A Critical Review of AODV, DSDV and DSR Protocol Presence of Malicious Node in Mobile Ad-Hoc Network

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ABSTRACT

Mobile Ad-Hoc NET works (MANETs) are autonomous and decentralized wireless systems. A Mobile Ad hoc Network is a collection of wireless mobile nodes forming a self-configuring   network without   using any existing infrastructure. Routing is a significant   issue and challenge in ad hoc networks. Many Routing protocols have been proposed to improvement the routing performance and reliability. This research paper describes overview of the characteristics of routing protocols based on the different performance metrics like packet delivery fraction, Average delay, Normalized Routing load and Throughput under low mobility and low traffic network as well as under high mobility and high traffic networks presence of malicious node.

Keywords : MANET, Routing Protocols, Attacks, Simulators etc.

I. INTRODUCTION

MANET belongs to wireless communication network area of ad hoc network. MANET is the not new area in the research in which mobile as the mobile node with in the network. The basic target of MANET is to increase to connectivity of node in the scenario. In MANET, mobile nodes work in two forms; as a node to send and receive packet as well as a router to route a packet. Nodes movement in MANET environment is mainly random, and the uniform movement is seen rare. MANET mainly used in areas where infrastructure based communication cannot be used such as areas, mall, campus, airport, station, business meetings etc. Nowadays numbers of wireless ad-hoc networks are available one of the popular is MANET, also called a mobile mesh network, is a self-configuring network of mobile devices connected by wireless links. Wireless devices operate within the range of each other to discover and communicate in peer-to-peer network without any central access points. MANET have dynamic frequency because each node is free to move independently in any direction, and will therefore change its links to other node frequently, they also generally gather loads of nodes evolving in large areas. MANETs usually has a routable networking environment. There are different Routing protocols works in the source needs to transmit and delivers the packets to the destination. MANET is the self-organizing network. It does not really on any fixed network infrastructure.

The main characteristics of MANET are dynamic node mobility, limited batter power and rapid power moment. The primary challenge in building a MANET is each device to continuously maintain the information required to properly route traffic. MANET contains various mobility patterns. The routing protocol behavior has to be analyzed using varying node mobility pattern, traffic and network size. The different types of routing protocols are used in MANET. In this paper, simulate AODV, DSDV and DSR protocols are analyzed in terms of packet delivery ratio, throughput, end to end delay and routing overhead in presence of malicious node. The performance of DSR is better than AODV,

DSDV in terms of Packet delivery ratio, Throughput, End to End Delay and Routing overhead. As the DSDV is a proactive routing protocol, it is having a less end to end delay as compare to AODV. The performance of AODV, DSDV and DSR gets affected by black hole attack but DSR provide better results in presence of malicious node. Thus the goal is to find the performance comparison of ad hoc routing protocol with mobility patterns. This study helps to improve the performance of MANET.

II. RELATED WORK

Extensive research work has been done in the field of MANET routing protocols. Different routing protocols were simulated in different kind of simulators. Here we will discuss different research papers about MANET routing protocols performance. M. K. Jeya Kumar et al. [1] In this paper random way point model the simulation results shows that performance produced by DSR & TORA decreases when the network becomes sparse or the traffic load become high. The performance of DSDV Protocol's is closer to AODV under the network size metric. The Performance of TORA protocol's was not so good under in mobility model. So, AODV Protocol can be chosen as the routing protocol in this type of mobility conditions. In Random walk model, AODV perform better under low & high mobility conditions. Random direction model produces better results than TORA, DSDV & DSR. DSDV Produces better results than TORA & DSR when the network size is large. Its shows the AODV is suitable choice under this mobility model.

