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Enhance multipath routing in topology transparent network for better QoS in MANET

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***Abstract*—the interconnected nodes in wireless environment are forming a dynamic, temporary and open network called Mobile Ad hoc Network (MANET). In Mobile ad hoc networks communication are not very easy because of limited available bandwidth. The network performance is also being possible to measures by Quality of Service (QoS). The QoS measures through criteria of modification in routing strategy, improvement in packets dropping and all the criteria that change the network parameters for improving performance. Conventionally, every network protocols follow the criteria of strictly layered structure and implement congestion control, routing and scheduling independently at different layers. In this paper we research for control congestion and collision in dynamic network. In term of lesser congestion and collision QoS of routing with multipath protocol is measures. In this research the three scenarios of routing is considered. In first scenario the normal performance of ad hoc one demand multiple distance vector routing protocol (AOMDV) is measures, second one is measures on the basis of unassigned slots utilization to senders and third is shows the enhancement by adding them the concept of location based routing and queue estimation approach. The multipath routing protocol in MANET has the capability of balance the load in network properly by providing the alternative paths possibility. The proposed scheduling techniques is reducing the bandwidth consumption and possible to handle the problem of congestion and collision i.e. necessary for improving the QoS of routing in dynamic network. The simulation results are shows that the proposed performance is better than the existing approaches.**

Keywords:-Congestion, Collision, AOMDV, QoS, Location, MANET.

INTRODUCTION

Mobile ad hoc network (MANET) is an autonomous system of mobile nodes connected by wireless links. It does not need much physical infrastructure such as routers, servers, access points or cables.

In a MANET, each mobile node is equipped with a wireless transmitter and receiver using antennas. Nodes can communicate directly with other nodes within their wireless transmission range.The two major classifications of MANET routing protocols are unipath and multipath routing protocols [7]. The unipath routing protocols discover a single route between a pair of source and destination. In multipath routing protocol discover more than one route between source and destination. There are some problems like power consumption, packet dropping, congestion and collision in unipath routing protocol.

Multipath on-demand protocols try to improve these problems by computing and caching multiple paths obtained during a single route discovery process [6]. The link failures in the primary path, through which data transmission is essentially taking place, cause the source to switch to another path instead of initiating a different route discovery. A fresh route discovery occurs only when all pre-computed paths break. This approach can result in reduced delay since packets do not need to be buffered at the source when an alternate path is available. This protocol discovers multipath route and path maintenance mechanism on the basis of a calculated cumulative metric value only on signal strength between two nodes in a path. This metric only address strength of link of the current path, does not address the durability of the path; which fully depends on the residual energy of node. Also does not consider the consistency of node through the previous behaviour. Since it does not consider node's behaviour and energy, it cannot be applied in heterogeneous MANETS having high mobility nature.

Collisions in ad hoc networks may occur in two ways: direct or hidden. Direct collision is a result of two adjacent stations broadcasting at the same time. Hidden collision occurs when two neighbour stations transmit simultaneously to a station that can receive messages from both senders. These networks apply a packet switching technique over a shared radio channel to provide flexible high-speed communications between a large numbers of potentially mobile stations which may be geographically disbursed [14].

Quality of Service (QoS)

We apply AOMDV to analyze the performance of reactive routing protocol of ad hoc network. Apart from this we also observe Qos (quality of service) parameter like throughput analysis, packet deliver ratio, drop analysis etc. AODV presently does not support better quality of service as compare to AOMDV because in AODV load balancing mechanism is not available and it provides single path. The QoS routing feature is very important in standalone multi-hop mobile network for real time application.

QoS model defines as structural design that will provide the probable best service. This model have to take into deliberation all challenges imposed by Ad-hoc networks, like network topology alter due to the mobility of its nodes, constraints of dependability and energy consumption, so it describes a set of services that permit users to select a number of safeguards (guarantees) that govern such properties as time, reliability, etc.[8]. Classical models like Intserv / RSVP [11] and DiffServ [12] proposed in first wired network types are not suitable (adapted) for MANETs. Various solutions or models [5] namely: 2LqoS (Two-Layered Quality), FQMM (Flexible

QoS Model for MANET), CEDAR, noise, SWAN (Service Differentiation in Wireless Ad-hoc Networks) and INSIGNIA have been proposed for the Ad-hoc networks. Each of these models attempts (tries) to improve one or numerous QoS parameters, as they may be part of one or numerous network layers architecture.

