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Comparing Routing Protocols in Mobile Ad hoc Networks for Better QoS

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Abstract*—A survey on Quality of Service (QoS) in ad hoc networks uses a framework based on the mechanisms in three important elements: resource estimations, multicast tree/mesh administration, and multicast routing. Our contribution is an exploration of the design space and an identification of areas that have not been fully explored. We discuss the design space of central mechanisms and classify proposed QoS routing schemes according to the mechanisms they used. In addition, we summarize the scenarios used for evaluating their performance. Furthermore, we identify issues, mechanisms, and scenarios that have not been fully investigated in existing works. The paper provides a coherent understanding of design principles, conceptual operation, and evaluated scenarios of schemes designed for QoS application in mobile ad hoc networks (MANETs).

***Keywords*—MANETs, QoS, Routing Protocols**

I. INTRODUCTION

The emergence of real-time applications and the widespread use of wireless and mobile devices have generated the need to provide better quality-of-service (QoS) in mobile networking environments. This paper provides a survey of current research concerned with the problem of providing QoS in a wireless network architecture called mobile ad hoc networks. Current wireless networks support mobile/wireless access for mobile communications devices by providing a wireless interface between the mobile devices and a fixed network of limited range base-stations (BS). On the basis of this infrastructure model for wireless communications, the air-interface consists of a single data-link terminating on a BS. Communication from that point is routed across a fixed network to its destination. Mobility is managed by allocating a limited set of communications frequency channels to each BS, and dynamically assigning a mobile device to a local channel as it moves from the coverage area of one BS to another. While providing QoS in an infrastructure environment is difficult, supporting QoS in mobile ad hoc networks, which do not depend on a BS for communications, is even more difficult. Essentially, a mobile ad hoc network is a network of mobile routers. The remainder of this section provides an overview of ad hoc networks including its distinguishing features and associated challenges.

In the next section, we present a review of problem in currently proposed QoS models for ad hoc networks. Evaluation metrics for QoS routing protocols are presented in Section 3 including the definition of the QoS routings. Section 4 discusses the various existing Routing Porotocol Section 5 Simulation parameters and tabulated results, Section 6 discuss future scope and conclusion.

II. AD-HOC NETWORK PROTOCOLS

Ad hoc wireless network is a special case of wireless network devoid of predetermined backbone infrastructure. This feature of the wireless ad hoc networks makes it flexible and quickly deployable. Nevertheless, significant technological challenges are also posed by this property. There are several challenges incorporating issues of efficient routing, medium access power management, security and quality of service (QoS). As the nodes correspond over wireless links, all the nodes must combat against the extremely erratic character of wireless channels and intrusion from the additional transmitting nodes. These factors make it a challenging problem to exploit on data throughput even if the user-required QoS in wireless ad hoc networks is achieved. Repeated route changes cause huge complications in implementing ad hoc networks owing to the mobility of the nodes and intrusion between nodes. The high packet loss rates and recurrent topological changes lead to unbalanced transport layer and constrained amount of traffic being carried out by the network. The three eminent problems in ad hoc networks are the lack of unswerving packet delivery due to the intrusion and movement of nodes, incomplete bandwidth owing to the channel limitations, and constrained node life span caused as an outcome of small battery size.

A. Problems of Adhoc Routing Protocols

(i) The massive dimension of ad hoc networks necessitates an excellent scalable QoS architecture. An ad hoc network may not be to limited to the number of hosts involved in the network. As more nodes join an ad-hoc network or the data traffic grows, the potential for collisions and contention increases, and protocols face the challenging task to route data packets and result in scalability. The prior works on QoS in ad hoc networks have barely considered the scalability problems.

(ii) The packets which are equipped to be transmitted are buffered by the Network Interface Queues (IFQ) implemented by AODV [1], TORA [2], and DSR [3] and the network protocol stack receives these packets. In general, the utmost numbers of packets that can be held in the IFQ are limited and in addition a maximum timeout policy for packets in the IFQ is implemented by IFQ. Hence, devoid of any notification, any packet in anticipation of a route in the IFQ for an extensive period may well merely be discarded [4].

