A QoS Enhancement in Hybrid Wireless Networks using QOD Routing Protocol

[1]Karri Manjula, [2]B. Srinu

[1]PG Scholar, [2]Assistant Professor
Department Of Information Technology
Gayathri Vidya Parishad College of Engineering, Andhra Pradesh, India

***Abstract*: - Wireless applications gained major popularity and noteworthy research has been studied to assist real time transmission with rigid QoS requirement for wireless communication and wireless applications. For the next generation's wireless networks, hybrid network with integration of mobile wireless ad-hoc network (MANET) along with wireless infrastructure network proves to be a next better alternative. Applying resource reservation based (RRB) QoS routing for MANETs and hybrid networks raises invalid reservation and race condition issues. So far assurance for the QoS in hybrid networks appears to be a open complication. In this present paper a quality of service oriented distributed routing (QOD) protocol has been enhanced to assist capability for hybrid networks. Hybrid networks have a feature of transmission hops and any cast transmission, these features can be advantageous. QOD changes packet routing problem to a resource scheduling problem in QOD we have five algorithms 1) QOS guaranteed neighbour selection algorithm to reduce transmission delay, 2) A distributed packet scheduling algorithm to decrease the transmission delay to an extent, 3) A mobility based segment resizing algorithm which adjusts the segment size with respect to node mobility for the reduction of transmission time, 4) A traffic redundant elimination algorithm to raise transmission throughput and, 5) Data redundancy elimination based transmission algorithm to remove the redundant data for the improvement of transmission QoS. Based on analytical and simulation results from real human mobility model and random way point model showed that QOD can provide higher QoS performance in the terms of scalability mobility resilience, overhead and transmission delay.**

Keywords*— *Ad-hoc network, hybrid wireless networks, Routing algorithms, QOD, QoS

---

1. INTRODUCTION

Hybrid wireless networks (HWN) can be explained as an integrated infrastructure that can supply absolute services over numerous networks. And moreover the research work is mainly on the infrastructure solely and a few algorithms has been proposed, for the application of hybrid wireless networks (HWN) and explore its usage in medium access layer and routing layer.

There is a requirement for high QoS quality of services in both real time and multimedia applications in aspects of their development and behold the key to the future of these applications. In order to maintain absolute or seamless communication network between the mobile devices and the wireless infrastructure the QoS is required, as it helps in reduction of the end to end transmission delay. It is proved that the hybrid wireless networks can be a better network structure to meet next generation wireless networks which help in tackling rigorous QoS requirements for different categories of applications.

Hybrid networks interdepends two networks to make one advantageous to other, here infra-structure networks and MANET's are the two networks that are combined synergistically in this combination infra-structure networks increases the scalability factor of MANET's while MANET's creates self-organizing networks, which increases the coverage of the infrastructure networks. But there arises a queried that to make QOS availability in hybrid networks where the networks having high mobility and fluctuations in bandwidth. In the case of infrastructure networks the QOS is proposed of the quality of service (QOS) routing, which often require node negotiation, admission control and priority scheduling of packets. Based on these observations numerous reservations based QOS protocols has been proposed. These protocols has as the reservation based protocols has introduced invalid reservation and race condition problems and to increase the capability of Hybrid networks.

In the present work, we mainly consider the neighbor nodes selection for QoS guaranteed transmission. For this we consider QoS guaranteed neighbor selection algorithm, in this process the algorithms selects the best neighbor and uses deadline driven scheduling to guarantee QoS quality of service routing. Distributed packet scheduling algorithm assign the higher queuing delay for the earlier generated packets and lower queuing delay for recently generated packets in order to reduce transmission delay after the neighbor selection process is done

2. QOD ROUTING PROTOCOLS:

QOD routing protocols follows five algorithms to enhance the QoS in hybrid wireless networks, they are

- QoS- guaranteed neighbor selection algorithm

- Distributed packet scheduling algorithm
- Mobility- based segment resizing algorithm
- Soft- deadline based forwarding scheduling algorithm
- Data redundancy elimination based transmission

