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Improved Route Selection Algorithm for Quality of Service Aware Dynamic Source Routing Protocol (QoS-DSR) in Mobile Ad Hoc Networks

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Abstract

Now a day's, due to the popularity of portable computers and the increasing demands of users to access computing services in a better way an alternative way of network service access is required. Thus mobile ad hoc network (MANET) is one of the alternatives to achieve this requirement by proving infrastructure less services with self-configuring and reduced cost set up capably. Due to the raped growing rate of multimedia applications (voce, video) n MANETs, quality of service (Quos) support has also grown up to be supplementary and more important. Particularly, Quos related with latency s very interesting, because latency is the most catcall Quos metrics n mobile ad hoc networks manly for delay sensitive applications. In this paper, we study the performance of two route selection metrics, and compare them against minimum hop-count "shortest path" routing. The first route selection metric is based on "recent-short path", whereas the second one is based on "recent path". The proposed RS-DSR and R-DSR routing protocols are simulated using Network Simulator-2.35 and comparisons are made to analyze its performance based on packet delivery rate, normalized routing overhead, and average end to end delay for different network scenarios.

Keywords: *Mobile ad hoc Network, Quality of Service, R-DSR Routing protocols, Network Simulation, End to End Delay Network.*

1. Introduction

Computing is an evolutionary process with each generation improving on the previous one's technology, architecture, software and applications. In recent years, with the advent of new technologies and the demand for flexibility and ease in working environment, the use of mobile computing has enjoyed a tremendous rise in popularity. Devices can be able to work everywhere at any time without the need of having a fixed infrastructure. Nowadays there are more than billions of wireless devices in use for the purpose of different applications. However, creating a connection and making message exchanging between mobile nodes is a big such kind of technologies.

Therefore, Mobile Ad Hoc Networks(MANET) [1, 2] a dynamic molt-hop wireless ad-hoc communication network that allows people and devices to seamlessly internetwork in areas with no pre-existing communication infrastructure or central administration. However, the biggest challenge in this kind of networks is to find a path between the communications ends punts, which is aggravated through node mobility. Thus, a routing protocol wall play a major role in an ad hoc network to connect nodes that cannot communicate with each other directly and does not stop to be a subject of research work to improve the performance of wireless networking solutions.

In MANET every host s acting's a router to forward the packet to other node and they act as a host also to send and receive packets. This type of network can be used in free, safety, rescuer and disaster recovery operations, conference and campus settings, car networks, personal networking, etc. Figure 1 shows the scenario of conceptual representation of mobile ad hoc network

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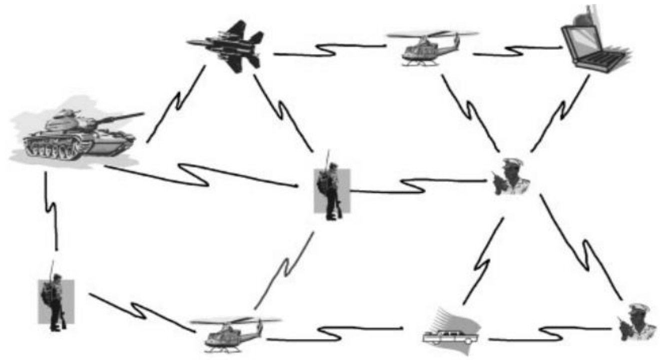

Figure 1: Conceptual Representation of MANET

Having this, the biggest challenge in this kind of networks is to find path between the communication endpoints, which is aggravated through node mobility. To accomplish information exchange among mobile nodes in MANET routing protocols have a great role. Routing [6] in MANET is the process that a node uses to send packets towards destination network and routing protocol allows one node to share information with other nodes regarding the networks it is aware of concerning in add to as its proximity to different routers. The current trend of connectivity anywhere, anytime, and anyhow brings a new paradigm of accessing real-time multimedia services (voice, video, and text) van MANETs specifically in the area of military, emergency, automotive application, etc. for many people, real-time multimedia services are getting to be one of the interesting networking communication services [6].A routing protocols developed for wired network are not suitable for MANETs due problems related to convergence and looping. Because, in MANETs the network topologies are changing dynamically as the node leave and the topology, hence, those conventional routing protocol convergence times are based on period updating of routing information’s which is against with the routing principle required by MANETs [8].

