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RELATIVE INVESTIGATION OF DSDV, DSR AND TORA IN MANET

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Abstract: ***Mobile Ad-Hoc networks (MANET) are autonomous and highly dynamic networks, no need of any pre-existing infrastructure to operate and support dynamic topology. In MANET, nodes can act as routers and send packets from source to destination and also nodes are able to move and synchronize with their neighbors. Due to mobility, topology of the network can change dynamically and nodes can be entered and exit at any time from MANET. In this paper, we are going to analyze the performance of MANET routing protocols DSDV, DSR and TORA using network simulator NS-2.34. We are comparing the performance of three routing protocols together and individually too. The performance matrix includes PDF (Packet Delivery Fraction), Normalized Routing Load (NRL) and throughput. We are analyzing the performance of routing protocols when simulation time changes, mobility of nodes changes.***

Keywords: DSDV, DSR, TORA, PDF, Normalized Routing Load, Throughput, Simulation Time, Mobility.

INTRODUCTION

The history of the wireless networks started within 1970s and therefore the interest has been growing ever since. At present, sharing of information is tough, because the users are performing administrative tasks and got wind of static, bi-directional links between the computers. This motivates the development of temporary networks without wires, communication infrastructure and there is no need of centralized control. Such interconnection between mobile devices is named as an Ad-hoc Network. Ad hoc networks are created on the fly which means that we can create network with mobile devices with wireless links without the need of any infrastructure. All mobile nodes which are forming network have the equal responsibility. Ad hoc networks are rising as the next generation of networks and outlined as a group of mobile nodes forming a short lived dynamic network without any infrastructure and there is no centralized administration or customary support services. In Latin, ad hoc virtually suggests that “for this,” any which means “for this purpose only” and so sometimes temporary [1]. An ad hoc network is sometimes thought of as a network with mobile nodes those are moving with relative speed compared to wired network. Hence the topology of the network is far additional dynamic and therefore the changes in the network usually unpredictable oppose to that could be appear in a wired network. This fact creates several challenging research problems, since the objectives of however routing ought to occur is commonly unclear as a result of the various resources like information measure, battery power and demands like latency.

MANETs have many silent characteristics: 1) Dynamic network topologies 2) information measure unnatural, variable capability links 3) Energy-constrained operation 4) restricted physical security. Thus the routing protocols employed in normal wired networks don't seem to be similar temperament for this type of dynamic setting. Routing algorithms usually tough to be formalized into arithmetic they're instead has been paid to use specific network parameters once specifying routing metrics. Examples may include delay of the network, link capability, link stability or distinguishing low quality nodes. These schemes typically supported by previous work, and we can enhance with the new metrics.

Paper Outline:

The rest of this paper is organized as follows: Section II presents the background of MANET. Section III presents routing protocols categories. Section IV provides an overview of the routing protocols. Section V presents simulation and performance metrics. Section VI provides performance results and analysis. Finally Section VII concludes the paper.

BACKGROUND

Many routing protocols been proposed but a less comparisons have been made on those existing routing protocol. The work done by the Monarch project at Carnegie Mellon University (CMU) had analyzed and compared a number of the various routing protocols and evaluated them based on constant quantitative metrics. The result was conferred within the article “A performance comparison of multi- hop accidental wireless network routing protocols.” [5] And the other simulation results are done on individual protocols. Many simulations primarily based performance comparisons are in dire straits ad-hoc routing protocols within the recent years. The performance comparison of two on-demand routing protocols AODV and DSR are conferred using NS-2.34 simulator. [4] Frequently Mobile Ad-Hoc networks are utilized in Military communication by troopers, planes, tanks, mobile offices, tiny aircrafts, education systems with set-up of virtual schoolroom conference rooms, conferences etc. [2] however the most drawback is of quality. As we know that all nodes are mobile. Major challenges in Mobile Ad-Hoc networks are routing of packets with frequently mobile nodes movement, there are resource problems like power, storage and there are wireless communication problems additionally. Mobile Ad-Hoc network consists of wireless nodes that will move usually. Movement of nodes leads to a change in topology that in-turn

