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Performance Analysis Of Qos For Different MANET Routing Protocols (Reactive, Proactive And Hybrid) Based On Type Of Data

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ABSTRACT
MANET (Mobile Ad-hoc Network) is a self-organizing network without the need of any centralized base station. On the other hand, Mobile Ad hoc Networking (MANET) has occupied large space in the world today and a huge number of protocols have been developed. Moreover, MANET is comprised of mobile nodes that exchange data dynamically among them over wireless links. The most significant element of MANET is the Routing Protocols required to control dynamic communication. They are also used to find route for the delivery of data packets to the correct destination. This paper evaluates the performance of various ad-hoc routing protocols such as Optimized Link State Routing Protocol (OLSR) in Proactive Routing Protocols, On-demand Distance Vector (AODV) in Reactive Routing Protocols and Gathering-based Routing Protocol (GRP) in Hybrid Routing Protocols while considering different types of data and provides better performance compared to all the above protocols.
KEYWORDS: MANET, Proactive; Reactive; Hybrid; Type of Data; Routing Protocols

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I. INTRODUCTION

Wireless networks are the networks which do not use any wired link to establish connection between nodes. They are classified into two types viz. infrastructured networks and infrastructure less or Ad-hoc networks. The infrastructured wireless networks uses access points to control the entire communication in the network while the infrastructure less wireless networks (MANETs for short) have no access points [1]. Mobile ad hoc network has been developed from ad hoc wireless networks that assure numerous advantages such as mobility, scalable system, self-healing and self-configuration. So, they have been appropriate for mobile applications, tactical communications, communications after disasters, and health monitoring for patients. [2]

Besides, in Mobile Ad-hoc Networks, mobile nodes can be connected with each other without the need of any dynamic infrastructure and can perform all tasks such as route discovery, connection setting up and information exchange between source and destination [3]. MANETs are, thus, able to create direct connection between source and destination. In case there is no direct connection between the source and the destination, they employ multihop technique that makes packets go over several hops to get to their destination [4]. And due to the fact that the MANET nodes are movable, the path will be changeable and the connection between the nodes unstable. The availability of stable and constant path routing in MANETs is, therefore, of great importance. Several solutions have been suggested for the routing issues in ad hoc networks [4].

In addition, MANETs can work even if there are changes in the network topology both in time and space. They need no infrastructure or centralized management to organize their operation. Hence, the nodes in MANETs are hosts as well as routers [5]. Every node which is a part of the network has to be inside the range of the other nodes presently connected in the network. As shown in Figure 1 below, the node A is inside the scope of the node B that is already a part of the MANET (represented by the B, C, D, E nodes) and it becomes a part of the network. They, therefore, can connect with each other. If the node E is outside the scope of the node A and there is a need to transfer data, then the communication will be done via the B, C and D nodes [5].

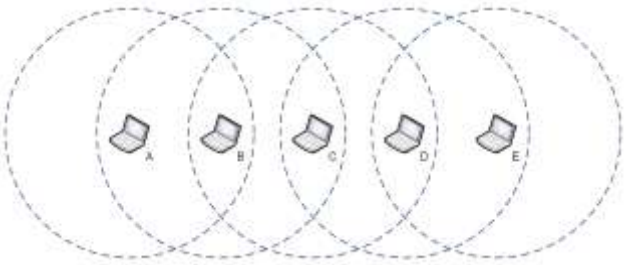

Figure 1: Mobile Ad Hoc Network

II. ROUTING

Routing can be defined as the process of transmitting data over a network from a source to a destination. No less than one intermediate node is come across all along the path. The role of the routing protocols is to employ routing algorithms. Besides, there are two other basic roles of the routing protocols: the first is choosing routes for different source destinations as well as the delivery of messages to their exact destinations, and the second is employing several protocols and data structures (routing tables) directly [1]

III. ROUTING PROTOCOLS IN MANETS

The routing in MANETs are classified into three routing protocols: proactive, reactive and hybrid . This classification of the routing protocols is based on their task [6]. Figure 2 below illustrates the classification.

