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Comparison Analysis of TORA Reactive Routing Protocols on MANET Based on the Size of the Network

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Abstract **Review Article**

MANET is a collection of mobile nodes that communicate with each other over relatively bandwidth constrained wireless links. Network topology may change rapidly and erratically, so it can considerably affect packet routing in terms of network throughout, load and delay. In this we are presenting paper on performance comparison on tora routing protocol on MANET with varying network sizes and with increasing area and nodes sizes. This performance is measured by using "OPNET MODELLER 14.0" Simulator .the parameters taken for simulation is Throughput, Network load and Delay. In the last conculsion is given for the performance of the TORA reactive protocol under varying network sizes .The final valuation is given at the end of this paper.

Keywords: Manet, opnet, TORA, simulation.

1. INTRODUCTION AND RELATED WORK

In the last couple of year, the use of wireless networks has become more and more familiar. A Mobile Ad-hoc Wireless Network (MANET) is a collection of autonomous nodes that communicate with each other by forming a multi- hop network, maintaining connectivity in a decentralized manner [1]. Due to self-organize and rapidly deploy capability, MANET can be applied to different applications including battlefield communications, emergency relief scenarios, law enforcement, public meeting, virtual class room and other security-sensitive computing environments. There are 15 major issues and sub-issues involving in MANET such as routing, multicasting/broadcasting, location service, clustering, mobility management, TCP/UDP, IP addressing, multiple access, radio interface, bandwidth management, power management, security, fault tolerance, QoS/multimedia, and standards/products. Currently, the routing, power management, bandwidth management, radio interface, and security are hot topics in MANET research. The routing protocol is required whenever the source to transmit and delivers the packets to the destination. Many routing protocols have been proposed for mobile ad hoc network [2].

A. **Proactive or Table-Driven Routing Protocols**: In proactive protocols, each node maintains individual routing table containing routing information for every node in the network. Each node maintains consistent and current upto-date routing information by sending control messages periodically between the nodes which update their routing tables. The proactive routing protocols use link-state routing algorithms which frequently flood the link information about its neighbors. The drawback of proactive routing protocol is that all the nodes in the network always maintain an updated table. Some of the existing proactive routing protocols are DSDV and OLSR.
B. **Reactive or On Demand Routing Protocol:** In Reactive routing protocols, when a source wants to send packets to a destination, it invokes the route discovery mechanisms to find the route to the destination. The route remains valid till the destination is reachable or until the route is no longer needed. Unlike table driven protocols, all nodes need not maintain up-to-date routing information. Some of the most used on demand routing protocols are DSR, TORA and AODV.

2. MANET ROUTING PROTOCOLS

There are several protocols proposed for wireless mobile ad-hoc networks. When we need to transfer the data from source to destination, we need a dedicated path or a route that is decided by various routing protocols. In this paper, we have used the TORA Routing Protocol.

Temporally Ordered Routing Algorithm (TORA):

TORA is adaptive and scalable routing algorithm based on the concept of link reversal. It finds multiple routes from source to destination in a highly dynamic mobile networking environment. An important design concept of TORA is that control messages are localized to a small set of nodes nearby a topological change. Nodes maintain routing information about their immediate one-hop neighbours. The protocol has three basic functions: route creation, route maintenance, and route erasure. Nodes use a "height" metric to establish a directed cyclic graph (DAG) rooted at the destination during the route creation and route maintenance phases. The link can be either an upstream or downstream based on the relative height metric of the adjacent nodes. TORA's metric contains five elements: the unique node ID, logical time of a link failure, the unique ID of a node that defined the new reference level, a reflection indicator bit, and a propagation ordering parameter. Establishment of DAG resembles the query/reply process discussed in Lightweight Mobile Routing (LMR). Route maintenance is necessary when any of the links in DAG is broken Figure 1. Denotes the control flow for the route maintenance in TORA. The main strength of the protocol is the way it handles the link failures. TORA's reaction to link failures is optimistic that it will reverse the links to re-position the DAG for searching an alternate path. Effectively, each link reversal sequence searches for alternative routes to the destination. This search mechanism generally requires a single-pass of the distributed algorithm since the routing tables are modified simultaneously during the outward phase of the search mechanism. Other routing algorithms such as LMR use two-pass whereas both DSR and AODV use three pass procedure. TORA achieves its single-pass procedure with the assumption that all the nodes have synchronized clocks (via GPS) to create a temporal order of topological change of events. The "height" metric is dependent on the logical time of a link failure [2, 3, 6].