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change in routes. Most of analysis works are acting on planning economical routing protocols. These protocols are designed and analysed by using CBR model, Poisson traffic model, which are inherently unable to capture traffic self-similarity. Other main problems are reliability and power consumption. How much any protocol is reliable means how much percentage of packets will be received by destination node successfully i.e. the packet delivery ratio (PDR). Power consumption is another main performance live to check these protocol performances. We've designated DSDV, DSR and TORA for analysis as heap of analysis goes on these 3 routing protocols. [3][6] Routing in Mobile Ad-Hoc networks and a few mounted wireless networks use multiple-hop routing. Routing protocols for this sort of wireless network ought to be able to maintain methods to different nodes and in most cases, should handle changes in methods thanks to quality. Thus we've chosen node quality as performance criteria for comparison routing protocols.

ROUTING PROTOCOLS

Mobile ad hoc networks Routing Protocols are often broadly classified into two main categories:
A. Table-driven routing protocols.
B. On-demand routing protocols.

A. Table-Driven (Proactive) Routing Protocols

In proactive or table-driven routing protocols, each node finds and maintains up-to-date routes to all possible destinations in the network. Routing information is periodically updated throughout the network in order to keep up routing table consistency. Thus, if there is a route has already existed before traffic arrives, then transmission occurs without delay. Otherwise, traffic packets should be wait in the queue until the nodes receives routing information corresponding to its destination. However, for highly dynamic network, the proactive schemes need a significant amount of resources to keep routing information up-to-date and reliable. Some of proactive routing protocols are Destination- Sequenced Distance Vector (DSDV), Global State Routing (GSR) and Optimized Link State Routing Protocol (OLSR)

B. On-Demand (Reactive) Routing Protocols

In contrast to proactive method, in reactive or on demand routing protocols, a node initiates a route discovery process throughout the network, only when it needs to send packets to its destination. This process is completed once a route is set or all possible permutations have been examined to destination. Once a route had been established, it will be maintained by a route maintenance process until either the destination becomes inaccessible on each path from the source or till the route is no longer desired. In reactive schemes, nodes keep up the routes to active destinations. A route search is needed for each unknown destination. Therefore, in theory the communication overhead is reduced at expense of delay due to route research. Some reactive protocols are Cluster Based Routing Protocol (CBRP), Ad hoc On-Demand Distance Vector (AODV), Dynamic Source Routing (DSR), and Temporally Ordered Routing Algorithm (TORA).In on-demand routing protocols, single path routing and multi-path routing protocols exist.

OVERVIEW OF DSDV, DSR, AND TORA

A. Destination Sequence Distance Vector (DSDV)

DSDV [7] is a hop-by-hop distance vector routing protocol. It is proactive routing protocol based on the improved version of Bellman-Ford routing algorithm. In DSDV each network node maintains a routing table that contains the all possible destinations, next hop for the destination and the number of hops to each destination. Nodes periodically broadcasts routing information to keep the routing table completely updated at all times. If there is a change in topology, nodes need to change the routing information, so that updates are transmitted immediately. The routing information updates can be exchanged between mobile nodes either time-driven or event-driven. DSDV protocol needs each node in the network need to advertise its own routing table to its present neighbors. This advertisement is done by either broadcasting or multicasting. When advertisements are received by the neighboring nodes, then nodes can know about any changes that have occurred in the network due to nodes movements. The routing updates might be sent in two ways, one is called a ‘‘incremental’’ and another is ‘‘full dump.’’ In case of incremental method DSDV uses the concept of sequence number to indicate the freshness of route and updates are broadcast only the entries which require changes are sent, where as in case of full dump method, the entire routing table is sent to their neighboring nodes.