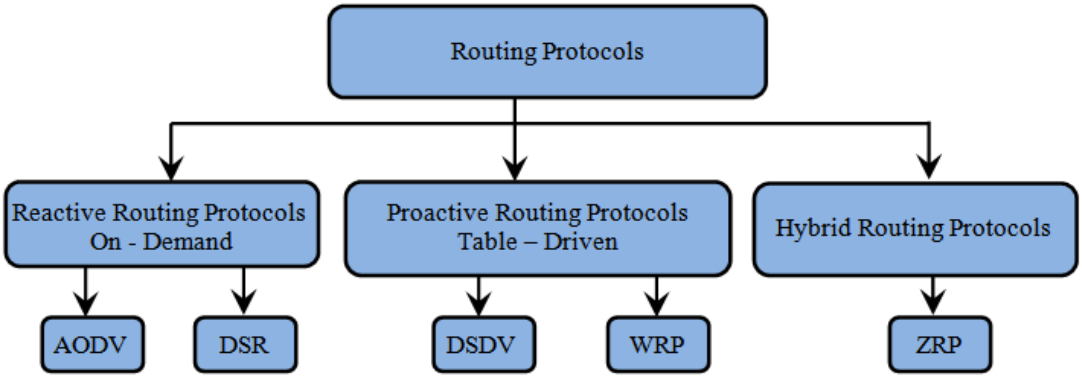

Figure 2: MANET routing protocol classification.

3.1 Proactive Routing Protocol

This kind of routing has been used in Optimized Link State Routing. It has been known as the table driven routing method. Here, the routing table is always up-to-date. The proactive routing protocol in MANETs is a customized version of Bell-men ford algorithm [7].
Example:
Optimized Link State Routing Protocol (OLSR) and Destination Sequenced Distanced Vector Routing Protocol (DSDV).

OLSR-(Optimized Link State Routing Protocol):

OLSR (Optimized Link State Routing Protocol) is a proactive routing protocol designed for mobile ad hoc networks. It frequently transmits data over the topology of the network to find out the routing tables. While the AODV generates the routing tables which are on request, the uniqueness of OLSR lies in the idea of multipoint relays (MPR Multipoint Relay) that enables it to organize the links among the mobiles via special packages, the 'Hello'. It manages the crowded networks by saving most of the band-width of the network. The importance of OLSR is that it can be adapted entirely to the Internet protocols and this feature provides every mobile the topology of the network at any time [8].

3.2 Reactive Routing Protocol

Reactive routing protocol can be defined as an on-demand routing protocol. In this type the routing table will be refreshed just each time a node sends a packet to another node. Here, the reactive routing protocol keeps the route constantly. Thus, this protocol is widely applied in Dynamic Source routing protocol(DSR) as well as the Ad hoc On-demand Distance Vector routing protocol(AODV) [7].

Ad-hoc On-Demand Distance Vector routing protocol (AODV)
AODV is a reactive routing protocol designed to be utilized when required. It has been described as a flat routing protocol because it needs no central administrative system in routing process. It can find out the route to the destination once a node needs to send data via route request (RREQ) packet from the source. In case an active route to the destination is available, a message with route reply (RREP) packet will be broadcasted by the receiver. The advantage of AODV routing is that it can simply adjust the connection state, yet, at the same time, it will go through much delay throughout the route operation as well as consume more bandwidth as the network size increases [2].

3.1 Hybrid Routing Protocol
Hybrid routing is a combination of both proactive and reactive routing protocols. Hybrid routing is specially used to provide hierarchical routing[7].
Some examples of Hybrid Routing Protocols include Zone Routing Protocol (ZRP) and Gathering-Based Routing Protocol (GRP).

Gathering-Based Routing Protocol (GRP)
GRP has the privileges of Proactive Routing Protocol (PRP) as well as of Reactive Routing protocol (RRP). The role of GRP for mobile ad hoc network is collecting network data fast at a source node without using a vast range of overheads. It provides an effective framework that is able to employ the powers of Proactive routing protocol (PRP) and reactive routing protocol (RRP) all together. PRP can be appropriate for sustaining the interruption important data such as voice and video. However, it will use up a massive size of the network power. Whereas RRP can be inappropriate for real-time communication. It has a distinguished characteristic that it is able to decrease routing overhead as soon as a network is somewhat static and the dynamic transfer is light.
On the other hand, the source node will remain awaiting a route to the destination is detected, and this will augment the reply period. The source node is able to provide capable routes based on the saved data, thus constantly broadcasting data packets although the present route is disconnected. This leads to attain rapid packet transfer delay without excessively compromising on control overhead performance.

