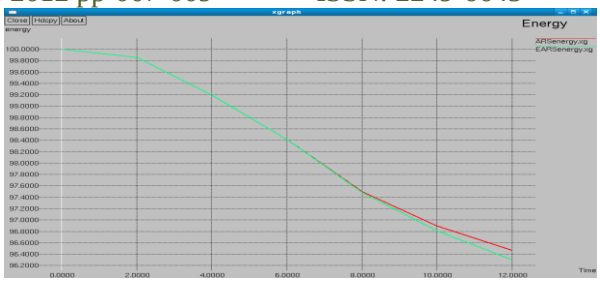

Figure 2: Energy Consumed

Then the third parameter which is considered is the packet delivery ratio. The packet delivery ratio are generally described by, ratio of received packets by the send packets. At the starting the packet delivery ratio tend to increase while considering both the algorithms. Since the packet delivery ratios are plotted for each 5 intervals, the ARS produce lesser packet delivery ratio at 10 ms its about 0.76. this is because of the group formation technique employed where as in case of the EARS it produces higher packet delivery ratio at 10 ms its about 0.91. Since the group formation is eliminated in the EARS, it provides higher packet delivery ratio. Then finally after the 20 ms the packet delivery ratio will be same for the both algorithms. Packet delivery ratio is plotted time vs packets. It is shown from the figure .3,

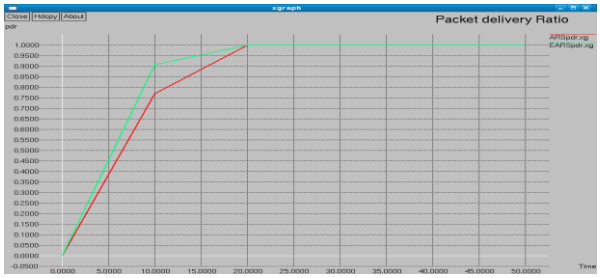

Figure 3 : Packet delivery ratio

The last parameter which is considered is the throughput. The throughput is defined as the average rate of successful message delivery through the communication link. It is generally expressed in terms of kb/s (kilo bits/sec) .But these can also be expressed in terms of data packets per time slot. While considering the throughput for the ARS algorithm , it tends to increase from 7 ms. Since it is the starting time for transmission. Then it will be constant from 8 ms to 9.5 ms because at that time there is no transmission will be occured. Because during this time only the packet dropping and group formation are employed. Then from 9.6 ms the throughput will tends to increase and finally they are kept constant levels from 10.5ms to end of simulation time , 50ms. Its value is about 119. Then while considering throughput for EARS, it also tends to increase from 7ms. Here also the transmission started from this time only. Then it will be constant from 8 to 8.6 ms then based on the shortest path only link are recovered instead of group formation. So that the time will be reduced and finally the throughput will be high for EARS .finally its value is about 127. It can be shown through from this figure 4,

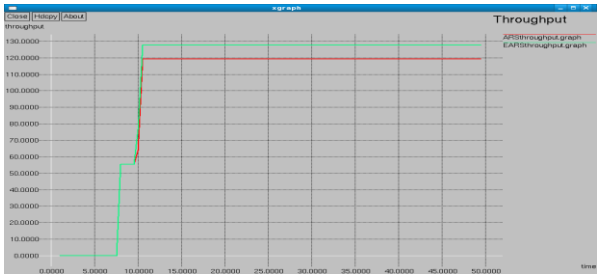

Figure 4 : Throughput

CONCLUSION

In this paper, the link failure recovery is considered as the main objective. It is done by using Autonomous Reconfigurable System algorithm. Though this algorithm provides link recovery, some kinds of limitations such as high drop, low throughput etc.. are produced. These are due to the group formation technique which is employed from the failure occurred node. In order to overcome from this limitations , a new enhanced algorithm called as Enhanced Autonomous Reconfiguration algorithm is used. These provides low drop ,high throughput etc.. Only the energy consumption is more compared to Autonomous Reconfigurable System (ARS) algorithm. This is because the traffic is increased compared to the Autonomous Reconfigurable System algorithm.

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