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Survey on QoS Improving Methods in MANET

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***Abstract*—Mobile Ad Hoc Networks (MANET) are dynamically formed by a group of mobile nodes that are connected via wireless links. MANETs are infrastructure-less and dynamic behavior networks. Due to this dynamic behavior and topology change of the network, QoS becomes a more challenging task in MANET. Node mobility and lack of central control are the main reasons, the QoS becomes a challenging task. There is a need to provide QoS guarantees in more demanding applications such as multimedia audio and video. Due to the increase in demand of MANET, there is a need to provide sufficient QoS requirements to vendors of MANET. There are many protocols available that satisfy the QoS requirement. There is need to improve the quality of service (QoS) of MANET. This work focuses on various QoS improving methods in MANET based on enhancing the routing technique, use of dynamic queue length and TTL value, find the optimal path from multiple paths. Thus it helps to improve or enhance the QoS and performance of MANET.**

Keywords— MANET, Queue Length, Quality of Service (QoS).

I. INTRODUCTION

Mobile Ad Hoc Network is a collection of mobile nodes forming an infrastructure-less network. MANETs are the networks without any centralized control such as routers, servers or access points. Nodes could be laptop computers, mobile phones or sensors. Each mobile node in an ad hoc network act as a both router and a host. Nodes within each other's radio range communicate directly via wireless links and those are apart from each other use other node as relays or routers. Since there is no central infrastructure in such networks, the control is distributed among all the mobile nodes in the network. Due to the mobility of these nodes limitations arises on their power capacity, channel access, bandwidth utilization and routing. Hence all these challenges may degrade the quality of service (QoS) of network.

Quality of Service is the level service provided by the network to user. Quality of service is a set of service requirements to be met by the network while transporting a flow of packet stream from source to destination.QoS is an agreement or a guarantee by the network to provide a set of measurable pre-specified service attributes to the user in terms of delay, delay variance (jitter), available bandwidth, probability of packet loss, energy etc. Applications of MANET are military/ battlefield communication, disaster management, rescue operations, industries, healthcare and academic, real time applications such as audio and video communication.Real time applications require to support quality of service in terms of throughput, delay and jitter. One of the challenging task or problem of MANET is Quality of Service due to dynamic topology or behavior, node mobility and lack of central control. In this paper, a survey on various QoS improving methods is presented. This survey is based on methods such as enhancing the routing technique, use of dynamic queue length and TTL value. This survey also describes the ways for enhancing the routing technique.

II. RELATED WORK

Seema et.al.in [12] presented an overview of Quality of Service in MANET. In this paper author have presented an idea about quality of service in MANET, layered architecture of QoS, QoS parameters and constraints, QoS provisioning and QoS routing in MANET.

CH. V. Raghavendran et.al.in [4] proposed various challenges and advances in QoS Routing protocols in MANET. Also author have proposed a survey of QoS aware routing protocols in MANET.

Ankita Sharma and Sumit Vashistha in [2] focused on AOMDV-QoS which is modification of existing AOMDV using drop minimization under MAC error control technique like collision minimization and dynamic queue scheme etc. The proposed multipath QoS aware routing protocol based on AOMDV improve the network performance.

Meena Rao and Neeta Singh in [10] presented AODV routing protocol with nth backup route in case of link failure. If one of the route is failed then other is available. If this route also fails then another route is available. Hence thus improves performance by selecting multiple backup routes.

Rajanigandha Metri and Sujata Agrawal in [11] presented a new protocol QAMR based on ANT COLONY OPTIMIZATION algorithm which provides plausible path from multiple paths for data transmission. QoS is measured using metrics such as delay, jitter, throughput, probability of packet loss.

Shweta Yadav and Vivek Richhariya in [13] presented a routing protocol based on AODV. In AODV-QoS the quality of AODV routing protocol has been improved to enhance the routing capability. In this method the TTL value and dynamic threshold value to establish the connection in long route and also measures the varying queue length.

III. SURVEY OF QOS IMPROVING METHODS

A. QoS Enhancement of AOMDV using Queue Length Improvement

In [1] proposed a QoS model for MANET. In this model the performance of the network is improved on the basis of queue

length by that the performance of AOMDV protocol is enhanced. EAOMDV (Enhanced AOMDV) is proposed to handle data efficiently in the network. This model is simple and easy to implement into MANET. This model required that control overhead is minimum, admission control provide soft QoS. In AOMDV routing should be done by using less bandwidth and less control overhead of packets.