IV. SIMULATION ENVIRONMENT

The simulations in this case have been carried out for different types of data (FTP, HTTP, DB, Voice, Email, and different resolution of Video) for three MANET routing protocols (AODV, OLSR and GRP). All simulations are for IEEE 802.11g WLAN Standard. The main goal of our simulation is to model the behavior of the routing protocols. Table 1 presents different parameters used in our simulation.

Table 1: Simulation Parameter

Simulation Parameter	Value
Simulator	OPNET Modeler 14.5
Area	1000*1000 (m)
Network Size	25 nodes
Mobility Model	Random way point
Traffic Type	FTP, E-Mail, HTTP, BD, Voice, Video.
Simulation Time	600 sec
Address Mode	IPV4
Standard	IEEE 802.11g, 54Mb/s
Routing Protocols	AODV, OLSR, GRP

V. SIMULATION RESULTS AND DISCUSSION

Twenty four scenarios were planned for the purpose of simulation. These scenarios were executed and the stimulation results gained had been analyzed on the basis of different kinds of nodes in order to probe the comparative studies amongst three major protocols in MANET namely (AODV, OLSR, and GRP) in parts of QoS matrices as follows:

5.1 Throughput
Figure 3 shows the average Throughput in different routing protocols like AODV, OLSR and GRP while considering different types of data. As it is seen from Figure 3, AODV is better than other routing protocols for small data rate such as FTP, VOICE, HTTP, E-MAIL expected for video data. So, GRP is the best for video streaming than the others.

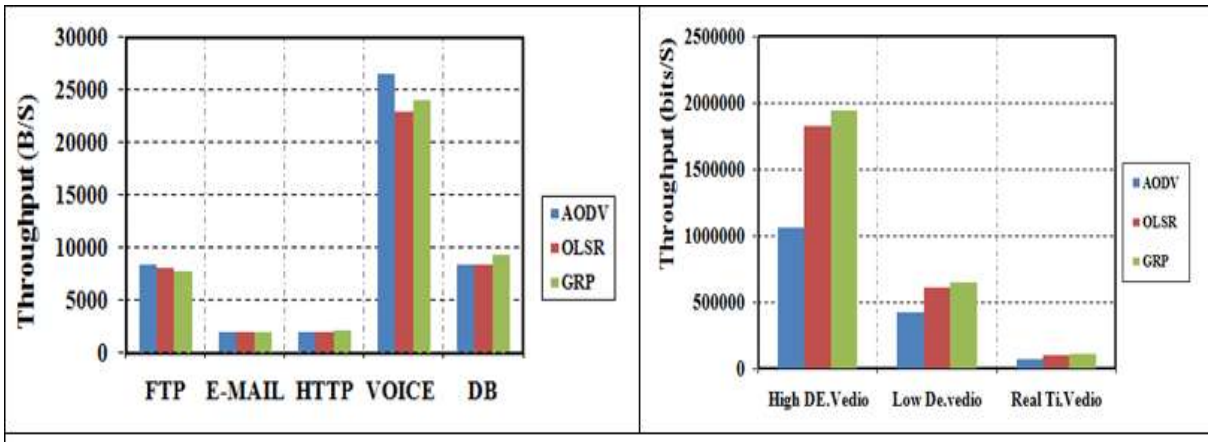

Figure 3: Throughput Vs Type of Data

5.2 Load

Average load with varying types of data under different MENET routing protocols is presented in Figure 4. As can be seen from Figure 4, AODV is better than other routing protocols while considering different data types including voice and video streaming