Priti Garg et al. [2] In this paper present the compression of Ad hoc routing protocols; in this paper are comparing on-demand and hybrid protocol; like temporally ordered routing algorithm (TORA) and Dynamic Source Routing (DSR). The protocols are analysis their relative performance with respect to quantitative metrics; throughput, average delay, packet delivery ratio and routing load. From the detailed simulation results and analysis of presented,

they use NS-2 simulator for simulation of DSR and TORA protocol and variation occurs in mobility of packets, time interval between the packets sent and packet size of packets sent in throughout the protocols. The results of the both DSR and TORA routing protocol on different mobility, packet size and time interval metrics we are analyzed. The comparison of DSR and TORA routing protocol includes routing load, average delay, packet delivery ratio and throughput to. Performance of TORA protocol at mobility variation of nodes it's much better throughput, packet delivery ratio and routing load than DSR protocol. But average delay of DSR is less then comparison to TORA in High mobility but qualitative metrics throughput, routing load and packet delivery ratio at High mobility of TORA protocol. This is involved in updating all the nodes with the new routing information in TORA. Different in time interval results better throughput, packet delivery ratio and routing load of TORA protocol but average delay is less in DSR than TORA. At packet size variation routing load, packet delivery ratio and throughput of TORA. Performance of TORA is much better than DSR protocol.

Madhuri Pal et al. [3] In this paper ,presented the impact of both reactive as well proactive type protocols by increasing the density of nodes in the network the performance of the routing protocol have been analyzed to improve and select efficient routing protocol for network setup and its designing for practical scenario. The first case analysis source node fixed and destination node variation. DSR routing protocol performance is quite well compared to AODV and DSDV The second case analysis destination node fixed and source node variation. that DSR performance improves much better compared to AODV as well as DSDV routing Finally increases the node density of your work ,then DSDV performance decreases, here the performance of DSR routing protocol is much better than AODV and DSDV.

Shrikant Upadhyay et al. [4] had research on ,to judge the impact of both reactive as well proactive type protocols by increasing the density of nodes in the network, keeping source node fixed and move the destination node and lastly, Keeping the destination node fixed and move source node. In all the three cases, the performances of the routing protocol have been analyzed to improve and select efficient routing protocol for network setup and it's designing for practical scenario. The performance matrix includes delivery fraction, packet loss and end to end delay. In this paper does the realistic comparison of three routing protocols DSR, AODV and DSDV in node mobility and node density increase in the network. In first scenario keeping source node fixed and destination node variation DSR routing protocol performance is quite well compared to AODV and DSDV. While keeping the destination node fixed and source node variation they again conclude that DSR performance improves much better compared to AODV as well as DSDV routing so, in second scenario DSR performs efficient for the network. And the loss would be much in DSDV routing protocol. Finally, in the last scenario of work when the node density increases then DSDV performance deteriorate poorly and it goes nearly to zero value. Also, here the performance of DSR routing protocol is much better than AODV and DSDV. So, under high traffic condition DSR performs well and is good for engineers while designing any ad-hoc real scenario network.

Ayush Pandey [5] "Performance Evaluation of MANET through NS2 Simulation" Simulation work illustrates the performance of three routing protocols AODV, DSR and DSDV. The performance of routing protocols AODV and DSR perform better under high mobility simulations than DSDV. In DSR uses source routing and route caches, and does not depend on any periodic or timer- based activities. While AODV uses routing tables, destination sequence numbers, a mechanism to prevent loops and to determine freshness of routes. SO observing the performance of

routing protocols, we can say DSR shows higher throughput than DSDV and AODV.

Paresh Acharekar et al. [6] To enhance the performance of DSR, MDSR has been introduced which using ACK path as the backup route and random delay on last node when the original route is no longer in use resolve the unnecessary data packets sends which means the retransmission happened when the any drop down packet then it should to resend. The intention of the mechanism is to reduce the waiting time of data transmission before route is re-established. In doing so, the packet dropping ratio will be reduced. Besides, the packet delivery ratio will been enhanced. These techniques perform significantly better than previously proposed modifications at high nodes in both scenarios.

Suhaila A. Dabibbi et al. [7] Three protocols ad hoc on-Demand Distance Vector Routing (AODV) , Dynamic Source Routing (DSR), and Destination-Sequenced Distance Vector (DSDV) were compared in terms of Average End-to-End Delay, Average Throughput, Packet Delivery Ratio, Total Dropped Packets, and Normalized Routing Load in different environment; varying number of nodes and simulation Time. First, by comparing these protocols on the basis of various performance metrics we have reached to a conclusion that reactive topology based protocols are better than proactive topology based routing protocols. Second, DSR is well suited for static and low-mobility networks. High mobility reduces its performance.

