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An Analysis upon Enhancing the Qos Oriented Hybrid Multipath Routing Protocol for Manet

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Abstract – A Mobile Ad Hoc Network (MANET) is a collection of mobile nodes, which dynamically form a temporary network, without using any infrastructure like wireless access points or base-stations. The provision of QoS guarantees is much more challenging in Mobile Ad hoc Networks. There are many interesting applications such as multimedia services, disaster recovery etc can be supported if Quality-of-Service (QoS) support can be provided for MANETs. But QoS provisioning in MANETs is a very challenging problem when compared to wired IP networks.

In Mobile ad hoc networks (MANET), the quality of service (QoS) depends on the available resources in the network and node mobility as mobility may result in frequent route failures. Some existing hybrid approach of multi-path routing technique rarely considers QoS metrics for path selection. In this paper, we propose a QoS enhanced hybrid multi-path routing protocol for MANET. In this protocol, topology discovery is performed proactively and route discovery is performed in the reactive manner. In proactive topology discovery phase, each node collects the battery power, queue length and residual bandwidth of every other nodes and stores in the topology information table (TIT). By exchanging the TIT among the nodes, the topology is discovered. When the source node wants to forward the data packet to the destination, it utilizes the reactive route discovery technique where the multiple paths are established using multi-path Dijkstra algorithm. When any intermediate node does not recognize the next 2-hop information from TIT towards destination, the new multi-path route discovery is performed. By simulation results, it is shown that the proposed approach reduces the overhead.

In cache based multipath routing protocols, several issues arise during cache updating and management. To resolve this, intelligent caching and redundant cache management techniques are proposed for QoS aware Hybrid Multipath Routing Protocol. In redundant cache, some information about the upstream path is attached to make a quicker response and reduce the average end-to-end latency. Intelligent cache technique is used to save the path discovered during route discovery and make the decision when the route is broken. This technique stores a new route without erasing the number of known route entries in the cache.

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INTRODUCTION

Mobile Ad Hoc Networks (MANETs) are self-organizing, rapidly deployable and with no fixed infrastructure. They are composed of wireless mobile nodes that can be deployed anywhere, and cooperate to dynamically establish communications using limited network management and administration. Nodes in an ad hoc network may be highly mobile, or stationary, and may vary widely in terms of their capabilities and uses. It is hoped that in the future, ad hoc networks will emerge as an effective complement to wired or wireless LANs, and even to wide-area mobile networking services, such as Personal Communication Systems (PCS). The successful implementation of mobile ad hoc networking technology presents a unique set of challenges, which differ from traditional wireless systems. These include effective multi-hop routing, MAC, mobility and data management, congestion control.

One of the most important aspects of the communications process is the design of the routing protocols used to establish and maintain multi-hop routes to allow the communication of data between nodes. As the MANETs are dynamic in nature, designing protocols for these networks is a challenging process. A considerable amount of research has been done in this area, and many multi-hop routing protocols have been developed. Most of these routing protocols build and rely on a uni-path route for each data transmission. The protocols are classified into two categories: table-driven, on-demand. While these protocols might be sufficient for a certain class of MANET applications, but are not adequate for the support of more demanding

applications such as multimedia audio and video. Such applications require the network to provide guarantees on the QoS. This is achieved by using some mechanism such as QoS routing to find the best route which satisfies these requirements in the best way. QoS routing appears to be a solution to handle these problems. QoS routing requires not only finding a route from a source to a destination, but a route that satisfies the end-to-end QoS requirement, often given in terms of bandwidth, delay or loss probability. Quality of service is more difficult to achieve in ad hoc networks than in wired networks.

Mobile Ad Hoc Networks (MANET) - MANET is raising technology that creates an instant communication infrastructure for many applications. MANET can quickly deploy without any pre-existing infrastructure. Nodes can dynamically join and leave the network without any warning. Due to high mobility of nodes in the network, rapid variation in the network topology may occur. Nodes exhibit traveling behavior by freely roaming in the area, and dynamically joining and leaving the link with other nodes. MANET should provide a data network that is immediately deployable in arbitrary communication environments and is responsive to changes in network topology. MANET is well known compared to the other ad-hoc networks due to the rapid changes in network topologies, network size and node mobility. Such networks typically have a large span and hundreds to thousands of nodes.

MANET is a standalone network that can be easily connected to the external networks i.e. Internet. MANET can be applied in many scenarios such as sensor networks, rescue operations, students on campus, free internet connection sharing and military scenarios.