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OVERVIEW OF ROUTING PROTOCOLS

In dynamic network the topology are frequently changes that are the cause of link breakage. The direct connection in between sender and receiver is rarely possible. The connections are created as multi-hop till the destination is not found. The routing protocol is play a important role at network layer for data accepting and forwarding through each router or node. The data is sending by sender and accepted by receiver in this procedure routing strategy is very important part of communication [10,11]. For connecting to destination and data delivery the routing protocol is necessary for routing the data in between sender to receiver. Every routing protocol has different routing strategy of connection establishment but has same method of select shortest path in between sender and receiver. The shortest path is decided on the basis of minimum hop count value in MANET. The classifications of routing protocols in MANET are as follows:-

1) Proactive Routing Protocol

The proactive routing protocols are also called as table driven routing protocol and these routing protocols are maintaining the routing information of each node that are participating in routing procedure. In Mobile Ad hoc network the topology in network is changes by that the overhead of maintain the information of each and every node is very difficult and required large amount of memory for storing routing information in network. In ad hoc network if the nodes are moves at slow speed then that protocol is suppose to be better for communication. The example of proactive routing protocol is DSDV routing protocol. There are some problems in DSDV like network overhead, no multipath provides, it's suitable for small network.

2) Reactive Routing Protocol

The Reactive routing protocols are also called as on demand routing protocol and these routing protocols are maintaining the routing information on the basis of requirement of request receives by the neighbour. There is no routing information is stored of each node that are participating in routing procedure. In Mobile Ad hoc network the topology in network is changes by that the overhead of maintain the information of each and every node is not needed to maintained. In ad hoc network if the nodes are moves at random speed then that protocol is supposes to be better for communication. The e8xample of reactive routing protocol is AODMV routing protocol.

3) Hybrid Routing Protocol

Since proactive and reactive protocols each work best in oppositely different scenarios, hybrid method uses both. It is used to find a balance between both protocols. Proactive operations are restricted to small domain, whereas, reactive protocols are used for locating nodes outside those domains.

LITERATURE SURVEY

Yiming Liu et al [15], they propose an efficient topology-transparent broadcast scheduling algorithm with a different design strategy. The main contributions of that work are as follows.

1. First, unlike the existing topology-transparent broadcast scheduling algorithms each node can transmit same packets repeatedly during one frame time according to the collected information of its two-hop neighbors.
2. They propose several methods to utilize the unassigned slots in a collision-free and traffic adaptive manner. They utilize the unassigned slots while ensuring that the transmissions in the assigned slots are not affected.

Victor O.K. Li et al [16], they employ erasure coding to combat collisions and channel errors in topology-transparent scheduling, implementing an efficient and reliable solution for broadcast in wireless networks. Moreover, the employed erasure coding scheme does not introduce any overhead. As far as we know, this is the first work improving both efficiency and reliability of a topology-transparent broadcast scheduling over error prone channel. We study the performance of our proposed algorithm analytically and by simulation, in terms of the average network throughput and the packet failure probability.

Juan Jos´e Jaramillo et al, [4] they extended to heterogeneous delays for the case of periodic traffic, which is an important practical extension since many examples of real-time traffic fall into this category. Here consider noisy channels where the transmitter does not have perfect channel state information and relies on feedback from the receiver to find out if a transmission was successful. The case with per-slot feedback is a non-trivial practical and theoretical extension. The difficulty arises due to per-slot feedback because the scheduler's decision at each time instant is a policy (i.e., a mapping from observed feedback so far in the frame to a scheduling decision). We have shown that the scheduling decisions in this case can be solved using a dynamic program encountered at the beginning of each frame. The dynamic program formulation provides a systematic way to solve for the optimal solution. The usefulness of the dynamic program solution is further demonstrated in the case of collocated networks, where only one link can transmit at any given time. For this case, we are able to provide a simple proof that a greedy solution is optimal.