(iii) The communication Gray Zone problem is an important challenge encountered by the existing routing protocols [4]. The detection and establishment of end to end routes are performed in most of the routing protocols such as AODV by depending on the control (RREQ) packets. Nevertheless, these control packets and data packets have appreciably different properties. For instance, In comparison to data packets, RREQ packets are in general greatly smaller and are also transmitted at considerably lower bit rates. Nodes that are distant might be able to transmit and receive bidirectional RREQ packets, however high bit-rate data packets cannot be sent or received as a consequence of the above mentioned property.

(iv) End-to-end delay estimation is a vital element of any QoS-enabled routing protocol. Current protocols determine the time taken to route RREQ and RREP packets along the specified path in order to estimate end-to-end delay. Nevertheless, RREQ and RREP packets are improbable to encounter the similar levels of traffic delay and loss like data packets as they are appreciably diverse from usual data packets.

We depend on the reality that communication is based on received power of the forwarding node, in order to be able to observe the movement of the node and that a route is about to break. As a result, the quality of the route is measured. The link breakage can be guessed based on the measured quality of the route. By using a proactive fault tolerant routing with QoS aware multipath route discovery, smaller end-to-end delay and a larger throughput to a host can be achieved.

In this paper, we compare Robust Multipath Routing (QRMR) protocol intended for mobile ad hoc networks. In this paper, we will employ the facility to determine multiple routes to a host and switch between them to expand the definition of AOMDV [6].Enabling a QoS constrained route from source to destination is one of the objectives of the routing protocol. The route chosen by the protocol must send packets with minimum bandwidth and end-to-end latency, in particular. The protocol should satisfy the above constraints and also select the most robust among all possible candidate routes.

III. EVALUATION METRICS FOR QOS ROUTING PROTOCOLS

As different applications have different requirements, the services required by them and the associated QoS parameters differ from application to application [16]. For example, in case of multimedia applications, bandwidth, delay and delay-jitter are the key QoS parameters, whereas military applications have stringent security requirements. The following is a sample of the metrics [23] commonly used by applications to specify QoS requirement to the routing protocol.

Responsiveness: One of the most important user experiences in networking applications is the perception of responsiveness if end-users feel that an application is slow; it is often the case that it is slow to respond to them, rather than being directly related to network speed.

Capacity and throughput: An important user metric, in the case of network applications that rely on bulk transfer, is capacity. In the past, many applications were hindered by the lack of available high-bandwidth connections. A quantitative measurement term for this experience is “throughput” defined as the rate at which a computer or network sends or receives data.

One-way Delay (OWD): One-way delay is the time it takes for a packet to reach its destination

Propagation Delay: Propagation delay is the duration of time for signals to move from the transmitting to the receiving end of a link

Serialization Delay: Serialization delay is the time it takes for a packet to be separated into sequential link transmission units (typically bits).

Delay Variation (Jitter): Jitter is the undesired deviation from true periodicity of an assumed periodic signal in electronics and telecommunications, often in relation to a reference clock source. Jitter may be observed in characteristics such as the frequency of successive pulses, the signal amplitude, or phase of periodic signals.

Maximum Transmission Unit (MTU): In computer networking, the maximum transmission unit (MTU) of a communications protocol of a layer is the size (in bytes) of the largest protocol data unit that the layer can pass onwards.

Bandwidth Delay Product (BDP): Bandwidth-delay product refers to the product of a data link's capacity (in bits per second) and its end-to-end delay (in seconds). The result, an amount of data measured in bits (or bytes), is equivalent to the maximum amount of data on the network circuit at any given time, i.e. data that has been transmitted but not yet received.

IV. COMPARING VARIOUS PROTOCOLS

Routing protocols belonging to different QoS philosophies have been proposed in the literature. A fairly comprehensive overview of the state of the field of QoS in networking was provided by Chen in 1999 [4]. The conclusions highlighted several significant points in MANET research. It includes admission control policies and protocols, QoS robustness and QoS preservation under failure conditions. Researchers have come up with various routing schemes,few of them have been explored below:

SQ-AODV - propose a novel energy aware stability based routing protocol for enhanced QOS in wireless ad-hoc networks, MILCOM 2008 a cross layering approach to exchange information about the residual energy in nodes to perform quality of service.