2. Related Work

Mobile Ad-Hoc Network (MANET) [1, 13, 14, 15] is a dynamic molt-hop wireless network that is established by a group of mobile nodes on a shared wireless channel. As shown n Figure 2, [16], nodes may be computers or devices such as mobile phones and pocket PCs with wireless connectivity. The nodes communicate with each other and exchange network information, and network topology changes could occur randomly, rapidly, frequently and unpredictably. As a host, a node functions as a source and destination in the network and as a router, nodes act as intermediate bridges between the source and the destination gang store and forward services to all the neighboring nodes in the network.

Easy deployments, speed of development, and decreased dependency on the infrastructure are the main reasons to use an ad hoc network. It allows people and devices to seamlessly internet work in areas with no pre-existing communication infrastructure or central administration, have wed applications ranging from military operations, natural disaster, search and rescue operations and other applications such as meeting n a room, transport, etc. Each node s responsible for forwarding a packet it has received from one to another f required, until the packet reaches the destination.

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Figure 2: Sample Wireless Ad Hoc Network

MANET technology plays a fundamental role in a possible future of ubiquitous computing n which users are no longer aware of computation bang done[17, 18].Due to their ably of bang intelligent, devices are self-organizing, packet forwarding, connecting to the internet and they can be embedded pervasively to the physical world.

In MANETs, many research areas have potential study value and thus attract much attention. Currently, the popular research sues are routing, multicasting/broadcasting, location service, TCP and reliable transport, medium access control, interface, Quality of service, power management, and security. Finding effect solutions to these fundamental sues could significantly increase the survivability of MANETs.

A MANET working group of the internet Engineering Task Force(ETF) is currently proposing a number of research directions for improving the services provided by ad hoc networks [1, 16]. The group standardizes P routing protocol functionalities which are suitable for wireless routing applications within both static and dynamic topologies with increase dynamics due to node mobility and other factors.

2.1. MANETs Protocol Stack

The MANET protocol stack,[34] which is smear to the TCP/P suet - s shown in Fgure3 below. The man distinction between these two protocols stacks les within the network layer. Mobile nodes (which are each host and routers) use an ad hoc routing protocol to route packets. Ad hoc routing s handled by the network layer that successively s spelt not network and ad hoc routing show in figure3.

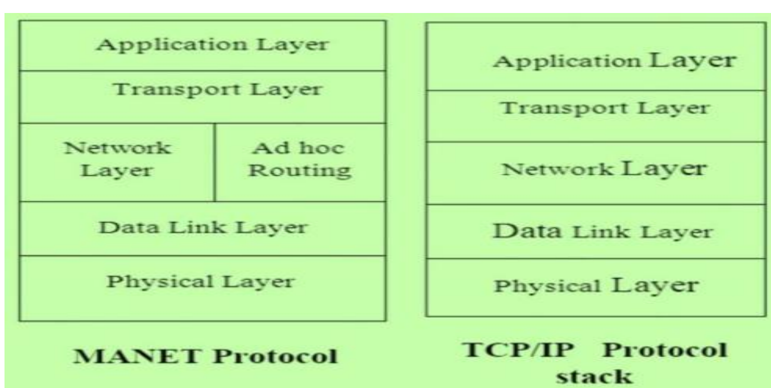

Figure 3: Mobile Ad hoc Networks Protocol Stack

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2.2. Mobile Ad Hoc Networks Technology

Due to the innovation of portable devices and EEE 802.11/W-F wireless protocol, ad-hoc network is becoming very popular[13, 16, 19] EEE 802.11 s a set of mead access control (MAC) and physical layer (PHY) specifications for implementing wireless local area network (WLAN) computer communication. its fundamental task is to regulate the access of a number of nodes to a shared medium i n such a way that certain application dependent performance requirements are satsfed.EEE adopted the term ad hoc networks for the EEE 802.11 Wireless LAN standards and EEE 802.11 b, a, n, and g, etc. are the most widely used types of versions. In add, today, Bluetooth and HperLAN2 are among other alternatives that offer further technologies that can be used n ad hoc communications in figure4.

