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Modified ABR (M-ABR) Routing Protocol with Multi-cost Parameters for Effective Communication in MANETs

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Abstract: Current developing year's lot of researcher's interested in Mobile Ad-hoc Networks (MANETs), a collection of mobile nodes that dynamically form a network connection temporarily without any base station of static infrastructure. Caused by mobility of nodes, routing take a vital role in transmission and numerous routing protocols are available like table-driven, on-demand and hybrid. The protocol presents the mechanism which reduces route loops and confirms trustworthy message exchange. The Associative Based Routing (ABR) routing system is a non-demand routing protocol designed for ad-hoc mobile nodes. Hop count, total interference, node link delay, residual energy of anode and the node transmission power are the cost parameters assigned for link and path of the ad-hoc networks. These parameters are combined in different optimization function with respect to various routing algorithm for selecting the optimal path. In this technical research paper accesses the modified ABR routing protocol with two different topology's multicast parameters to acquire dynamic network performance metrics like Packet Delivery Ratio (PDR), Routing Overhead (RO), Average Energy (AE), End-to-End Delay (E-to-E D) and Throughput via Network Simulator 2 (NS2).

Keywords: MANET, Routing protocol, Multicast Parameters, ABR, PDR, RO, AE, E-to-E, Throughput.

I. INTRODUCTION

WI-FI ad-hoc networks are paradigms for cell verbal exchange wherein mobile nodes are with dynamism and randomly positioned in the sort of manner that conversation among nodes does now not rely on any underlying static community infrastructure. The verbal exchange medium is broadcast and the nodes in a cell advert-hoc network are generally transportable mobile devices with inhibited sources, along with strength, computation aptitude and garage potential. in view that no fixed infrastructure or centralized administration is to be had, these networks are self-organized and E-to-E communication may additionally require routing statistics via numerous intermediate nodes. The routing protocols are critical function and it has to adapt fast to the repeated adjustments inside the ad-hoc network topology.

Ad-hoc routing protocols Fig 1 are categorized into following three types. Table driven routing protocols: This kind of routing protocols are retains the network topology information in routing tables contains an updated list of destinations all the time swapping their routing information with nearby nodes. Routing information is usually flooded in the entire network. At any time a node wants a route to the destination it runs a suitable path finding algorithm on the topology information it retains. E.g. OLSR, DSDV, GSR. On-demand routing protocols are not maintaining topology information of the network, with the help of connection establishment process nodes can obtain necessary route when it is required, therefore this type of protocols is not exchanging the routing information all the times. E.g. AODV, DSR, LAR. Hybrid routing protocols both table driven and on-demand routing advantages are combined. The routing is in the beginning established with certain proactively prospected routes then it serves the demand from additionally activated nodes through reactive flooding. E.g. ZRP, ZHSL, DDR.

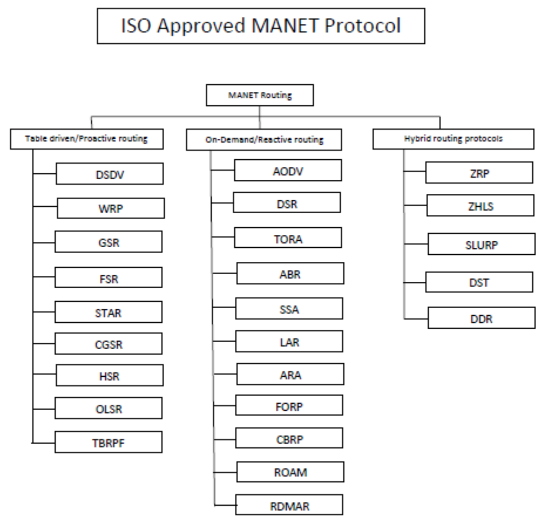

Fig 1 ISO Routing Protocols for MANETs

From the above protocols which have been proposed for providing communication among all the nodes in the network. Due to the lack of infrastructure and the limited transmission range of a node in a MANET a node has to rely on neighbor nodes to route a packet to the destination node. In specific, all network functions are based on the node cooperation. Currently, routing protocols for MANET are based on the assumption that all nodes will cooperate. And without node cooperation, in a wireless ad-hoc network, no route can be established; no packet can be forwarded, let alone any network applications. However, cooperative behavior, such as forwarding other node's messages, cannot be taken for decided.

This paper focuses and analyzes through NS2 which compares the quality of service metrics like throughput, E-to-E, PDR, AE and RO ratio of both regular ABR and modified ABR using multi-cost parameters. Hop count (h), total interference (I), node link delay (d), residual energy of a node (R) and the node transmission power (T) are the cost parameters assigned for link and path of the ad-hoc networks. These parameters are combined in different optimization function with respect to various routing algorithm for selecting the optimal path. The simulation result shows that the M-ABR performs well in significant metrics of wireless network performance.

