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Performance Metrics Comparison for On-demand Routing Protocols using NS2

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Abstract: Mobile Ad Hoc Network (MANET) is a self configuring network of one or more devices connected by wireless links. MANET is a infrastructure less wireless network, so it is very easy to design and deploy. Currently, most of the transactions are performed through the use of networks only. The devices in the network are independent in joining or leave the network. Each device in the network should act as a host or router or both. Opposed to the infrastructure wireless networks, where each user directly communicates with an access point or base station, a mobile ad hoc network, or MANET does not rely on a fixed infrastructure for its operations. The network is an autonomous transitory association of mobile nodes that communicate each other over wireless links.

Nodes that lie within each other's sending range can communicate directly and are responsible for dynamically discovering each other. In order to enable communication between nodes that are not directly within each other's send range, intermediate nodes act as routers that rely packets generated by other nodes to their destination. The nodes in MNAET are generally energy constrained.

In this paper, we simulated on-demand routing protocols like DSR, AODV and TORA using open source network simulator NS2. Performance of the MANET is measured using metrics like Delay, Energy, PDR and Throughput.

Keywords: MANET, Routing Protocols, simulators, performance Metrics.

I. INTRODUCTION

The desire of wireless networking is to be connected anytime, anywhere and anyhow [3]. MANET is a kind of wireless network. In ad hoc networks, for transmission of data packets some sort of protocol is necessary to make the routing decisions. Currently there does not exist any standard for a routing protocol in ad hoc networks [1]. Mobile ad hoc networks (MANETs) are wireless networks without the need of any infrastructure or administration [2]. MANETs has a highly challenged network environment due to its special characteristics such as decentralization, dynamic topology and neighbor based routing.

MANETs can be implemented in battle fields and in disaster recovery operations where infrastructure is not available. Due to high mobility of nodes the topology may change rapidly and uncertainly [6]. Routing is important problem in wireless ad hoc network because of limited bandwidth, low device power, dynamic network topology etc [6]. MANET is a distributed system and it uses open medium to perform communication between nodes. So MANETs are more vulnerable to security threats.

II. ROUTING IN MANET

Now a day's routing is a major challenging task in wireless networks to carry packets information from source to destination. Many routing protocols have been developed to carry routing functionality but most of the research work has been carried out using DSDV, OLSR, DSR, and AODV.

MANET routing protocols can be classified as shown in the following figure.

Table driven routing protocols use pre computed paths for transmission of information from source to destination. In this category of protocols it is compulsory that every node should maintain information about every other node in the network this causes waste of memory and routing overhead.

In on-demand routing protocols, the node generates route request when it wants to transmit data to other node in the network. In on-demand routing protocols, nodes need not to maintain information about every other node in the network. On-demand routing protocols take more latency for establishing path from source to destination.