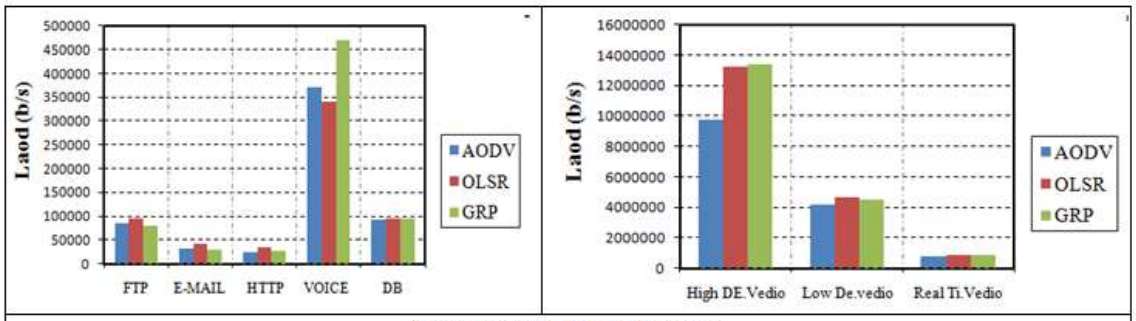

Figure 4: Load Vs Type of Data

5.3 Delay

End-2-End delay has been depicted in Figure 5. As to author's knowledge, zero E2E delay means it is better. So, from Figure 5, it seems that OLSR is better in terms of FTP, EMAIL, HTTP, and DB. Whereas, AODV is the best when using voice and video streaming (large data).

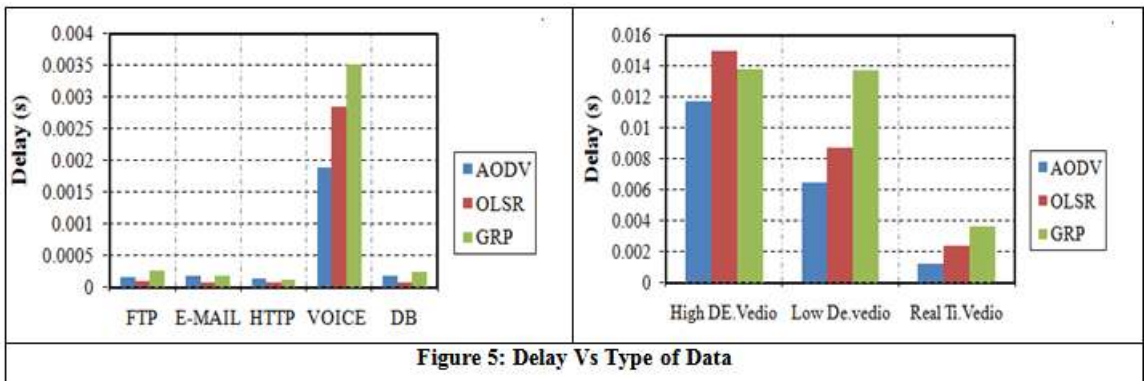

Figure 5: Delay Vs Type of Data

5.4 Data Dropped Retry

As can be seen from Figure 6, the Data Dropped Retry of AODV protocol is the lowest than others. Therefore, AODV protocol is the best.

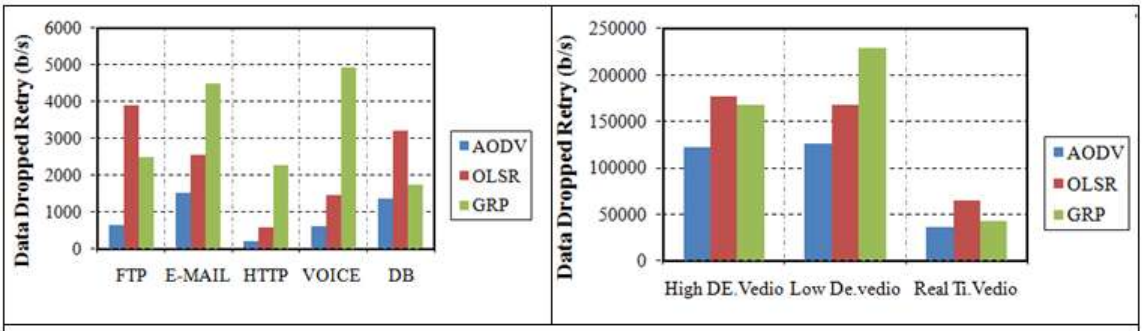

Figure 6: Data Dropped Retry Vs Type of Data

5.5 Data Dropped

As shown in Figure 7, it is clear that there are no data dropped for all routing protocols (AODV, OLSR, and GRP) when using small data like (FTP, EMAIL, DB, and HTTP). However, it seems that AODV is the best when large data is used.