Improved AODV - proposed improved AODV routing protocol for reset a new shortest routing path during sending packet. Improved AODV routing protocol maintains expire time that created first. So expire time in routing table is not updating until expire time. Therefore, routing table updated in a cycle. Improved routing protocol ensures shortest routing path through fixed expire time. So the source packet sends to destination quickly than original AODV routing protocol.

Multi Objective AODV - Multi Objective AODV[10] based on realistic model. In their simulation research, they find new algorithm which find the optimum path for mobile ad hoc node. Their algorithm considered realistic movements and environments like facing obstacle or pathway. The proposed protocol considers not only hop count but also other objectives, such as mobility model, mobile node specification and routing algorithm. By considering these multi objectives, the protocol can find the best paths. In their proposed protocol, the selection of object that participates in finding path is optional. If a node lacks of facilities such as GPS, objectives which need GPS cannot be considered.

EM-AODV Energy Multipath AODV (EM-AODV)[33] ,a new adaptive approach which considers the metric "residual energy of nodes" instead of the number of hops in the process route selection. In this we define the rate of energy consumption for each node to estimate its lifetime and as well define a cost that fits this lifetime and the energy level. This information is used for calculating the cost of routes and the path with minimum cost is selected. EM-AODV improves the performance of AODV in most metrics, as the packet delivery ratio, end to end delay, and energy consumption.

CPC-AODV - an on-demand routing algorithm based on cross-layer power control termed as called CPC-AODV (Cross-layer Power Control Ad hoc On demand Distance Vector) taking account of the geographic location of nodes, the energy of packet transmission

TABLE I. VARIOUS ROUTING PROTOCOLS AND THEIR FULL NAMES

No	Protocol	Full Name of Protocol
1.	QAMNET	Quality of service for Multicast in MANETs
2.	CQMRP	Cluster-based QoS Multicast Routing Protocol
3.	QMRPCAH	QoS Multicast Routing Protocol for Clustering Mobile Ad Hoc Network
4.	HVDB	Hypercube-based Virtual Dynamic Backbone
5.	QOS-ODMRP	QoS On-Demand Multicast Routing Protocol
6.	E-QMR	Cross-layer QoS Multicast Routing Protocol
7.	QMRP	QoS aware Multicast Routing Protocol
8.	QOS-AODV	QoS Ad Hoc On-Demand Distance Vector Routing
9.	HQMRP	Hybrid QoS Multicast Routing Protocol
10.	QOS-MEM	QoS-aware Minimum Energy Multicast
11.	LTM	Lantern-Tree-based QoS Multicast
12.	MPT	Multiple paths/trees
13.	EQMGA	Entropy-Based Genetic Algorithm To Support Qos Multicast Routing
14.	QMOST	Qos-Aware Multicast Overlay Spanning Tree
15.	LACMQR	Location-Based Multicast Routing For Mobile Ad Hoc Networks
16.	AQM	Ad Hoc Qos Multicasting
17.	M-CAMP	Call-Admission Multicast Protocol For Manets
18.	MCEDAR	Multicast Core-Extraction Distributed Ad Hoc Routing
19.	QOS-	Qos–Multicast Ad Hoc On-Demand Distance Vector Routing
20.	HQMGA	Hierarchical Qos Multicast Routing Using Ga In Manet
21.	QMR	Qos Multicast Routing Protocol
22.	EGA	A Genetic Algorithm For Energy-Efficient Based Multicast Routing On
23.	SEQMRAN	Secure Efficient Qos Multicast Route Discovery For Manets
24.	FQM	Framework For Qos Multicast
25.	ODQMM	On-Demand Qos Multicast For Manets
26.	MACO	Ant Colony Algorithm Based On Orientation Factor For Qos Multicast
27.	AMOMQ	Ad-Hoc Mesh-Based On-Demand Multicast Routing Protocol
28.	QOS-	Qos Constrained Multicast Routing For Mobile Ad Hoc Networks
29.	HTQ	Hexagonal-Tree Tdma-Based Qos Multicast Protocol
30.	QMMRP	Qos Multilayered Multicast Routing Protocol

MRAODV –proposed Modified Reverse AODV (MRAODV) stability estimation method is used for route selection and to increase performance. In the proposed routing algorithm, when a source node wants to communicate with a destination node, first it broadcasts a RREQ packet. This stage is like that of AODV algorithm. When destination receives a RREQ message, it broadcasts R-RREQ message to find source node. Each intermediate node which receives the R-RREQ message, calculates its route stability for each route using equation given below and this stability is used for selecting the path.

