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Study of Routing Algorithms on Hybrid Wireless Networks

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Abstract*— This paper gives survey of existing Quality of service QoS oriented routing algorithms for hybrid wireless networks. HWN are integrated networks that provide seamless services over several networks. HWN integrate infrastructure networks and Mobile adhoc networks. So HWN are the next generation 4G networks. The emerging multimedia applications like online movie, online video conferencing, etc require high support of QoS networks. Hence the stringent end to end network quality is on demand research.

***Keywords*— MANET, Hybrid Wireless network, Base station, QoS**

I. INTRODUCTION

QoS is a set of service requirements that should be provided by the network while transporting a data flow. QoS is measured by parameters like available bandwidth, packet loss rate, estimated delay, packet jitter, hop count and path reliability. The main task is how to determine paths that satisfy QoS constraints. Routing is the process of discovering the path, selecting the best with QoS, and maintaining paths from a source node to destination node to deliver data packets.The goal of every routing algorithm is to transmit data traffic from source to destination with maximizing network performance and minimizing costs. The infrastructure mode has the base stations as central control.It acts as wireless interface between the mobile devices providing fixed network of limited range. On the basis of this infrastructure model for wireless communications, the data communication from base stations is routed across a fixed network to its destination. Mobility is managed by allocating a limited set of communications frequency channels to each BS. Here the quality of service isachieved by providing admission control, resource reservation, priority scheduling of packets etc.Intserv[1]. The RSVP [2] Reservation Setup Protocol is for providing the QoS for real time applications. This protocol reserve bandwidth for each flow in route as well as indicate its desired quality of service to all nodes (routers) along its path. Differentiated service (DiffServ)[3] uses coarse grained class-based mechanism for traffic management. It classifies the packets according to their class or type of service (ToS).Anumber of queuing scheduling algorithms have been proposed for DiffServ to further minimize packet droppingsand bandwidth consumption [4]. In case of MANETS the infrastructure in not available .The mobile nodes itself from the network without taking help of Base stations. Hence the MANET has the properties like unpredictable node mobility, wireless multi-hop communication, contention for wireless channel access, limited battery power and range of mobile devices as well as the absence of a central coordination authority. Hence the QoS routing algorithms designed for MNAET should consider all these aspects to meet network quality.This is more challenging task than routing in cellular networks. The hybrid wireless networks are combining both kinds of networks. So the routing algorithms for hybrid networks should consider all properties of cellular and MANETs. They should take full advantage of available base stations and multi interface properties of mobile nodes. A routing protocol for hybrid wireless networks should have the following characteristics 1)It must be fully distributed. 2) It must be adaptive to dynamic topology changes caused by the mobility of nodes. 3) Route computation and maintenance must involve a minimum number of nodes. 4) It must avoid invalid routes reservation problem. 5) It must avoid race condition problems for resources.6) The number of packet collision must be kept to a minimum.7) It must optimally use resources like bandwidth, computing power, memory and battery power. 8) It should take advantage of available resources like base stations and multi interface feature of mobile nodes .9) It should be able to provide QoS demanded by the applications.

II. LITERATURE SURVEY

The various routing algorithm proposed in literature Here for comparative study they can be categorized into by following aspects:1) Resource reservation based 2)No of hopes between source node and destination.

The QoS provision for mobile adhoc networks is very challenging task. Because the nodes in the MANET are mobile and also has limited bandwidth, energy consumption requirement. Due to dynamic nature of this networks the routes between the nodes are frequently breaking. Hence we cannot directly adapt the routing algorithms available for cellular networks. Numerous QoS routing protocols for this dynamic environment are proposed. Most of these protocols provide QoS support for the available bandwidth requirement for a given path. This is because bandwidth is the most critical parameter MANET applications due to the scarcity of this resource in the wireless environment. For hybrid wireless networks specially,very few algorithms are proposed by considering its whole properties. The existing algorithms concentrate on system capacity, cooperative resource sharing, path discovery to improve the only cellular network performance. But at the same time mobile ad hoc mode is ignored. Also the property of mobile nodes with multiple

interfaces is also not fully utilized. service oriented algorithm for HWN are still has lot of work to be done.The current works inhybrid networks focus on increasing network capacity or routing reliability but cannot provide QoS-guaranteed services.