S.Madhavi et al, [13], they propose an adaptive distributed broadcast scheduling for spatial time division multiple accesses in mobile ad hoc networks that computes the slot assignments according to the changes in the topology. . A new adaptive broadcast scheduling method called NABS for transmission scheduling in Mobile Ad Hoc networks. The main aim of NABS is to obtain the Minimal frame length and the maximum node transmissions. This new method obtains a Minimal frame length and finds the maximum node transmissions. Results show that this method improves the guaranteed throughput and outperforms an improvement over others

Hongju Cheng et al,[2] they have originally proposed an *H*-hop interference mode to describe the case that the interference range is larger than the transmission range. Then we have shown the NP completeness of the scheduling problem and proposed two heuristic algorithms for it, namely, the Speak Once algorithm and the Speak Separately algorithm. In the Speak Once algorithm, only one time-slot is assigned on the switchable radio to each node. Differently the Speak Separately algorithm assigns several time-slots on the switchable radio so that the node can transmit the control packet to all one-hop neighbors in one scheduling cycle. The assignment results not only indicate the timeslot, but also the channel that the switchable radio will switch to at this time-slot.

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PROBLEM STATEMENT

Mobile Ad-hoc network work under dynamic nature and use dynamic protocol so in the field of mobile ad hoc networks routing protocols, there are several problems to be handled such as Quality of service, power awareness, routing optimization and security issues. That all issue resolve through quality of service parameter like throughput analysis, packet delivery ratio analysis and apply Transport layer and Network layer reliable mechanism for improving mobile ad-hoc network performance. MANET uses dynamic routing protocol for better route establishment but cannot control the node motion that property increases the overhead as well as unreliability of network. So here design a strategy to decreases the overhead and increases the quality of service of network using "Enhance multipath routing in topology transparent network for better QoS in MANET".

PROPOSED WORK

In this section describe the proposed algorithm and provide quality of service to the network, proposed algorithm are based on multipath, location estimation with un-assign slot utilization and get more reliable communication network as compare to existing approaches. In this methodology input as a mobile node, intermediate node, channel capacity, location and un-assign slot and retrieve the output i.e. un-assign slot utilization, throughput and drop minimization. Node location is useful for local route repair while communication break down during node move from one location to another and predecessor of break link re-search the route in particular destination direction instead of re-broadcasting by sender node. That proposed location estimation and local route repair methodology is minimized the routing overhead of the network.

Modi et al proposed AOMDV [1] routing protocol algorithm.

AOMDV [1] Algorithm Steps

Step 1: N nodes are distributed in network.
Step 2: Initially all nodes conserve same energy.
Step 3: Each packet sensed by a node is assigned a unique number id & broadcast it to all nodes in the network.
Step 4: Each node that receives the id checks if it is already stored in its memory.
Step 5: If yes, the data will be discarded.
Step 6: Else, select the higher residual energy node with the shortest distance path.
Step 7: Else if node with same residual energy and distance then packets will be transmitted with higher timestamp value.
Step 8: Maintain the location information of node and continue the same process till destination found.
Step 9: check whether the data reach to the destination
Step 10: If yes, broadcast the packet id to all nodes.

Algorithm: Multipath un-assign slot and node location aware for QoS

Input: M: mobile nodes
S: Sender ϵ M
R: Receiver ϵ M
I: Intermediate ϵ M
S_p: Speed of node
C_p: channel capacity
C_i: Channel utilized
$L(x_{i,} y_{i})$: node location
U_s: un-assign slot

Output: Un-assign slot utilized by some M nodes, routing overhead minimization, throughput, drop minimization

Routing:
S← call (AOMDV)
Broadcast routing packets
While (I in range && $C_p > C_i$) **do**
Check queue limit
If (queue limit < full) **then**
Receiver route packet
Forward to next hop
Else
Increase queue limit
End if
Get S_p of all I in route
Calculate $L(x_{i,} y_{i})$ for future
R found
R← send Ack(I,U_s, C_p)
End do
Data sending Module
S-send (data, I,R)
If I← C_p is lower than C_i **Then**
I← receive data
Forward to R node
Else
Search U_s slot
I← receive data
Forward to R node
End if
While I move out of range **do**
Point predecessor of break I node
Calculate $L(x_{i,} y_{i})$ of R
Established new path based on $L(x_{i,} y_{i})$
Send data to R
End do
Stop

The multipath routing is provides the alternative path if the existing one is failure i.e. reduces the some possibility of congestion. In order to achieve high end-to-end throughput and efficient resource utilization, congestion control, routing and scheduling should be jointly designed while the network separation among different layers of network is preserved. In further research we proposed the some solution related to scheduling of data sending and receiving. The whole simulation is done in ns-2 simulator. The scheduling is possible to remove the problem of collision and minimizes the congestion in MANET. The proposed scheme improves the bandwidth utilization that shows through better throughput performance.

The routing overhead is minimized because due to congestion link is break rapidly but if it minimizes then strong link is established then no need retransmit data in dynamic network.

