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PERFORMANCE EVALUATION OF DSR ROUTING PROTOCOL UNDER DIVERGING AND CONVERGING NODES

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ABSTRACT

Structure less wireless mobile networks or Ad hoc networks under the MANET scheme are created on a limited temporary basis. But its importance can never be over-emphasized as it has found applications in so many fields of human endeavour. Thus, it is important to consider effective routing procedures which assists the proper functioning and deployment of MANET. In this paper, the overall performance of the Dynamic Source Routing (DSR) protocol, which is basically on-demand, under diverging and converging nodes is investigated. Detailed simulations were carried out, using OPNET Modeller.

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KEY WORDS

MANET, Routing Protocols, Dynamic Source Routing (DSR), Performance analysis.

INTRODUCTION

MANET (Mobile Ad hoc Networks) are unstructured wireless networks which are temporarily used in timely projects [1]. A cost effective project management technique suitable for technologically arid regions, wireless networks of this category has been researched for a few decades, and after dedicated efforts put into research, a variable format of MANET was formed comprising of several levels of applications.MANETs are well suited in a situation in which the deployment of an infrastructure is not feasible and cost effective. Over last two decades, MANET became a very interesting reasearch area. Many institutes and corporations have sponsored MANET. It is commonly used in daily communication technologies, such as, conferencing and also a host of emergency services; local home networks; embedded computing applications; and personal networks, etc. [2].

A major problem concerning MANET networks are proper routing methods, because neither does it have specialized infrastructure to counter mobile network needs nor does it have an assurance of stable positions. Thus, the goals of MANET is to enable tackling mobility issues through their limited resource capacity, heterogeneity, etc. [3]. This technique enables multiple alternatives to resolve the above challenges. So in interest among researchers is to supply suitable ad hoc routing networks for assisting academic and industrial spheres.

Several routing protocols have been designed for multi-hop ad hoc networks. The routing protocols obtained here needs a range of design choices and approaches, from simple modifications of internet protocols, to more complex multi-level hierarchical schemes. Although the ultimate end goal of a protocol may be operation in large networks, most protocols are typically designed for moderately sized networks of 10 to 100 nodes [4].

The Dynamic Source Routing protocol (DSR) [5], an basic and well-functioning protocol designed for wireless multiple hop ad hoc networks utilizes DSR to self-configure and process data, without the use of existent administrative structures. Communication is processed through several "hops" transmitted between each other, but not within the direct range of existent networks. Since routing networks are automatically formatted and maintained through routine DSR checkups, nodes are often made to join or exit wireless transmission networks to prevent any source of interference. But the above process can be rapidly changing and due to this issue it becomes difficult to estimate the number of intermediary hops.

DSR sequential protocols depend on two main techniques which function together to propagate encounters and procedural maintaince of ad hoc source network routes in:

A method technique under Route Discovery, uses package systems to transfer between nodes S to its destination to gain a proper route. It is only used to send packages to the destination without the need to know a stable route.

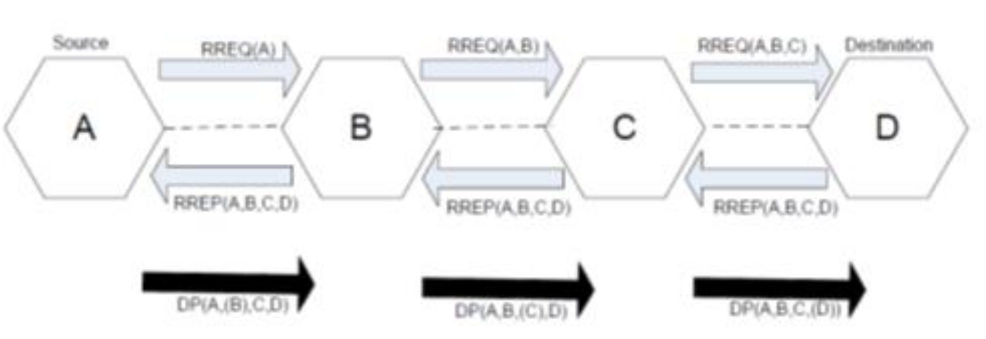

Fig: 1.Route Discovery in DSR

This is a detectable mechanism used to source linkages to D, if the topopogy of the networks have been modified and is no longer capable of of creating functional connections. Broken links are usually replaced by other routes to D, or the nodules of S attempt to create new links to contacted destinations D. This method is only used for transferring packages between S and D.

