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Real Time Based QoS Analysis in MANET

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Abstract*— A mobile Ad hoc network (MANET) is a set of wireless mobile nodes that can communicate with each other without using any fixed infrastructure. It is also necessary for MANET devices to communicate in a seamless manner. There are multiple routing protocols that have been developed for MANETS. There is a need to support real time and multimedia applications in MANETs as they gain popularity. This paper focuses on performance investigation of reactive and proactive MANET routing protocols, namely AODV, TORA and OLSR. Therefore, this paper presents a performance comparison of the selected MANET routing protocols in a Real time data (voice) with increasing area and nodes size to investigate mobility and scalability of the routing process.

***Keywords*—MANET, AODV, OLSR, TORA, Mobility, Scalability, OPNET.**

I. Introduction

MOBILE ad hoc networks (MANETs) are made up of mobile devices that use wireless transmission for communication. They can be set up anywhere and at any time because they require neither infrastructure nor central administration. The overall routing protocol types responsible for transmission of packets between different mobile hosts in ad-hoc network falls into three broad categories [1].

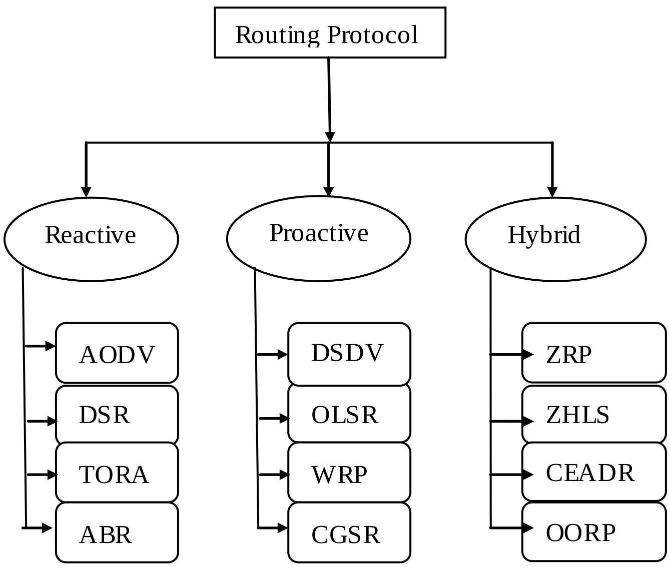

Fig 1.Routing Protocols

All mobile nodes will help each other to forward packets to other mobile nodes in the network that may not be within immediate wireless transmission range of each other. These MANETs are characterized by frequently changing network topology, multihop wireless connectivity, and the need for efficient dynamic routing protocols [1]. Analysing performance of MANET routing protocols. Their study involved comparison of OLSR and AODV [2] and TORA at real time data (voice).

QoS support in MANETs [6] has become a significant area of research. The QoS requirements generally include high bandwidth availability, high packet delivery ratio and low delay rate. This paper presents QoS comparative study results of these three MANET routing protocols in a real time data. This research allows us for better understanding of frameworks that offer the best QoS in terms of performance of AODV, TORA and OLSR.

II. Ad Hoc Routing Protocol

A. AODV (Ad Hoc On-demand Distance-Vector Protocol)

AODV offers low network utilization and uses destination sequence number to ensure loop freedom. It is a reactive protocol implying that it requests a route when needed and it does not maintain routes for those nodes that do not actively participate in a communication. An important feature of AODV is that it uses a destination sequence number, which corresponds to a destination node that was requested by a routing sender node [3]. The destination itself provides the number along with the route it has to take to reach from the request sender node up to the destination. If there are multiple routes from a request sender to a destination, the sender takes the route with a higher sequence number. This ensures that the ad hoc network protocol remains loop-free.

The AODV is a reactive [4] protocol derived from Dynamic Source Routing and DSDV and DSR it combines the advantages of both protocols. Its route discovery procedure is similar to DSR. When a node has a packet to send to a particular destination, if it does not know a valid route, it broadcasts a route request packet, by specifying the destination address. The neighbours without a valid route to the destination establish a reverse route and rebroadcast route request packet. Destination on reception of route request it sends the route reply to the source. The route maintenance is done by exchanging beacon packets at regular intervals. This protocol adapts to highly dynamic topology and provide single route for communication. The major disadvantage is large delay for large networks.