SIMULATION OVERVIEW AND PARAMETERS

The simulation is done in NS-2 simulator [17]. This simulator version is used NS 2.31. This is a freeware tool for simulating the scenarios of wired, wireless, sensor and Ad hoc network. The performance of three routing scheme is compared through performance metrics with considered simulation parameters in this research.

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Performance Parameter

In our simulation we apply network simulator-2 and analyse the behaviour of the network through following parameter

- **Packet Delivery Ratio:** The ratio between the number of packets originated by the application layer CBR sources and the number of packets received by the CBR sink at the final destination.

$$PDR=(\sum P_R/\sum P_S)*100$$

- **Average End-to-end Delay**: This includes all the possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times.
- **Packet Dropped:** The routers might fail to deliver or drop some packets or data if they arrive when their buffer are already full. Some, none, or all the packets or data might be dropped, depending on the state of the network, and it is impossible to determine what will happen in advance.
- **Routing Load:** The total number of routing packets transmitted during the simulation. For packets sent over multiple hops, each transmission of the packet or each hop counts.

Simulation Parameter

We get Simulator Parameter like Number of nodes, Dimension, Routing protocol, traffic etc. According to table 1 (shown below) we simulate our network.

Table 1 Simulation Parameter

Number of nodes	40
Dimension of simulated area	800×800
Routing Protocol	AOMDV
Simulation time (seconds)	100
Transport Layer	TCP ,UDP
Traffic type	CBR , FTP
Packet size (bytes)	1000
Number of traffic connections	10
Maximum Speed (m/s)	Random

RESULTS EVALUATION

The simulation results are evaluated through considered parameters and also the proposed scheme is applied on it to modify the routing and channel accessing. The results description of performance metrics are mention below:-

Routing Packets Overhead Analysis

The control packets or routing packets flooding is network is flooded by sender in network to reach to the destination. Routing message overhead is calculated as the total number of control packets transmitted. The increase in the routing message overhead reduces the performance of the ad-hoc network as it consumes portions from the bandwidth available to transfer data between the nodes. In this simulation the routing packet flooded into the network that decreases the network performance. The routing packets overhead of all the three methods are almost equivalent but proposed scheme is slightly less show in fig. 1.

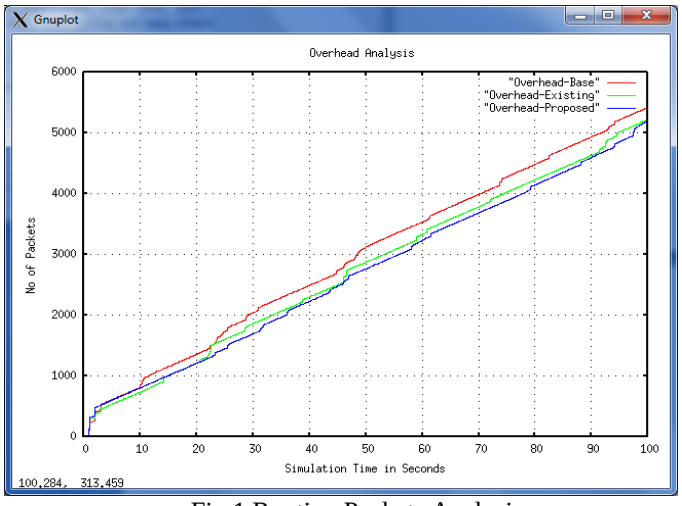

Fig.1 Routing Packets Analysis

Packet Delivery Ratio Analysis

The better packets sending and receiving is showing the better network performance. The more sending and receiving and of packets is shows the better utilization of available bandwidth and other resources. Packet delivery ratio is a ratio of receives packets from packets sends at time unit. If the PDR is best that means our performance is very good, here our result shows in fig.2 at the end of simulation PDR value is nearby 95% and only 5% data loss but rest of the protocol performance is about 85% that means 15% loss is calculated.

