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Performance Improvement of GRP Routing Protocol in MANET for UDP Traffic Load

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Abstract: Mobile Ad Hoc Networks (MANETs) are dynamic, infrastructure-less networks where efficient routing is essential for reliable communication. This network used in various areas like medical, education military etc. In MANET number of routing protocols works for reliable and effective communication. Therefore, we perform experiment and study for different routing protocols. In this work we have taken GRP, AODV, DSDV and OLSR routing protocol. The Geography Routing Protocol (GRP) is a hybrid and location based routing protocol that integrates the advantages of proactive DSDV, reactive AODV routing strategies to achieve faster data transmission and lower control overhead. However, its performance can degrade under varying traffic loads. This paper proposed an adaptive enhancement to the GRP routing protocol that dynamically adjusts location of nodes according to network traffic conditions to optimize packet forwarding and reduce routing overhead. The Performance evaluation is carried out using the NS-3 simulator under different traffic of UDP application.

Keywords: *MANET, GRP, DSDV, OLSR, AODV, DSR, PDR, NS-3 Simulator.*

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I. INTRODUCTION

A Mobile Ad-hoc Network (MANET) is a network of mobile nodes that can set itself up and connect to each other wirelessly without help of any fixed infrastructure or centralized administration. In this network, each node acts as both a host and a router, sending packets from one node to another so that they can communicate to each other even when they are not in direct wireless range. Because wireless interfaces have a limited range for sending data, it usually happens over several hops. Ad hoc networks are good for number of area like military operations, disaster recovery, agriculture, education, and mobile conferencing because they are flexible, easy to set up, and don't need any infrastructure[1][8].

Traffic load in MANETs is the amount of data that is sent over the network in a certain amount of time. Heavy traffic, like that caused by video conferencing and voice transmission, can have a big impact on network performance, causing congestion and packet loss. So, for reliable end-to-end communication, it's important to have good routing systems [3]. To solve these problems, hybrid routing protocols have been made that use the best parts of both proactive (table-driven) and reactive (on-demand) methods. In this paper, a modification on GRP is presented. The Geographic Routing Protocol (GRP) is one example. It uses the location information of nearby nodes to send packets quickly to their destination without the need for routing tables. In the GRP routing protocol that some parameter is dynamically adjusts according to the location of nodes.

II. MANET ROUTING PROTOCOLS

- *DSDV Protocol*

Destination-Sequenced Distance Vector (DSDV) is a proactive, table-driven routing protocol in MANETs that uses the most popular graph Bellman-Ford algorithm. It has important changes to stop routing loops and speed up convergence time [4].

Every node maintain routing table that identified every location and can reach the number of hops required to get its neighbors. The destination node generates a sequence number for each route entry. This prevents loops from forming and aids nodes in locating previous routes. Every node in a dynamic topology updates the routing table often or if there are significant topological changes. By keeping track of the time gap between the first and best route advertisements, DSDV delays broadcasting unstable routes.

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This reduces unnecessary control traffic. The route with the superior metric is selected when two routes to a destination have identical sequence number. DSDV helps mobile ad hoc networks route more stably by controlling the timing of updates and the order in which they happen. It does this by reducing routing loops, route fluctuations, and overhead [7].

- *AODV Protocol*

AODV is a source initiated on-demand (Reactive) routing protocol with less delay that determines the route when it's needed. If a source wants to begin communication with another node as target in the network then AODV use control messages to find a route to the target node in the network. Although this protocol was primarily designed for the wireless realm, it can function on both wired and wireless media. In this protocol routing table contains address of neighbor node and sequence number of destination node. It finds path using a Route Request Query (RREQ)/ Route Reply Query (RREP) massage [6][13].

- *OLSR Protocol*

This is a proactive, table-driven routing protocol, Means that it always keeps updated route information therefore routes are prepared to depart whenever data requests to be sent. There is no delay in forwarding packets at first because the routes are already known. One of the most essential features of OLSR is its use of Multipoint Relays (MPRs), which are a set of nodes that are in incriminate of transmitting broadcast messages throughout the flooding process. It reduces the network overhead and improves the efficiency form traditional flooding by using through every node rebroadcast packets [7].