2.1 QoS- guaranteed neighbour selection algorithm:

The neighbour selection algorithm selects best fit neighbours that can assure QOS services. The transmission delay is a major real time QOS prerequisite, so in QOD to reduce this transmission delay it uses EDF Earliest Deadline First Scheduling algorithm. EDF is a deadline driven algorithm that schedules for data traffic in the intermediate nodes. Here intermediate nodes assigns highest priority to the packets that are closer to the deadline and forwards the packet with highest priority. Here eq.1 has to be solved to get the allocations in set A

$$A = \begin{cases} W_g = \sum_{i=1}^{N_s} A_i \\ A_i \le U_{as}(i) * W_i \end{cases} \quad \text{(eq-1)}$$

$U_{as}(i) * W_i$: available workload rate source node needs to distribute its packets to the N_q

A_i : workload rate allocation from source node to immediate node

W_g : the packet generating rate of the source node

2.2 Distributed packet scheduling algorithm:

In this algorithm packet routing is proposed, here the early generated packets are assigned with higher queuing delay and the recently generated packets are given lower queuing delay.so that the transmission delay of the packets can be reduced based on this scheduling algorithm.

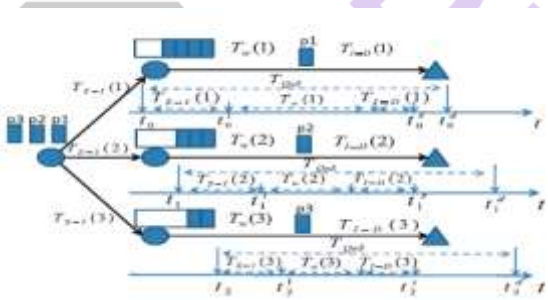

FIG.1: Distributed queuing mechanism

2.3 Mobility- based segment resizing algorithm:

Wireless networks are highly dynamic in nature, the links are tend to break between the nodes. The delay generated in retransmitting can reduce the QoS of packet flow. A node in a high dynamic networks has higher probability of meeting different AP's where it is beneficial for resource scheduling. Reduction in packet size can effect the feasibility of intermediate nodes and increases possibility of packet dropping. So reduction can no longer be a solution for this problem, for this problem a Mobility- based segment resizing algorithm is proposed where larger size packet is assigned to lower mobility intermediate nodes similarly smaller packets are assigned to higher mobility intermediate nodes. Which increases the QoS in transmission of packet. The size of packet $\mathbf{S_p}$ that is sent from one node to another is given by

$$S_p(new) = \frac{\gamma}{v_i} S_p(unit) \quad \text{(eq-2)}$$

Where:

γ : Scaling parameter

vi : The mobility speed of the source node and intermediate node

$\mathbf{S_p}$(unit):1 kb

2.4 Soft- deadline based forwarding scheduling algorithm:

This algorithm comes in where the Earliest Deadline First Scheduling algorithm (EDF) fails to work satisfactorily.in the EDF we assign highest priority to the packet that are closer to the deadline, if the EDF can forwards all packet then the EDF algorithm can work satisfactorily .in the case where there are number of packets, there is probability of packet can be missed. EDF forwards the packet closer to the deadline but delay the packets with farthest deadlines. Where the missing packets are not feasible and EDF can work effectively here. In order to achieve the packet forwarded without missing for the soft driven applications mainly, Soft- deadline based forwarding scheduling algorithm is proposed where the least slack first algorithm (LSF) is used.

For example:

(a) Packet's remaining forwarding time = 5 secs

(b)Time from current time to its deadline = 20 secs

Then, slack time = (b)-(a)

20 - 5 = 15 secs

Based on this formula the LSF continuously calculates the slack time for all of its packets and forwards the packet with the least slack time.in case if there are any similarly slack times the its selects the packets randomly. Here LSF does not aim in transmission scheduling, it rather aims in making delay and size the packet delayed and different packets flows almost the same. Therefore, LSF can achieve more transmission scheduling than EDF. An intermediate node forwards the packet with least wait time. The slack time of a packet is denoted by ***p*** can be given as

$$p = D_p - t - c' \quad \text{(eq-3)}$$

Where

Dp : Deadline of packet ***p***

t : The current time

c' : The remaining transmission time of the packet

2.5. Data redundancy elimination based transmission:

In mobile networks nodes set their NAV values based on the overheard messages. NAV value denote the available bandwidth and the scheduling the feasibility of the intermediate nodes. Larger NAV values denoted the less bandwidth and less scheduling feasibility. Reducing the NAV value can sequential increase the QOS of packets transmission in QOD. Here we use End to end traffic redundancy elimination (TRE) algorithm to eliminate redundancy and increase the QOS in the transmission. The source node often caches the data it has sent when it find a duplicated chunk in the cache it is replaced with a signature and hash value. It also sends the same signature to the AP to find the any duplicated chunks in the received cache. The AP scan the received packets and find the duplicate chunks when it find the duplicate chunk it sends confirmation to the sender and replaces the chunk with the hash value. If sender doesn't send any signature hash values it requests from the sender to send the duplicate. Chunk signatures