B. *Temporally-Ordered Routing Algorithm (TORA)*

The Temporally-Ordered Routing Algorithm (TORA) is a distributed routing protocol for multihop networks with a unique approach for routing the packets to their destination. TORA is fully distributed, in that routers need only maintain information about adjacent routers (i.e. one hop knowledge) and there is no centralized control. This is essential for all Ad Hoc routing protocols. Like a distance-vector routing approach, TORA maintains state on a per-destination basis. However, it does not continuously execute shortest-path computation and thus the metric used to establish the routing structure does not represent a distance. The destination-oriented nature of the routing structure in TORA supports a mix of reactive and proactive routing on a per-destination basis. During reactive operation, sources initiate the establishment of routes to a given destination on demand. This mode of operation may be advantageous in dynamic networks with relatively sparse traffic patterns since it may not be necessary or desirable to maintain routes between every source/destination pair at all times [3].

The Temporally-Ordered Routing Algorithm (TORA) is a reactive routing protocol that establishes route quickly. TORA possesses the following attributes:

Loop-free routes
Provide minimal routing functionality
Minimize algorithm reaction
Multipath routing

TORA creates a direct acyclic graph with the destination as the head of the graph. It requires IMEP (Internet MANET encapsulation protocol)-guarantees reliable in-order delivery of routing message. Each node keeps a reference value and the height of reference destination. IQuery packets are sent out until on reaches the destination or a node with a route to the destination. This node sends an updates to its neighbours listing its height for that destination. TORA is designed to minimize the communication overhead associated with adapting to network topological changes. The scope of TORA's control messaging is typically localized to a very small set of nodes near a topological change

C. *Optimized Link State Routing Protocol (OLSR)*

This protocol works in collaboration with other nodes through the exchange of topology information. This exchange of information is done periodically. To avoid the broadcast of unnecessary packet re-transmissions, this protocol uses multipoint relays. In a network, a node broadcasts a message periodically to its neighbouring nodes. This is done to compute the multipoint relay set as well as the exchange of information about the neighbourhoods. From the information about the neighbourhood this node calculates the minimum set of one hop relay point that is needed to reach the two hop neighbours and this set is called the Multipoint relay set. OLSR differs from link state protocols in two factors based on the dissemination of routing information. First is by construction i.e. only the multipoint relay nodes of a node A need to forward updates about link state that are issued by A. reduced because it only consists of those neighbours that selected node A as their multipoint relay node. Thus we can conclude that OLSR reduces the Link state protocol. It is used in a network where nodes are densely deployed; the OLSR calculates the shortest path in such networks to an arbitrary destination [7].

In this research we are using simulation software known as OPNET (optimized Network Engineering Tool) Modeler version 14.5. OPNET is very large and powerful software with wide variety of possibilities, Enables the possibility to simulate entire heterogeneous networks with various protocols. The simulation on the performance of routing protocols with increase the mobility and scalability at real time data. Therefore, two simulation scenarios consisting of 25 nodes initially and doubling amount nodes i.e. to 50 is considered. The nodes were randomly placed within certain gap from each other in 2.5*2.5 kilometres campus environment for 25 and 50 nodes respectively. The constant Voice conferencing traffic as generated in the network explicitly i.e. user defined via Application configuration and Profile Configuration. The transmitters and receivers parameter were configured with defining RXGroup in the network. Every node in the network was configured to execute AODV, TORA and OLSR respectively. The simulation time was set to 6 minutes and all the nodes were configured with defined path trajectories for mobility in space. All nodes were configured to move in a path defined in the 'trajectory4_AS' parameter. The trajectory basically defines the path for nodes to move in space in given periodic interval of time [8].

A. *Wireless Parameters*

Wireless LAN MAC Address	Auto Assigned
BSS Identifier	Auto Assigned
Physical Characteristics	Direct sequence

Data Rates	11 Mbps
Channel settings	Auto Assigned
Transmit Power	0.050
Packet Reception Threshold	-95
AP Beacon Interval(sec)	0.02
Maximum Receive Life Time(sec)	1.0
Buffer Size(Bits)	102400000
Large packet Processing	Fragment
HCF	Promoted