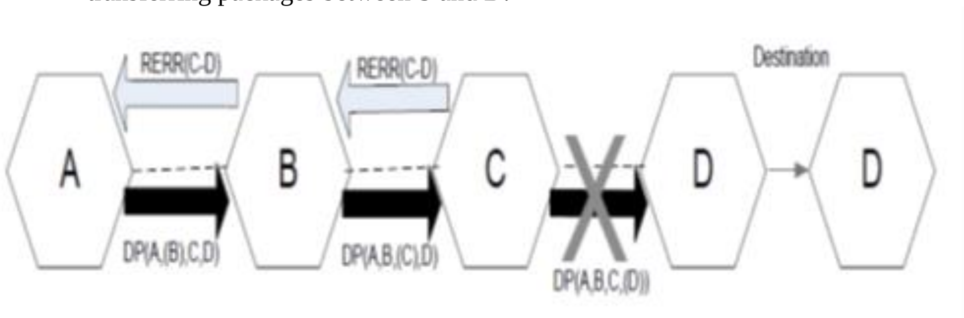

Fig: 2. Route Maintenance in DSR

A demand based system, DSR technology completely operate on Route Discovery and Route Maintence. Unlike other protocols, DSR does not need any form of periodic packages within any layer of the network, such as, the lack of necessity to depend on periodic routing for advertizing, status link sensing or detecting neighbor packages, without relying on unwritten protocols of the system.

ROUTE ERRORS in DSRs occur when there is a disconnection in linkages, and the package is sent back to its source through another route discovery operation. Adding to this procedure, every broken link is removed through its intermediate cache nodules transmitted to the source. Thus, the increase in overhead traffic is the aftermath of complete routing procedures and knowledge acquisition among DSR systems. The size of the network is taken to be 5 to 10 nodes diametrically, even though the network might be small, it is applicable only to a relatively minute number of nodes, usually less than 100 nodes. This is done to maintain equilibruim in the system and not to cause problems in the system later.

In this paper, the overall performance of the Dynamic Source Routing (DSR) protocol, which is basically on-demand, under diverging and converging nodes is investigated. Detailed simulations were carried out, using

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OPNET Modeller. The paper is organized as follows: this section introduces MANET, routing protocols and explains in the routing protocol DSR.

RELATED WORKS

Functional ad hoc networks or MANET, researched through works by Valentina Timcenko et al., [6] proposed routing protocols under group mobilities and entity measuring models. The most commonly used and rsearched routing systems are: Destination Sequence Distance Vector (DSDV), Ad-hoc On-demand Distance Vector (AODC), and Dynamic Sourcing Route (DSR). These models include mobility structures like the Reference Point Group Mobility, Gauss-Markov (GM) and Manhattan Grid (MG) models.

Simulator models are usually merged with Bonn Motion scenario tools to process any simulation under the Network Simulator Version 2 (NS2). Successful results of the above simulator process have assisted in creating a set of specific simulated scripts which are applicable for usage on a wider range of MANET scenarios. The procured results indicate a relative ranking among protocols, which vary based on the level of mobility. Depending on nodular speeds, mobility presence can indicate failed linkages, which reacts depending on routing levels. Entity models enhhance performances due to its low level of GM and MG randomness, under which the AODV model performs better with RPGM group models. Although some models experience stipulated delays, AODV models experience high levels of overhead routing speed, whereas DSR has a lower overhead speed with higher standard delays, especially under a MG and GM model. The above method performs the best with RW models. Hence, researchers need to consider energy efficient consumption patterns by allocating varied propagation and MAC models in the future.

Mobile ad hoc networks, based on "random walk" unrestricted mobile simulations, recreate an unrealistic vision of a world in which individuals try to surpass walls, no need for cars on the road and people drive on waterbodies. A new graph model introduced by Jing Tian et al., [7], provides better movement which are realistic unlike random walk models. This graph model portrays real-world spatial constraints. DSDV, DSR and AODV, the most common techniques use both a random walk-based and the proposed graph-based mobility model are analyzed. The simulation results show that the spatial constraints have a strong impact on the performance of ad hoc routing protocols. A graph from external spatial data is extracted to represent the realistic movement constraints of pedestrians walking in the city. As the result showed, routing protocols performed quite differently in this graph walk model from the random walk model. Moreover, comprehensive simulations are made with short radio ranges considering the energy constraint of handheld devices.