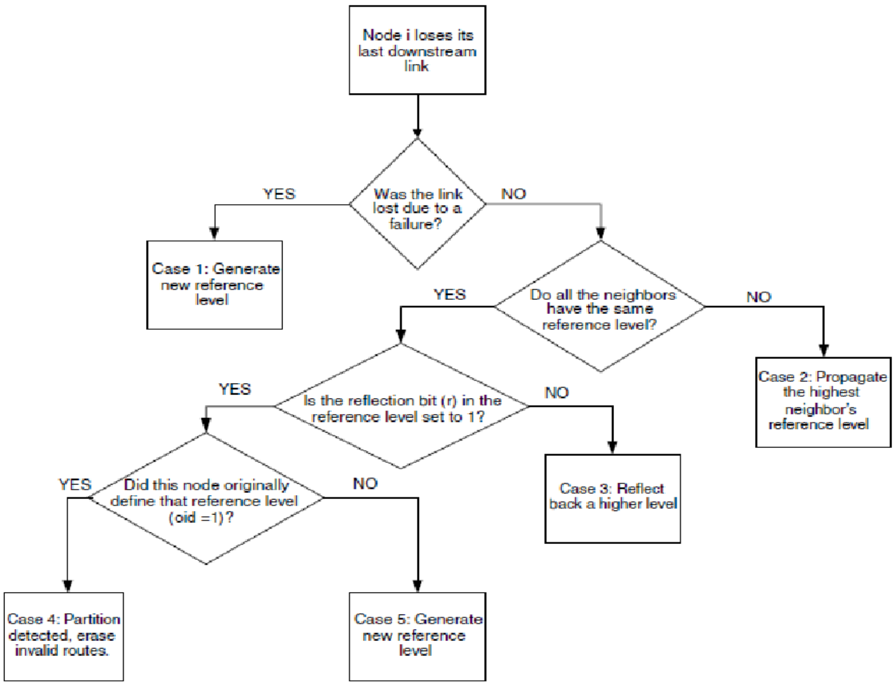

Fig. 1: Flow Diagram of Route Maintenance in Tora

Advantages and Limitations

The advantage of TORA is that the multiple routes are supported by this protocol between the source and destination node. Therefore, failure or removal of any of the nodes is quickly resolved without source intervention by switching to an alternate route to improve congestion. It does not require a periodic update, consequently communication overhead and bandwidth utilization is minimized. It provides the support of link status sensing and neighbor delivery, reliable in-order control packet delivery and security authentication. Also TORA consist some of the limitations like which depends on synchronized clocks among nodes in the ad hoc network. The dependence of this protocol on intermediate lower layers for certain functionality presumes that the link status sensing, neighbor discovery, in order packet delivery and address resolution are all readily available. The solution is to run the Internet MANET Encapsulation Protocol at the layer immediately below TORA. This will make the overhead for this protocol difficult to separate from that imposed by the lower layer [3].

3. SIMULATION PARAMETERS

To analyse the performance of TORA OPNET 14.0 simulator is used. Scenario is created with 30 and 10 numbers of mobile nodes. Simulation parameters used for the implementation of TORA are listed in the Table 1.

Table 1

Simulation Parameter	Value
Number of Nodes	30 and 10
Simulation Time	300 sec
Simulation Area (30 and 10 nodes)	10 km *10 km
Routing Protocols	TORA
Data Rate	11mbps
Application Name	FTP (High load)
Buffer size	1024000
Simulator	Opnet Modeller 14.0

4. PERFORMANCE PARAMETERS

The following performance parameters are used to analyze the simulated result:-

- Throughput [4]: Throughput is defined as the ratio of the total data reaches a receiver from the sender. The time consumed by the receiver to receive the last packet is called throughput. Throughput is expressed as bytes or bits per sec (byte/sec or bit/sec).
- Delay- The packet end-to-end delay is the average time of the packet passing through the network. It includes over all delay of the network like transmission time delay which occurs due to routing broadcasting, buffer queues. It also includes the time from generating packet from sender to destination and express in seconds.
- Load- 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 on the network, and it is difficult for the network to handle all this traffic so it is called the load. The efficient network can easily cope with large traffic coming in, and to make a best network, many techniques have been introduced [5].
- Media Access Delay:- The Time taken by a node to access a media in order to transfer a data packet from source node to destination node is known as Media Access Delay.