B. Voice Application Parameters

Attribute	Value
Scilence Length(sec)	Default
Talk spurt length(sec)	Default
Symbolic Destination Name	Voice destination
Encoder Scheme	GSM FR
Voice frames Per Packets	1
Types Of services	Best Effort(0)
Traffic Mix(%)	All Discrete
Compression Delay(sec)	0.02
Decompression Delay(sec)	0.02

C. Routing Protocol Parameters

a. AODV Parameters

Route Request Retry	7
Route Request Rate Limit(Pkts/sec)	11
Gratuitous Route Reply Flag	Enabled
Active route time out	32
Hello Interval(sec)	Uniform(10.2,10.5)
Allowed hello Loss	2
Net Diameter	40
Node traversal Time(sec)	.04
Route Error Rate Limit(Pkts/sec)	10
Time Out Buffer	3
Addressing Moda	IPv4

b. TORA /IMEP Parameters

Mode of Operation	On demand
OPT transmit intervals(sec)	300
IP Packet Discard Time Out(sec)	10
Beacon Periods(sec)	5
Max Beacon Timer(Sec)	11
Max Tries	5 attempts
Max IMEP Packets length(bytes)	1500

c. OLSR Parameters

Willingness	Willingness Always
Hello Interval(sec)	4
TC Interval(sec)	7
Neighbour Hold Time(sec)	8
Topology Hold Time(sec)	20
Addressing Mode	IPv4

III. Results and Analysis

A. Media Access Delay

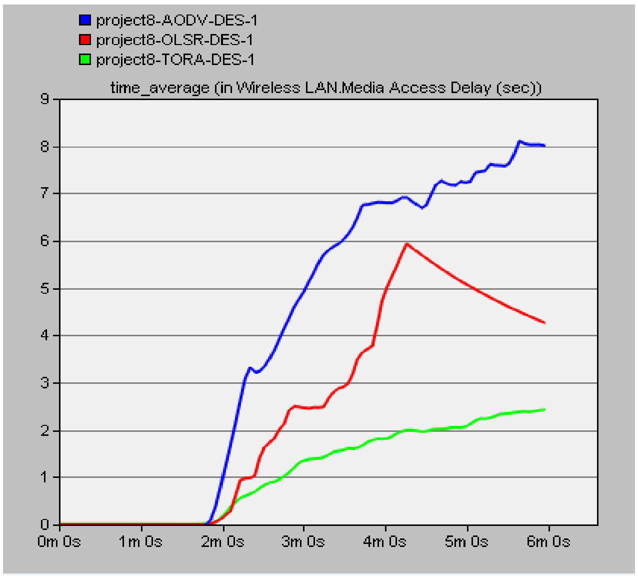

Fig 2.Media Access Delay (for 25 nodes)

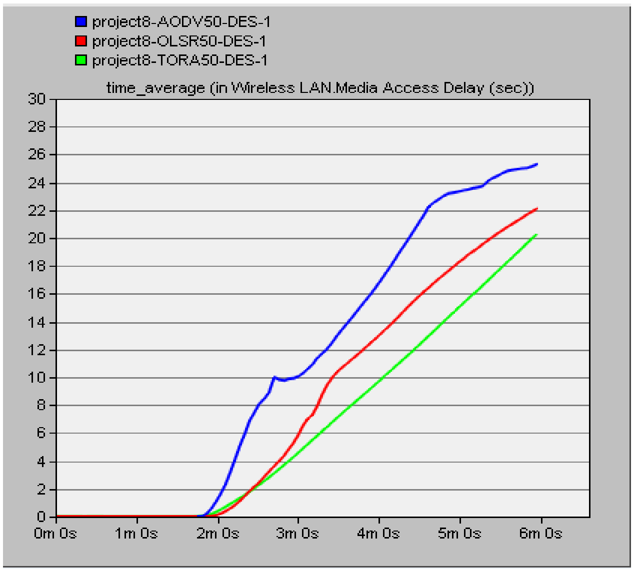

Fig 3.Media Access Delay (for 50 nodes)

In Fig. 2 and 3 we have taken 25 and 50 client node and using with real time data (voice) and compare the routing protocol. In which the AODV shows the media access delay due to the process of reinitializing the route flooding process every time while discovering new routes and determining the changes in the topology. AODV broadcasts RREQ messages in order to maintain smaller cache memory.

B. *Network Load*

Network load represents the total load in bit/sec submitted to wireless LAN layers by all higher layers in all WLAN nodes of the network. When there is more traffic coming into the network, it is difficult for the network to handle all this traffic, it is called the network load. An efficient network can easily cope with large traffic coming in, and to make the best possible network.