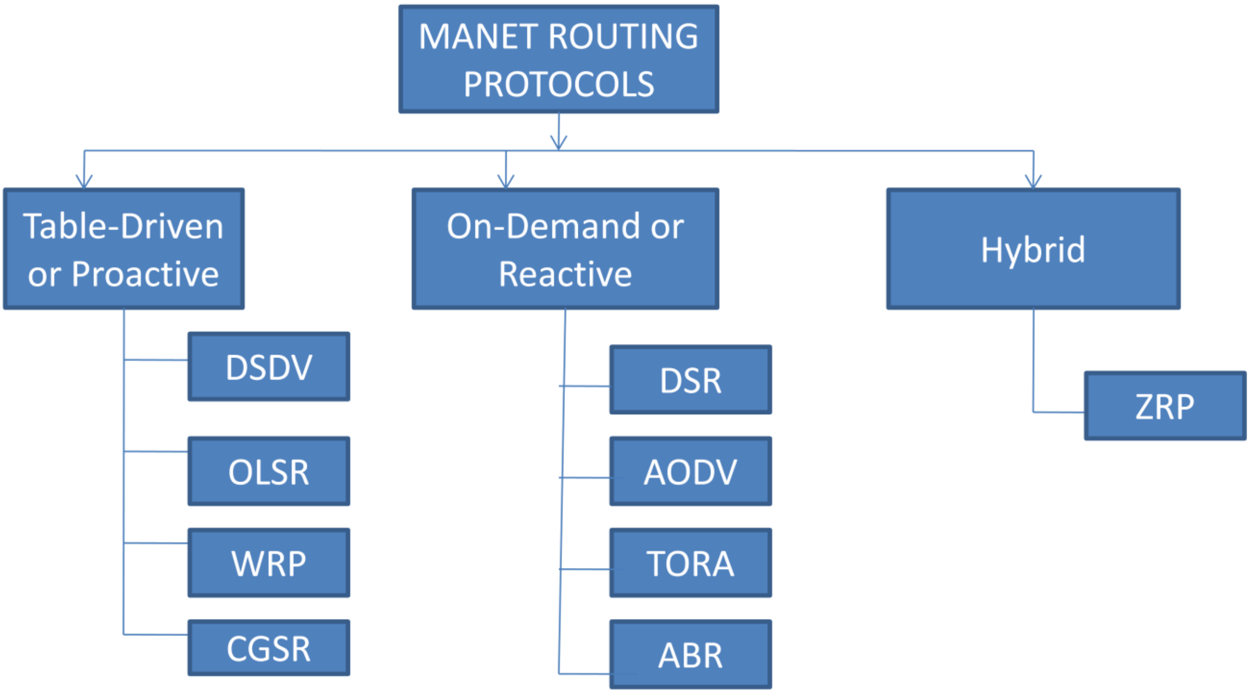

Figure: classification of MANET routing protocols.

III. TEMPORALLY ORDERED ROUTING ALGORITHM (TORA)

The key design concept of TORA is localization of control messages near the occurrence of topological change. To accomplish this, nodes need to maintain the routing information about adjacent (one-hop) nodes.

It was developed by Vincent Park and Scott Corson at the University of Maryland and the Naval Research laboratory.

TORA attempts to achieve a high degree of scalability using a flat non-hierarchical routing algorithm.

Logically separate copy of TORA is run for each destination to which routing is required. Like other link reversal protocols, a Directed Acyclic Graph (DAG) is maintained rooted at the destination.

TORA protocol performs three functions such as 1.Route Creation 2. Route Maintenance 3.Route erasing

During Route Creation, any node who wants route to forward packets should establish path to the destination by query/reply mechanism. In TORA, source node broadcasts a query packet containing the address of the destination node. This packet travels throughout the network until it reaches destination or an intermediate node having route to the destination node. The recipient of the query packet broadcasts an update packet having its height with respect to the destination. In transmission of packets each node increments its height greater than height of its neighbor from which update packet was received [3].

Maintaining routes is only performed for nodes that have a height other than NULL. Furthermore, any neighbor's height that is NULL is not used for the computations. Partitions of the network where link failures occur are removed from the network.

During Route Erasing, node who want to clear the path which broadcast CLR packet.

3.1 TORA Algorithm

An ordered quintuple $H_i = (\tau_i, Oid_i, r_i, \delta_i, i)$: it determines the direction to which the data packets are transmitted. The first values represent a reference level and the last two represent the delta with respect to the reference level. The values in the height quintuple indicate the following.

Where

τ_i: logical time of a link failure.

Oid_i: Unique ID of the node that defined the reference level.

r_i: Reflection indicator bit used to divide each of the unique reference levels into two unique sub-levels.

δ_i: Propagation ordering parameter

i: Unique id of the node.

(1)Initially the height of each node in the network other than the destination is set as NULL, NULL=(-,-,-,-,K). the height of the destination is always ZERO,

ZERO= (0,0,0,0,j).

(2)A set of neighbors of node i: N_i

(3)A height array with an entry $HN_{i,j}$ for each neighbors j€ N_i : initially the height is set to NULL, $HN_{i,j}$=(-,-,-,-,j).

(4) a Route-Required flag RR_i : it is unset initially.

(5) A link state array with an entry $LS_{i,j}$: the state of the links is determined by heights H_i and $HN_{i,j}$ and is detected from the higher node to the lower node.