Multi-path Routing Protocols in MANET - Multipath routing is the process in which the multiple paths are selected from source to destination using route discovery. Multipath routing is used to provide a backup route. Backup route is used, when the primary route fails to deliver the packets. It provides a better fault tolerance in the sense of faster and efficient recovery from route failures. Multiple paths can also provide load balancing and route failure protection by distributing traffic among a set of disjoint paths.

Caching in Multi-path Routing Protocols - Cache is used to eliminate the overhead while discovering a new route for sending data packet. However, cache becomes difficult, due to the changes in different node position or wireless propagation environment. Cache is mainly used to store the paths. When any problem occurs during the transmission of packets, cache is used to resolve it. Cache entries are invalid when two nodes moving out of wireless transmission range of each other. If the cache is not periodically updated, some issues may happen. Hence, periodic cache updating plays a vital role. Some periodic routing protocols are link-state or distance-vector routing. These protocols distribute the updated information in a timely manner. However, these protocols take more time to detect a link failure and distribute this information.

Wireless network performance is a major issue and an important factor for many network resources. It prevails over the entire world. However the multimedia applications such as audio and video being sent over public networks packet switched networks for accessing the required information. The guarantee of giving quality service to the present networks than it in the earlier is more important. Here various methods will be applied for finding ways to provide the reliability of the network and it will increases the network performance and also simultaneously it utilizes the several resources of the network in a required manner. Multiple challenges are associated with providing the services and guarantees the specific network availability. However, many more challenges will exists for wireless networks and mobile networks above those in wired networks respectively. For this reason, there are different sets of QoS techniques are needed for respective wireless networks than for wired networks in the network area.

These additional mechanisms and challenges helps to overcome the problems like network security and authority for securing the information. In this paper the organization should be as follows: Primarily it is associated with which application is used to guarantee the QoS in the network area, what type of applications will be required that should provide the guaranteed quality of service. And it is also associated with the what type of network challenges are used in that. Then this will defines some wireless QoS domain that is in the data link layer of the layered architecture..

LITERATURE REVIEW

Xin Yu et al., (2006) have proposed an algorithm, which proactively disseminating the broken link information to the nodes that have the link in their caches. A new cache structure called a cache table is defined to propose a distributed cache update algorithm. Each node maintains the information necessary for cache updates in its cache table. When a link failure is detected, the algorithm notifies all reachable nodes in a distributed manner. This algorithm does not use any ad hoc parameters, thereby making route caches fully adaptive to topological changes.

Shusen Yang et al., (2006) have proposed a simple and effective technique called Deleting Redundant Address (DRA) to minimize data packet header overhead. This overhead is a major source of the total control overhead for dynamic source routing. In DRA, each intermediate node between the source and destination node delete its own node address carried by data packets, because these routing information is almost useless for forwarding the data

packets. DRA reduces the total control overhead by deleting this redundant control information in the data packet header. Hence, it alleviates the congestion in the network and improves the performance.

Dong Shi et al., (2007) have proposed a new cache-storage mechanism called redundant cache. With the help of cache, the intermediate nodes in Dynamic Source Routing (DSR) with redundant cache are able to make quicker response to Route Request (RREQ) than in original DSR with current cache storage mechanism. This mechanism can reduce the overhead substantially. However, all nodes have the cache path so that large amount of cache memory is wasted.

Luo Liu et al.(2008) have proposed architecture for assuring QoS based on Node-Disjoint multipath routing protocol (NDMR) in mobile ad hoc networks. The problem related to provisioning of QoS is extremely difficult task in MANETs. But the multiple node-disjoint paths help in assigning the packets to paths in a best possible method to handle some limitations. The proposed methodology offered limitations and also compared the functioning in variation circumstance of NDMR. This method also determined ways of establishing NDMR with the help of queue length field and updates route packets for permitting QoS computations over node-disjoint paths.

Shobha.K.R et al., (2009) have proposed an analysis of the effect of intelligent caching in a non-clustered network using on-demand routing protocols in wireless ad hoc networks. The analysis is carried out based on the DSR protocol that operates entirely on-demand. DSR uses the cache in every node to save the paths that are learnt during route discovery procedure. Methods like caching these paths only at intermediate nodes and using the paths from these caches are tried here. This technique helps in storing more number of known routes without erasing the entries in the cache while storing a new route that is learnt.