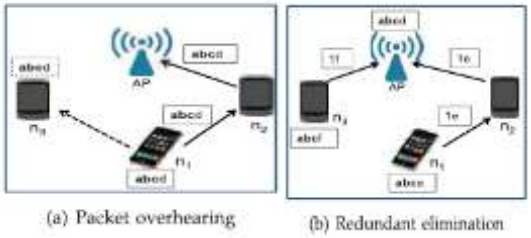

Fig-2: Example of packet redundant elimination

3. NETWORK MODEL

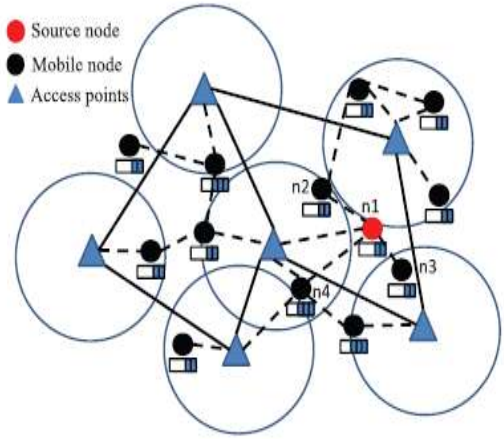

Fig-3: Network Model of a Hybrid System

4. PSEUDOCODE FOR QOD ROUTING PROTOCOL EXECUTED BY SOURCE NODE

1. **if** receive a packet forwarding request from a source node then
2. **if** this SpaceUtility < threshold then
3. Reply to the source node.
4. **end** if
5. **end** if
6. **if** receive forwarding request replies for neighbor nodes **then**
7. Determine the packet size Sp(i) to each neighbor i
8. Estimate the queuing delay Tw for the packet for each neighbor
9. Determine the qualified neighbors that can satisfy the deadline requirements based on Tw
10. Sort the qualified nodes in descending order of Tw
11. Allocate workload rate Ai for each node
12. **for** each intermediate node ni in the sorted list do
13. Send packets to ni with transmission interval Sp(i)/Ai .
14. **End for**
15. **End if**

5. Architectural Flow Diagram of Implementation System:

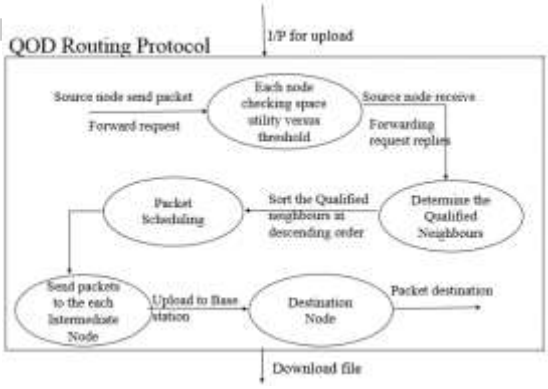

Fig-4: Architectural Flow Diagram of QOD Routing Protocol

6. Modules:

6.1 Network Formation:

1. Create a Hybrid wireless network with a random amount of base stations that are speeded over a network.
2. Let N nodes are moving in the network. As nodes equipped with multi-interface can transmit with less interference when compared with the hybrid network with the single Wi-Fi interface. Here each node acts as single Wi-Fi interface to deal with a different problem. Therefore a Aps are considered as the base stations. Wi-Fi interface enables to communicate between the Aps and the mobile nodes.

6.2 Upload Packets Using QOD Protocol:

To ensure the packet arrives to its destination with QoS requirements, scheduling feasibility has to be made. When QoS of transmission is not achieved between the source nodes and the AP, it requests the neighboring nodes. The neighboring node with the availability of resources respond back. The reply consists of the packet arrival interval, transmission time, deadline details, and the flow in the transmission path. The flow in neighboring nodes can be estimated using their queuing delay and the nodes mobility speed.