5. RESULTS AND ANALYSIS

Throughput: Fig a shows the throughput for each protocol. The maximum throughput for TORA protocol is at 7,500 bits/sec for 30 nodes and 1,500 nodes for 10 nodes after 300 sec.

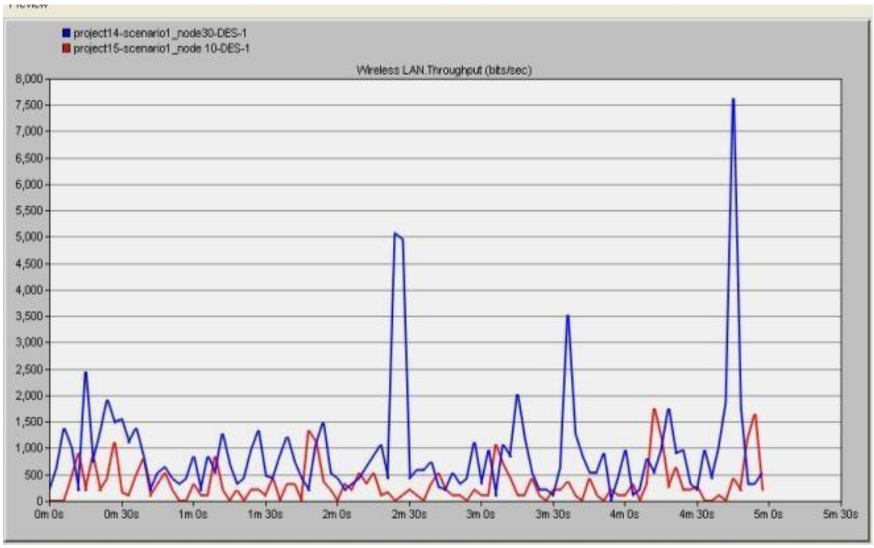

Fig. a: Throughput of TORA for 10 and 30 nodes

Load: Fig. b shows the increase in network load for TORA for 30 and 60 nodes respectively. From fig it is observed that network load starts increasing and then reaches its maximum value at below 6,500 bits for 30 nodes whereas for 10 nodes it is somewhat below then 1,500 bits.

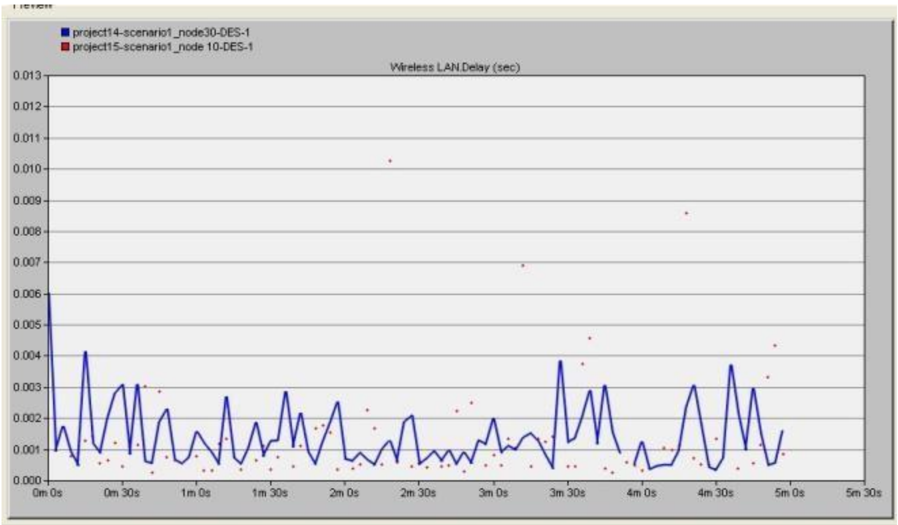

Fig. b: Load of TORA for 10 and 30 nodes

Media Access Delay: fig c shows the media acces delay of TORA protocol for 30 nodes it is highest at 0.0020 bits.