Samuel Pierre et al. (2009) have proposed a new approach based on a mobile routing backbone for supporting Quality of service (QoS) in MANETs. This proposed protocol allocates the traffic inside the network as per the existing network traffic level and nodes processing loads. The QoS support is recognized with the help of communicating packets possessing particular necessities to nodes that are loaded with more resources and connected through stable links.

Fujian Qin et al. (2009) have proposed a new Multipath source routing protocol with bandwidth and reliability constraints for MANET. In order to get the multipath routing, they expand DSR's routing discovery and maintenance technique. To attain a better cooperation among load balancing and network overhead, an ultimate count of multipath route is examined. Also, per packet granularity is utilized to allocate the packets from multiple links between the paths in MSR.

Sanguankotchakorn et al. (2010) have proposed NQoS AODV by altering the conventional AODV. NQoS AODV upholds a routing table which frequently offers routes thus minimizing the average delay. This approach increases the packet delivery ratio since it upholds the QoS information and observes for the path fulfilling QoS necessities of the applications. Further it forwards a smaller number of control packets to maintain route discovery and route failure which causes reduced control overhead.

Nityananda Sarma et al. (2010) have proposed a Route Stability based QoS Routing (RSQR) protocol in Mobile Ad Hoc Networks (MANETs) which is an extension of QoS routing with throughput and delay constraints. In order to guarantee the suitable data path for adequate longer duration in MANET, they have proposed easy model for measuring the link stability and route stability depending on received signal strengths. Some additional fields in route request/ reply packets is taken into consideration so that the route stability information can be used to choose a route with increased stability when compared to all possible routes among existing source destination pair.

Chunxue Wu et al. (2010) have proposed Q-AOMDV protocol for ad hoc networks. The proposed protocol with path preference probability calculates the delay, bandwidth, hop count for choosing the path for forwarding the packet. The provision of multiple paths is more efficient in ad hoc networks since the source can just utilize the existing routes in case of any route failure instead of carrying out route recovery process.

Kun-Ming Yu et al. (2011) have proposed a new protocol (ARMBR) to enhance the prevailing on demand routing protocols. This is performed by building multiple backup routes. During the modulation in network topology, the protocol can transfer the data packets actively via backup routes. In addition, they have developed an analytical model to determine the reconnection probability of the proposed algorithm.

HYBRID QOS AWARE MULTIPATH ROUTING PROTOCOL

In this paper, we propose a hybrid QoS aware multi-path routing protocol for MANET. In this technique, topology discovery is performed proactively and route discovery is performed in the reactive manner. In topology discovery phase, each node learns the battery power, queue length and residual bandwidth of every other nodes and stores in the topology information table (TIT). By exchanging the TIT among the nodes, the topology is discovered. When source

wants to forward a data packet to destination, it verifies TIT and computes the link metric (LM) using the data in its TIT. The source chooses the nodes with minimum LM and initiates the packet transfer through the chosen node within 2-hop. The Multi-path Dijkstra algorithm is employed to transmit the data through multiple paths with the nodes holding minimum link metric. When any intermediate node does not recognize the next 2-hop information from TIT towards destination, then it propagates route request (RREQ) message to all the nodes as per any reactive multi-path routing protocol like AOMDV. Then route reply (RREP) messages are sent along the reverse routes to the source, using which it can setup the best path to the destination. Whenever the new path is discovered reactively, the source then updates its TIT.

QOS AWARE ROUTING PROTOCOLS FOR MANETS

The QoS-aware routing protocols are supposed to determine a path from a source to the destination that satisfies the needs of the desired QoS. The QoS-aware path is determined within the constraints of distance, bandwidth, minimal search, and traffic conditions. As the selection of path is based on the desired QoS, the routing protocol can be termed QoS-aware. The QoS routing protocols are classified:

- Treatment of network topology – flat, hierarchical, or location-aware
- Approach to route discovery – proactive, reactive, hybrid or predictive.

They are classified in to three different ways as follows:

- The interaction between the route discovery and QoS provisioning mechanism (coupled or decoupled)
- The interaction with the MAC layer (either independent or dependent)
- Again, on the approach to route discovery.

Core Extraction Distributed Ad Hoc Routing -

The Core Extraction Distributed Ad Hoc Routing (CEDAR) algorithm was proposed in. This algorithm is proposed for small to medium-sized ad hoc networks consisting of tens to hundreds of nodes. CEDAR algorithm has three key components: Core extraction – A dynamic, self-organizing backbone routing infrastructure referred as Core is constructed. This used for performing route computations and topology management. A core is a set of nodes elected by approximating a Minimum Dominating Set (MDS) of the ad hoc network. All nodes are either part of this MDS or have a neighbor that is part of the set. The Fig 1 shows a simple core network in CEDAR. The shaded circles represent core nodes and unshaded stand for non-core nodes. The core is constructed by each node selecting a dominator from among its neighbors. The dominator is a neighbor node with the highest degree of connectivity. A node joins the core if it is selected b at least one node as dominator. In the figure the arrows point from node to the dominator.