B. Dynamic Source Routing Protocol (DSR)

The Dynamic Source Routing is an efficient routing protocol designed specifically for use in multi-hop wireless ad-hoc networks of mobile nodes [9][10][14]. It allows nodes to dynamically discover a source route across multiple network hops to any destination in the ad-hoc network and also maintains multi-paths in nodes route cache. It finds an unexpired route and shortest path from source to destination within the networks. Each data packet sent then carries in its header the complete ordered list of nodes through which the packet must pass, allowing packet routing to be a trivially loop free and avoiding the need for up-to-date routing information in the intermediate nodes through which the packet is forwarded. With the inclusion of this source route in the header of each data packet, other nodes forwarding or overhearing any of the packets may easily cache this routing information for future use and also DSR quickly adapts to topological changes. DSR protocol has two mechanisms in MANET. The purposes of these mechanisms are route discovery and route maintenance from the source to destination node. In route discovery, source node broad-casts route request packet to all nodes within the network to get the route from source to destination. In DSR protocol, route discovery is initiated by the source node when the unexpired route is not available to destination node by broadcasting RREQ message. It contains request-id which is unique and record listing of the address for each intermediate node. This message has forwarded. Destination node of the route discovery returns the RREP message to the source node. When the source node received RREP it records this route in the route cache. Before sending packets, node saves the copy of original packet in a local buffer. It is called send buffer. In route maintenance, source node finds another route towards

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the destination if topology the network change or existing link breaks. Each node transmitting the packets which confirm the packets are received by the next node through the source route. If confirmation is not received, this node receives ROUTE ERROR (RERR) message to the source node. Here link is broken.

C. Temporary Ordered Routing Algorithm (TORA)

The Temporally Ordered Routing Algorithm (TORA) is a destination based routing algorithm. It is a highly adaptive, efficient and scalable distributed routing algorithm based on the concept of link reversal [8]. TORA is proposed for highly dynamic mobile, multi-hop wireless networks. It is a source-initiated on-demand routing protocol. It finds multiple routes from a source node to a destination node and reduces communication overhead. The advantage of TORA is that route discovery process is not required for any alteration because multiple routes from a source to destination. The protocol reacts only when all routes to the destination are lost. This feature conserves bandwidth usage and increases adaptability to topological changes by reducing communication overhead. To achieve this, the nodes maintain routing information about adjacent nodes. The protocol has three basic functionalities: Route creation, Route maintenance and Route erasure. It uses three types of packets, query packet for route creation, query update packet for route creation and maintenance and clear packet for erase route. TORA can suffer from limitless worst-case convergence time for very stressful scenarios [11, 12]. In the event of network partitions the protocol is able to detect the partition and erase all invalid routes.

SIMULATION AND PERFORMANCE METRICS

A. SIMULATION MODEL

The simulations are performed by using Network Simulator 2.34 [13], particularly popular in the mobile ad hoc network community. The traffic model is CBR (continuous bit –rate). The source-destination pairs are spread randomly over the network.

The mobility model used is 'random waypoint model' in a rectangular filed of 1000m x 1000m with 25 nodes. During the simulation, each node moves from a random location to a random chosen destination point. Once that point is reached, the node takes rest a period of time in second and another random destination point is chosen after that pause time. This process will be repeated throughout the simulation, causing continuous changes within the topology of the underlying network. The simulation model parameters which are used, those are in the following experiments are summarized in Table 1.

TABLE 1. SIMULATION PARAMETERS

Parameter	Value
Simulation time	10,20,30,40,50
Simulator	NS-2.34
Channel Type	Channel/Wireless channel
Antenna type	Antenna/Omni Antenna
Radio-propagation model	Propagation/Two Ray Ground
Link layer type	LL
Mac type	Mac/802_11
Protocols studied	DSDV , DSR and TORA
Simulation area	1000*1000
Trace format	New wireless format
Node movement model	Random waypoint
Traffic type	CBR(UDP)
Number of nodes	25
Packet Size	1024bytes
Pause time	10 sec

B. PERFORMENCE METRICS:

Network performances of these protocols are observed by using the performance metrics such as packet delivery ratio, normalized routing load and throughput.

(i) Packet Delivery Fraction (PDF): It is the fraction of the total data packets received at destination to total data packets sent from source to destination.

Packet delivery fraction = Received packets/Sent packets

(ii)Normalized Routing Load: The number of routing packets transmitted per data packet delivered at the destination. Each hop wise transmission of a routing packet is counted as one transmission.

Routing Load = Routing Packets Sent / Received Packets

(iii)Throughput: It is the measure of how fast a node can actually sent the data through a network. So throughput is the average rate of successful message delivery over a communication channel.