QoS- AODV- A new QoS-aware routing protocol based on AODV[34] named QAODV (QoS- AODV) is further proposed. QAODV makes the following modification: It can exclude some nodes unfit to the QoS requirements before establishing the route and reduce invalid transmission of RREQ and save the overhead in the routing establishment process. It comprehensively considers bandwidth, delay, the number of hops and congestion situation of nodes in selecting route, so it is more useful to on-time services than AODV. It utilizes virtual carrier sense via NAV to be aware of busy and free states of nodes in transmission channel to compute their available bandwidths through cross-layer design. To facilitate a comparison among the different QoS-aware routing protocols a list of all the protocols that exist are tabulated below in Table I. The different protocols discussed in the paper are very effective and useful for new researchers to identify new topics for further research. Several important research issues and open questions need to be addressed, it includes discovering path which is free from or has minimum number of malicious node by incorporating behaviour history of member nodes and incorporate measures like the throughput, response time, queuing delay, network link.

V. SIMULATION RESULTS

Comparison among the different QoS-aware routing protocols, is described in a table IV, for comparison the simulation parameter that are considered are tabulated in II and III. The tables lists the design constraints listed earlier such as Route discovery, Resource reservation, Route maintenance, QoS metrics constrained, Network architecture and routing overhead and discussing how each protocol addresses.

The proposed algorithm will be tested in simulation experiments. In the simulation environments, all nodes communicate using the IEEE 802.11 medium access protocol The mobility model we will be used in each node independently chooses random starting point and waits there for a duration called the pause time. All nodes shall be distributed in the area and change their directions and speeds randomly. The network topology configuration file will contain following information to start a simulation and will be designed in a format of Tcl script. Each node will independently repeat the movement pattern through the simulation. The mobility and traffic model for the mobile nodes will be generated with following settings:

TABLE II. SIMULATION PARAMETERES FOR VARIOUS QOS AWARE PROTOCOLS

No.	Protocol	Network Parameters					Density & Hops		Speed (m/s)	Mobility Model	Type of Radio
		Simulator	*Area (mxm)*	*Transmission Range (m)*	*Capacity (Mbps)*	*No of Nodes*	*Neighbour Count (Density)*	*No of Nodes/Neighbour Count*			
1.	QAMNET	NS-2	1500x300	250	2	50	21.8	2.3	0-20	RWP	802.11
2.	CQMRP	NS-2	500x500		----	50	---	---	10-45	RR	----
3.	QMRPCAH	NS-2	-----		1	200	----	----	2-20	CR	----
4.	HVDB			250		50	---	---	----	RWP	802.11
5.	QOS-ODMRP	GloMoSim	1000x1000	250	2	50	9.8	5	0.25-5	RWP	802.11
6.	E-QMR	GloMoSim	1000x1000	250	2	50-100	---	----	0-20	RWP	802.11
7.	QMRP	GloMoSim	1000x1000	250	2	50	9.8	5	3-20	RR	802.11
8.	QOS-AODV	NS-2	1000x1000	250	------	50	21.8	2.3	0.5-20	RWP	----
9.	HQMRP	OMNeT++	6500x6250	2000	.02	10-45	11-14	1.1-3.2	0-15	----	----
10.	QOS-MEM	----	1000x1000	.05	-----	20	---	---	---	----	----
11.	LTM	----	1000x1000	100	2	50-100	1.6	31.3	0-25	----	---
12.	MPT	-----	100x100	30	-----	100	28.3	3.5	LOW	----	----
13.	EQMGA	NS-2	1000x1000	250	2	100	19.6	5.5	0-20	RWP	---
14.	QMOST	NS-2	1000x1000	250	-----	100	19.6	5.5	0-10	RWP	802.11
15.	LACMQR	GloMoSim	1000x1000	----	2	300-1500	---	---	----	----	----
16.	AQM	OPNET	1000x1000	250	10	10-100	2	5	1-4	RWP	----
17.	M-CAMP		1000x1000	250	2	---	--	---	--	RWP	802.11
18.	MCEDAR		1000x1000	250	2	---	2	5	---	RWP	802.11
19.	QOS-MAODV	Qualnet	1000x1000	250	2	50	9.8	5	0-42	RWP	802.11
20.	HQMGA	GTNets	3000x3000	160	2	1000	8.9	112.4	0-1	RWP	802.11
21.	QMR	GloMoSim	1000x1000	250	2	50	9.8	5.5	0.25-5	RWP	802.11