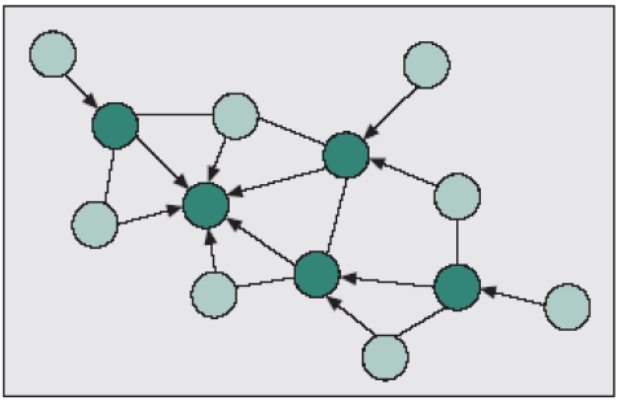

Fig. 1 Simple Core network found in CEDAR.

Link State Propagation – After establishing the core, it incrementally propagates the link states of stable high-bandwidth links to the core nodes. Information about stable high bandwidth links is made known to nodes far away in the network, and information about the low bandwidth links remain local. Route Computation – This is performed on demand, and is done by the core nodes using only local state. A Core path is established from the dominator of the source node to the dominator of the destination. Using the directional information provided by the core path, CEDAR iteratively tries to find a partial route from the source to the domain of the utmost possible node in the core path satisfying the requested bandwidth. This node then becomes the source of the next iteration. This process repeats until the destination is reached or the computation fails to find a suitable path. The important features about this algorithm were the core broadcast and link capacity dissemination mechanisms. These make efficient use of network resources and relatively accurate and up-to-date knowledge of the QoS state where it is required. The drawback of this approach is that the total amount of updates needed to maintain the topology and state information makes this an undesirable due to random mobility patterns.

Spatial Reused Bandwidth Reservation -

Spatial Reused Bandwidth Reservation (SRBR) algorithm is proposed in used resource reservation and directional antenna technology. The Resource reservation in wireless networks is an essential component needed to support multimedia and real time applications, such as audio/video conferencing. Directional antenna technology provides the capability for considerable increase in spatial reuse that increases the efficiency of communication. In this approach the source node tries to discover multiple node-disjoint paths that are capable of

satisfying the desired Quality of Service (QoS) requirement in ad hoc networks using directional antennas. Implementation of this SRBR shows that there is a significant gain in the performance with a decrease in the number of paths, as well as an increase in the percentage of successfully received data packets and reservation success rate.

Ad Hoc Quality of Service On-demand Routing -

Ad hoc QoS On-demand Routing (AQOR) provides end-to-end quality of service (QoS) support, in terms of bandwidth and end-to-end delay, in Mobile Ad hoc Networks (MANETs). QoS is provided in AQOR by integrating (1) on-demand route discovery between the source and destination, (2) signaling functions for resource reservation and maintenance, and (3) hop-by-hop routing.

In AQOR, Neighborhood information is very important. This provides the local topology, traffic and mobility information. This is critical for traffic measurement, QoS violation detection and recovery. To maintain the neighborhood information, every node in the network periodically send out a Hello' 'packet, announcing its existence and traffic information to its neighbors. In this, the route is discovered on-demand by propagating the route request and route reply packets between the source and the destination. The route discovery algorithm is implemented by route exploration from source to destination and route registration in the reverse path.