The last years has seen a surge in the popularity of Mobile Ad hoc Networks (MANETs), among researchers, especially in military and civilian applications due to its rapid deployment abilities. Due to its capacity to function albeit proper infrastructure and durability to sustain itself through rapid network changes. MANET systems are mainly evaluated through simulations, although there have been instances where variable graphs have been employed to formally research it. Anuj K. Gupta et al., [8] attempts to make a comprehensive performance evaluation of three commonly used mobile ad hoc routing protocols (DSR, TORA and AODV) which contain identical capabilities and working conditions with identical loads and conditions in environment which help in evaluating its relative performance with respect to the other two performance metrics: average End-to-End delay and packet delivery ratio. Over the past few years, new standards have been introduced to enhance the capabilities of ad hoc routing protocols. The latest simulation environment NS 2 is used to evaluate the protocols using packet-level simulation. Various simulation scenarios with varying pause times were investigated. From the detailed simulation results and analysis, a suitable routing protocol can be chosen for a specified network and goal. The experimental results obtained can be concluded as follows:

- Increase in the density of nodes yields to an increase in the mean End-to-End time deficiencies.
- The ability to delay means in end-to-end delays through adding more pauses in time
- The mean time loop detections are recognized through the spiraling in the number of nodes.

The above pointers indicate te steady performance of AODV. Unlike TORA systems which are suitable for moderately steady and mobile networks, DSR systems suitable for low bandwidth power usages is also suitable for moderate mobility rates. The major benefit of TORA systems is its excellent support for multiple routes and multicasting.

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A collection of wireless mobile nodes or an Ad Hoc Network can dynamically form temporary networks without using any older network infrastructure or forms of centralized administration. There are a number of routing protocols like Dynamic Source Routings (DSR), Ad Hoc On-Demand Distance Vector Routings (AODV) and Destination-Sequenced Distance-Vectors (DSDV) which can be implemented. Samyak Shah et al., [9] attempted to compare the performance of two prominent on-demand reactive routing protocols for mobile ad hoc networks: DSR and AODV using ns-2 simulations, alongside traditionally proactive DSDV protocols. Thus, simulation models using MACs and physical layer models are used to investigate interlayer interactions and possible implications in performance. It is to be noted that on-demand protocols like AODV and DSR can perform better than any table-driven DSDV protocols. Eventhough DSR and AODV do share mutual on-demand behavioral patterns, differences in the protocol mechanics leads to significantly different level of performances. There is a variety of workload and scenarios patterns which are characterized by mobility, load and size of an ad hoc network. Performance differentials are then analyzed via differential network load, mobility, and network size. And the above simulations are carried out through the Rice Monarch Project which has managed to procure substantial extensions to the ns -2 network simulator to run ad hoc simulations. General observations from the above simulations show that for application-oriented metrics like packet delivery fractions and AODV delays can outperforms DSR in intensely "stressful" situations (i.e., smaller number of nodes and lower load and/or mobility), with wider gaps in performance gaps through each increasing stress level (e.g., more load, the higher the mobility rate).However, DSR, can consistently produce less routing load than standard AODV lebels. Poorly performing DSRs can mainly be attributed to a growing role of aggressively using caching techniques, and lack of proper mechanisms to shut down non-functional routes or even predict the age of given routes especially when there exists multiple choices. But,Aggressive caching seems to assist DSR in low load situations and it also keeps the load levels in routing down.

Md. Anisur Rahman et al., [10] made a comprehensive attempt to study and compare performancea ofprominently existent on-demand routing protocols especially for mobile ad hoc networks like DSRs and AODVs, alongside traditional proactive methods like the protocols for DSDV. Simulation models with MAC and physical layer models have been used to study interlayer interactions and their performance implications. The On-demand protocols, AODV and DSR perform better than the table-driven DSDV protocol. Even though both DSR and AODV seem to share the same on-demand behavior,differences in the protocol mechanics lead to significant differentials in performance. Performance differentials are analyzed through the varying network loads, network size, and mobility. DSRs have a remarkably low packet dropping rate when compared to DSDV and AODV which indicates its efficiency level. But it is to be noted tha both models of AODVs and DSRs can fare better in high mobility situations unlike DSDVs. High mobility situations can be caused due to frequency in linkage failures and any overhead cost which is incurred while updating all newly routed information node as DSDVsare more involved than in the case of AODVs and DSRs. Particularly, DSRs utilise source routes and caches, and it does not purely depend on periodically involved activities. Thus, DSRs exploits caches for the purpose of route storage and it maintains a set of multiple routes per every destination. Unlike the above case, AODVs, on the other hand, utilize routing tables, at one route per destination, and proposed sequence of destination numbers, a mechanism to prevent loops and to determine freshness of routes. General observations made from the above simulation is based on application-oriented metrics such as packet delivery fraction and delay, DSR performs higher than the DSDV and AODV. DSR consistently generates less routing load than AODV.