IV. SIMULATION STUDY

Plenty of simulation tools are available for simulating MANET routing protocols for various performance metrics. In this work, we use NS2 (Network Simulator Version 2) for simulating DSR, AODV and TORA. Generally TORA is not a working protocol in NS2 because TORA has several bugs in NS2, so simulation of TORA is not possible [4]. We took it as a challenge and tried a lot to simulate TORA in NS2. Finally we got success after modification of TORA files tora.h, tora.cc and imep.cc.

4.1 Performance Metrics

There are various parameters are available to check the performance of MANET routing protocol. In this work we used the following performance metrics to compare DSR, AODV and TORA.

Average End-to End Delay

This is average end to end delay of all successfully transmitted data packets from source to destination.

$$AVG\ E\ to\ E\ delay = \frac{\sum_{i=1}^{n}(CBR - Sent\ Time - (CBR - Received\ Time)}{\sum_{i=1}^{n} CBR - Received}$$

Packet delivery Ratio (PDR)

PDR shows how successful a protocol is delivering packets from source to destination.

$$PDR = \frac{\sum_{i=1}^{n} CBR - Received}{\sum_{i=1}^{m} CBR - Sent}$$

Throughput

Throughput is number of successfully received packets in a unit interval of time. Throughput is generally represented in bps (bits per seconds).

V. RESULTS

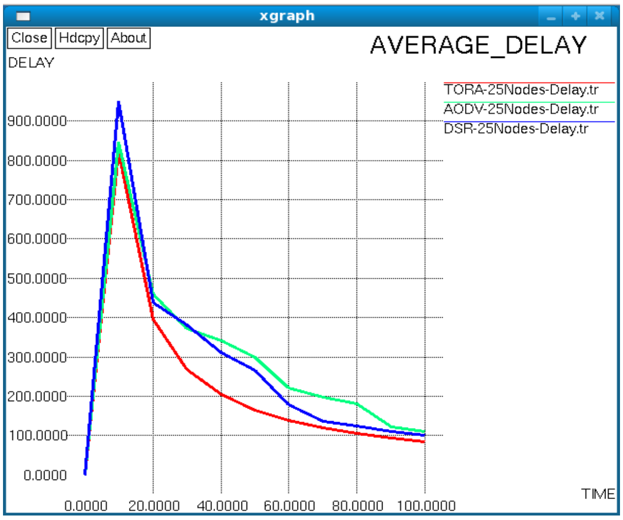

Figure: Average Delay Comparison of DSR, AODV and TORA for Network Size 25-Nodes

As shown in the above graph, TORA takes less average end to end delay than DSR and AODV. All the protocols have the same delay at beginning but with increase in simulation time, DSR and AODV posses more delay.

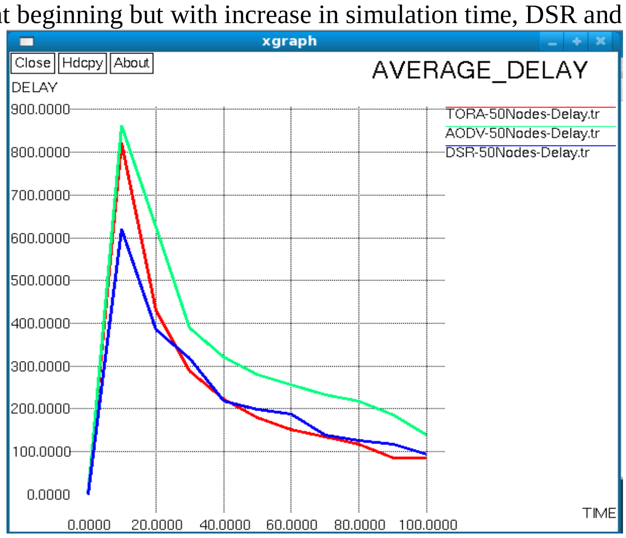

Figure: Average Delay Comparison of DSR,AODV and TORA for Network Size 50-Nodes

As shown in the above graph, TORA takes less average end to end delay than DSR and AODV. All the protocols have the same delay at beginning with small variation but later DSR and AODV posses more delay.