B. Multi-constrained and Multipath QoS Aware Routing Protocol

In [8] proposed a node disjoint on-demand multipath routing protocol which makes routing decisions based on the QoS metrics such as delay, route lifetime and energy. These metrics are used to compute multiple paths and the paths are selected based on the computation of these metrics. The paths which satisfy these QoS requirements, only those paths are selected and stored in to the routing table. A node disjoint route discovery give multiple routes which are loop free and distinct paths. So if any one node fails then another route is used for further data transmission.
This method contains the calculation of average delay, calculation of percentage lifetime ratio and energy efficiency of nodes. After calculating all these parameters values are stored in the routing table.

C. QoS Aware Adaptive Multipath Routing Protocol

In [9] proposed a QoS aware adaptive multipath routing protocol. Itis an on demand multipath routing protocol proposed to find node disjoint routes and for periodic route maintenance prior to route breakage based on the QoS metrics. In this method when a source wants to communicate with the destination, source node broadcasts a RREQ message to all its neighbors. Then intermediate nodes forward this message with first hop information towards destination. Destination node replies to neighbors by unicasting a RREP message. Hence source gets distinct routes with multiple next hops to destination. Author proposed a dynamic route maintenance method which selects best routes from multiple routes and also switches to alternative route prior to route breakage based on QoS metric. QoS metrics are signal strength, link stability and remaining battery energy. Every node calculate its signal strength, link stability and remaining battery energy.

D. QoS Enhancement in MANET with an Efficient Routing Algorithm

In [10]presented a network model for selection of nodes for routing when failure has occurred. When a node failure occurs because of any attack or energy depletion of the node. When such condition arises then there is need to maintain or search for an alternative route or backup route to continue the data transmission and avoid loss of data due to failure. These alternative routes are found based on distance and energy of nodes. The node nearest to failed node is found with the help of distance vector calculation. Then energy efficiency of that node is checked. If the remaining energy of that node is within the threshold value required for ongoing packet transmission then the node is selected for backup route.

E. AODV variant to Improve Quality of Service in MANET

In [6] presented a modified variant of AODV to improve the Quality of service in MANET by discovering multiple paths from source to destination. In this method multiple node disjoint routes are discovered during route discovery phase. Hence multiple routes are present from source to destination. When one of node fails in between the route then also communication is carry on successfully. Modified-AODV supports to reduce packet loss due to path failure or node failure by providing multiple paths from source to destination. Route maintenance phase include the transmission of 'HELLO' control message to know in advance the consistency or availability of a link. So route maintenance phase reduces the overload or overflow of packets after detection of failure. Modified-AODV reduces the packet loss and overload in network.

F. Enhanced AODV for Providing QoS of Multimedia Application in MANET

In [14] proposed new mechanism for supporting QoS for multimedia application by enhancing the route discovery phase of AODV protocol. This method is used to find most optimal or relevant paths to satisfy the required QoS constraints of a particular application and improve routing mechanism more accurately. This method computes the multiple disjoint routes which are used as alternative routes when link breakage occurs. The proposed method used different parameters such as hop count, end to end delay and bandwidth for different application. These parameters helps to reduce the unnecessary processing overhead and complexity. For route maintenance Hello message and Route Error messages are used. Neighboring nodes determine the link status of next hop by exchanging Hello messages periodically, when it does not receive Hello message then it understands that there is failure. When a node detects link failure it sends RERR packet to source. After that when the source node receives the RERR message, it performs Backup Route algorithm. Providing backup routes data transmission becomes reliable.

G. An Enhanced AODV Routing Protocol for MANET

In [3] presented an enhanced AODV routing protocol to find the path based on combination of parameters such as power level and hop count of a node. Enhanced AODV is also on demand routing protocol. When a source node wants to communicate with the destination, it first checks that valid route from source to destination is available or not. If route is not available, it starts route discovery phase by broadcasting RREQ message to its neighboring nodes. Neighbor nodes forward this request message until it reaches to the destination. Source node gets the new routes to destination. Neighboring nodes or intermediate nodes update their routing table and provide fresh routes from source to destination. Depending on the power level of a node and hop count route cost is calculated. When link failure occurs then link failure notification message is sent to each upstream neighbor from the downstream node. If the source node receives the link

failure notification message, it starts again the route discovery process.