- *GRP Protocol*

The Geographic Routing Protocol (GRP) is a mixed MANET routing method that uses both proactive and reactive methods to send data quickly with little control overhead. In this protocol, the initial source node first gets information about the network by sending petite control messages. The GRP method uses the geographical position of nodes instead of their network addresses. In this routing technique each node sends self geographic coordinates to its nearby nodes, and the source node knows destination node location. Routing decisions are prepared by considering at the positions of nearby nodes, without using routing tables.[14]

Greedy forwarding is frequently used in this routing to route packets geographically. With this approach, packets are always routed to the node closest to the destination. When local minima prevent greedy forwarding from working, the protocol switches to routing, this ensures that the path can be recovered by traversing a planar graph method. Geographic routing works well, is simple to use, and can manage a large number of node. The state of the nodes is dependents on the number of nodes in the network.[15]

Including UDP traffic load awareness along the time of routing decisions can help optimize in the Geographic Routing Protocol (GRP). Nodes can probe the degree of congestion and route packets through less congested neighbors reducing packet loss and transmission delay. This mechanism allows for adaptation of delivery based on modeled reactions, improving efficiency and stability. GRP, on the other hand, balances traffic dynamically and becomes much more reliable and efficient in highly mobile and constantly changing network environments.

III. LITERATURE REVIEW

In this section a brief overview performance, characteristics and different issued of implementation of various MANET routing protocol is presented.

V. Verma et. al[14] Implemented the GRP Routing Protocol in MANET. They evaluated the performance of the MANET network with Geographical Multicast routing Protocol. They also found that GRP Routing Protocol with bit rate 90bits/sec gives better results.

L. Shrivastava et al.[15] presented the performance comparison of the reactive Protocols and proactive protocols for varying traffic load in mobile ad hoc networks (MANETs) in NS2 simulator. They found that reactive protocols perform better than proactive protocols.

B.Jain et. al [16] presented the study characteristics and application issues on MANETs routing protocols. In this paper they presented the communication overloaded through dynamitic nature of node direction. They also give study of geographical routing challenges which can increases the overhead.

R. Kaur et. al [17] presented the intelligent model that extends the operational lifecycle of IoT-driven MANETs by minimizing the overall network energy consumption. They proposed a prediction-based route repair approach that offers a solution to identify link failures before their occurrence and allows the network to tackle them in advance.

V. Verma et. al[18] gives the study of GRP routing protocols for mobile ad hoc network with centralized system that checked to know the performance of the network. They also study of the change in the performance of the network if they deploy centralized system in MANET. Their results shows GRP protocol had give better performance in the term centralized system than MANET. The same result also holds good for other networking applications.

H. Singh et.al [19] presented the performance evaluation of commonly used reactive AODV protocol with hybrid GRP routing algorithm under varying node density conditions in terms of QoS using OPNET Modeler 17.5 academic. They observed for random behavior of these protocols using application-oriented metrics such as Delay, Network load, PDR, Normalized Routing Load. Hybrid GRP outperforms Reactive AODV Routing Protocol in terms of Delay, network load, packet delivery ratio under high data rates of IEEE 802.11n standard.

Karthikeyan et al. [4] examined the Reactive protocols, DSR and AODV, alongside a Proactive Protocol, DSDV, analyzing their characteristics in relation to varying mobility.

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They performed the simulation in NS2 amd results has been computed on packet delivery fraction, routing load, end-to-end delay, packet loss, throughput, and jitte. They found that OLSR give better than others in both delay and throughput.

In this work we are trying to implement GRP routing protocols for effective communication on UDP traffic loads.

IV. EXPERIMENTAL SETUP

In this paper, we used the NS3.34 simulation tool. which is a full system simulator. NS3 is an open-source simulation tool for discrete events which is widely used in research and education. It supports Python scripts and is developed in C++ [13]. The effectiveness of MANET routing protocols is assessed through simulation and measurement. This work makes use of the accurate, timely, and economical simulation tool NS3.34. The Network Simulator (NS-3.34) simulator is used for the experimental work. The initial step in our experiment is to develop a cpp file for MANET routing protocols and implements and configure the GRP protocol in NS3.34 simulator.

The parameters are shown in table 1.

Table 1 Simulation Parameters

Parameter	Values
Protocols	GRP, AODV, DSDV, OLSR
No. of Nodes	10, 20, 30, 40, 50
Simulation Time	500 sec.
Mobility Model	Random Way Point mobility
Application	UDP Application
Packet Size	64 Byte to 1024 Byte
Network Area	500 x 500
Maximum Speed	10 m/sec

V. PERFORMANCES PARAMETER

Here we described the performances parameter which is use for GRP traffic load analyses are

- Throughput: It is the data packet is delivered successfully from one node to another over a communication network. It is measured in bit/sec.