P. Manickam et al. [8] Performance comparisons of routing protocols in mobile ad hoc networks. The performance of the three MANET Routing protocols such as DSDV, AODV and DSR was analyzed using NS-2 Simulator. We have done comprehensive simulation results of Average End-to-End delay, throughput, and packet delivery ratio over the routing protocols DSDV, DSR and AODV by varying network size, simulation time. DSDV is a proactive routing protocol and suitable for limited number of

nodes with low mobility due to the storage of routing information in the routing table at each node. Comparing DSR with DSDV and AODV protocol, byte overhead in each packet will increase whenever network topology changes since DSR protocol uses source routing and route cache. Hence, DSR is preferable for moderate traffic with moderate mobility. As AODV routing protocol needs to find route by on demand, End-to-End delay will be higher than other protocols. DSDV produces low end-to-end delay compared to other protocols. When the network load is low, AODV performs better in case of packet delivery ratio but it performs badly in terms of average End-to-End delay and throughput. Overall, DSR outperforms AODV because it has less routing overhead when nodes have high mobility considering the above said three metrics.

Ayush Pandey et al. [9] Performance Evaluation of MANET through NS2 Simulation. Simulation work illustrates the performance of three routing protocols AODV, DSR and DSDV. The performance of routing protocols AODV and DSR perform better under high mobility simulations than DSDV. In DSR uses source routing and route caches, and does not depend on any periodic or timer- based activities. While AODV uses routing tables, destination sequence numbers, a mechanism to prevent loops and to determine freshness of routes. Therefore by observing the performance of these routing protocols, we can say DSR shows higher throughput than DSDV and AODV.

Gurdeep Kaur et al. [10] Comparative Study of the performance of existing protocols of MANET with simulation and justification of an improved Routing Protocol. In this paper, protocols have first been simulated in NS2 Simulator and the results are compared on the basis of some performance metrics such as End to End Delay, Throughput and Packet loss so as to suggest the best routing protocol could establish a best suited effective path from source to the destination. To improve the path establishment

in a protocol, a hybrid technique has also been proposed.

Preetha K G et al. [11] Discusses Improving the Routing Performance of Mobile Ad hoc Networks Using Domination Set. The main objective of the paper is to reduce the control overhead by using the domination set based routing. The nodes which use to connect all the other nodes in the network are called dominating nodes, and the set of dominating nodes forms domination set. This paper proposes a new approach for finding the route and reducing the reroute establishment delay and increasing the packet delivery ratio and analyze the problem occurs during the route reestablishment process.

Mehdi Alilou et al. [12] Routing in mobile ad hoc networks is a challenging task because nodes are free to move randomly. In DSR like all On- Demand routing algorithms, route discovery mechanism is associated with great delay. More Clearly in DSR routing protocol to send route reply packet, when current route breaks, destination seeks a new route. In this paper we try to change route selection mechanism proactively. We also define a link stability parameter in which a stability value is assigned to each link. Given this feature, destination node can estimate stability of routes and can select the best and more stable route. Therefore we can reduce the delay and jitter of sending data packets.

III. TYPES OF WIRELESS NETWORKS

The wireless networks types, a minimum difference between wired and wireless network will be discussed. A network that sends data from one point to another point with cable or wire is called wired network. The data sent over a network which uses wireless medium from one device to another device is called wireless network. In wireless network data is transmitted from one point to another through wireless links. For communication the devices have to be in the transmission or radio range of each other. Wireless networks are divided into two main groups

such as infrastructure wireless network and Ad hoc or infrastructure-less network.

Infrastructure Networks: An infrastructure network act as a bridge, which connect wired network and wireless network. The base stations are fixed and the mobile network move during communication. An Infrastructure mode network requires the use of an Access Point. The Access Point controls Wireless communication and offers several important advantages over an Ad-hoc network. An Infrastructure mode network requires the use of an Access Point. The Access Point controls Wireless communication and offers several important advantages over an Ad-hoc network. For example, a Infrastructure based network supports increased levels of security, potentially faster data transmission speeds and integration with a wired network. For example, a Infrastructure based network supports increased levels of security, potentially faster data transmission speeds and integration with a wired network.