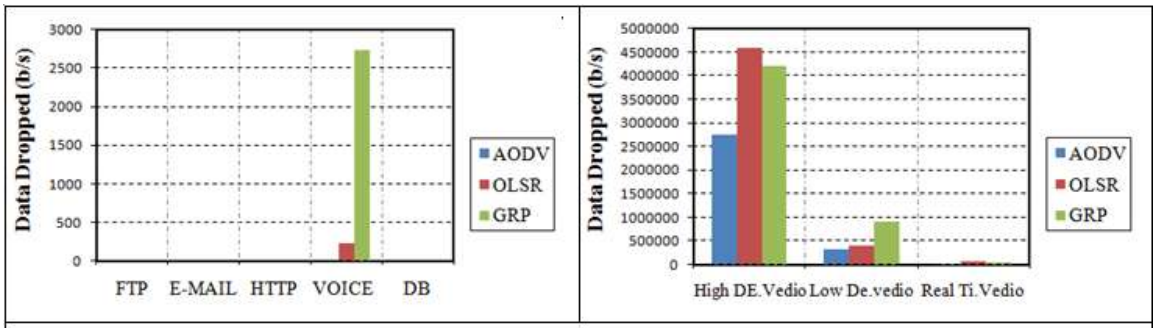

Figure 7: Data Dropped Vs Type of Data

5.6 Retransmission Attempts

The average Retransmission Attempts with varying data types have been shown in Figure 8. It is clear from the Figure 8, that AODV routing protocols have lower Retransmission Attempts than others protocols.

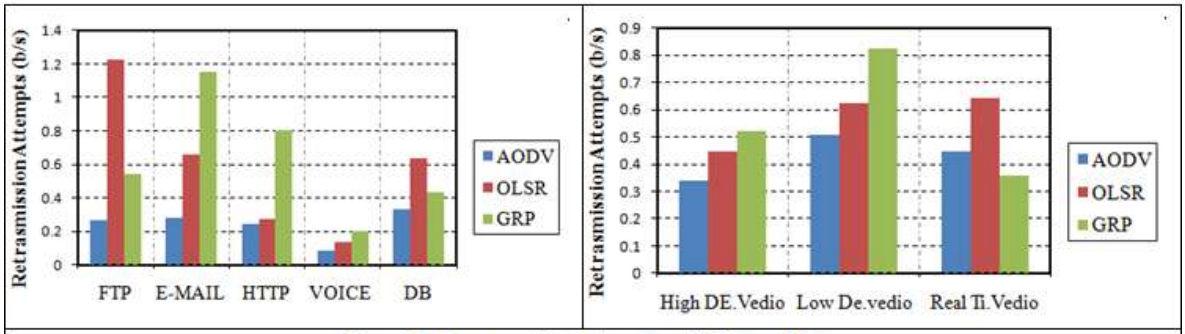

Figure 8: Retransmission Attempts Vs Type of Data

5.7 Media access Delay

It is obvious from the Figure 9 that AODV is better than others in terms of Media Access Delay while using large data types as voice and video streaming.

