Study of QoS Parameters for Stable Routing Protocol in MANET

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Abstract
A Mobile Ad Hoc Network is a collection of portable devices that establish communication without the help of any infrastructure such as base stations or access points. As the MANET is infrastructure less, it is having dynamic nature of random network topology. Due to movement of nodes, the link between nodes breaks. The network needs to find a new route from source to destination. In order to find a route network initiate a route discovery procedure by broadcasting route request packets. In this paper some parameter are studied like end to end delay, throughput, packet delivery ratio, normalized routing load and frequency of route request for routing protocol in MANET.

Keywords
MANET, Routing, end to end delay, throughput, packet delivery ratio, normalized routing load and frequency of route request.

Introduction
A Mobile Ad Hoc Network (also called MANET) is a collection of mobile nodes that establish communication without the help of any infrastructure [1]. Furthermore, Mobile Ad hoc networks are easy to deploy and does not require any back bone support. MANET is Useful in the absence of infrastructure. Mobile Ad Hoc networks should be self-organizing, multi-hopping, mobile and scalable. Each device in a MANET is free to move independently in any direction, therefore change its links to other devices over and over again. Each node in MANET is equipped to continuously maintain the information regarding route. Topology of the ad-hoc network depends on the transmission power of the nodes and the location of the portable nodes, which may change from time to time [1,13, 14].

The main goal of Ad Hoc routing is to send data packets among nodes distributed randomly in the network. Since mobile ad hoc networks have random topology, routing in such networks is a tough task. There is so much work has been done on routing in ad hoc networks [4]. The routes are created as and when required in on-demand or reactive routing protocols. Route discovery mechanisms are used to find a path from source to destination. To maintain low control overhead and reduce the network load only the routes that are currently in use Are Maintained [1].

II. Background
Depend on the network structure ad-hoc network is classified as hierarchical , hybrid etc, and depend on the Routing algorithms, routing protocols are classified as Proactive routing protocols, Reactive Routing protocols and Hybrid Routing protocols [8,9].

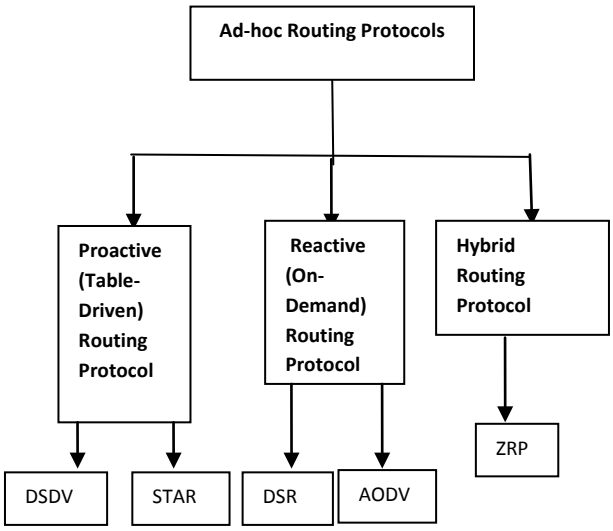

Figure 1: Classification of Routing Protocols in MANET.

1. Source Tree Adaptive Routing (STAR)
In STAR protocol each node is required to send an update message to its neighbors during initialization and also send update messages about new destinations, chances of routing loops, costs of paths. Every node broadcasts its source-tree information to wireless links used by the node in its preferred path to destinations. A

router in STAR communicates to its neighbors the parameters of its source routing tree, which consists of each link that the router needs to reach every known destination (and address range) in the ad hoc network every node in the network should have a path to every destination. If a node does not have a path to a particular destination which the node wants to send packets to it, the node initiate a path absence message to its neighbors [10].