Ad hoc Networks: An Ad hoc network is deployed where wireless network infrastructure is not available. This kind of ad hoc network is called infrastructure less network or ad hoc network. In infrastructure or ad hoc network each node is connected through wireless links these nodes get connected to each other and also act as a router, by forwarding data to other wireless nodes. Ad hoc networks have two forms; one is static ad hoc networks (SANET), the other is called mobile ad hoc network (MANET).

IV. ROUTING PROTOCOLS

There are several kinds of routing protocols for wireless ad hoc networks. These routing protocols are categorized as reactive or proactive routing protocols. The ad hoc routing protocols which have both proactive and reactive merits, is called hybrid routing protocols. The first kind of protocol is called reactive or on-demand routing protocol. The sec

kind of protocol is proactive or table driven routing protocol. The first kind of protocol is simply called Reactive MANET Protocol (RMP). In these kinds of protocols the communication is only possible when the source node requests to communicate with the other node. The sec kind of protocol is simply called Proactive MANET Protocol (PMP). Proactive routing protocol detects the layout of the network activity. A routing table can be maintained at every node from which a route can be determined with less delay. The proactive routing protocols provide good reliability on the current network topology and minimize the time for deciding a route. Hybrid protocols combination the strengths of both reactive and proactive protocols, and combine them together to get better results. Hybrid routing protocols are proposed to combine the merits of both proactive and reactive routing protocols There exit a number of routing protocol of global reactive and locally proactive state. Normally, hybrid routing protocols for mobile ad hoc networks are hierarchical network architectures. Proper proactive routing approach and reactive routing approach are exploited in different hierarchical levels, respectively. as examples of hybrid routing protocols for mobile ad hoc networks, the Zone Routing Protocol (ZRP).
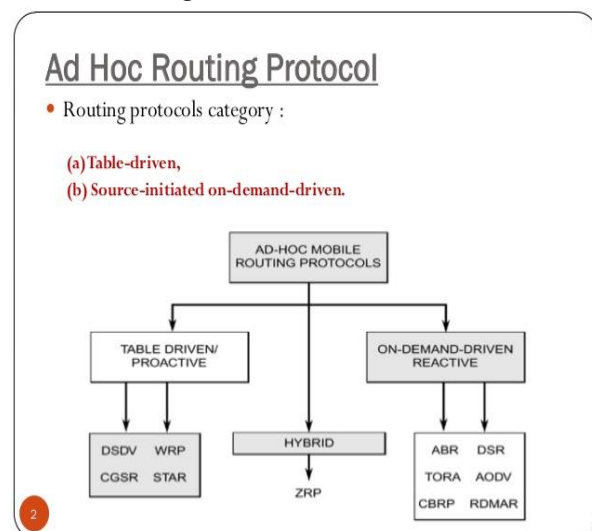

Figure 1. Protocols

AODV

The Ad-hoc On-demand Distance Vector routing protocol is a reactive protocol which does not keep global routing information for the entire network,

therefore routes are formed on demand. If nodes are not part of a route then they do not need to maintain any information for that route. Nodes do not transmit or receive topology update information packets; hence they have information only for their live routes. A route is considered live by a node, if node can transmits, accepts or advanced packets for that route with in a stable time period. Therefore in the AODV protocol, when a source node wishes to communicate with a proposed destination and it does not have a valid route towards the destination, route finding packets known as RREQ are commenced and broadcasted. Any change in network topology scenario must be sent using Route reply message (RREP), merely to those nodes that will require this info. Therefore, AODV vigorously creates entries in the route table. In case of link failure a routing error message (RERR) is used for link failure notification and a HELLO message is used for link detection. Asymmetric links are not maintained by AODV protocol. The main benefit of AODV protocol is that on demand routes are created and destination sequence numbers are used to detect the up-to-date route toward the particular destination. The association setup delay is less. The routes conservation HELLO messages are range-limited, so they do not cause needless overhead in the network.

