Performance Analysis of DSR, STAR, ZRP Routing Protocols for a Dynamic Ad-Hoc Network

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***Abstract*—A dynamic ad-hoc network is a collection of mobile hosts with frequently changing network topology. Due to the mobility of nodes, interference, multipath propagation and path loss there is no fixed topology in this network. Hence some routing protocol is needed to function properly for these networks. This paper provides an overview of one of each type of routing and a review of performance analysis that is acheived on the basis of certain parameters. The parameters involve throughput, jitter and end-to-end delay. All simulations are carried out on the Qualnet Network Simulator.**

Keywords—DSR, STAR, ZRP, Routing protocols, MANET, Ad-hoc network, WANET

I. INTRODUCTION

A wireless ad hoc network (WANET) is a decentralized type of wireless network. The network is ad hoc because it does not rely on a pre existing infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks.

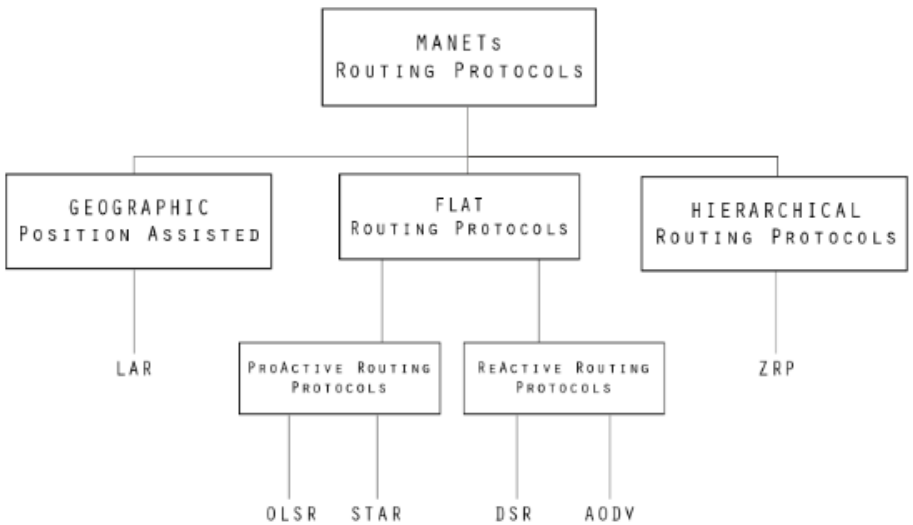
Although, a network can be classified into static or dynamic, where a dynamic network is the one in which the network topology changes over time and the nodes may come and go, and edges may crash and recover. In a Mobile ad-hoc Network(MANET), these nodes act both as router and a host which can instantaneously form networks. Here, the load on the network changes over time where changes constantly occur and the system constantly has to adapt to them.

The main challenge of designing MANETs is to develop scalable routing protocol which can help to communicate between mobile nodes. The role of routing protocols is to find a path which data packets can follow to transfer data from source to destination.

The routing protocols for Ad Hoc wireless networks can be broadly classified into four categories- Routing information update mechanism, use of temporal information for routing, routing topology, and utilization of specific resources. Based on routing information update mechanism the routing protocols can be reactive, proactive and table driven. A few examples of those are as shown in the table below :

A. Proactive Routing Protocols

Proactive routing is also known as table - driven routing protocol. In this type of routing each node maintain the routing table for containing the latest route information of any node in the network. All proactive protocols have different method in the way of propagating information through all the nodes at the time of topology changes. These types of routing protocols are not suitable for larger networks because each node table maintains the entry of all nodes. These types of routing protocols are: Destination



sequenced distance vector (DSDV), Optimized link state protocol (OLSR), Bellman ford protocol, etc.

B. *Reactive Routing Protocols*

It is also known as on- demand routing protocol. Here, in this type of protocols are discovered the route on-demand bases when a node want send data packet to other node. By the flooding route request packet are disseminate throughout the network in the route discovery phase. Examples of reactive routing protocols are Ad-hoc On-demand Distance Vector routing (AODV), Dynamic Source Routing (DSR) and Location Aided Routing (LAR).

C. *Geographic Position Assisted Routing*

As suggest the name of this routing protocol used for proving the correct location of a node in the ad networks. Global Positioning System (GPS) to make possible to this work within the few meters range. All GPS equipped nodes use the same universal clock for global synchronization between the GPS nodes but there must be additional concern taken on the mobile environment. Due to mobility, given location information may or may not be incorrect. Examples of Geographic Position Assisted Routing are: GPSR (Greedy Perimeter Stateless Routing), LAR (Location Aided Routing) etc.