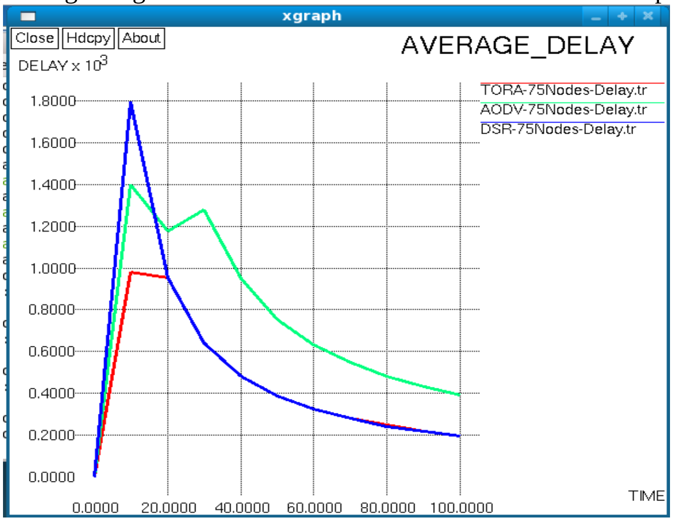

Figure: Average Delay Comparison of DSR, AODV and TORA for Network Size 75-Nodes

As shown in the above graph, TORA takes less average end to end delay than DSR and AODV initially. Later DSR and TORA have almost same end to end delay throughout end of the simulation.

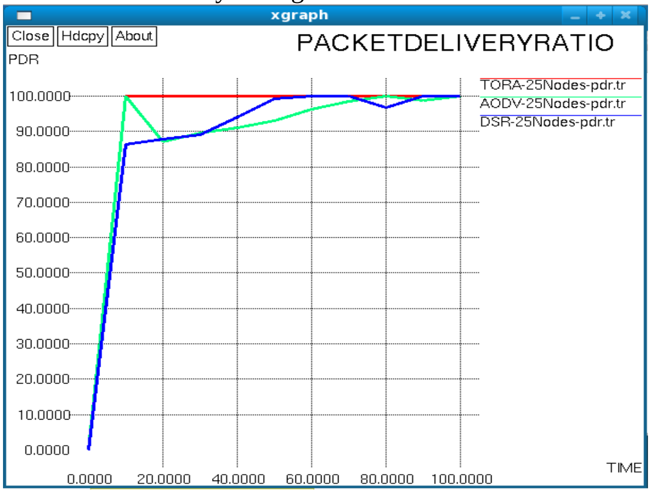

Figure: PDR Comparison of DSR, AODV and TORA for Network Size 25-Nodes

As shown in the above graph, TORA has constant packet delivery ratio. Both DSR and AODV have up and down packet delivery ratio throughout end of the simulation and both these protocols have almost equal packet delivery ratio.

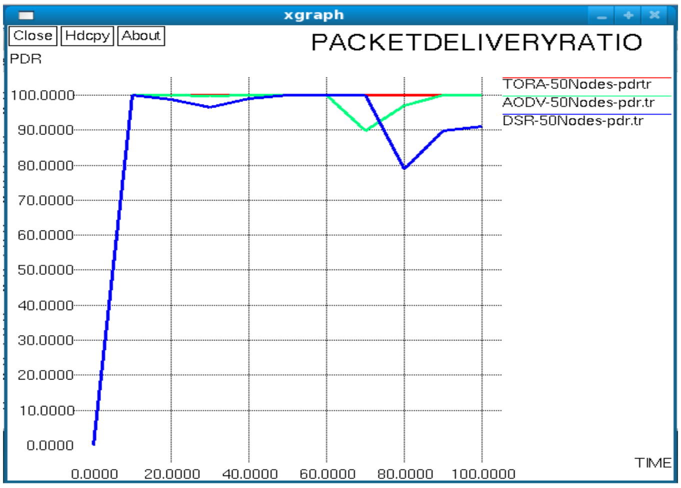

Figure: PDR Comparison of DSR, AODV and TORA for Network Size 50-Node

As shown in the above graph, TORA has constant packet delivery ratio. Both DSR and AODV have up and down packet delivery ratio throughout end of the simulation and DSR has more pdr than DSR.