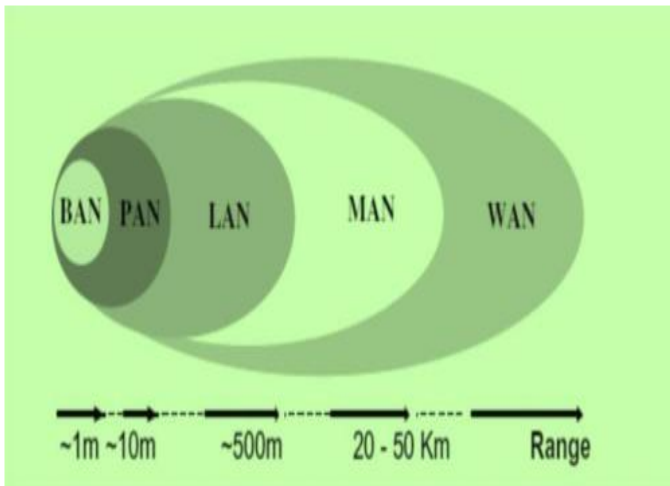

Figure 4: Mobile Ad Hoc Networks Technologies

2.3. Proactive Routing Protocols

Every proactive routing protocol usually needs to manta accurate information in its routing table [10, 18]. It attempts to continuously evaluate all of the routes within a network. This means the protocol mantas recent lasts of destinations and their routes by periodically distributing routing tables throughout the network so that when a packet needs to be forwarded, a route s already known and can be used immediately. Once the routing tables are setup, then data (packets) transmissions wall be as fast and easy as the traditional wired networks.

Unfortunately, it as big overhead to manta routing table's in a mobile ad hoc network environment. Therefore, the proactive routing protocols have the following common disadvantages:

- Consume lots of network resources to date status of network topology.
- Slow reaction on restructuring network and failures of individual nodes.

Therefore, proactive routing protocols are more appropriate for less number of nodes in networks which wall need minimum delays of QoS required applications. These routing protocols are not suitable for larger networks, as they need to manta node enters for each and every node n the routing table of every node. This causes more overhead and leads to consumption of more resources like bandwidth, processing power, etc. DSDV and OLSR are the most widely used proactive routing protocols which are discussed n the sequel.

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2.4. Reactive Routing Protocols

In bandwidth starved and power starved environments, it is interesting to keep the network slant when there is no traffic to be routed. Reactive routing protocols do not manta routes, but bold them on demand [28, 31, and 32].A reactive protocol finds a route on demand by flooding the network with Route Request packets.

These protocols have the following advantages:

- No big overhead for global routing table maintenances in proactive protocols.
- Quack reaction for network restructure and node failure.

Even reactive protocols have become the main stream for MANET routing, they still have the following man disadvantages:

- High latency time n route finding.
- Excessive flooding can lead to network clogging.

Therefore, these routing protocols perform better QoS n terms of packet delivery rate and in lower routing overhead especially in the presence of high mobility[33].Compared with the other routing protocols, they need relatively unconditional low storage, and the routes are available only when they are needed. However,because of high latency time in route finding process reactive routing protocols are not suitable for most time sensitive applications in which delay is a catcall issue. Some of the reactive routing protocols for MANETs are AODV, DSR, and DYMO.
The authors, *Leung, Roy, and Joe Lu et.al proposed a distributed Molt Path Dynamic Source Routing protocol (MPDSR*) for wireless ad-hoc networks to improve QoS support with respect to end-to-end reliability. In this paper, in order to select a subset of end-to-end paths to prove increased reliably of routes, a new QoS metric, end-to-end reliably, is incorporated on the existed one. A simulation study s performed on the proposed approach and t shows that MP-DSR achieves a higher rate of successful packet delivery than existing best effort ad-hoc routing protocols such as DSR [31].

The authors, *Sngh Ban, Alam M.Afshar et.al* proposed a new QoS-DSR strategy for reactive route discovery. The strategy is based on two QoS parameters, minimum bandwidth requirement and maximum allowable end to end delay.DSR routing protocol was used as a bass for implementing the proposed route discovery mechanism. Using NS2 network simulation the proposed approach was evaluated on 50 nodes and the result shows that in all comparisons odds and QoS-DSR, the proposed approach (QoS-DSR) exhibits reduced end to end delay while minting high packet delivery rate [35].

The authors, *Asokan,R., Natarajan A et.al* proposed Ant Based Dynamic Source Routing (ADSR) algorithm to proved QoS support routing, such as acceptable delay, jitter and energy in the case of multimedia and real time applications. The proposed protocol selects a minimum delay path with the maximum residual energy at nodes. The performance of DSR and ADSR are analyzed using NS2 simulator and the result shows that the proposed algorithm s better than the existing ones n terms of delay, energy, jitter and throughput. Even f ADSR performs well in route discovery with dynamic changes in the network topology and produces much better throughput with very low variance in the delay, t results in slightly higher routing overhead than DSR [25].

3. Research Design and Methodology

This chapter elaborates the design of the research described in this paper. First this chapter provides a brief description of the study’s research methodology that is design sconce on which the Design Sconce Research Methodology (DSRM) of Puffers et al.(2007) is based. This particular methodology forms the basic of the paper’s

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research design. Next, this chapter describes the design and development of the proposed QoS-DSR algorithm including the architecture, pseudo-code, flowcharts and dental working flow explanation about the proposed solution.