PERFORMANCE RESULTS AND ANALYSIS

A. Packet Delivery Fraction

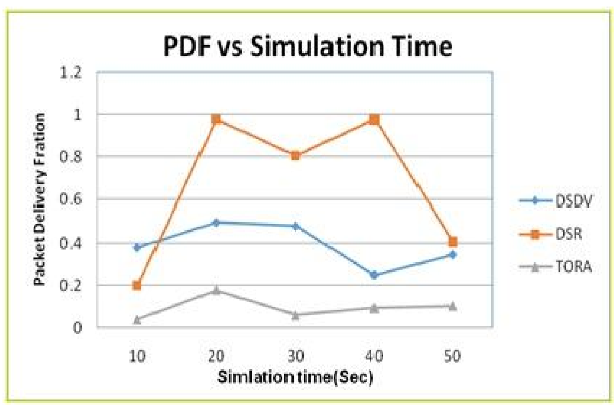

Fig-1 Packet Delivery Fraction for 25-node model increasing in simulation time with low mobility

In low mobility situation as in Fig-1 shows that at staring simulation point the packet delivery fraction is high in DSDV as compared to other two routing protocols. When the simulation time increases the packet delivery fraction of DSR routing protocol is high as compared to DSDV and TORA routing protocols and also DSDV has the better packet delivery ratio than TORA.

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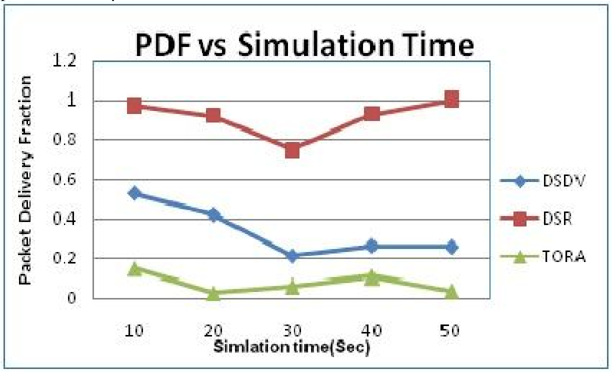

Fig-2 Packet Delivery Fraction for 25-node model increasing in simulation time with high mobility

In high mobility situation as in Fig-2 shows that the packet delivery fraction is high in DSR as compared to DSDV and TORA routing protocols with increased in simulation time. DSDV has packet delivery fraction than TORA and low packet delivery fraction than DSR.

B. Normalized Routing Load

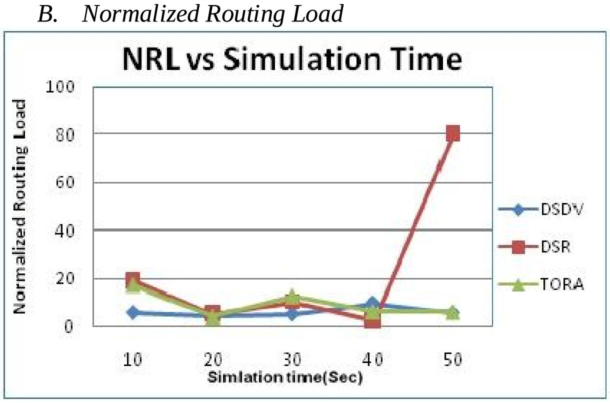

Fig-3 Normalized Routing Load for 25-node model increasing in simulation time with low mobility

In low mobility situation as in Fig-3 shows that DSDV routing protocol have low normalized routing load compared to TORA and DSR routing protocols except at simulation time 40sec. At simulation time 40sec DSR routing protocol has less normalized routing load than DSDV and TORA. After that DSR routing load is increased as increase in simulation time and also DSDV and TORA have same normalized routing load except at time 10 and 30sec. At that point TORA has high normalized routing load than DSDV.