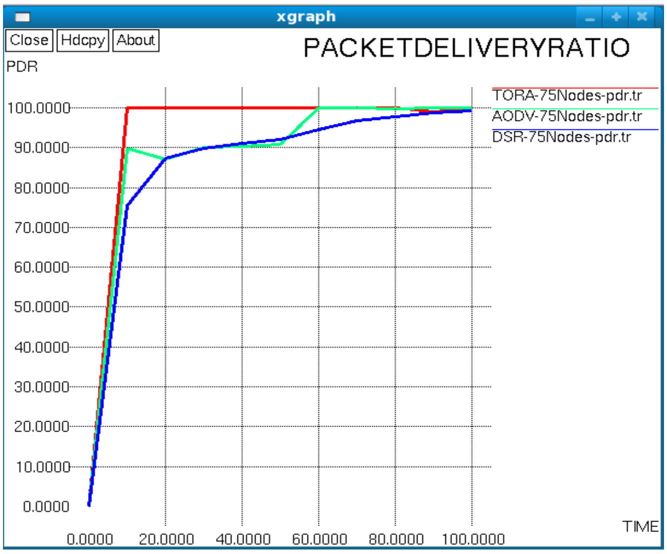

Figure: PDR Comparison of DSR,AODV and TORA for Network Size 75-Nodes

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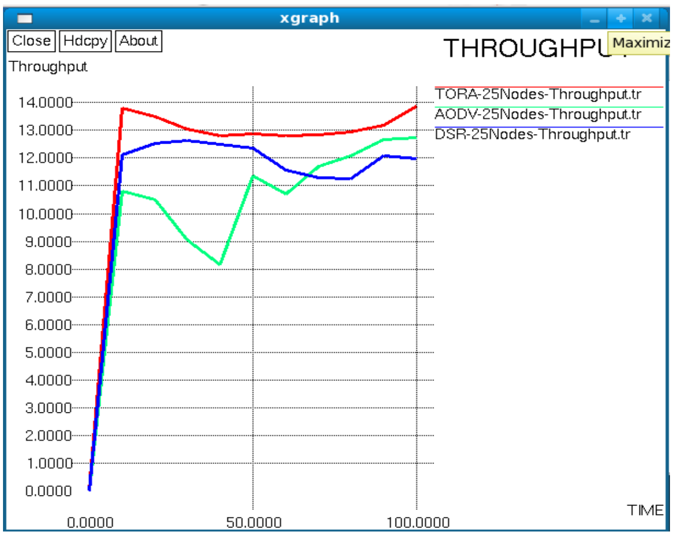

Figure: Throughput Comparison of DSR, AODV and TORA for Network Size 25-Nodes

As shown in the above figure, initially, three protocols start with the same throughput but later TORA produces more throughput than other protocols.