3.1 Design Sconce Research Methodology

The overall research design used in this paper is derived from the design sconce research methodology(DSRM) by Puffers et al.(2007).The use of the design sconce research methodology results in the creation of an artifact as solution to a problem's order to come to such a solution the DSRM process consists of six steps show in figure5: problem identification and motivation, define the objectives for a solution, design and development, demonstration, evaluation, communication (March & Storey, 2008).

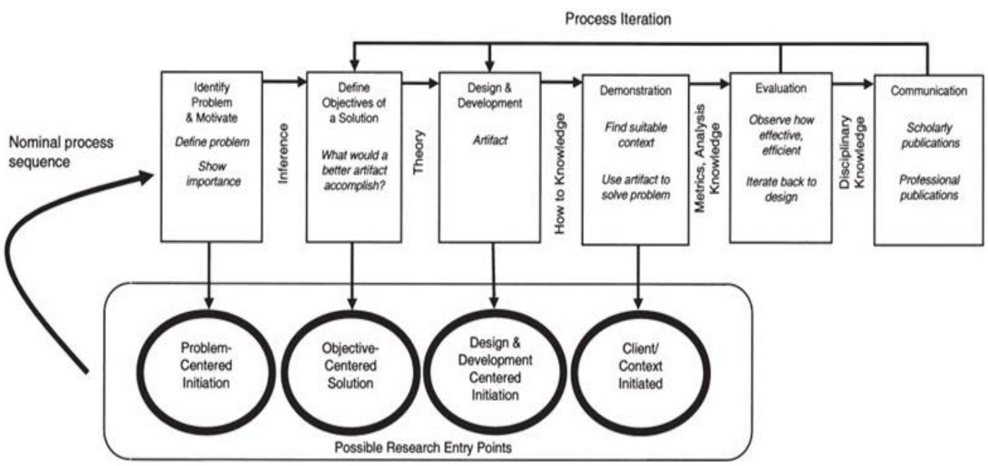

Figure 5: The Design Sconce Research Model

Research in information systems are concerned with people, organizations and technology(Hiver, March, Park, & Ram, 2004).Researches try to understand problems related to developing and successfully implement information systems in organza tons Development of information systems are often performed to help an organza ton to increase the efficiency and effectiveness. People, existing systems, development methodologies, and the capable of the information system are factors that wall affect this process. Hiver teal (2004) argues that there are two different paradigms that characterize this fled, behavior sconce and design science. The first paradigm seeks to develop or justify theorems that explain or predict human behavior. The latter is based n engineering and seeks to create innovations that effectively and efficiently solves problems for people and organza tons (Hiver et al., 2004).This is the paradigm we will use in this theses to manta control over the development, and research results.

3.2 Simulation Tools

In this sub section, the widely used simulator for MANETs to evaluate the protocols performance s analyzed. The selection of a development environment and simulation tools to be used for the implementation and evaluation of the proposed solution wall be described in this Section. There are different ways of doing an experiment for various research works, such as sung analytical model, emulation, real tested and Simulation to measure the behavior and performance of protocols n wireless networks as general. The construction of real test beds for any predefined scenario is usually expensive or even possible task if factors like mobility, testing area. Additionally, most measurements are not repeatable and require a high effort. Therefore, simulations are needed to bypass these problems [5, 24].

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Simulation-based software environment is used to study the behavior of networking system and relevant protocols.[50] There are plenty of MANETs simulators currently in use for computer networks and protocols evolution and testing purpose, For instance, NS-2, NS-3, OMNET++, SWAN, OPNET, QUALNET, J-SM, GLOMOSM, etc. All these network simulators have varied factors to be considered n simulating a MANET environment. Thus, selecting an appropriate network simulator and assessing which one wall proved optimum performance and suitably of network simulator for implementing and evaluating the proposed work is crucial. Here we have summarized surveys on various network simulators as follows:

Author's n[15] punted out that various simulators have different features and they have their own advantage and disadvantages, furthermore, none of the simulation tools fulfills all the requirements. According to this paper, authors made analyses on various available simulation tools and they selected NS-2 and OMNET++ as the best chokes for the MANETs.

