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| Comparative Analysis of CBRP, DSR, AODV Routing Protocol in MANET<br>Checked<br>INTRODUCTION<br>A Mobile ad-hoc network (MANETs) is a system of wireless mobile nodes dynamically self-organizing in arbitrary and temporary network topologies. Mobile ad-hoc networks can turn the dream of getting connected "anywhere and at any time" into reality. Typical application examples include a disaster recovery or a military operation. Not bound to specific situations, these networks may equally show better performance in other places[1]. In MANET, all the nodes are mobile nodes and the topology will be changed rapidly. The structure of the MANET is shown in Fig. 1.<br><br>A MANETS is expected to be of large size than the radio range of wireless antenna, because of this reason it could be necessary to route the traffic through a multihop. Routing protocols in MANETs can be classified as Proactive (Table driven), Reactive (On demand) and Hybrid. The primary goal of an ad-hoc network routing protocol is to provide correct and efficient route establishment between pair of nodes so that the messages may be delivered on time[2].<br>In table-driven protocol, each node maintains a routing table, containing routing information on reaching every other node in the network. All the nodes update these tables so as to maintain a consistent and up-to-date | Phân tích so sánh các giao thức định tuyến CBRP, DSR, AODV trong MANET<br>GIỚI THIỆU<br>Các mạng tùy biến di động (MANET) là một hệ thống các nút di động không dây tự tổ chức động tron tô pô mạng tùy ý và tạm thời. Các mạng tùy biến di động có thể biến giấc mơ kết nối mạng "ở bất cứ nơi đâu và bất cứ lúc nào" thành hiện thực. Ví dụ ứng dụng điển hình bao gồm khắc phục thảm họa hoặc hoạt động quân sự. Không bị ràng buộc bởi từng trường hợp cụ thể, nững mạng này có hiệu suất như nhau ở những nơi khác nhau [1]. Trong MANET, tất cả các nút là các nút di động và tô pô sẽ thay đổi nhanh. Cấu trúc của MANET được biểu diễn trong H.1.<br>Theo dự đoán MANET có kích thước lớn hơn phạm vi phát sóng của ăng ten không dây, vì lí do này cần phả định tuyến lưu lượng thông qua multihop. Các giao thức định tuyến trong MANET có thể chia thành chủ động (Bảng ghi), đáp ứng (theo yêu cầu) và lai hóa. Mục tiêu chính của giao thức định tuyến mạng tùy biến là cung cấp thiết lập tuyến chính xác và hiệu quả giữa một cặp nút để tin nhắn được phân phối đúng lúc [2].<br><br>  |

view of the network. Proactive routing protocol use periodic broadcast to establish routes and maintain them. The advantage is that routes to any destination are always available without the overhead of a route discovery.

In on-demand routing, all up-to-date routes are not maintained at every node, instead the routes are created when required. When a source wants to send a destination, it invokes a route discovery mechanism to find the path to the destination. The route remains valid till the destination is unreachable or until the route is no longer needed.
Hybrid protocols combine the benefit of both approaches. Hybrid protocols are scalable to network size.

The remainder of the paper is organized as follows. Section 2 shows issues and difficulties in MANET, also briefly reviews the three on-demand routing protocols: AODV, CBRP and DSR and analyze the differences between these protocols that may affect their performance in Section 3. Section 4 presents the simulation experiments carried out to study and compare the performance of the three routing protocols, followed by the conclusions in Section 5.