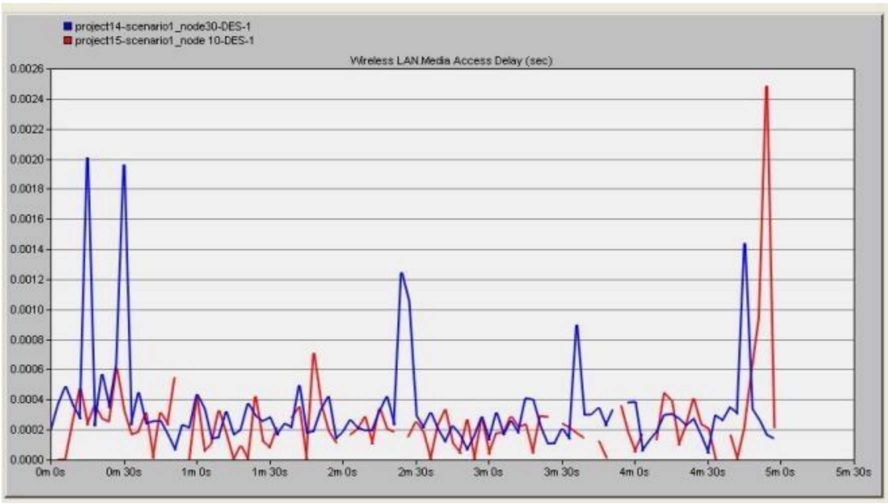

Fig. c: Media Access Delay for 10 and 30 nodes

Wireless LAN Delay: fig d shows the delay for 30 and 10 nodes .for 10 nodes it is seen only as dots and for 3o nodes it is highest at 0.006 bits.

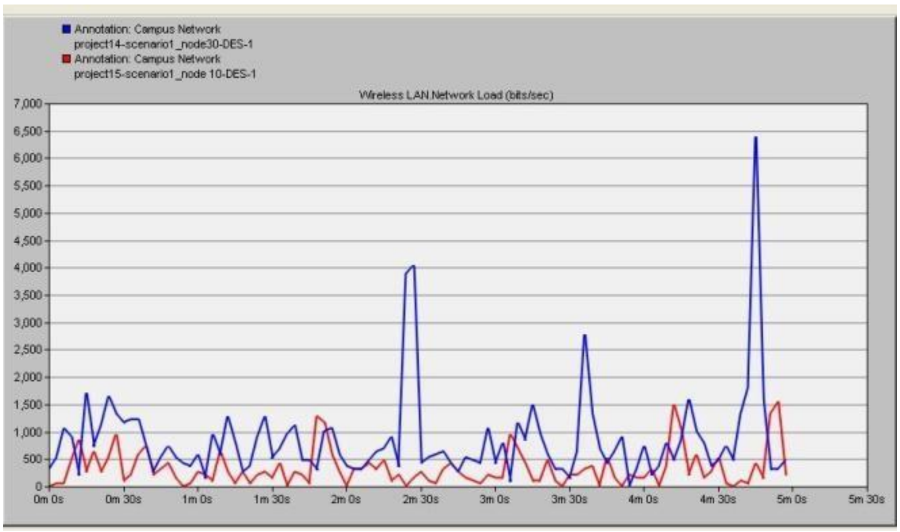

Fig. d: LAN Delay for 10 and 30 nodes

6. CONCLUSION

In this paper, performance of TORA is analysed using OPNET modeler 14.5 as shown above Throughput is highest for 30 nodes whereas media acces delay is at its highest value for 10 nodes. Finally when overall performance is compared throughput is the main factor because it is the actual rate of data received successfully by nodes in comparison to the claimed bandwidth. Over the past few years, new standards have been introduced to enhance the capabilities of ad hoc routing protocols. As a result, ad hoc networking has been receiving much attention from the wireless research community. With regards to overall performance TORA performed good. The simulation study of this report consisted of routing protocol OLSR deployed over MANET using FTP traffic analysing their behaviour with respect to five parameters i.e. delay, network load, throughput, media access delay.

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