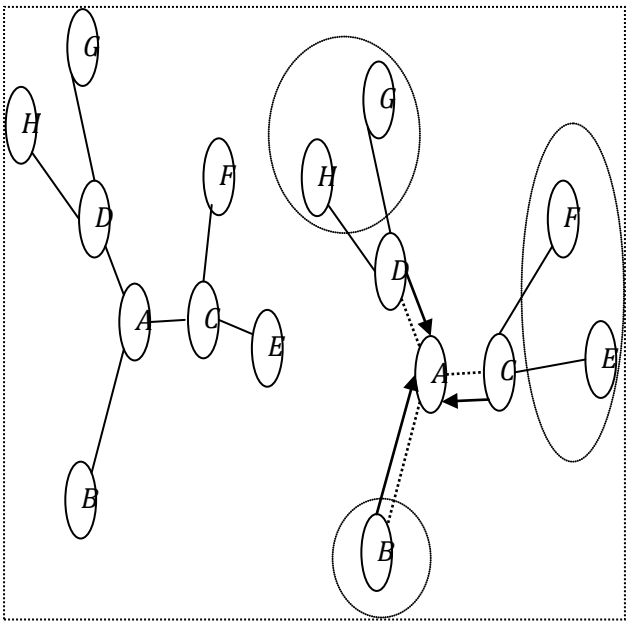

Figure 2: Example of STAR Protocol

2. Ad-hoc On-Demand Distance Vector Routing (AODV)

AODV is a reactive protocol that discovers routes as and when needed. It uses routing tables with one entry per destination. RREQ (route request) packet is sent by the sending node whenever there is a need to find a route. The RREQ traverses from the intermediate node to its intended recipient. In response to RREQ packet the RREP (route reply) packet is sent by the destination. To prevent routing loops and maintain the freshness of route AODV uses sequence numbers, which are maintained at each destination for [4]. All routing packets carry these sequence numbers. Timer-based states are maintained at each node to remove the unused or older entries in the routing table. List of precursors is maintained for each routing table entry, indicating the neighboring nodes sets which use that entry to route packets. The nodes in a precursor list are notified by RREQ (route error) packet whenever the next-hop links breaks .These RREQ packets are forwarded by each predecessor node to its Predecessors, effectively erasing all routes currently using the broken link. [7].

The advantage of AODV is that only active routes are maintained, it requires less memory space which in turn increases the performance. The disadvantages of AODV are, it is not scalable, and it does not perform well in large networks and does not support asymmetric links.

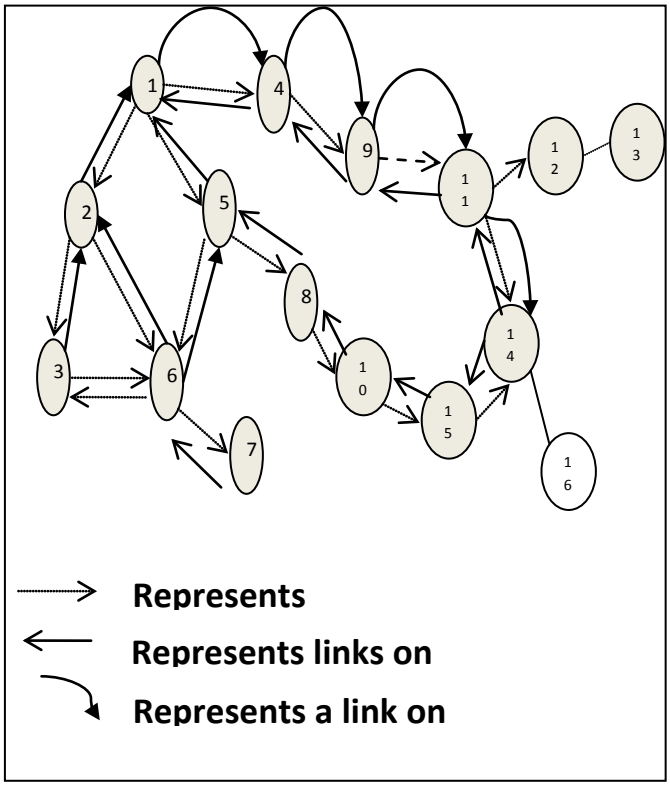

Figure 3: Routing in AODV

III. Literature Servay

Nityananda Sarma et al. [6] 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 the adequate longer duration in MANET, they have proposed an easy model for measuring the link stability and route stability depending on received signal strengths. Some additional fields in route request/ reply packets are 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.

Shitalkumar Jain et al. [13, 9] have reviewed a signal strength based measurements to improve upon packet losses and retransmission of packets. Their goal was to improve TCP performance by using signal strength based cross layer approach which obviously resolves the congestion. Node based and link based signal strength can be measured. If a link fails due to mobility, then signal strength measurement provides temporary higher transmission power to keep link alive. When a route is likely to fail due to weak signal strength of a node, it will find alternate path. Consequently avoids congestion. They made changes at MAC routing and routing layer to predict link failure. They have selected two routing protocols AODV and DSR. Packet Delivery Ratio, Packet Drop, Throughput and end to end delay are the metrics used for performance analysis of the AODV routing protocols.