Another author(s) in[21] made detailed analyses on many of existing wireless network simulators and they punt out that the simulator has long lasting features and characteristics but none of the simulator that can support all of them. Thus, according to their analyses result, they conclude that NS2 the best simulation tool available today for both wireless and wired networks including to its popularity, supportably and flexibly support. OMNET++ s also can be put as a successor of NS2 due to its GU supportably and having various good features. However, NS2 s the most popular simulation tools in the area of academic research specifically. Another author (s) n[31], described a brief introduction to various network simulators with their distinct characteristics and they gave a clear guide for the researchers to focus their attention on the software that meets specific requirements. The paper punted out that NS-3 s the best chokes for the MANETs; t supports a wed range of protocols in all range of protocols in all layers as described in [32] various simulators like NS-2, NS-3, and OMNET++ are evaluated. The authors have analyzed these simulators on the bass of the factors like the impact of simulation runtime on the network size and probably of dropping packets. They have also considered the memory usage as metrics n order to analyze the memory requirements of various simulators. The large variation n runtime performance as well as n memory usage was found when the simulation results were analyzed. The following table1 summarizes the comparisons between different simulation tools n different criteria's [11].

Table 1: Comparison of Network Simulators

Network Simulators	***License***	***interface***	***Parallelism***	***Popularity***	***Granularity***
NS-2	Open Source	C++, TCL	NO	88.8 %	Finest
Glooms	Open Source	Parsec	SMP/Beowulf	4 %	Fen
Ponte	Commercial	C	Yes	2.61 %	Fen
Monet++	Free	C++	MP/PVM	1.04 %	Medium
Quaint	Commercial	Parsec (C-based)	SMP/Beowulf	2.49 %	Finer
J-Sum	Open Source	Java	RM-based	0.45	Fen

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SWANS	Open Source	Java	NO	0.3 %	Medium

In general, as we have observed from the surveys, NS-2, OMNET++ and NS3 are the best chokes which proved better performance and simulation environment for MANETs. Therefore, considering sues discussed above, criteria like the ably to run large networks, availably of arêtes of modules, debugging and tracing support, popularity, flexibly and dynamic topology creation, we have selected NS2 for implementing and evaluating our proposed work.

3.3 Design and Development of the Proposed Quos-DSR Algorithm

In this paper, we study the performance of two route selection metrics, and compare them against minimum hop-count "shortest path" routing. The first route selection metric s based on "recent-short path", whereas the second one i s based on "recent path".

3.3.1 Proposed Techniques for DSR Route Selection

In this paper, we consider two route selection methods based on different routing metrics for DSR protocol. The first one based on "Recent-Shortest Route", whereas the second one s based on "Recent Route". We also support minimum hop-count routing by defang a "Shortest Route" metric for standard DSR. Each of these routing metrics represents a different concept of DSR route selection. The shortest path doesn't always describe the best available path n terms of QoS from the source node to the destination node n MANET's environment. In the updated DSR, the metric of route selection has been changed from hop count(or the shortest path) to: the recent-short path (the selected path depends on two operators; the number of hop-count, and the source of RREP), and the recent path (the selected path depends on two operators; the source of RREP, and the construction time of path).

3.3.1.1 Route Selection based on "Recent-Shortest Route First"

For DSR protocol, we present new route selection scheme, and the key of improvement n our scheme s that the performance of DSR can be achieved by selecting the recent shortest route to the intended destination. We call it RS-DSR algorithm's-DSR apples the recent-shortest route as routing mercers-DSR estimates the recentness of the route sung a new policy. Where, the source node gives the priority to RREP packets which answered back by the destination of data packet rather than intermediate nodes' standard DSR protocol, RREP packets reply back to the source node by intermediate nodes or the intended destination node. Wherever, nodes employ there caches to send RREP packets to the source node. Mostly, due to the high mobility of nodes; cached routes are likely to be disjointed. As result, f the selected cached route falls frequently, the path selection scheme wall is a time consuming method. In this work, for estimate recent-short route; the proposed RS-DRS mechanism gives the priority for shortest routes that answer back by the intended destination rather than intermediate nodes. The source labels each a source route as a recent route, was replied by the destination itself. If there is more than one source route labeled as a recent route for a destination, the recent-shortest route among the recent routes wall be selected by the source node. Whereas, f there s no source route labeled as a recent route, the shortest route in the route cache wall be selected as a source route regardless of the source of RREP. This criteria wall ensures a better route is selected and not simply the shortest route. A trade-off can be made between the recentness of the route and the hop count from source to destination. Essentially, the proposed RS-DSR method has five cases:

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Case 1: f a source (S) desires to send information to a destination(D):

- If S has one or more routes n its route cache: select the shortest route(the priority gives for routes which replied by the destination which maples recentness of the route).
- If S has not a route to D: propagate a route request packet(RREQ), and watt for RREP.