Bai, et al., [11] proposed framework aims to evaluate the impact of different mobility models on the performance of MANET routing protocols. Interesting characteristics on mobility are captured through various independent protocol metrics, which include both spatial and temporal dependence and eventhe proposal of geographic restriction. Additionally, a set of richly parameterized mobility models will be introduced through mechanisms like the Group Mobilities, Random Waypoints, Group, and Manhattan and Freeway models. And based on the above 'test suite' models severalscenarios are carefully chosen to expand metric space. The utility of the proposed test-suite is demonstrated by evaluating various MANET routing protocols, including DSR, AODV and DSDV. Results from the above test showcase how performanes of protocol can drastically vary across various models and this can affect the ranking of performance protocols alongside each model used. This has been effectively explained through the interaction ofmobility characteristics alongside connectivity graph properties. Finally, decomposing the reactive routing protocols into mechanistic ''building blocks'' to gain a deeper insight into the performance variations across protocols in the face of mobility is attempted.

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METHODS

Performances of different protocols are determined by various interrelated metrics. Most important parameters to be regarded are the End to end delays, routing traffic data received, routing traffic data transferred and Throughputs which have been considered altogether to draw analytical observations. The throughput is generally taken as the key parameter. Throughput is the measure of how soon an end user is able to receive data. It is determined as the ratio of the total data received to required propagation time. A higher throughput will directly impact the user's perception of the quality of service (QoS).

Experiments carried out in a structured set up using an OPNET where the topology structure of the network and the motion mode of the nodes, to configure the service source and the receiver, to create the statistical data track file and so on is defined. Traffic models are often used as continuous bit rate (CBR) sources where the source-destination pairs are spread randomly over the network of area 4 Sqkm. Only 512-byte data packets are used. The number of source-destination pairs and the packet sending rate in each pair is constant. End to end delay includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times of data packets.

Mobility models thus, attempt to understand movements of real mobile nodules. These are based from settling different parameters which can be relatable to nodular movements. Basic parameters are the starting location of mobile nodes, their movement direction, velocity range, speed changes over time. Mobility models can be classified to entity and group models [12]. Each entity models covers situations in which mobile nodes can shift independently from each other, while on the other hand in-group models nodules are highly dependent on each other or on a predefined leader node. In this study, Mobility Model used is diverging and converging nodes. It is noted that each packet is bound to starts its journey from a randomly selected location to another randomly elected destination with an unspecified speed (uniformly distributed between 0–20 m/s). Simulations are run for 1000 simulated seconds

RESULTS AND DISCUSSION

The following **[Figures- 3-6]** show the simulation results of end to end delay, routing traffic received, routing traffic sent and throughput.