Hina Tariq et al [14] had evaluated two important routing protocols for MANETs namely the Ad-hoc On-demand Distance Vector (AODV) protocol and Destination sequence Distance Vector (DSDV) protocol. They compare the performance of these protocols in terms of end to end delay, normal routing load and throughput. In their research they observe AODV giving better throughput in large sized networks while DSDV gives better results in terms of end to end delay

Pankaj Rohal et al [11] had considered Topology based routing protocols. In Topology-based routing protocols, both proactive (DSDV) and reactive protocols (AODV, DSR) have been considered for the study. Performance metrics such as packet delivery ratio, throughput, and end-to-end delay are evaluated. They find out the performance of three topology based routing protocols (both reactive and proactive) like DSDV, AODV and DSR by increasing numbers of nodes. Here, they find out the performance on the basis of throughput, delay and packet delivery ratio. By comparing these protocols on the basis of various performance metrics we have reached to a conclusion that reactive topology based protocols are better than proactive topology based routing protocols.

Samyak Shah et al [6] had compared the performance of DSDV, AODV and DSR routing protocols for ad hoc networks The general observation from the simulation is that for application-oriented metrics such as packet delivery fraction and delay AODV, outperforms DSR in more “stressful” situations with widening performance gaps with increasing stress(e.g., more load, high er mobility). DSR, however, consistently generates less routing load than AODV. The poor performances of DSR are mainly attributed to aggressive use of caching, and lack of any mechanism to expire stale routes or determine the freshness of routes when mult iple choices are available. Aggressive caching, however, seems to help DSR at low loads and also keeps its routing load down.

Iv. Different Parameter For Routing Protocol

1. PACKET DELIVERY RATIO

The packet delivery ratio can be determined by dividing number of packets received by number of packet sent[5, 12]. This performance metric gives us an idea of how well the protocol is performing in terms of packet delivery at different speeds using different trafficmodels.

Mathematically, we can define Packet Delivery Ration as,

Average Packet delevery Ratio (%) =

$$\sum_{i=1}^{m} \frac{\text{Sum of data packets received by each destination}}{m}$$

where, i, indicates the number of output file

m, indicates the total number of output files

2. NORMALIZED ROUTING LOAD

The normalized routing load is the overhead on the network in order to find and maintain the route[6]. Normalized routing load can be determined by finding number of routing packets sent per number of data packet received, the fraction of all routing control packets sent by all nodes over the number of received data packets at the destination nodes. In other words, it devides the routing packets sent over the network to data packets received [5,12].

Normalized Routing Load =

$$\frac{\text{Total Routing Packets Sent}}{\text{Total Data Packets Received}}$$

3. AVERAGE END TO END DELAY

The average end to end delay of the route can be determined by finding the total delay and dividing it by hop count. To compute the average end-to-end delay, add every delay for each successful data packet delivery and divide that sum by the number of successfully received data packets. In other word the average end to end delay of the route can be determined by finding the total delay and dividing it by hop count [5, 12].

Average End to End Delay = $\frac{\sum \text{Total Data Packets Received}}{(\text{Time Received} - \text{Time Sent})}$

4. THROUGHPUT

The total data transmitted per second is called throughput of network. A network throughput is the average rate at which message is successfully delivered between a destination node (receiver) and source node (sender). It is also referred to as the ratio of the amount of data received from its sender to the time the last packet reaches its destination. Throughput can be measured as bits per second (bps), packets per second or packet per time slot. For a network, it is required that the throughput is at high-level. Some factors that affect MANET's throughput are unreliable communication, changes in topology, limited energy and bandwidth. Simply the total data transmitted per second is called throughput of network. Also we can say that throughput can be defined as the total number of packets delivered over the total simulation time [11]. The throughput comparison shows that the three algorithms performance margins are very close under traffic load of 50 and 100 nodes in MANET scenario and have large margins when number of nodes increases to 200 [11]. Mathematically, it can be defined as:

Throughput= N/1000

Where N is the number of bits received successfully by all destinations [11].

V. Conclusion

In this paper various Parameters has been studied like end to end delay, throughput, packet delivery ratio, normalized routing load and frequency of route request for routing protocol in MANET. And also some other work which used this parameter as their result parameter form that observation is : "The role of these parameter is considered in performance of any routing protocol like : a efficient protocol should have high packet delivery ratio, lower normal routing load , high throughput, less end to end delay and less number of frequency of routing request".

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