Case 2: fan intermediate node received a RREQ:

- If it has a route to D, send RREP with Flag=0 to S.
- If not; re-propagates RREQ.

Case 3: f D received new RREQ:

- Stop the propagating of RREQ.
- Send RREP with Flag=1 towards S.

Case 4: fan intermediate node received a new RREP:

- Caches the route with its flag status (0/1).
- Forward the RREP to next intend intermediate node towards S.

Case 5: When S receives new RREP, caches the route, then:

- f S has one or more than cached route with Flag=1(recent route), select the recent-shortest one as the candidate source route.
- f there s no RREP with Flag=1, select the shortest route as source route.
- Stop the propagating of RREP.

3.3.1.2 Route Selection based on "Recent Route First"

The key of improvement in this approach is that the performance of DSR can be achieved by selecting a recent source route. We call t as R-DSR (Recent Route Selection for DSR).As the response to solve route selection problems in DSR protocol, R-DSR introduces a new route selection strategy that utilized the recentness of the source route as route selection mercer-DSR tress to select the recent source route based on two operators: the source of the route reply and the time of construction of the source route. It allows mobile nodes to reorder the cached routes as soon as a new route has learned; the reordering wall do according to "Recent Route First(RRF) policy" by gang the priority to the route whose reply by D and has the recent time of construction (the recent time of building the route compared to the cached routes).

As result, in small MANET's environment, R-DSR gives some advantages; nodes can save its resources(.e., bandwidth and power consumption) by reducing recall the route discovery process, which s costly. Also, some performance objectives can be achieved by R-DSR such as high delivery rate, low overhead and fewer dropped packets.

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Case 1: f a source (S) desires to send information to a destination(D):

- f S has one or more routes to D: gave the priority to the route whose reply by D (Flag =1), and has the recent bold time "D apples RRF policy".
- f S has not; propagate route request packet(RREQ), and watt for route reply packet (RREP).

Case 2: f S receives new RREP:

- Reorder routes cache according to RRF policy.
- Stop the forwarding of RREP.

Case 3: f an intermediate node receives a new RREP:

- Reorder cached routes according to RRF policy.
- Forward the RREP to next intend node.

The shortest path doesn't always describe the best available path from the source node to the destination node n MANET's environment. In the updated DSR, the metric of route selection has been changed from hop count (or the shortest path) to the recentness of path (the path selection strategy depends on two operators; the bold time of path, and the source of RREP).

4. Result and Discussion

The man objective of this chapter s to proved brief discussion regarding to the performance evaluation scenarios of the proposed QoS aware RS-DSR and R-DSR routing protocol against with the traditional DSR protocol. Aching QoS n MANETs is a very challenging task due to the dynamic nature of network topology and lack of centralized control. Routing has a great role where researchers should take not an account to improving QoS for delay sensitive applications. Thus, this theses work provided a QoS improvement approach over the existing DSR routing protocol by modifying the way that selection of route during route construction n the existing DSR routing algorithm.

4.1 Simulation Scenario and Model

The proposed RS-DSR, R-DSR, and the DSR routing protocols are compared and contrasted a typical MANET environment of 1000m x 1000m simulation area with a maximum of 60 nodes under different mobility speed scenarios. The parameters to be evaluated are Packet delivery rate (PDR), average end to end delay (AEED) and normalized routing overhead (NRL).A number of node variations to be taken is 10, 30 and 60 that represents

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sparse, medium and dense networks respectively. The transmission range used for this simulation s 250m with 550 interference range. Furthermore, drop tall priority queue is used as a queuing algorithm with the maximum of 50 packets queue size per each node.

4.2 Simulation Parameters

Table 2: Simulation Parameters

4.3 Impact of Network Density

This section examines the impact of network density on the performance of three routing protocols namely; DSR, RS-DSR, and R-Darn this simulation scenario, we test the routing protocols by varying the number of nodes. The simulated network consists of a number of nodes of 10, 30 and 60.The size of nodes to be taken is 10, 30, and 60 that represents sparse, medium and dense networks respectively.

4.4 Average End to End Delay

Figure 6 plots the impact of network density on the performance of the three routing protocols in terms of end-to-end delay. As the result shows that, end-to-end delay for each of the routing protocols increases for both sparse and dense networks. This is due to the fact that in dense network a greater number of routing packets is generated and transmitted and hence the interference between neighbor nodes, packet collisions and channel contention increases. Therefore, the time required to reach to destination increases. On the other hand, when the network is sparse, due to poor connectivity the routing packets fall to reach to destination nodes and thus increase the end to end delay.