From the figure 4, it is observed that mobility for all three protocol AODV TORA and OLSR, AODV has higher network load(bits/sec) due to the fewer routing information packets kept in its cache. The graph is taken in time average wireless LAN network load (bits/sec).

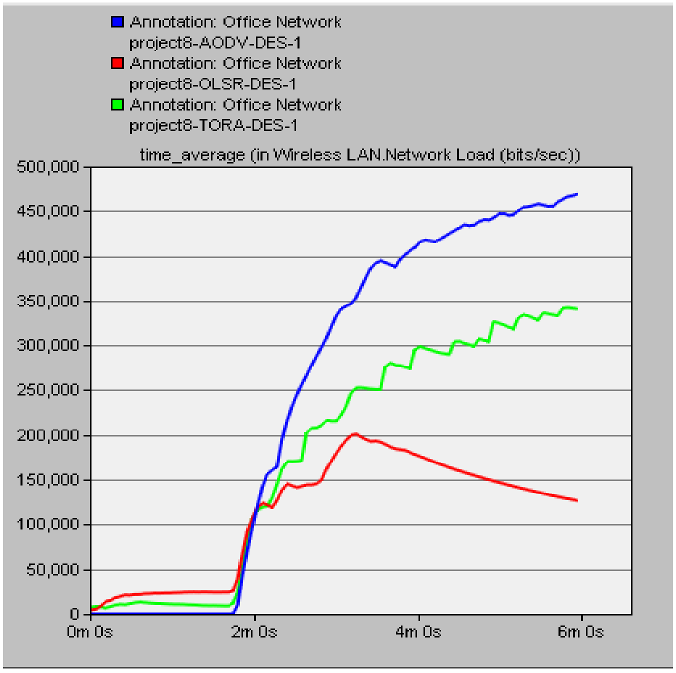

Fig 4.Network Load (for 25 nodes)

Therefore, the frequent transmission of RREQ and RREP messages results in generation of higher communication overhead. This uses the bandwidth available and increases the routing load within the network. On the other hand, TORA limits the communication overhead to the node area in order to increase the bandwidth utilisation. In addition, due to the link reverse algorithm employed within TORA, link failures are localised to certain area of the topology which in return improves the performance of the network. From figure 5when we increase the clients nodes and check the overall performance then the highest network load is in the AODV and the lowest network Load for the OLSR l then we find the maximum network load is in the AODV.ie scalability is performed after increasing the nodes.

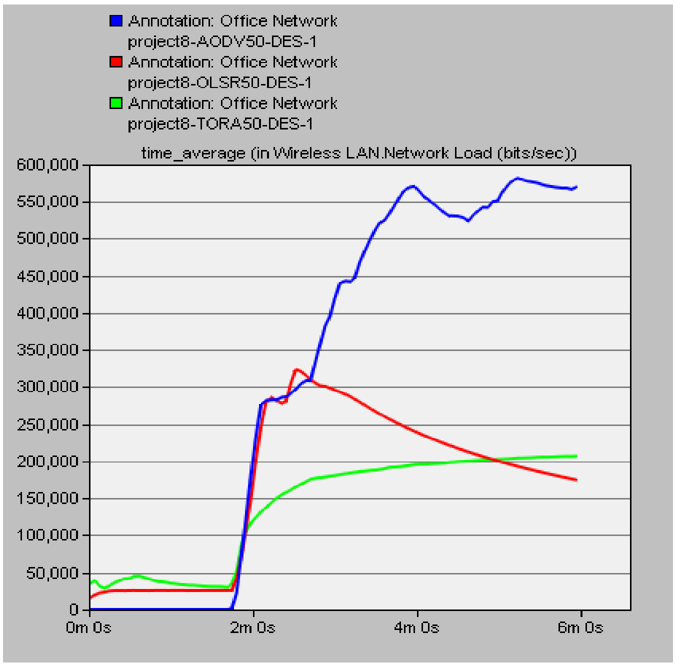

Fig 5.Network Load (for 50 nodes)

C. *Throughput*

Throughput is measured by the total amount of packets which is received by a destination node. It is measured by bits/sec or bit/sec. High throughput is always expected for any routing protocol from the figure 6 and 7 throughput is maximum of the AODV protocol for both 25 and 50 client nodes. We are comparing these three protocols like as AODV TORA and OLSR and obtain the output result from the graph which is given below.