No.	Protocol	Network Parameters					Density & Hops		Speed (m/s)	Mobility Model	Type of Radio
		Simulator	*Area (mxm)*	*Transmission Range (m)*	*Capacity (Mbps)*	*No of Nodes*	*Neighbour Count (Density)*	*No of Nodes/Neighbour Count*			
22.	EGA	Self developed	-----	-----	----	----	--	--	1-5	----	----
23.	SEQMRAN	NS-2	1500x300	250	11	50	21.8	2.3	0-1	RWP	802.11
24.	FQM	GloMoSim	1000x1000	250	2	100	19.6	5.1	0-20	RWP	802.11
25.	ODQMM	Self developed	----	250	----		19.6	5.5	----	RWP	802.11
26.	MACO	----------	----	----	----	20-100	---	----	---	----	----
27.	AMOMQ	GloMoSim	1000x1000	250	2	50	9.6	5.5	1-20	RWP	802.11
28.	QOS-MAODV	NS-2	1000x1000	250	2	60	11.8	5.1	10-60	RWP	802.11
29.	HTQ	NCTUns2	1000x1000	250	5	20-50	2.5	8	0.28-11.1	---	----
30.	QMMRP	Matlab	1000x1000	250	-----	50-100	9.8	5.1	---	----	----

TABLE III. SIMULATION PARAMETERES FOR VARIOUS QOS AWARE PROTOCOLS

No.	Protocol	Multicast group				Traffic type /Pattern			Simulating Background Traffic
		Group	*Source per Group*	*Receivers per Group*	*%Receivers per Group*	*Traffic Type*	*Packet Size*	*Rate (Kbps)*	
1.	QAMNET	1	3	15	30%	CBR	330	118.8	Yes
2.	CQMRP	--	--	--	--	CBR	512	--	No
3.	QMRPCAH	1	--	10,20,50,60,100	5%-50%	ML5kb	---	Max 20Mbps	No
4.	QOS-ODMRP	3	1	--	--	CBR	512	128,256,512	No
5.	E-QMR	1	3	15	15-30%	CBR	512	8	No
6.	QMRP	1	5	20	40%	CBR	512	8	No
7.	QOS-AODV	1	10	10-50	20%-100%	CBR	512	16kbps	No
8.	HQMRP	1	1	3-7	15-30%	Session per	--	--	No
9.	QOS-MEM	1	1	5-20	25-100%	---	--	--	No
10.	LTM	--	--	--	--	Message length 1-30Kb	--	--	No
11.	MPT	1	1	1-30	30%	--	--	--	Yes
12.	EQMGA	1	1	5-30	5-30%	CBR	512	16-40	No
13.	QMOST	1	1	5-50	5-50%	CBR	--	200	Yes
14.	LACMQR	2	1-2	--	--	CBR	512	8	No
15.	AQM	--	--	--	--	Audio &voice	--	--	No
16.	QOS-MAODV	3	1	3-30	6-60%	CBR	1024	128,256,512	No
17.	HQMGA	--	--	--	--	stream	--	64	No
18.	QMR	1	3	15	15-30%	CBR	512	8	No
19.	EGA	1	2	--	--	Stream	--	64	No
20.	SEQMRAN	9	1	5-50	10-100%	CBR	256	4	No
21.	FQM	1	3	15	15%	CBR	--	118.8	Yes
22.	MACO	--	--	--	--	--	--	---	---
23.	AMOMQ	1	1-25	50	100%	CBR	512	--	No
24.	QOS-MAODV	1	5-25	50	100%	CBR	512	--	No
25.	HTQ	1	1	2-5	10%	1-4Mb	--	5Mbps	No
26.	QMMRP	1	1	10-30	5-60%	--	--	--	No

TABLE IV. COMPARISON OF QOS MULTICAST ROUTING PROTOCOLS IN MANETS.