DSDV

Protocol Destination-Sequenced Distance-Vector (DSDV) Protocols specifically table-driven which is a modification in the Distributed Bellman-Ford Algorithm which was used successfully in many of the dynamic packet switched networks. In case of DSDV, every node in the mobile network is required to send a sequence number, which is periodically increased by two and it is transmitted along with other routing update messages to all other neighboring nodes.

DSR

The Dynamic Source Routing protocol permits sources to find out paths to any destination. Before arriving at desired destination, all data packets of source include an entire list of nodes, which the packets must go through. Therefore, all nodes that advanced or listen in these packets may collect routing info for further use. In addition to assist rapid network topology transforms, DSR protocol also provide asymmetric links and on demand route conservation; hence no regular update packets are required for topology changes. Upon link failures, merely nodes that advanced packets through failed links must have accurate advertisements for routing. Furthermore, DSR permits sources to obtain and reserve more than one path to a specific destination in a cache. When a link failure is informed midway nodes have the chance to choose another cached route.

V. TYPES OF ATTACK

Table 1. Types of attack

Attacks	Definition
Wormlole	An attacker could redirect traffic between two zones geographically isolated to create a vertex in the topology and have a good geographical position to monitor the traffic that passes through it.
Routing attack	A malicious node can disrupt the operation of a routing protocol by modifying the routing information, making false routing information or usurp the identity of another node.
Jamming	This is a classic attack on the availability of the channel communication through the mass generation of a large amount of radio interference.

Blackhole attack	The purpose of this attack is falsification of information routing or traffic diversion.
Attack on resources	The MANET resources are characterized by limited (battery and bandwidth). An attack on resources may affect availability.
Byzantine attack	Through this attack, a malicious node alters the messages and could create problems of routing loops, routing packets to non-optimal paths, selecting the packets to reject … This type of attack is difficult to detect because the network seem to work properly.
DoS	This type of attack consists of sending deliberately messages to cause saturation of the bandwidth and paralyze the network.
Discloser of information	Exchange of confidential information must be protected against listening or unauthorized access.
Repudiation	This type of attack has an impact on the integrity of communications between nodes in the network.
Identity fraud	Identity fraud is designed for falsifying information relating to identities which could lead to isolation of nodes sharing false information Routing, affect the confidentiality and integrity.

Black Hole Attack

A Black Hole Attack is a malicious node waits for neighboring nodes to send RREQ messages. When it receives, it replies to them blindly RREQ as if it is the shortest route to the destination. When the data is actually start transferring it absorbs all the packets actually send to the destination. Black Holes are difficult to find if they start using sequence number comparable to the current sequence number of networks.

VI. SIMULATION RESULTS

There are various parameters which we are considered in our simulation. Table 5.1 show the simulation parameter which we used.

Table 2. Simulation Parameters

Parameters	Value
Simulator	NS2.35
Protocol used	DSR
Number of nodes	10, 20, 40, 60, 80
Simulation Time	Up to 5 minutes

Map size	Order of 1000
Mobility model	Random way point
Traffic type	Static
Packet size	Same in all cases
Connection Range (Nominal Radio range)	Average
Pause time	10ms

Packet Delivery Ratio

The PDR in this simulation is defined as the ratio between the number of packets sent by constant bit rate sources and the number of received packets by the CBR sink at destination. It describes percentage of the packets which reach the destination.

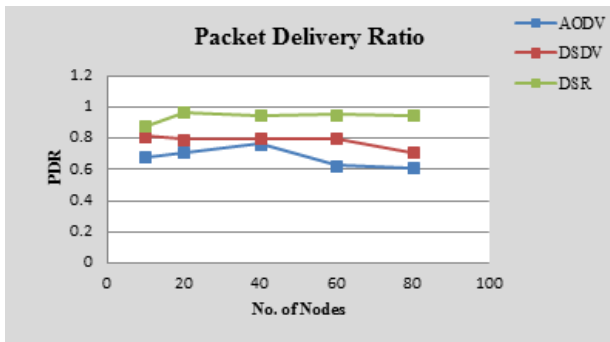$$PDR = \frac{\Sigma Number of Packet Received}{\Sigma Number of Packet send}$$