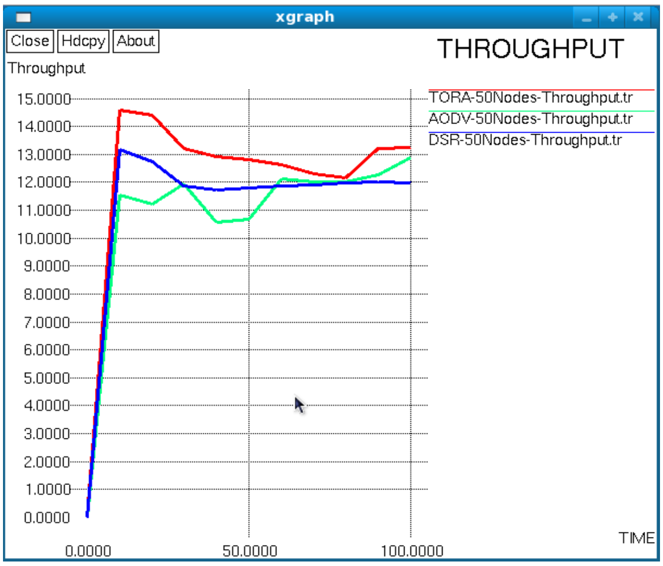

Figure: Throughput Comparison of DSR, AODV and TORA for Network Size 50-Nodes

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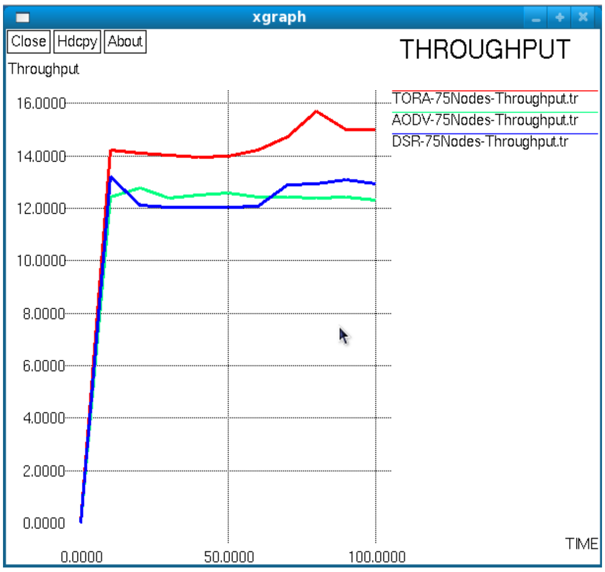

Figure: Throughput Comparison of DSR, AODV and TORA for Network Size 75-Nodes

As shown in the above figure, initially, three protocols start with the same throughput but later TORA produces more throughput than other protocols. Both DSR and AODV have up and down throughput.

VI. CONCLUSIONS

In this research work, we compare performance of On-Demand MANET routing protocols DSR, AODV and TORA for the performance metrics like Delay, PDR and Throughput. AODV and TORA protocols posses almost same Average End-to End Delay. In future, extension of TORA is necessary because lot of research work have been done using DSR and AODV only.

REFERENCES

[1] K.Ramesh Reddy, S.Venkata Raju and N.Venkatdri, " Reactive, Proactive MANET Routing Protocol Comparison", International Journal of Video&Image Processing and Network Security, IJVIPNS, Vol 12, No:05, 2012.

[2] N.Venkatadri and K.Ramesh Reddy," On-Demand MANET Routing Protocols Performance", International Journal of Mobile & Adhoc Networks|Vol 1| issue 2| August,2011.

[3] N.Venkatadri and K.Ramesh Reddy," Performance Evolution of DSR,AODV and TORA using ViSimulator", International Journal of Graphics&Image Processing |Vol 3|issue 3|Aug,2013.

[4] Annapurna P Patil, Narmada Sambaturu and Krittaya Chunhaviriyakul, "Convergence Time Evaluation of Algorithms in MANETs" (IJCSIS) International Journal of Computer Science and Information Security,Vol. 5, No. 1, 2009

[5] Neha Hajare, Presenjit Debnath, Prashanth Ramteke and Vikas Ostwal," SAODV: A Secure Trust Based Routing Protocol in MANET", IEEE sponsored International Conference on Empowering Emerging Trends in Computer, Information Technology & Bioinformatics (IJCITB) ISSN:2278-7593, Vol 2, Issue 2

[6] Saida Ziane, Abdelhamid mellouk " A QOS Adaptive Multi-path Reinforcement learing routing Algorithm for MANET" IEEE 207, 1-4247-1031-2/07 pp. 659-664.

[7] A. Boukhalkhal, MB yogoubi etal. " Simulation of Mobile Ad hoc Routing strategies" IEEE 2008, 978-1-4244-1841-1/08 pp. 128-132.

[8] Sontosh Kumar Soni "Performance Simulation of MANET protocols with the combination of Horizontal and vertical topology using NS2" IEEE 2012, 978-1-4673-1989-8/12.

[9] Fenglien Lee etal. " A Global on-Demand Routing protocol for Mobile Ad Hoc Networks" IEEE 2007, 0-7695-2922-4/07.

[10] Allaa R. Hilal etal. " RT-TORA, A TORA modification for Real-Time interactive applications" IEEE 2008, 978-1-4244-1643-1/08 pp. 1403-1406.