No.	Protocol	*Routing Scheme*	*Multicast Distribution*	*Multicast Model*	*QOS Constraints*	*MAC Sublayer*	*Maintenance Mess/Tree*	*Resource Estimation*	*Failure Handling*	*Group Fomation*
1.	QAMNET	Reactive	Mesh	Yes	B	802.11	Soft	Yes	Soft	Source
2.	CQMRP	Hybrid	SST	No	B,D	--	Hard	No	Local	Source

No.	Protocol	*Routing Scheme*	*Multicast Distribution*	*Multicast Model*	*QOS Constraints*	*MAC Sublayer*	*Maintenance Mess/Tree*	*Resource Estimation*	*Failure Handling*	*Group Fomation*
3.	QMRPCAH	Hybrid	SST	No	B,D	MACA	Hard	No	Global	Source
4.	QOS-ODMRP	Reactive	Mesh	Yes	B	802.11	Soft	Yes	Soft	Source
5.	E-QMR	Reactive	Mesh	Yes	B	802.11	Soft	Yes	Soft	Source
6.	QMRP	Reactive	Mesh	Yes	B	802.11	Soft & Hard	Yes	Soft & Local	Source
7.	QOS-AODV	Reactive	ST	Yes	D	--	Soft	Yes	Soft	Receiver
8.	HQMRP	Hybrid	SST	No	B	TDMA	Hard	No	Local	Source
9.	QOS-MEM	Reactive	SST	Yes	B	TDMA	Hard	Yes	---	Source
10.	LTM	Hybrid	SST	Yes	B	CDMA	Soft	Yes	Soft	Source
11.	MPT	Reactive	SST	No	B	CDMA	Hard	Yes	Global	Source
12.	EQMGA	Proactive	SST	No	B	--	Hard	No	--	Source
13.	QMOST	Hybrid	ST	No	B	802.11	Hard	No	Global	Source
14.	LACMQR	Hybrid	SST	Yes	B	--	Hard	No	--	Source
15.	AQM	Reactive	ST	Yes	B	---	Hard	Yes	Global	Receiver
16.	QOS-MAODV	Reactive	ST	Yes	B	802.11	Soft	Yes	Soft	Receiver
17.	HQMGA	Proactive	SST	Yes	B,D	802.11	Hard	No	--	Source
18.	QMR	Reactive	Mesh	Yes	B	802.11	Soft	Yes	Soft	Source
19.	EGA	Proactive	SST	Yes	D,C	Any	Hard	Yes	--	Source
20.	SEQMRAN	Reactive	ST	Yes	B,D	802.11	Hard	No	--	Source
21.	FQM	Reactive	Mesh	Yes	B	802.11	Soft	Yes	Local	Source
22.	MACO	Proactive	SST	No	B,D	Any	Hard	No	---	Source
23.	AMOMQ	Reactive	Mesh	Yes	B	802.11	Soft	Yes	Soft	Source
24.	QOS-MAODV	Reactive	ST	Yes	B,D	802.11	Soft	Yes	Soft	Receiver
25.	HTQ	Reactive	Any	Yes	B	TDMA	Hard	Yes	Back Up	Source
26.	QMMRP	Reactive	SST	Yes	B	CDMA	Hard	Yes	Local	Source

Notes:

1. Multicast distribution type: ST—Shared tree; SST—Source specific tree; Hybrid (reactive + proactive or geographical + proactive)
2. Type of admission control (AC): Source—Source AC, Receiver—Receiver AC, Intermediate—Intermediate node AC
3. QoS constraints: B—Bandwidth; D—Delay; J—Jitter; Buf—Buffer capacity level; ST—Stream latency; SR—Stream resolution; SC—Stream continuity; S—Stability.
4. Failure handling: Soft—soft handling; Local—hard handling and local recovery; Global—hard handling and global recovery; Backup—Backup path switching .
5. Group formation: Source—source initiation; Receiver—receiver initiation; Common core—common node initiation
6. ----: there is lack of information about the characteristic in simulation of the protocol