T= (D p * P s) /T d.

T = Average Throughput.

Dp =Number of Delivered packets.

Ps =Packet Size.

Td= Total time of communication.

With the help of this formula, we calculate the average throughput of network communication.

- End-to-End Delay: This assesses the ability of the routing protocols in terms of use- efficiency of the network resources.

The end-to-end delay is the time needed to traverse from the source node to the destination node in a network.

- *PDR (Packet Delivery Ratio):*

The Packet Delivery Ratio (PDR) is the number of packets that the destination successfully received compared to the total number of packets that the source sent. The calculation formula of Packet Loss ratio and Packet Dropped given below:

Packet Loss Ratio = (Total received packet / Total sent packet) *100

Packet Dropped = Total sent packet – Total received packet

VI. RESULT AND DISCUSSION

Simulation results are the cumulative of the result obtains after running same parameter 5 times for each scenario. Here we are compared the result of AODV, OLSR, DSDV and enhanced GRP protocol. Simulation results are obtained for UDP traffic load in various parameters such as PDR, Throughput, End to End Delay and packet Drops. Here we present the graphs of these parameters and analysis the performance of MANET.

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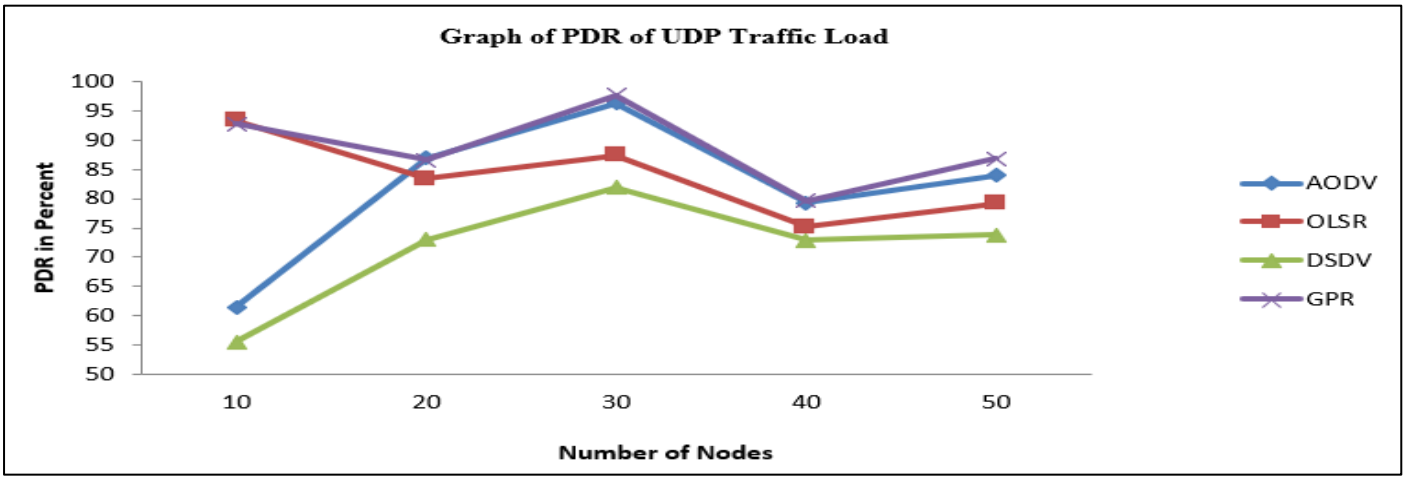

Fig 1 Graph of PDR of UDP Traffic Load in MANET

The figure 1 is the packet delivery ratio for UDP application on MANET for AODV, OLSR, DSDV and GRP protocols. This metric shows how well data is sent over the network. Form this PDR graph we observed that GRP and OLSR protocol gives the better data transfer ratio as compared with other.