D. *Hierarchical Routing Protocols*

Hierarchical routing protocols are known as hybrid routing protocols because these protocols are based on the combination of proactive and reactive routing protocol. Actually combination is based on the merits of both types (proactive, reactive) routing protocols. The hybrid routing protocols examples are zone routing protocol (ZRP), CGSR (Clusterhead-Gateway Switch Routing), and HSR (Hierarchical State Routing).

II. PROTOCOL DESCRIPTION

There has been a considerable amount of erudition put into experimentations with routing protocols. In MANETs, every node act as a host and router i.e, it is autonomous in behavior.

There is a multi-hop radio relaying- once a source node and destination node for a message is out of the radio range, the MANETs are capable of multi-hop routing. Distributed nature of operation for security, routing and host configuration. A centralized firewall is absent here. The nodes can join or leave the network anytime, thus the network topology becomes dynamic in nature.

Mobile nodes are characterised with less memory, power and light weight features. The reliability, efficiency, stability and capacity of wireless links are usually inferior compared with wired links. This shows the unsteady link bandwidth of wireless links.

All nodes have identical features with similar responsibilities and capabilities and thence it forms a totally symmetrical environment.

III. RELATED WORKS

There has been a considerable amount of erudition put into experimentations with routing protocols to analyze which perform best under certain conditions. The authors of [4] concluded that AODV performs best in all aspects after comparing DSR, DYMO and AODV routing protocols where DSR has the worst packet-delivery ratio. The authors of [6] have thought-about 3 routing Protocols DSR, ZRP & STAR for simulation and the energy performance metrics, routing power and residual energy have been thought of in 3 modes (transmitting, receiving, and idle). In line with the results DSR has most noise, least energy consumption and throughput performance is incredibly high. DSR offers higher knowledge packet delivery magnitude relation and end to end delay performance compared to ZRP when additional variety of nodes is applied for simulation. STAR has minimum noise and lowest memory consumption. Once the simulation it's determined that DSR is best in comparison to STAR and ZRP.

IV. SIMULATION SETUP

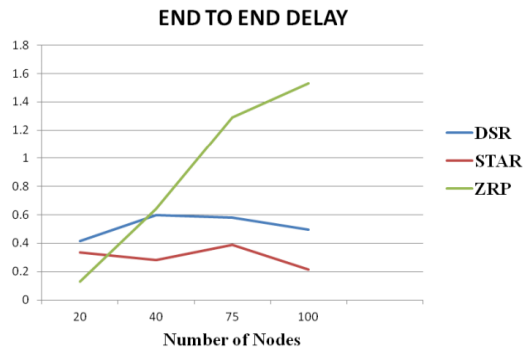
The comparitive analysis of protocols can be done by real world experiments or by simulation. Since simulation is a more viable and feasible option, most of the research work of ad-hoc networks is performed by using simulation software. It destroys the need for time consuming and costly real world implementations. The simulator which has been used for this research is is Qualnet 5 that computes the performance of wireless, wired and mixed platform network and networking devices. Qualnet is a paid software and the reason for selecting it is because of its accuracy, speed and portability.

The main aim of the analysis was to match the performance of DSR, STAR and ZRP in several simulation environments. The comparison was created by varied the node density and the simulation setting one at a time and keeping all the factors to be constant. 3 conditions were thought of. within the 1st condition, i.e., static, the nodes were unbroken stationary. Then all the nodes were created dynamic and therefore the pause time of every node was virtually negligible. The quality model used was Random manner purpose quality. A third condition was outlined wherever the pause time of every and each node was set every which way. Some nodes were unbroken static whereas the opposite nodes were allowed to maneuver every which way with varied pause time. This condition was assumed to be semi-dynamic. The simulation was carried on a part of size 1600*1600 square units. The node density was varied from 25, 50, 75, and 100, 125 in every case. the quantity of rounds for every condition was ten.

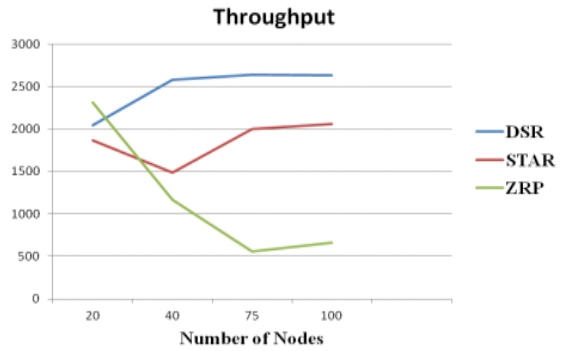
Within the situational UDP (User Datagram Protocol) affiliation was used and information traffic of Constant bit rate (CBR) was applied between supply and destination. The multiple cosmic microwave background radiation applications were applied over half-dozen totally different supply nodes – 17, 8, 14, 10, 16, 19 and destinations nodes -22, 25, 11, 13, 6, 15 severally. Every simulation was dispensed for three hundred seconds. The performance metrics used for comparison were turnout, end- to-end delay, packet delivery magnitude relation and disturbance. The values for the various parameters is summarised within the table given below.