6.3 Download Packets:

Now the required file has to be downloaded, so at this point QOD routing protocols are again executed and the packets are being downloaded through the neighboring nodes, fig.8 .

Fig-5: Source file selection page with ip address as input.

Fig-6: Destination selection page

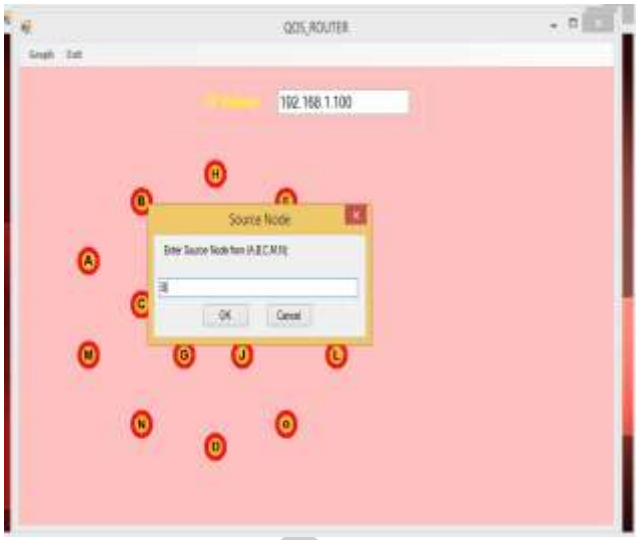

Fig-7: QoS Router page with selection of source and destination node

Figure-7, indicates the page where the source node and the destination nodes are selected such that neighbor mode is activated.

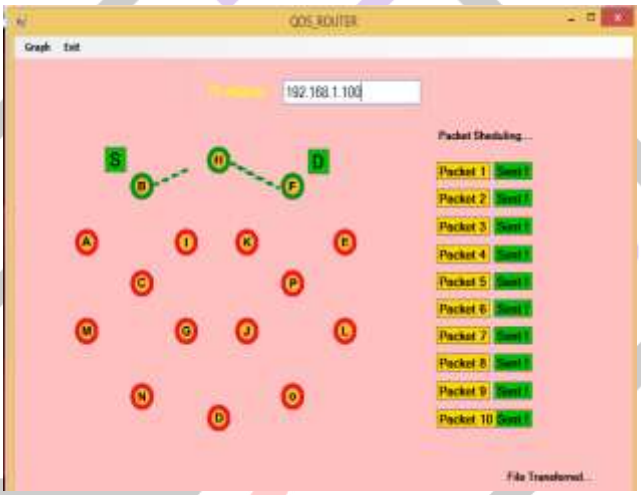

Fig-8: QoS Router page after the neighbor mode activated.

7. Results

In a network there are number of nodes to transmit packet data like the receiving nodes and transmitting nodes. The QoS is required to send the data without loss of any data. There by QoS is checked in the implemented system. For the QoS to be achieved the following characters that is fig.9 QoS Throughput, fig.10 Packets Loss Ratio. In the following the results of the implemented system are shown.