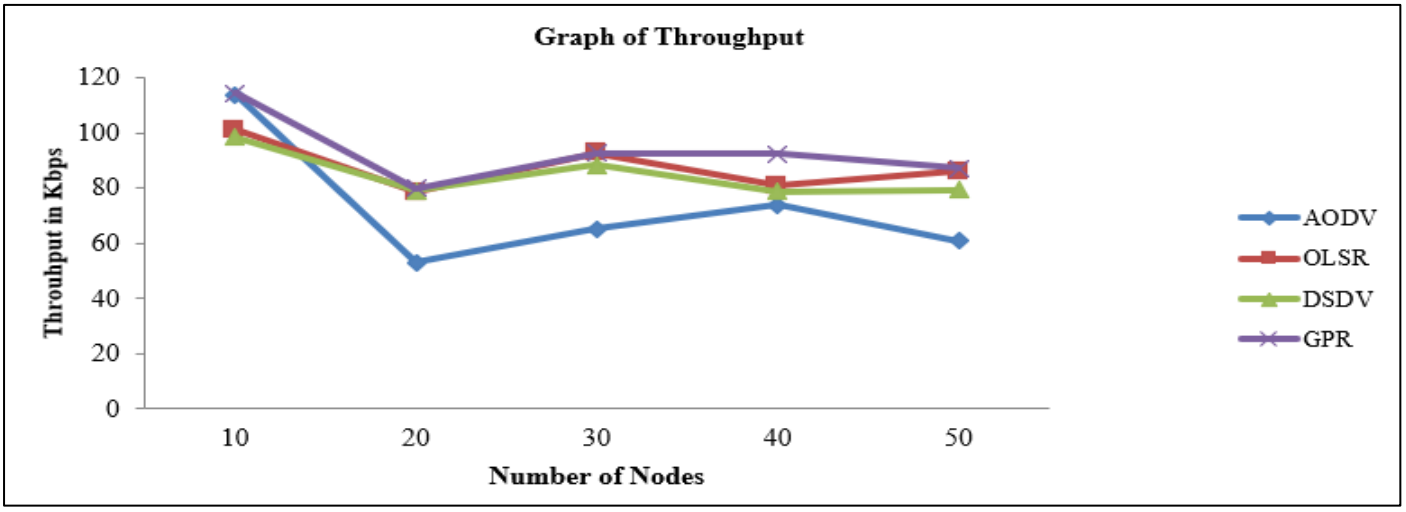

Fig 2 Graph of Throughput of UDP Traffic Load in MANET

The figure 2 is the throughput for UDP application on MANET for AODV, OLSR, DSDV and GRP protocols. Form this throughput graph we observed that GRP and OLSR protocol gives the better data transfer rate compared with other.