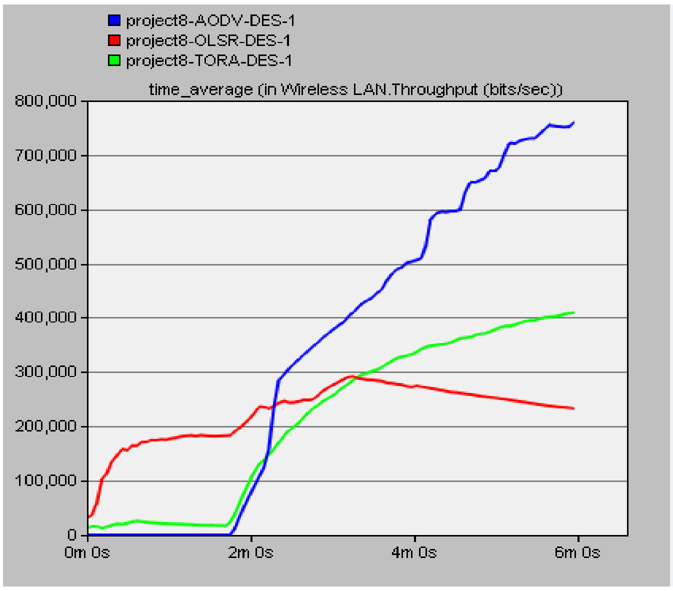

Fig 6.Throughput (for 25 nodes)

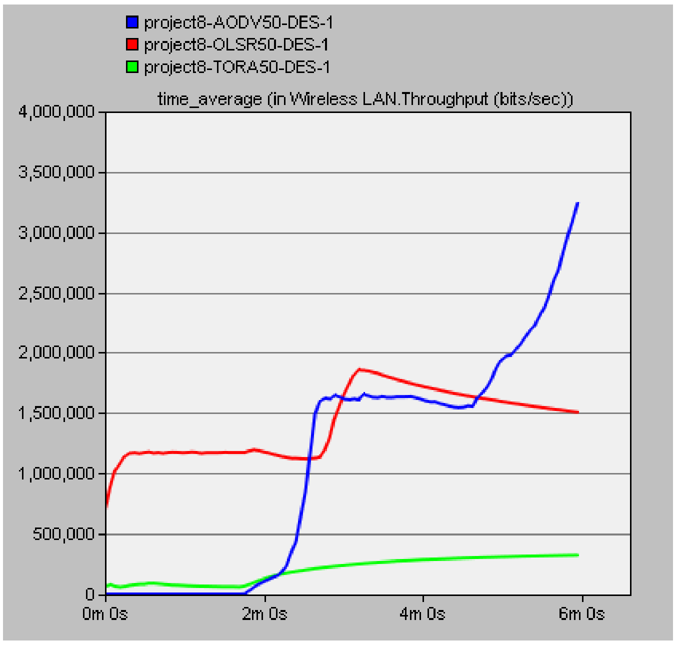

Fig 7 Throughput (for 50 nodes)

IV. *Conclusion*

In this paper, the simulation results of the comparative performance of the routing protocols AODV, OLSR and TORA for wireless ad hoc networks in a simulated environment against different routing protocol parameters and real time data (voice traffic generator) sing OPNET modeler 14.5. The protocols were tested using the same parameters with real time data (voice) traffic flow and random mobility. Performance of protocols with respect to scalability has also analysed. Results showed that, AODV and OLSR experienced higher packet delay and network load compared to TORA. This was due to the localisation mechanism employed in TORA. Similar characteristics were also shown in. On finally, when overall performance is compared, Throughput was considered as the main factor because it is the actual rate of data received successfully by nodes in comparison to the claimed bandwidth. TORA again performed worst among the three analysed protocols, delivering much lower throughput than AODV and OLSR. It was argued that, this was due to table driven approaches having more complicated routing procedure. With regards to overall performance, AODV and OLSR performed pretty well showing average performance throughout the simulation which is equivalent to result generated by other researchers. However, AODV showed better efficiency to deal with high congestion and it scaled better by successfully delivering packets over heavily trafficked network compared to OLSR and TORA.

V. References

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