In Figure 6 we observe that the average end to end delay of RS-DSR s improved when compared to DSR. This is because of that, the existing DSR routing protocol uses minimum hop could not only as a cost metrics to select route which might have the congested path and finally t leads to higher end to end delayers-DSR routing protocol considers the recent route to the destination rather than a minimum hop count route to the destination.

In general, at network size 10, RS-DSR outsmarts DSR approximately by -4 %, and when the number of nodes becomes 30, t showed -5 % end to end delay improvement. Similarly, when the number of nodes is 60, -13% end to end delay improvement have been attuned. This statistical record shows that, as the number of nodes is increasing RS-DSR becomes outsmart than DSR routing protocols. This is because RS-DSR considers the recent route to the destination beside of the minimum hop count during route selection process, as a result the rate of congestion and lank breakage is reduced, and hence, the amount of retransmission invocation and route maintenance control packets are reduced, consequently, average end to end delay is reduced general, n average -7.33% of an end to end delay improvement has been attuned by RS-DSR routing protocol compared to the standard DSR routing protocol.

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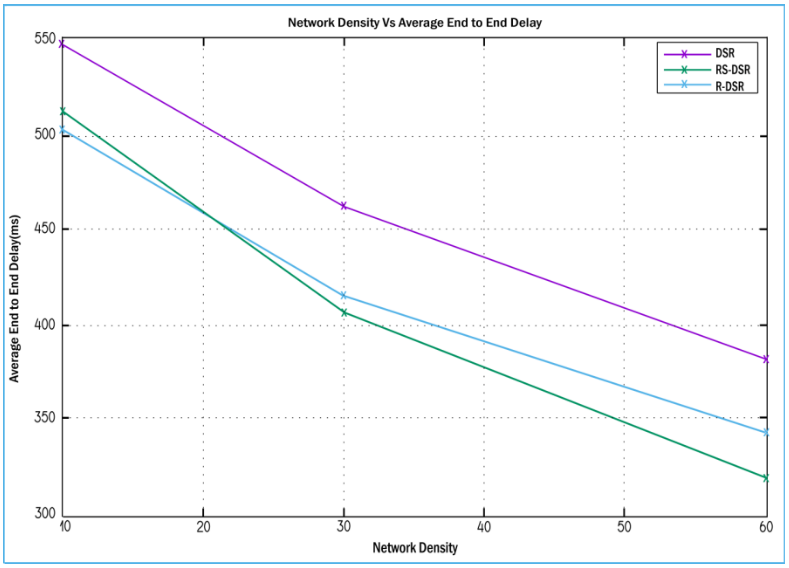

Figure 2: Network Density Vs Average End to End Delay

4.5 Packet Delivery Raton

In Figure 7, the packet delivery rate is plotted against the network density's the figure shows that, the percentage of packets delivered for each of the routing protocols decreases when the network density s set high (.e. 60 nodes) and low (.e. 10 nodes).This is due to the fact that, in a dense network there is an excessive redundant retransmissions of control packets (e.g. RREQ packets) because of the channel contention and packet collisions, thereby lowering the bandwidth available for data transmission whereas in sparse network, the request packets fall to reach to destination nodes due to poor connectivity.

As shown Figure 7, compared with DSR and R-DSR, RS-DSR has the highest packet delivery rate particularly when the network density is high because, RS-DSR selects route that is recent route to the destination and is not congested while t selects route. So that, the number of dropped data packets due to node's buffer overflow at the intermediate nodes and probably of lank breakage decreases and hence the packet delivery rate increases. As t can be seen n the diagram an average increment of 3.00% packet delivery rate has been achieved n RS-DSR, as the number of node size increases RS-DSR outsmarts than the standard DSR routing protocol. For example, when the number of nodes is 10, 1.10% packet delivery increment has been gamed and when the number of nodes 30, 0.90% improvement was achieved and finally when the number of nodes increased to 60, RS-DSR outperforms by 7.00% as lustrated n Figure 16.