Figure 2. PDR vs No. of nodes

Throughput

The rate of successfully transmitted data per second in the network during the simulation.

$$Transmission\ Time = \frac{File\ Size}{Bandwidth\ (sec)}$$

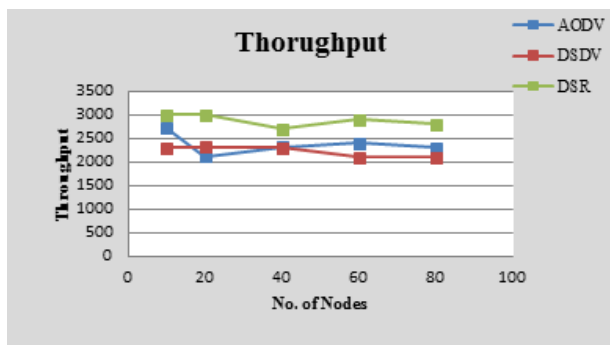$$Throughput = \frac{File\ Size}{Transmission\ Time}$$

Figure 3. Throughput vs No. of Nodes

End to End Delay

It is defined as the difference between two time instances: one when packets generated at the sender and the other, when packet received by the receiving application.
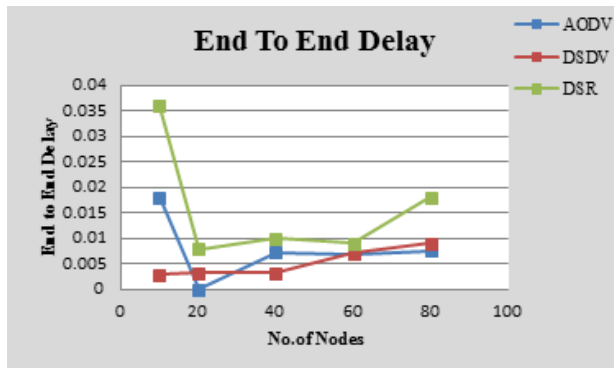

Figure 4. End to End Delay vs No. of Nodes

Control Overhead

Control/routing overhead is the total number of routing packets divided by total number of delivered data packets.

$$ControlOverhead = \frac{Total\ no.\ of\ routing\ packets}{Total\ no.\ of\ delivered\ data\ packets}$$
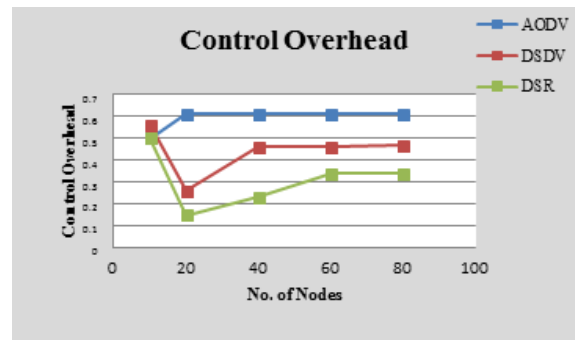

Figure 5. Control overhead vs No. of nodes

VII. CONCLUSION

Routing protocols in new modern area of telecommunications, internet systems and in communication play the role to develop better communication between end users. Different routing protocols have different attributes according to their environmental situation. There are still various scopes for researchers to the routing protocols in mobile ad hoc network The selection of suitable protocol according to the network definitely increases the reliability of that network, for example in case of mobile ad hoc networks routing protocols should be loop free according to our research. In this paper illustrates the evaluation of three different routing protocols named as AODV, DSDV and DSR in presence of malicious node. We analyzed them over four metrics named packet delivery ratio, Throughput, End to End Delay and overhead. On doing the evaluation of these three routing protocols using the simulation we get DSR have minimum packet loss than AODV and DSDV. Similarly the result for packet receives DSR get the better packet received ratio than DSDV and AODV. This simulation will be optimized the different parameters which will be better than the present protocol in one and other environment. The research work will be

fruitful and beneficial for the society. In this research paper we are analyses has been done to focus on comparative study and performance of different routing protocol reactive, proactive and hybrid etc.

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