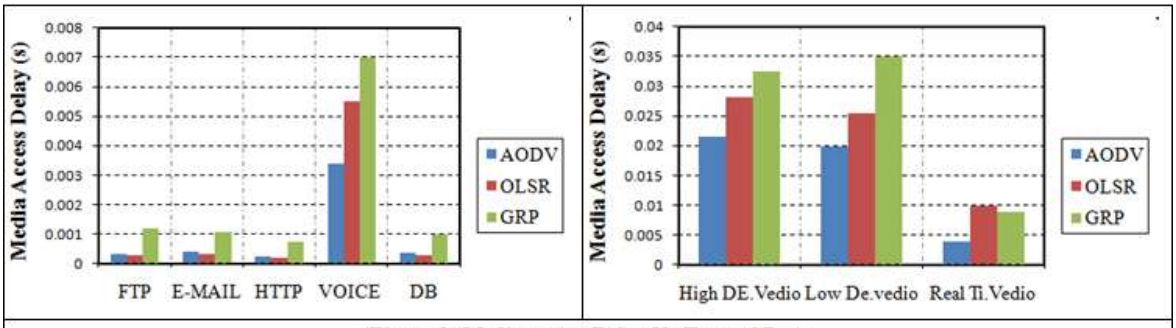

Figure 9: Media access Delay Vs Type of Data

5.8 Routing Traffic Send

As can be viewed from Figure 10, GRP Routing protocol is best than others in terms of Routing Traffic Send.

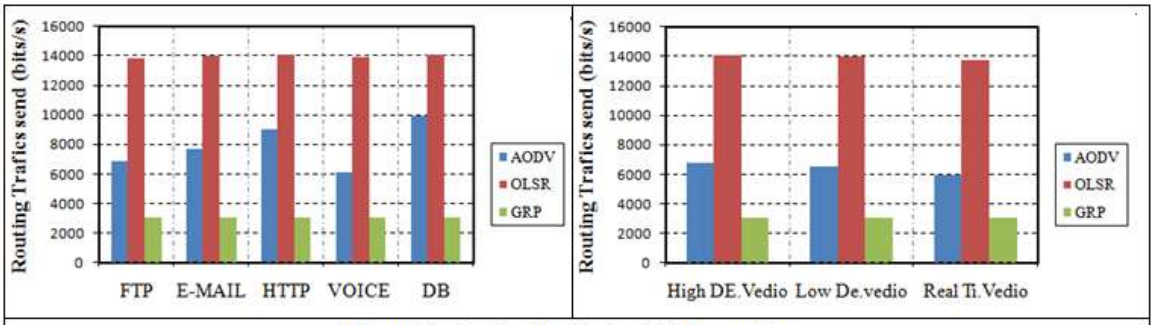

Figure 10: Routing Traffic Send Vs Type of Data

5.9 Packet Delivery Ratio (PDR)

From Figure 11, it is apparent that AODV routing protocol is better than other protocols in terms of packet delivery ratio (PDR).

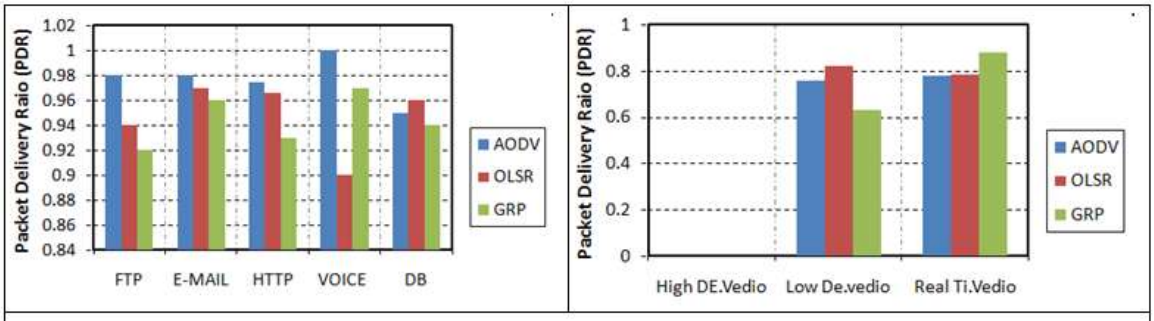

Figure 11: Packet Delivery Ratio (PDR) Vs Type of Data

VI. CONCLUSION

A comparative study for different MANET routing protocols like AODV, OLSR and GRP has been designed and implemented in this paper for evaluating and analyzing different QoS metrics such as Media Access Delay, Network Load, Throughput and Retransmission Attempts, etc. while considering two cases such as: increasing number of nodes and different data types. As a result, we found out that AODV performs well in each case in terms of throughput, data dropped retry, retransmission attempts, and packet delivery ratio. However, the GRP protocol has been seen better in parts of load, and routing traffic send. Therefore, we can conclude that under different environments, every protocol behaves differently because there are many parameters which differ under varied situations. So, according to our simulation, results show that AODV is better than the other protocols.

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