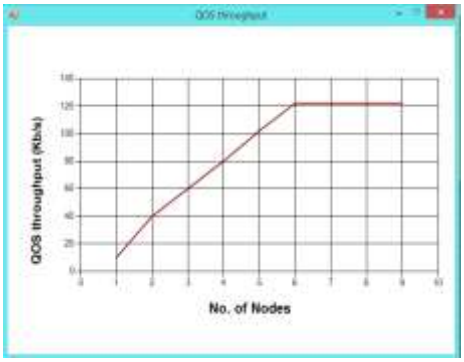

Fig-9: Throughput of a packet data

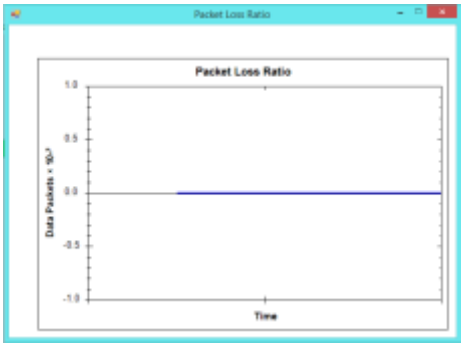

Fig-10: Packet Loss Ratio of Transmitted packet data

8. CONCULUSION

The integration of MANETS and the infrastructure wireless networks in to the Hybrid networks has proven to be a better network structure for the upcoming generations. Direct adoption of QoS protocols to hybrid networks produce reservation and race condition problem.so in this work QOD is proposed for hybrid network to increase QoS, even in high dynamic network conditions. Taking the advantage of both type networks hybrid networks can cast transmission with short transmission delay. QOD eliminates the problem by converting the packet routing problem to the packet scheduling problem. In QOD if source node directly transmits the file to the destination then it is known as direct transmission that can producing promising QoS qualities. If not the source node schedules the packet forwarded to the destination through the best fit neighbours. The selection of neighbours are based on the neighbor section algorithm. The distributed packet scheduling algorithm reduces the transmission delay and the mobility based algorithm resides the packet size and forwards to ensure the routing QoS. The TRE based transmission algorithm can reduce transmission delay and increase the transmission quality. The soft deadline algorithms achieve more promising results in packet scheduling feasibility when compared with EDF. Finally, the experimental result shows QOD can achieve high mobility, scalability, reduced delay in transmission.

REFERENCES

[1] E. Crawley, R. Nair, B. Rajagopalan, and H. Sandick, Resource Reservation Protocol RSVP, *IETF RFC* 2205, 1998.
[2] I. Jawhar and J. Wu, "Quality of Service Routing in Mobile Ad Hoc Networks," Network Theory and Applications, Springer, 2004.
[3] H. Wu and X. Jia, "QoS Multicast Routing by Using Multiple Paths/Trees in Wireless Ad Hoc Networks," Ad Hoc Networks, vol. 5, pp. 600-612, 2009.
[4] J. Xie, R.R. Talpade, A. McAuley, M. Liu, Amroute: ad hoc multicast routing protocol, 429–439, 2002.
[5] D. Li, Q. Liu, X. Hu, X. Jia, Energy efficient multicast routing in ad hoc wireless networks, Computer communications 3746–3756, 2007.
[6] H. Wu, X. Jia, QoS multicast routing by using multiple paths/trees in wireless ad hoc networks, Ad Hoc Networks 600–612, 2007.
[7] B. Sun, L. Li, QoS-aware multicast routing protocol for ad hoc networks, Journal of Systems Engineering and Electronics 417–422, 2006.
[8] K. Bür, C. Ersoy, Ad hoc quality of service multicast routing, Computer Communications 136–148, 2005.
[9] E. Crawley, R. Nair, B. Rajagopalan, and H. Sandick, Resource Reservation Protocol RSVP, *IETF RFC* 2205, 1998.
[10] M. Conti, E. Gregori, and G. Maselli, "Reliable and Efficient Forwarding in Ad Hoc Networks," Ad Hoc Networks, vol. 4, pp. 398-415, 2006.
[11] T. Reddy, I. Karthigeyan, B. Manoj, and C. Murthy, "Quality of Service Provisioning in Ad Hoc Wireless Networks: A Survey of Issues and Solutions," Ad Hoc Networks, vol. 4, no. 1, pp. 83-124, 2006.
[12] G. Chakrabarti and S. Kulkarni, "Load Balancing and Resource Reservation in Mobile Ad Hoc Networks," Ad Hoc Networks, vol. 4, pp. 186-203, 2006.
[13] C.E. Perkins, E.M. Royer, and S.R. Das, Quality of Service in Ad Hoc On-Demand Distance Vector Routing, *IETF Internet draft*, 2001.
[14] Z. Shen and J.P. Thomas, "Security and QoS Self-Optimization in Mobile Ad Hoc Networks," *IEEE Trans*. Mobile Computing, vol. 7, pp. 1138-1151, Sept. 2008.
[15] R. Braden, D. Clark, and S. Shenker, Integrated Services in the Internet Architecture: An Overview, *IETF RFC* 1633, 1994.
[16] X. Du, "QoS Routing Based on Multi-Class Nodes for Mobile Ad Hoc Networks," Ad Hoc Networks, vol. 2, pp. 241-254, 2004.