Route Stability-based Multipath Quality of Service Routing -

The Route Stability-based Multipath Quality of Service Routing (SMQR) is proposed in to support routing stability along with throughput and delay in MANETs. The main components in the proposed algorithm are 1) A model for computing route stability based on received signal strengths and using the model to choose QoS routes that endure longer time. 2) A route stability-based QoS-aware multipath route discovery mechanism with a special route request forwarding rule to reduce request forwarding rule to reduce the path diminution problem. 3) Incorporation of a hop-by-hop admission control and a soft resource reservation in the route discovery procedure. 4) A method to select a primary path and two other secondary paths (if possible) which are node disjoint. 5) A route maintenance mechanism to handle QoS violation and for the maintenance of secondary paths; and 6) A proactive path switching by the source, so that the highest stable route among the multiple paths is always selected for transporting data. This is achieved through path quality values obtained from periodic route maintenance. In this protocol, a periodic maintenance and validation of the alternate paths is performed. If the stability value of the alternate route is higher than that of the primary route, then the primary route is switched to the alternate route. A new route discovery is initiated only when all the paths in the multipath fail. When a QoS routing path is discovered, the source admits real-time traffic into the primary path. To reduce QoS disruptions, route is maintained in two ways – QoS violation on the active primary path and other is continuous maintenance of alternate paths to ensure that only valid paths are maintained. This multipath routing significantly reduces the number of route recoveries required during QoS data transmission. Detection of route failure and switching to a stable route before actual route break saves route recovery time and reduces packet loss.

Hybrid Hop Count-based Multiple Quality of Service Constraints Routing Protocol with Mobility Prediction -

Hybrid Hop Count-based Multiple Quality of Service constraints Routing Protocol with Mobility Prediction (HMQRPMP) is a source-based hybrid routing protocol proposed in. This protocol deals with QoS parameters like delay, delay-jitter, bandwidth, cost, link expiry time and residual battery power of mobile nodes. HMQRPMP selects the best routing path with minimal hop count, maximal link expiry time and high energy level among multiple paths between a source and a destination as to increase packet delivery ratio and reduce control overhead in MANET.

DISTRIBUTED ROUTING PROTOCOL FOR ENHANCING QOS

Here by implementing the reservation based quality of service routing, the wireless networks meets the problems like race condition as well as the invalid reservation in the mobile ad hoc networks. In the QoS Oriented Distributed routing protocol (QOD) has been used to support the Qos capability in wireless networks. This protocol will offers the good QoS performance of wireless networks. The QOD helps in reducing delay in transmission of packets, scalability and mobility resilience. Protocol which is consisting of five algorithms:

- A QoS-guaranteed neighbor selection algorithm.
- A distributed packet scheduling algorithm.
- A mobility-based segment resizing algorithm.
- A traffic redundancy elimination algorithm.
- A data redundancy elimination-based transmission algorithm.

In QOD there the very first work was QoS routing for the networks of hybrid. Here we are discussing five major things. In the QoS guaranteed neighbor

selection algorithm when the source node is not able to transmit the packets then it will takes the help of another node, it requests for the reliable neighbor node for the reliable routing. Then the Distributed packet scheduling algorithm will schedules the packets and transmits the packets in reliable manner. After selecting the qualified neighbor the source node then forwards the packet to the destination node with specific IP address of the node. After qualified, neighbors are selected, this algorithm schedules packet routing. Then in the Mobility-based segment resizing algorithm, the source, node will resizes the every packet of the specific packet stream respectively. The each neighbor node in spite of the neighbor's mobility will increases the feasibility of scheduling of packets in the source node. In Soft-deadline based forwarding scheduling algorithm, the algorithm should associated with the intermediate node which forwards packets with the least time span to achieve scalability. The redundancy of data elimination which is based on the transmission and nodes of mobile which overhears cache packet because of broadcasting feature in wireless networks. So by this algorithm we can improve QoS in transmitting the packet by eliminating data redundancy. QOD protocol can increase the capacity of network with increase in scalability of network. This will increase the life duration of network.

RELIABLE AND EFFICIENT FORWARDING IN HYBRID NETWORKS

A hybrid wireless network is associated with the reliable transmission and also incorporated with efficient forwarding in a network and is meant for reliability and efficiency that is made up of mobile nodes allocated in a network topology. It is also a form of wireless networks. Wireless networks include the wireless mesh users and gateways for reliable transmission of data. The network user needs information from the specific source. Then the wireless devices are able to forward the reliable information to the required node. Often the wireless devices consisting of mesh routers to forward the traffic In the data stream. The various wireless devices in the wireless network will often associated with the routing devices and also communication devices respectively. The area of network will work with the help of mobile nodes and the radio nodes as a single network and is sometimes called a wireless mesh networks. Hence the wireless network access will be dependent on wireless radio nodes in the network. If one is not able to operate or if one node is not able to communicate, the other nodes are also fails to communicate in the network respectively. They can communicate with each other directly or through the specific intermediate nodes. In wireless network, we can implement the various techniques of wireless networks including additional technologies of communicating the network.