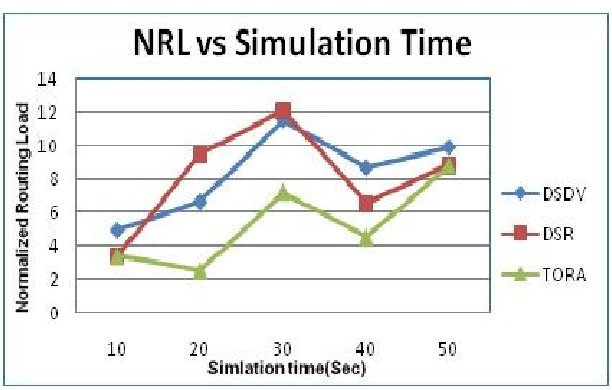

Fig-4 Normalized Routing Load for 25-node model increasing in simulation time with high mobility

In high mobility situation as in Fig-4 shows that TORA routing protocol has less normalized routing load than DSDV and TORA with increasing in simulation time.DSR has high routing load at simulation time 30sec and at remaining times DSR has high routing load than TORA and less routing load than DSDV.

C. Throughput

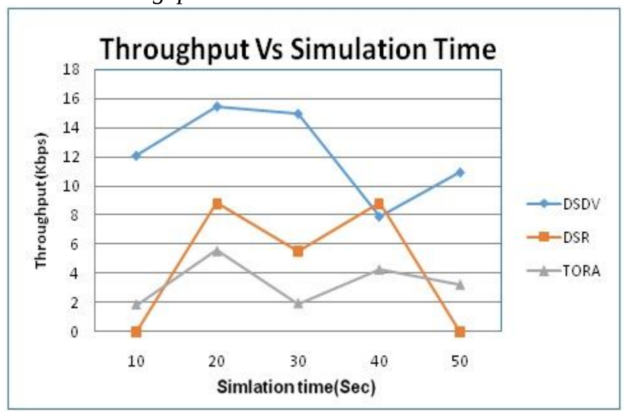

Fig-5 throughput for 25-node model increasing in simulation time with low mobility

In low mobility situation as in Fig-5 shows that DSDV routing protocol has high throughput as compared to DSR and TORA routing protocols except at simulation time 40sec. DSR routing protocol has high throughput than DSDV and TORA at simulation time 40sec.

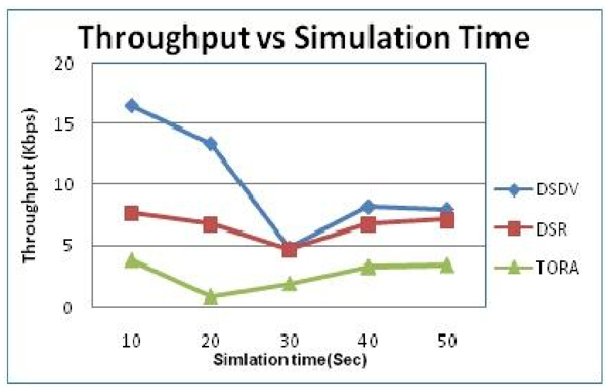

Fig-6 throughput for 25-node model increasing in simulation time with high mobility

In high mobility situation as in Fig-6 shows that DSDV routing protocol has high throughput as compared to DSR and TORA routing protocols except at one simulation time. The simulation time at 30sec both DSDV and DSR have same throughput.

CONCLUSIONS

In our simulation, three MANET routing protocols DSDV, DSR and TORA were evaluated with fixed MANET Size and varying Simulation times for mobile ad hoc networks using NS-2.34 simulation. The general observation from the simulations are the application oriented performance metrics such as Packet Delivery Fraction, Normalized Routing Load, throughput , fixed number of nodes and varying Simulation times were analyzed. DSR exhibits a better behavior in terms

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of the Packet Delivery Fraction. In Normalized Routing Load in stress less situation DSDV demonstrate lower routing load in lower Simulation time. When simulation time increases TORA has lower routing load than DSDV. In Stressful situation TORA has lower routing load with increased simulation time as compared to DSDV and DSR routing protocols. In throughput in stress less situation DSDV has better throughput than DSR and TORA. In stressful situation DSDV demonstrate high throughput in lower Simulation time. When the simulation time increases DSDV and DSR have better throughput than TORA.

FUTURE WORK

In future, extensive complex simulations might be carried out by using other existing performance metrics, so as to gain a more in-depth performance analysis of the ad hoc routing protocols. Other new protocols performance would be studied too.

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