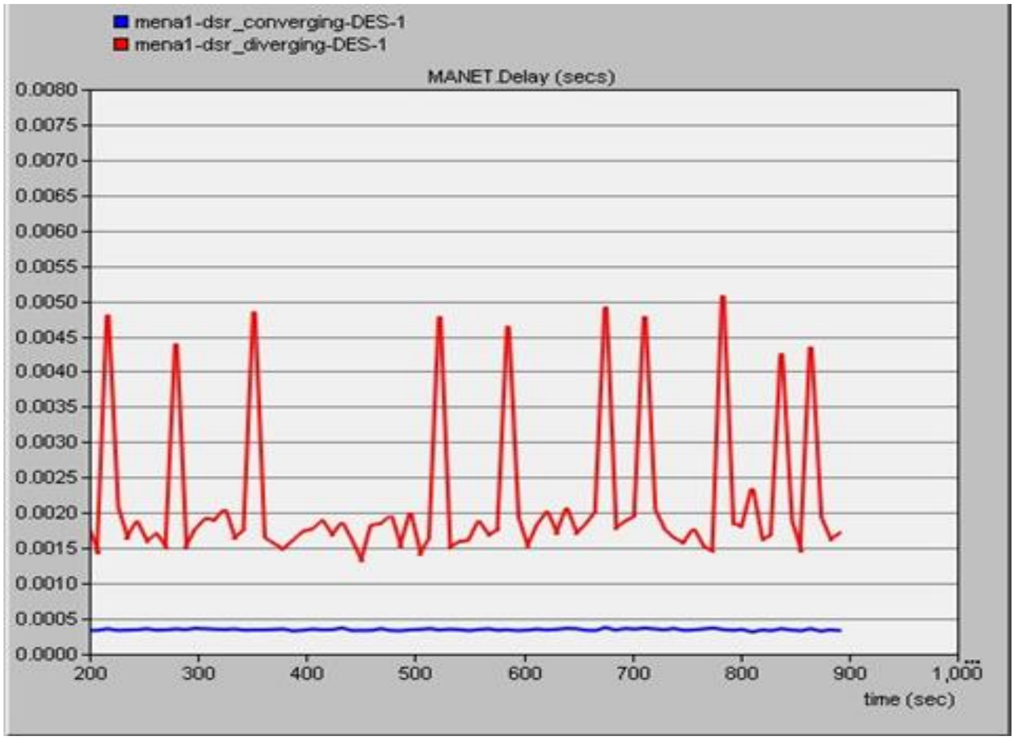

Fig:3. End to end delay for the converging and diverging nodes

It is observed from **[Figure- 3]** that the end to end delay increases substantially due to diverging nodes while the end to end delay is constant for converging nodes.

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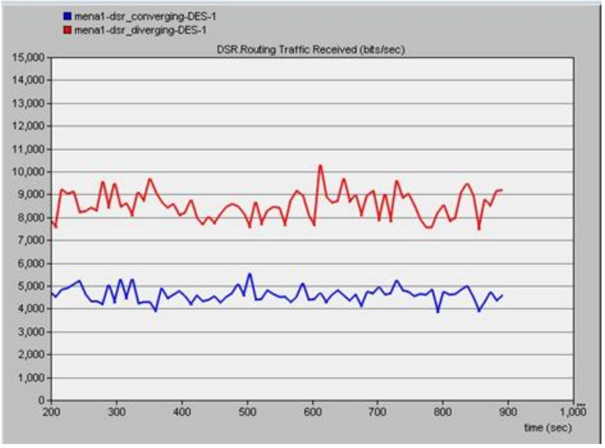

Fig: 4. Routing traffic received for the converging and diverging nodes

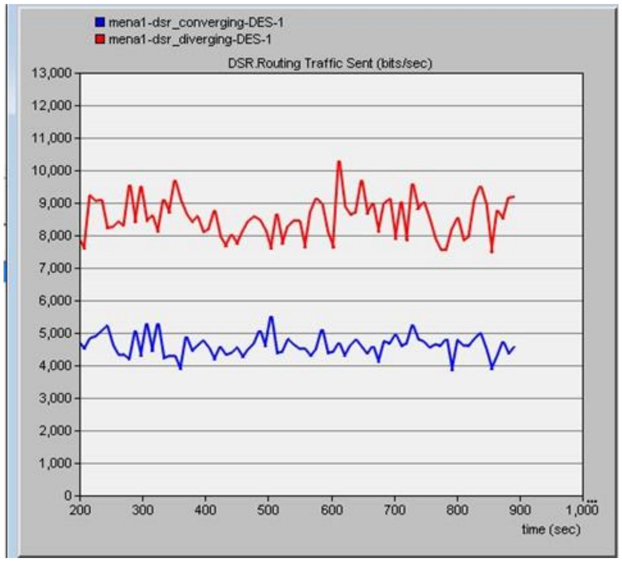

Fig: 5. Routing traffic sent for the converging and diverging nodes

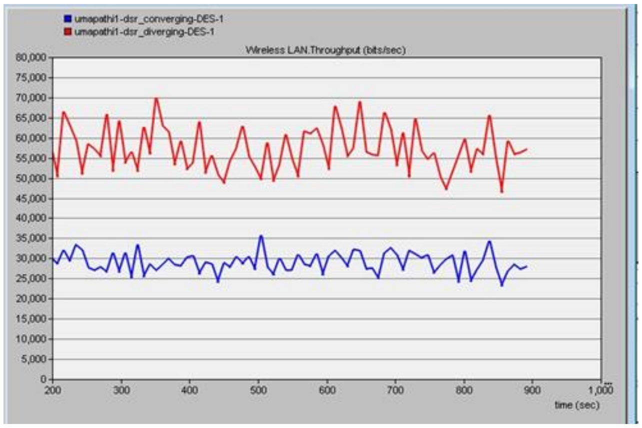

Fig: 6. Throughput in bits/sec

[Figure -6] shows the throughput for the diverging nodes and converging nodes. It is seen from the graph that the throughput falls drastically for the diverging nodes.

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CONCLUSION

In this paper, the overall performance of the Dynamic Source Routing (DSR) protocol, which is basically on-demand, under diverging and converging nodes is investigated. Detailed simulations were carried out, using OPNET Modeller. Simulation results show that the end to end delay increases and throughput reduces drastically in diverging scenario. Since throughput is lower in diverging scenario, further work can be done to improve the parameters by optimizing techniques.

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