The hybrid wireless network consists of the wireless network architecture and it mainly concentrated on providing low cost and also effective bandwidth across the network. Here the wireless network architecture is associated with the reliable routers of network for the reliable data transmission in wireless network. Here the mesh architecture will also be able to forward the packets in wireless mesh networks. The intermediate nodes will not only transfers the packets but also helps in security by providing the IP address of the specific nodes. Wireless mesh network is having addition of nodes and needs some security devices while transmitting the packets.

Also the wireless devices will be associated with various advantages according to the reliable forwarding. The wireless mesh networks are often associated with reliable transmission of data and it also incorporates the efficient forwarding of packets in the hybrid networks.

PROPOSED ARCHITECTURE

The proposed distributed enhanced routing approaches which will reduce service disruption and minimize the worst-case maximal link utilization after link failures. Every link will be analyzed and updated in the routing table using the Q-ORP frequently. Below figure shows our proposed architecture.

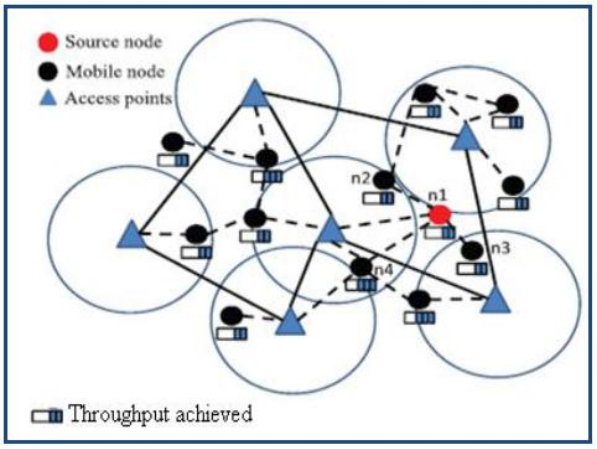

Fig 2: Our Proposed Architecture of HWC.

Our proposed protocol adopts the resource reservation based QOS routing scheme. In this proposal a QOSOriented Distributed optimal routing protocol (Q-ORP) to enhance the QoS support capability of hybrid networks. The proposed protocol can provide high QoS performance in terms of transparency, delay in transmission, delay in propagation, queuing delay, mobility-resilience, traffic reduction, and scalability.

Proposed algorithm:

Nearest Neighbor Finding Algorithm-

Algorithm: Distance Measurement

Input: Objects positions (o1, o2)

Output: Distance (in points)

Step1: Identify object A

Step2: Identify Object B

Step3: Identify position of object1 x and y O1(x1, y1)

Step 4: Identify position of object2 x and y O1(x2, y2)

Step5: difference between (x1-x2) and (y1-y2)

Step6: Return value

Algorithm: Pseudo code for the QOS_DARP routing protocol executed by a 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 based on Equation (4).
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

Finally the proposed protocol Q-ORP works with the above QOS metrics such as follows.

- With the use of neighbor selection algorithm it solves the transmission delay problems.
- A distributed packet scheduling algorithm to further reduce transmission delay, propagation and queuing delay
- A mobility-based segment resizing algorithm that adaptively adjusts segment size according to node mobility in order to reduce transmission time,
- Increase the transmission throughput use of redundant elimination algorithm.
- A data redundancy elimination-based transmission algorithm to eliminate the redundant data to further improve the transmission QoS.

CONCLUSION

In this paper, we have proposed a QoS enhanced hybrid multi-path routing protocol for MANET. In this technique, topology discovery is performed proactively and route discovery is performed in the reactive manner. In topology discovery phase, each node learns the battery power, queue length and residual bandwidth of every other nodes and stores in the topology information table.

Here we were discussed about providing the quality of service across the mobile ad hoc networks. QoS guarantees and efficient utilization of bandwidth also simultaneously increased. And the cross-layer architecture should enable the low-complexity implementation and analysis, provides service across the network and increases the scalability. QoS reduces the transmission delay. Respective protocols are used in this paper to enhance the quality of service. The effectiveness of the network performance is checked using simulation and faces robustness issues are briefly discussed. Various examples demonstrate the increased performance of a single user and multiple users also with the network behavior for a large number of users should also be matters. Hence the data transmission will be secured across the wireless networks. The QoS increases the network capacity and increases the scalability of the network. This should also increases the life time of a network. QoS guarantees and efficient utilization of bandwidth and hence the required services will be provided at the wireless communications. Hence we can guarantee the services and security for the data that should be transmitted across the wireless networks.

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