## 2. ISSUES AND DIFFICULTIES IN MANETS

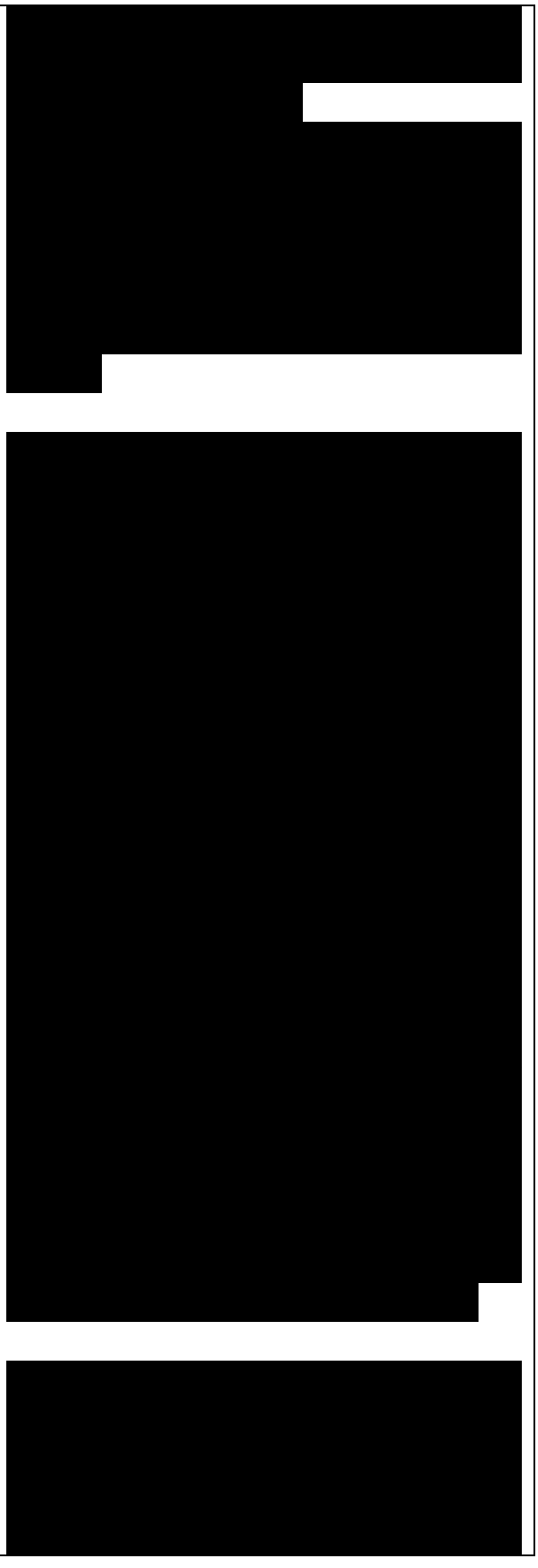
MANETs differ from the traditional wired Internet infrastructures. The differences introduce difficulties for

achieving Quality of Service in such networks. Some of the problems as listed below:

A. Dynamic topologies: Nodes are free to move arbitrarily; thus, the network topology - which is typically multi-hop - may change randomly and rapidly at unpredictable times, and may consist of both bidirectional and unidirectional links.

B. Bandwidth-constrained, variable capacity links: Wireless links will continue to have significantly lower capacity than their hardwired counterparts. In addition, the realized throughput of wireless communications - after accounting for the effects of multiple access, fading, noise, and interference conditions, etc.- is often much less than a radio's maximum transmission rate. One effect of the relatively low to moderate link capacities is that congestion is typically the norm rather than the exception, i.e. aggregate application demand will likely approach or exceed network capacity frequently. As the mobile network is often simply an extension of the fixed network infrastructure, mobile ad hoc users will demand similar services. These demands will continue to increase as multimedia computing and collaborative networking applications rise.

C. Energy-constrained operation: Some or all of the nodes in a MANET may rely on batteries or other exhaustible means for their energy. For these nodes, the most important system



design criteria for optimization may be energy conservation.

3. ROUTING PROTOCOL

CLUSTER BASED ROUTING PROTOCOL

CBRP (Cluster Based Routing Protocol) is an on-demand routing protocol, where the nodes are divided into clusters. It uses clustering's structure for routing protocol. Clustering is a process that divides the network into interconnected substructures, called clusters. Each cluster has a cluster head as coordinator within the substructure. Each cluster head acts as a temporary base station within its zone or cluster and communicates with other cluster heads.

CBRP is a routing protocol designed to be used in mobile ad hoc networks. The protocol divides the nodes of the ad hoc network into a number of overlapping or disjoint 2-hop- diameter clusters in a distributed manner. Each cluster chooses a head to retain cluster membership information. there are four possible states for the node: NORMAL, ISOLATED, CLUSTERHEAD and GATEWAY. Initially all nodes are in the state of ISOLATED. Each node maintains the NEIGHBOR table wherein the information about the other neighbor nodes is stored cluster heads have another table (cluster heads NEIGHBOR) wherein the information about the other neighbor cluster heads is stored[4].

3.2. ADHOC (AODV)

Adhoc On-Demand Distance Vector (AODV), which is used to provide secure and reliable data transmission over the MANETs [5]. AODV discovers a route through network-wide broadcasting. The source host starts a route discovery by broadcasting a route request to its neighbors. In the route request, there is a requested destination sequence number which is 1 greater than the destination sequence number currently known to the source. This number prevents old routing information being used as reply to the request, which is the essential reason for the routing loop problem in the traditional distance vector algorithm.

When a node wants to send a packet to some destination node and does not have a valid route in its routing table for that destination, it initiates a route discovery process. Source node broadcasts a route request (RREQ) packet to its Neighbours, which then forwards the request to their neighbours and so on. Nodes generate a Route Request with destination address, Sequence number and Broadcast ID and sent it to his neighbour nodes. . Each node receiving the route request sends a route back (Forward Path) to the node as shown in the fig. 1.