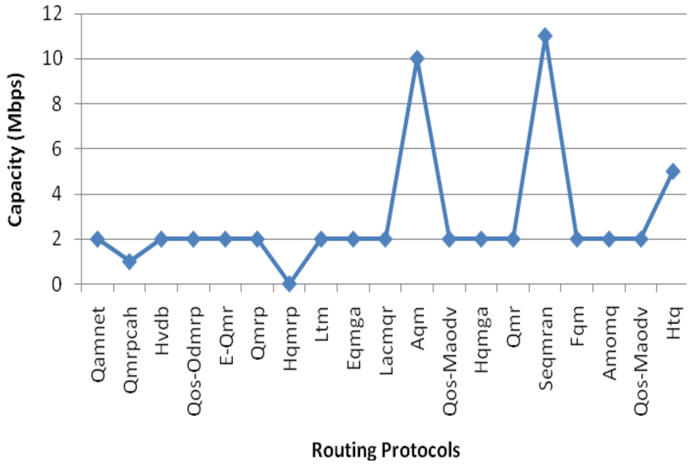

Figure 1. Comparing Routing Protocols and their capacity in Mbps

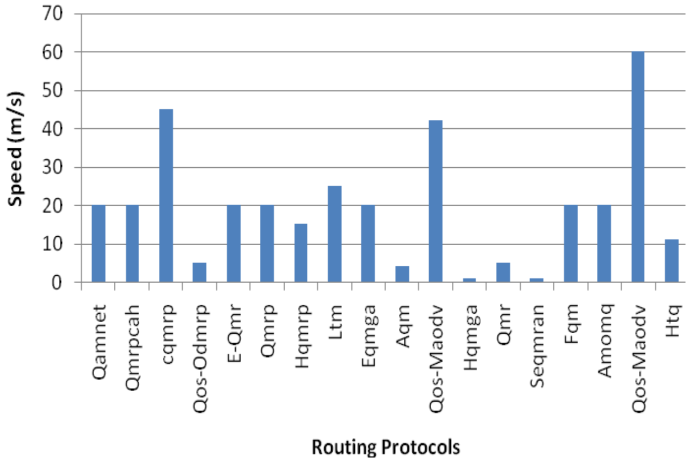

Figure 2. Comparing Routing Protocols and their Speed in Meters per Second

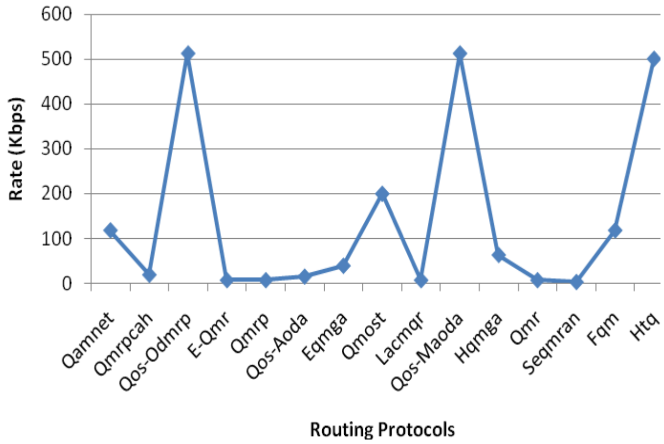

Figure 3. Comparing Routing Protocols and their Rate of data transfer in Kbps.

VI. CONCLUSION

In this paper, an effort has been made to develop comparative study and performance analysis of various on demand/reactive routing protocols on the basis of mentioned performance metrics. MANETs are likely to expand their applications in the future communication environments. The support for QoS will thus be an important and desirable component of MANETs. Several important research issues and open questions need to be addressed to facilitate QoS support in MANETs. Energy efficiency is one of the main problems in a mobile ad hoc network, especially designing a routing protocol. Power control and accommodating multiple classes of traffic requires further research attention. Further we can say that due to decentralized characteristics, dynamically changing topology, it is too difficult to achieve security and power management in MANETs. Future research work and effort will be made to discover an efficient power aware routing scheme in MANETs which can support both real and non real time traffic.

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