The various resource reservation based algorithms for MANETs like Extension of Dynamic Source Routing protocol (E-DSR), Ad Hoc on Demand Distance Vector protocol (E-AODV), Temporally Ordered Routing Protocol (E-TORA), Destination Sequenced Distance Vector protocol (E-DSDV),Zone Routing Protocol (E-ZRP)[5]. All these routing algorithms are resource reservation-based routing protocol for QoS routing in MANETs. This protocol extends some addition to its basic version for QoS provisioning. Here the intermediate nodes along the path reserve the resources for the source node. But due to dynamic nature of MANET the nodes are moving. Hence the reserved path are no longer remain valid .Hence this algorithm has invalid reservation problem. When the workload of the system increases, the probability that two or more source nodes simultaneously reserve the same resources at a node increases due to the race condition problem. Also, the nodes close to the APs are more likely to be congested .These algorithms does not have a resource scheduling mechanism. Therefore, the QoS throughput of reservation based algorithms decreases in a highly loaded system. As the number of nodes in the system increases, the average path length grows, which increases the probability of path breakdown and decreases its QoS throughput.

In the algorithms that uses two-hop mechanism , the source node adaptively chooses direct transmission (i.e., directly transmit packets to the AP) and forward transmission (i.e., transmit packets through a forwarding node) to forward packets to APs. In two hop there is always two hop distance between the source node and base stations or between the base station and destination node. A single relay node is present between source and destination. As Two-hop only concerns node bandwidth in packet forwarding rather than buffer usage, it may suffer severe buffer congestion in the selected node with high bandwidth . In two-hop, the packets are always forwarded to the nodes with higher transmission link rate. Without any buffer management strategy, the nodes with higher transmission links are very easily overloaded as the workload in the system increases.[6] In S-Multihop, a node always forwards a packet to a next hop node that has small buffer usage than itself until the packet reaches an AP. In S-Multihop, as several source nodes may send packets to the node with smaller buffer usage at the same time, the node is very easily congested. Also the node mobility speed effects on quality of service of networks. As the node mobility increases the probability of path break increases and QoS decreases.[7]

In S-Multihop, although more resources are available to transmit packets based on the buffer usage as the network size increases, the average number of routing hops from the source node to destination node also increases, which lead sto a higher frequency of link breakdown. The reduced QoS throughput due to the longer routing path dominates the increased QoS throughput due to the more available resources. Thus, the QoS throughput of S-Multihop decreases lightly.The algorithm E-AODV,E-DSDV,E-DSR etc and S multi-hop routing QoS decreases sharply with mobility speed. S-Multihop only focuses on buffer usage of the next hop node, which increases the QoS of packet transmission to a certain extent but cannot ensure the QoS of the forwarding. Two-hop has less QoS throughput increase rate than S-Multihop as the number of source nodes increases.

H.Wu et al.[8] propose a new scheme that uses multiple paths/trees in parallel to meet the QoS requirements of a call.The trees are maintained by source node by collecting network information on demand. The major advantages are it greatly reduces the system blockings. Thus, system resources can be better utilized. Multicast routing is done in a distributed fashion. X.Du et al. [9], considers non-homogeneous properties of mobile nodes such as transmission range, transmission bandwidth. They design more efficient QoS routing protocol that calculates bandwidth and reserves slots for MANET.Here the node location information is used to help the routing. M.Conti et al. [10], proposes REEF Reliable and efficient forwarding mechanism takes advantage of multipath routing and transport layer information to estimate the best route through which packets have to be forwarded.

C.Shen et al. [11] designed and implemented a packet delivery improvement service for multicast routing in mobile ad hoc networks called PIDIS.

Z.Shen et al. [12], proposed a distributed flexible mechanism to optimize security and QoS in mobile ad hoc networks.

The routing algorithms for hybrid networks, authors focuses on increasing network capacity or routing reliability but cannot provide QoS guaranteed services. Here a utility maximization framework that is capable of selecting the best relay strategy, and the best power, bandwidth and rate allocation is proposed.Various relay selection protocols, which achieves higher bandwidth efficiency are given. [13], [14], [15], [16].

The new algorithm proposed for hybrid wireless network is QoS oriented distributed routing algorithm(QOD).It utilizes the available resources properly.It takes advantage of base station range in network, nodes different mobility speed in order to improve QoS.[17]

III. CONCLUSIONS

This survey gives study of quality of service requirements of hybrid wireless networks.The existing routing algorithms are not fully focusing on whole properties of hybrid wireless networks.The algorithms for MANETs are having drawbacks like invalid reservation problem and race condition problem.The most routing for hybrid is for network capacity.

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