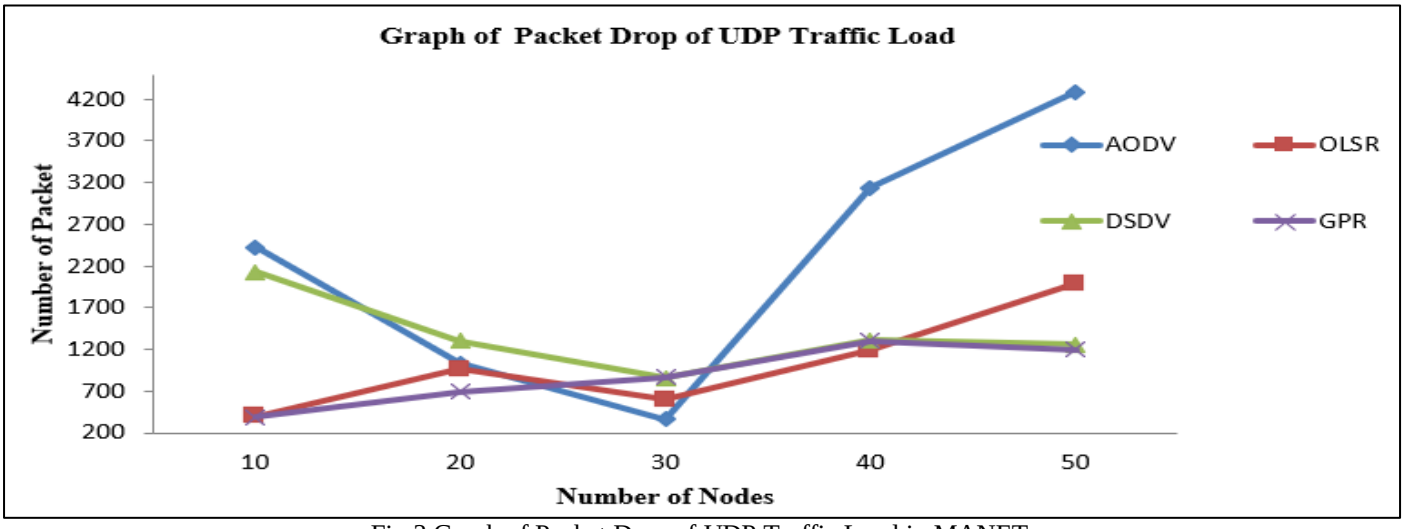

Fig 3 Graph of Packet Drop of UDP Traffic Load in MANET

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The figure 3 is the packet drop for UDP application on MANET for AODV, OLSR, DSDV and GRP protocols. Form this packet drop graph we observed that GRP and OLSR protocol gives the less number of data loss as compared with other.

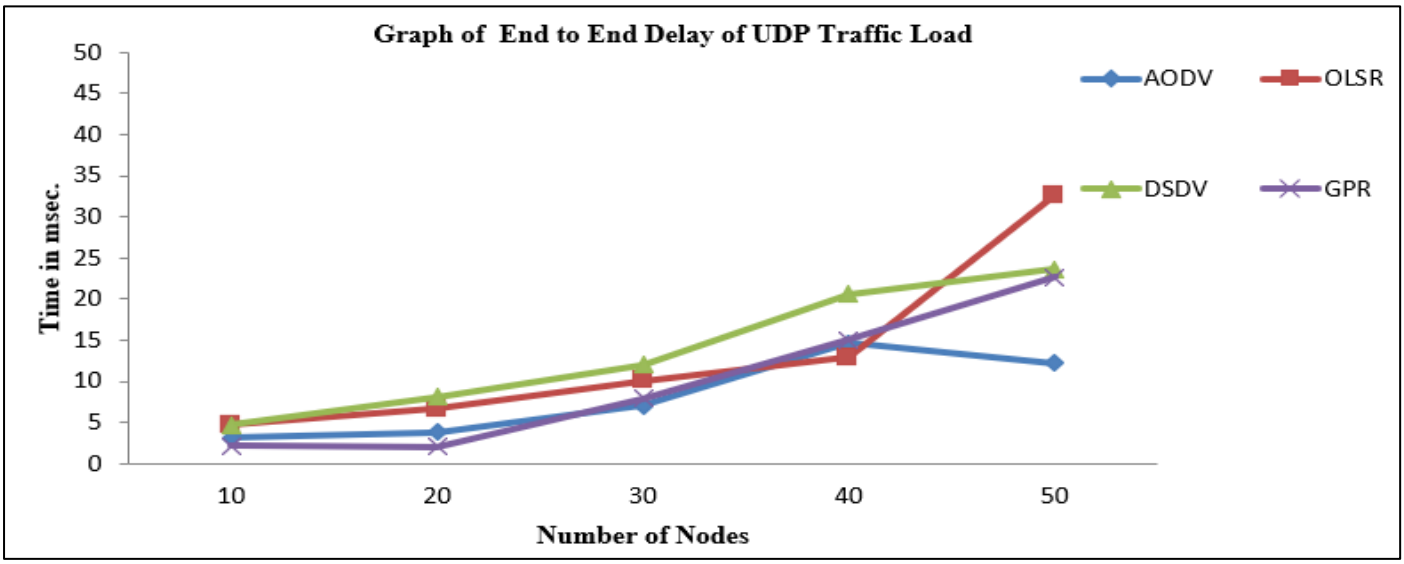

Fig 4 Graph of End-to-End Delay UDP Traffic Load in MANET

The figure 4 is the end to end delay for UDP application on MANET for AODV, OLSR, DSDV and GRP protocols. Form this packet drop graph we observed that GRP and AODV protocol gives the minimum delay to transfer data as compared with other.

VII. CONCLUSION

In this paper we have presented an enhancement GRP routing protocol for UDP traffic load on mobile adhoc network. This routing protocol dynamically adjusts location of nodes according to network traffic conditions to optimize packet forwarding and reduce routing overhead. Therefore, results show that the GRP achieves higher Packet Delivery Ratio (PDR), reduced Average End-to-End Delay, and improved Throughput compared to others. Similarly OLSR and AODV are also giving the better performance. The findings confirm that adaptive routing optimization significantly improves network performance on MANET environments. In future the energy and optimum performance achieved through intelligent GRP protocol. This works is also extends for different workload, applications and communication channels.

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