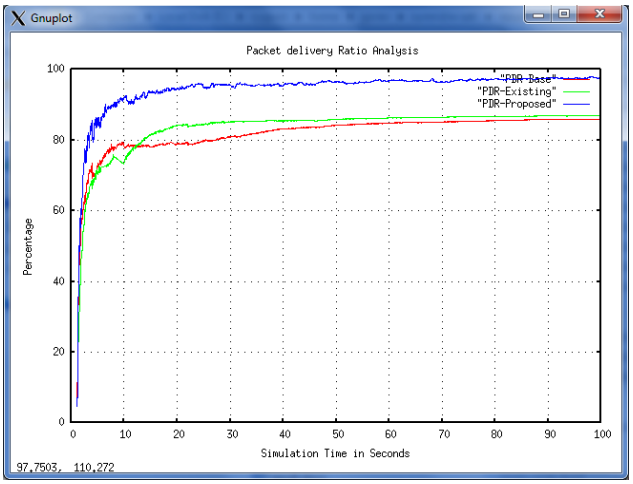

Fig.2 PDR Analysis

Throughput Performance Analysis

The throughput performance is evaluated through data packets received at destination in unit time or Kbps in unit time. The better throughput represents the better data receiving in dynamic network. In this fig.3 the throughput performance of proposed and other exiting routing approaches are compare and observe that the proposed routing method is more efficient and provides better performance in dynamic network.

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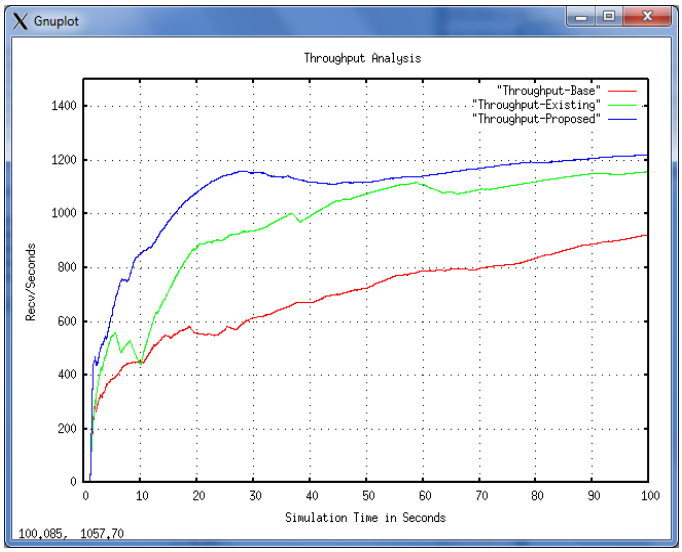

Fig.3 Throughput Analysis

Conclude Result

The three scenarios like Base, Existing and Proposed analysis with different drop analysis is mentioned in table 2. Here we deploy summarize table and conclude that in proposed routing highest packets are send and also be received in network. That result concludes, if we not improves performance then QoS parameter gives poor performance. In this table we observe that eliminate this type of drop reason and improve the performance of the network so better quality of service gives the network.

Parameter	Base	Existing	Proposed
SEND	5873	5982	7028
RECV	5041	5196	6871
ROUTINGPKTS	5430	5228	5195
PDF	85.83	86.86	97.77
NRL	1.08	1.01	0.76
DROPRTS	184	149	74
No. of dropped data	832	786	157
Actual Performance	16344	16406	19094
DROP ANALYSIS			
Mac Layer	39	26	22
Queue Full	1148	1060	0
Repeat Call	95	76	79
Route Not Exist	9	2	1
Congestion	1016	935	231
Total Drop	2307	2099	333

Table 2 Overall Summery

CONCLUSION AND FUTURE RESEARCH

In MANET, transmission collapsing is occurs due to several reasons, such as mobility of nodes, collision of packets and abnormal channel conditions like congestion i.e. the reason of QoS degradation. The proposed QoS solution of reducing congestion is must have capability to handle bad channel condition and connectivity failures in unicast multipath transmission. The multipath protocol is able to handle problem of congestion by balance the load through alternative path. The enhance QoS scheduling of data packets is necessary for improving the performance of network. The shorter radio range of communication in dynamic network is available to reach to destination, direct connection is not possible by that multiple hops. Mobile devices are connected via wireless link to communicate with each other. The proposed scheme is utilized the unassigned slots for communication with location based routing and queue estimation on each node in MANET. The proposed scheme is mentioned in the results with name of proposed and identified that their performance is too good as compare to only AOMDV routing and existing only slots utilization scheme. The performance metrics like PDR, throughput and routing load are showing the better results in same scenario.

The problem of congestion is not possible to completely removes in network because it is the traffic of channel and traffic jamming conditions are never be possible to removed completely. In future proposed the concept of security scheme against flooding attack because this attack is also congested the network through unwanted packets and apply the proposed IDS based on the packet threshold level for detection attack in dynamic network.

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