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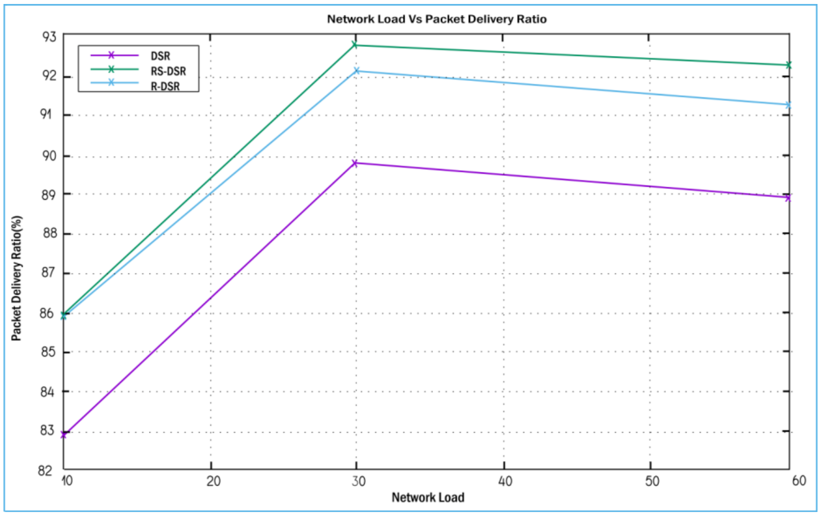

Figure 3: Network Density Vs Packet Delivery Raton

4.6 Normalized Routing Overhead

As it can be seen in figure 8 the routing overhead of DSR, R-DSR and RS-DSR were evaluated. The normalized routing overhead generated by each of the considered routing protocols increases almost linearly as the network density increases. This is due to the fact that the larger network density in a network the more RREQ packets generated and retransmitted. Accordingly, the normalized routing overhead generated by RS-DSR is slightly increased at sparse network, meanwhile, at node number 10, and shows decrement when the number of nodes increases (.e. anode 60).This s because, since, RS-DSR routing protocol chooses route which is not congested hence, the route which is recent. The amount of retransmission and generating control packets are decreased especially as the network sizes are increased. However, when the number of nodes becomes 30, RS-DSR and DSR routing protocols perform comparably. At node number 10, RS-DSR experienced by 10% of normalized routing overhead, this is because some extra header fields were added on the existing DSR routing algorithm while implementing the proposed algorithm and this leads to have slight normalized routing overhead increment. However, when the number of nodes increase, for example as lustrated in the Figure 17, when the network size is 60, -6% of normalized routing overhead decrement has been achieved. In general, normalized routing over head for RS-DSR s increased approximately by 1.33% than the DSR.

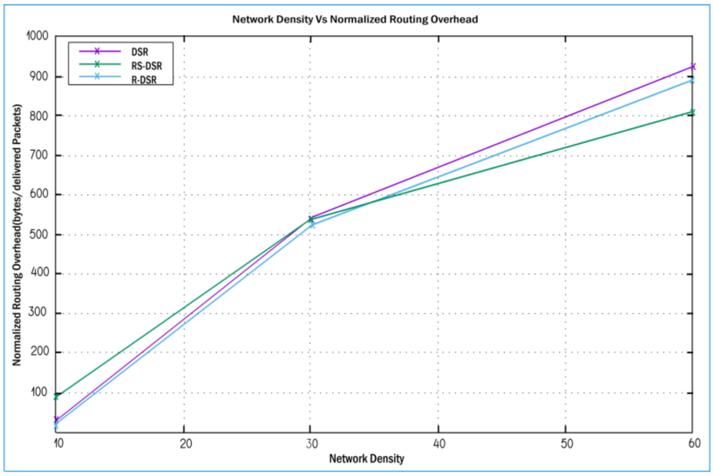

Figure 4: Network Density Vs Normalized Routing Overhead

5. Conclusion

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The main contribution of these theses was the development of quality of service aware DSR routing protocol that can mime latency for delay sensitive applications. Our proposed RS-DSR algorithm allows the DSR to consider recent route during route selection process beyond considering the minimum hop count so as to improve the overall performance of the organ DSR as presented so far. As the man target of this theses work was to develop an effect QoS aware routing strategy protocols, the researcher has focused on QoS related metrics and three evaluation metrics namely packet delivery rate, normalized routing overhead and end to end delay have been selected to evaluate the performance of the proposed algorithm. The researcher explores various MANET's research works and review standards and scholar's recommendation to select appropriate QoS related evaluation metrics and the above mentioned metrics have been selected accordingly. The investigation on selecting widely used simulation tool for MANETs has conducted and based on the criteria's that the researcher used during analyses, NS 2.35 simulator has been selected to evaluate the performance of RS-DSR, R-DSR and DSR routing protocols' selecting the widely used network simulator, the researcher considered different evaluation criteria's such as popularity, license and compatibly. In conclusion, the proposed RS-DSR routing protocol which is based on the recentness of the route during route construction approach performs better in terms of packet delivery rate and end to-end delay with reasonable slight normalized routing overhead increment compared to the DSR and R-DSR routing protocols. This confirms that RS-DSR s better for delay sensitive applications than the standard DSR routing protocols.

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