H. Optimal Link Managed On-Demand Routing Protocol (OLMOD)

In [5] proposed an optimal link managed on demand routing protocol for improve the quality of service of routing. In this method paths are maintained throughout the transmission of data, the paths links are not discarded when they are not in use during this transmission. This method consists of four phases Neighbor Management, Route Discovery, Link Management and Link Tracking. In neighbor management phase neighboring nodes are discovered by broadcasting a hello message. In route discovery phase each node discovers the available routes to reach other nodes in the network, whereas in link management phase each node maintains the path links to other nodes efficiently without deleting it and in link tracking the path links are verified means the presence of a complete link in the path is verified.

I. Improving the QoS in MANET by Enhancing the Routing Technique of AOMDV Protocol

In [2] proposed on demand multipath routing protocol which is an extension of AOMDV routing protocol to find out various packet drop reasons. The proposed algorithm finds out drop reasons and provide drop minimization techniques to improve the QoS of AOMDV. The drop reasons are collision, MAC busy, route is not existed and queue is full. The drop minimization techniques: collision minimization by applying SMA/CA technique, if MAC is busy then find alternative path where channel is ideal, if queue limit is full then update the queue length dynamically and if route is not existed the wait for the next RTT.

J. Improvement of QoS of AODV Routing Protocol On the Basis of Varying Queue Length and Dynamic TTL Value

In [13] proposed an AODV routing protocol to improve QoS on the basis of varying queue length and dynamic TTL value. This method is used to minimize the routing overhead and packet drops in the network. In this method constant TTL Value and dynamic threshold values are used to establish the connection in long route.The varying queue length technique means if the node buffer size is full then no packet drop from queue, but increment the queue by one. The dynamic TTL value establish the connection with long route receiver and the varying queue minimizes the packet loss.

K. Multipath QoS Aware Routing Protocol (MQARP)

In [7] presented multipath QoS aware node disjoint routing protocol. This method discovers multiple node disjoint routes and select the best path from them on the basis of Average Timestamp and Link lifetime ratio. This method provide the routes which are link reliable and delay aware. It finds multiple node disjoint routes in a single route discovery process. Then every node on the route calculates the values for timestamp and lifetime ratio. If the calculated values exceed the threshold value, then it sends a notification message to sender. Then the sender switches to another Quality of Service path available in the routing table. If path is not available, then the source node starts the route discovery phase once again.

L. QoS Enabled Ant Colony based Multipath Routing Protocol (QAMR)

In [11] proposed an Ant Colony based QoS enabled multipath routing protocol, to find optimal path from multiple paths. This path is selected on path preference probability. Path preference probability is calculated using bandwidth, delay and next hop availability (NHA) parameters. These parameters are required to maintain the QoS. This method consists of two phases: route exploration and route safeguarding phase. In route exploration phase it discovers the multiple routes. In route safeguarding phase, if link failure occurs then upstream node sends a notification ant to the source to notify. If source node receives this notification ant, then it selects alternative route.

Table 1: Comparison of QoS Improving Methods in MANET

Protocol	QoS Metrics	Base protocol	Multiple Path Support	Routing Overhead	Loop Free	Proactive /Reactive
AODV with n^{th}BR	Energy, Distance	AODV	Yes	-	No	Reactive
AOMDV-QoS	Throughput	AOMDV	Yes	Less	Yes	Reactive
MQARP	Timestamp, Lifetime Ratio	AOMDV	Yes	-	Yes	Reactive
QAMR	Delay, Bandwidth and Hop count	ACO	Yes	-	No	Reactive
AODV-QoS	Throughput	AODV	No	-	No	Reactive
QAAMR	Signal strength, link stability, Remaining battery energy	AOMDV	Yes	-	Yes	Reactive
OLMOD	Link stability	AODV	No	Less	No	Reactive
PH-AODV	Power level, Hop count	AODV	No	-	No	Reactive
Enhanced AODV	Hop count, end to end delay, Bandwidth	AODV	No	Less	No	Reactive
MMQARP	Timestamp, Energy, Lifetime Ratio	AOMDV	Yes	-	Yes	Reactive

IV. CONCLUSION

This survey is focused on various QoS improving methods in MANET such as enhancing the routing technique, use of dynamic queue length, find the optimal path from multiple paths,to find multiple node disjoint routes, selection of routes based on QoS metric. This survey also contains comparison of all these methods based on parameters such as QoS metric, base protocol, routing overhead, protocol is loop free or not, it supports multiple paths or not and the protocols are proactive or reactive. Hence overall these methods helps to improve the QoS and performance of MANET.

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