When the RREQ is received by a node that is either the destination node or an intermediate node with a fresh enough route to the destination, it replies by unicasting the route reply (RREP) towards the source node. As the RREP

is routed back along the reverse path, intermediate nodes along this path set up forward path entries to the destination in its route table and when the RREP reaches the source node, a route from source to the destination established. Fig. 2 indicates the path of the RREP from the destination node to the source node.

Fig. 2. RREP in AODV

3.3 DSR

The Dynamic Source Routing protocol (DSR) is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing 20 network infrastructure or administration. Dynamic Source Routing, DSR[6], is a reactive routing protocol that uses source routing to send packets. It uses source routing which means that the source must know the complete hop sequence to the destination. Each node maintains a route cache, where all routes it knows are stored. The route discovery process is initiated only if the desired route cannot be found in the route cache. To limit the number of route requests propagated, a node processes the route request message only if it has not already received the message and its address is not present in the route record of the message.

4. SIMULATION

The simulations were performed using GLOMOSim [], popular in the adhoc

networking community. CBR is the traffic sources. The source-destination pairs are spread randomly over the network.

Random waypoint model is one of the mobility model which is used for the scenario in a terrain dimension area of 1000m x 1000m with 50 nodes. During, the simulation, each node starts with journey from a random spot to a random chosen destination. Table 1 shows the simulation parameters used in the evaluation.

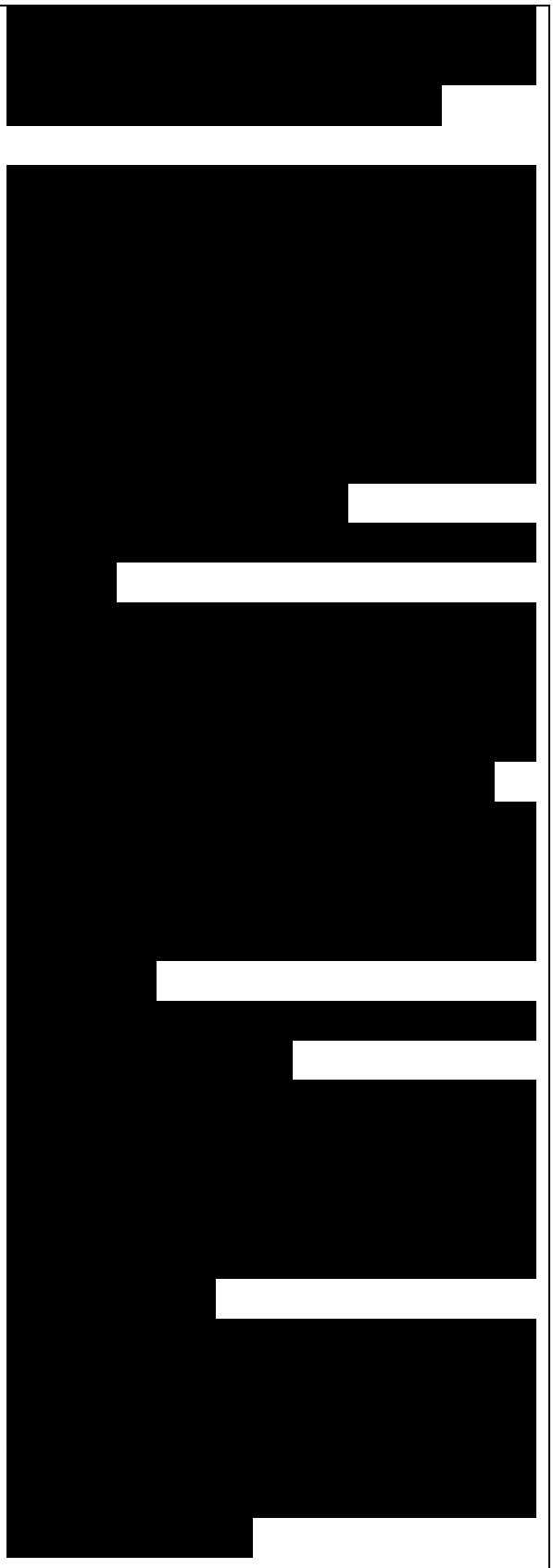
Table 1 : Simulation parameters for scenario

To evaluate QoS parameters performance for IEEE 802.11 using different reactive routing, use the following QoS performance metrics.

Packet delivery ratio(PDR): It is the ratio of the number of data packets successfully delivered to destination nodes to the total number of data packets sent by source nodes.

Mathematically, it can be expressed as:

Where PDR is the fraction of successfully delivered packets, C is the total number of flow or connections, f is the unique flow id serving as index, Rf is the count of packets received from flow f and Nf is the count of packets transmitted to f. Average End-to-End delay: It indicates the length of time taken for a packet to travel from the CBR (Constant Bit Rate) source to the destination. It represents the average data delay an application experiences during transmission of



data.