V. PERFORMANCE METRICS/ PERFORMANCE ANALYSIS

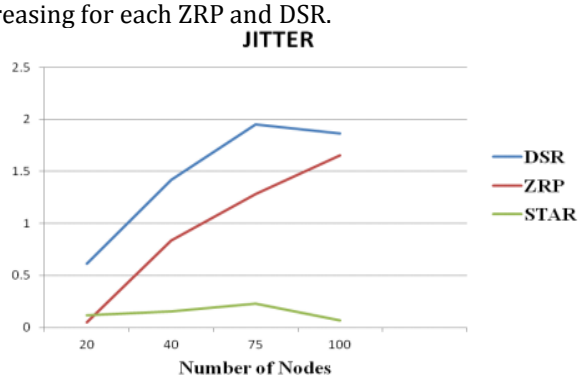
Average End-to-End Delay End-to-end delay indicates however long it a packet takes to travel from the CMB supply to the application layer of the destination. in step with our simulation results, average end to end delay with range of nodes (vehicles) variable from twenty to one hundred for DSR, STAR and ZRP protocol. The fundamental distinction between STAR and DSR is extremely less throughout the nodes variation. Average end to end delay of ZRP is beyond each STAR and DSR. however when range of nodes multiplied by 30, STAR is giving lesser end to end delay than DSR. in case of ZRP, at the start it's giving lesser end to end delay as compared to DSR and STAR. when range of nodes increases thirty, there's systematically increment within the price of end to end delay. In ZRP protocol routes discovery is slow. Inter-Zone routing (IERP) is liable for this work. If link is broken during route rather than using another path, it uses the native route repair to create a replacement route as in some reactive protocol. In some cases this route will be pretty long (in range of hops) and continues to send the info packets on the long route. Therefore, the end-to-end delay will increase for these information packets, leading to multiplied average end-to-end delay for all information packets.



Throughput The throughput is defined as the total amount of data a receiver receives from the sender divided by the time it takes for the receiver to get the last packet. The throughput is measured in bits per second (bit/s or bps). Figure shows throughput with range of nodes variable from twenty to one hundred nodes for STAR, DSR and ZRP routing protocol. Throughput of DSR is better than STAR and ZRP.As the range of nodes is increasing, the value of throughput is additionally increasing which shows that DSR supports quantifiability. STAR additionally shows higher throughput as compared to ZRP. Up to thirty five nodes there's slight distinction within the throughput of each STAR and ZRP, however after this, STAR is showing systematic increment in throughput value. Whereas DSR throughput remains constant once range of nodes become eighty. Therefore DSR is the only routing protocol that supports quantifiability as the number of nodes increasing its throughput are additionally increased .



Jitter is the variation within the time between packets incoming, caused by network congestion, temporal order drift, or route changes. It ought to be less for a routing protocol to perform better. In DSR, there's additional probability for interference as source node initiate route discovery mechanism by broadcasting a route request packet to its neighbors. According to our simulation results, ZRP has less average jittering than DSR routing protocol. The figure shows interference with range of nodes varied from twenty to a hundred nodes for STAR, DSR and ZRP routing protocol. Interference of STAR is lesser than each DSR and ZRP. As the range of nodes is increasing, the value of interference is additionally increasing for each ZRP and DSR.



VI. CONCLUSION

Initially, varied routing protocols are surveyed in this paper. Keeping challenges and problems with Dynamic ad-hoc networks in our mind, we've chosen 3 routing protocols to be compared based on their simulation performance. In this paper, the performance of Position based routing protocol (STAR), Reactive routing protocol (DSR) and Hybrid routing protocol (ZRP) is evaluated using QUALNET 5.1 simulator on urban situation. The performance of the protocols was measured with relevance metrics like noise, end to end delay and throughput on the premise of variable range of nodes. Simulations were administered with identical topologies and running completely different protocols on the moving vehicles. The results of the simulation indicate that performance of the STAR protocol is superior to both DSR, ZRP protocols. It's additionally discovered that the performance is better especially once the amount of nodes is magnified. In case of output DSR perform higher than both ZRP and STAR. However in other 2 performance metrics STAR outperformed in jitter and end to end Delay.

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