Where N is the number of successfully received packets, I is unique packet identifier, ri is time at which a packet with unique id I is received, si is time at which a packet with unique id I is sent and D measured in ms. It should be less for high performance.

Normalized routing overhead: the number of control packets "transmitted" per data packet "delivered" at the destination.

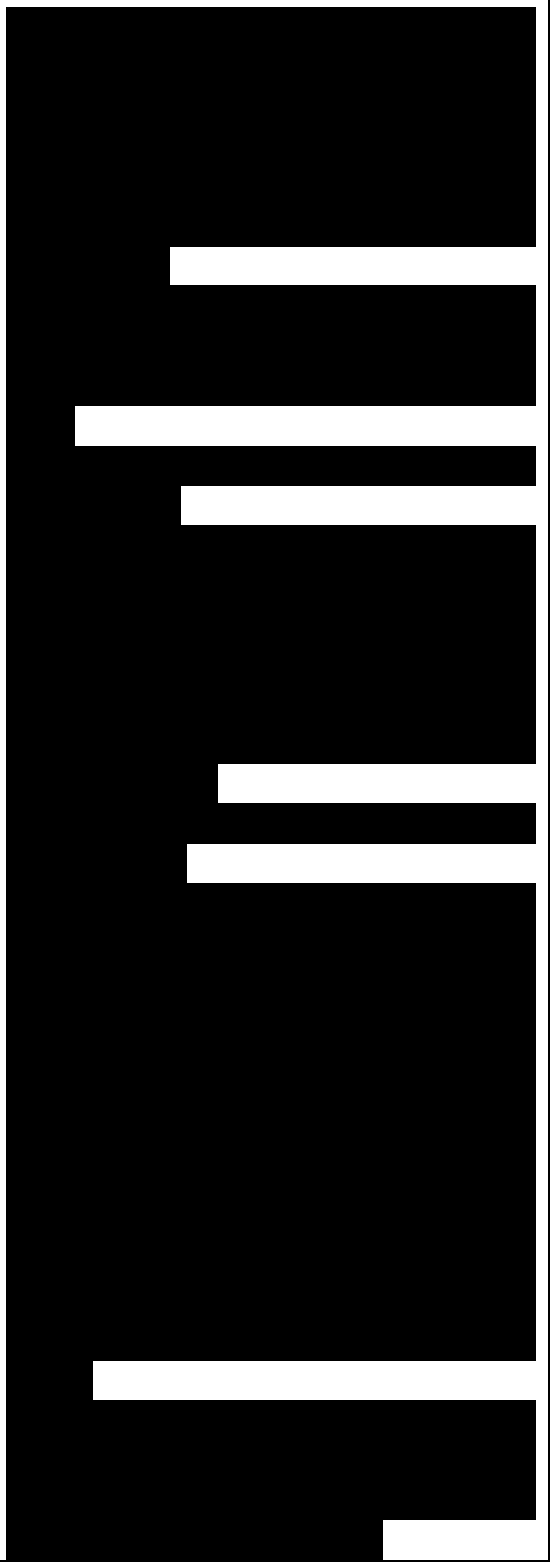
## 5. SIMULATION RESULTS & OBSERVATIONS

The simulation results are shown in the following section in the form of line graphs. Graphs show comparison between the three protocols by varying different number of sources on the basis of the above-mentioned metrics as a function of pause time.

### A. Packet Delivery Ratio(PDR) or Throughput

Fig. 4.1-4.3, shows a comparison a comparison between the routing protocols on the basis of packet delivery ratio as a function of pause time and using different number of traffic sources. Throughput describes the loss rate as seen by the transport layer. It reflects the completeness and accuracy of the routing protocol. According to the graphs, it is clear that throughput decrease with increase in mobility. As the packet drop at such a high load traffic is much high.

The given graph shows that CBRP and DSR performs better in delivering packets which is 90% and 88% but AODV shows an average PDR equals



to 80% .

## 5. CONCLUSION

This study was conducted to evaluate the performance between the three MANET routing protocols i.e. DSR, AODV and CBRP based on CBR traffic. These routing protocols were compared in terms of Packet delivery ratio, Average routing overhead and Average end-to-end delay when subjected to change in pause time and varying no. of nodes. Various algorithms developed by researchers cannot competing the requirement of mobile adhoc networks. Simulation results show that by comparing the performance between DSR, AODV and CBRP, we can conclude that a cluster structure bring scalability and routing efficiency for a MANET as the network traffic load or network size increases. A more stable cluster structure brings efficiency in route discovery and maintenance whereas a less overlapping cluster structure brings efficiency in routing overheads reduction.