II. BACKROUND

Multi-cost routing in max-min fair share networks was done by Gutierrez, et al (2000). An energy concern in wireless networks was done by Ephremides (2002).Energy aware on-demand routing for mobile ad-hoc networks was done by Gupta and Das (2002).A minimum energy path for reliable communication in multi-hop wireless networks was done by Banerjee and Misra (2002). Prophet address allocation for large scale MANETs was done by Hongbo Zhou, et al (2003). An energy efficient routing protocol for mobile ad-hoc networks was done by Chansu, et al (2003). Ad-hoc wireless networks: architectures and protocols were done by Siva Ram Murthy and Manoj (2004). Multi-cost routing over an infinite time horizon in energy and capacity constrained wireless ad-hoc networks was done by Papageorgiou, et al (2006). Routing in wireless ad-hoc networks with variable transmission power was done by Karagiorgas, et al (2007). Joint scheduling, power control and routing algorithm for ad-hoc wireless networks were done by Li, et al (2007). Joint multi-cost routing and power control in wireless ad-hoc networks was done by Nikos Karagiorgas, et al (2010). TCP: performance through simulation and test-bed in multi-hop mobile ad-hoc network Chandra Kant Samal (2010). Performance Evaluation of On Demand Routing Protocols AODV and Modified AODV (R-AODV) in MANETS was done by Humaira Nishat, et al (2011). Performance analysis of AODV, DSR, OLSR and DSDV was done by Mohapatra and Kanungo (2011). Multi-cost routing approach in wireless ad-hoc networks Loganathan and Ramamoorthy (2012).

III. ABR

ABR implements an exclusive technique to keep routing information in wireless ad-hoc networks, on-demand routing protocol and basic essential for connectivity is to discover the routes to a mobile node through flooding of request messages. Usually reactive protocols are never maintaining the routing information at the mobile nodes if no connectivity in the network. ABR uses old-style routing tables like one entry per destination node, whereas TORA is maintains several route scathe entries for every destination node.ABR finds route when node needs to communicate from source to destination and moreover assurance the loop-free routing. Every node is transmitting with other node through various wireless links and the nodes function as a router to route the data packets from one node to another node. The ABR protocol mechanism as to send a message, the data source starts a path-discovery process so as to discover the route, routines sequence numbers retained at each destination to discover freshness of routing data and to avoid routing loops. The route request packet (RREQ) is flooded to the network and the transitional nodes record the neighbor from which they get the route request packet (RREQ) first, so as to establish inverse paths back to the source. When the RREQ reaches at the destination, it then directs back to a route reply (RREP) to the source node in reverse paths. ABR wants symmetric links; else the RREP may possibly not to reach the source and ABR might fail. And also, all the routing packets are bringing these sequence numbers; main feature of this protocol is maintaining each node with timer-based states for deployment of individual routing table entries. If fail to use recent entry, the recent entry get expired in the routing table. A pair of predecessor nodes is maintained individually for the routing table entry, stating that the pair of neighboring nodes to transmit the data packets. In distinction with DSR, The Route Error Message (RERR) data packets in ABR are projected to inform all sources using a link when a failure happens. A single source shortest path Dijkstra algorithm, computes of the shortest path from the source to every left behind vertices in the graph and find shortest path through Dijkstra algorithm in ABR routing protocol.

IV. M-ABR ROUTING PROTOCOL

A. ABR with Multi-cost Parameters

This section affords the improvement of the ABR protocol as a way to enhance the PDR, RO, AE, E-to-E delay and Throughput in wi-fi advert-hoc networks. The ABR routing protocol with other parameters hooked up a direction between the cellular nodes within the network as traditional with performance metrics. The test simulation shows that the network overall performance with respect to PDR and throughput of the wi-fi ad-hoc networks. The M-ABR routing protocol with multi-value parameters used to whilst the foundation node desires to direction a packet or a consultation to a given destination, a scalar price optimization feature ‘f’ is practical to the value vectors of the non-dominated paths leading to that destination, and the path that offers the minimum value is selected. The optimization function f used depends on the QoS requirements of the consultation and can be one of a kind for specific periods for the reason that optimization feature does no longer need to be carried out to every capability path for a given source-vacation spot pair, however best to the set of non-ruled paths.

To be more exact (Eq.1), it can denote by V (P) = ( ) the link cost vector of Link l, by V (P) = ( ) the cost vector of the path P that contains of links l = 1, 2… L and by f (V) the optimization function that has to be minimized in order to select the optimal path. The cost vector V (P) = ( ) of a path P containing of links l = 1, 2… L is then obtained from the cost vectors of the links that comprise it by spread on component-wise a monotonic associative operator to each cost vector parameter(1): Parameter of the cost vector

B. MAX / MIN Energy-Half-Interference-Half Hop Multi-cost algorithm

The optimization function is used as maximum representative of cost metrics in MAX/MIN Energy-Half-Interference-Half Hop multi-cost algorithm (Eq.2)

Where,

Hop count of the path. = maximum transmission power of the nodes on the path. = maximum interference of the path. = residual energy of the path. = delay link of the path.

Generally, the number of different non-dominated paths depends on the number of parameters in the cost vector, and on the type of operators used for calculating a path's cost vector from the establishes links' cost vectors. The cost parameters, h, d, are additive metrics, while R, T∞ and I∞ are concave (restrictive or maximum representative). Based on, if the cost vector comprises at most one additive metric (other than the hop count), then the algorithm is polynomial, individually of the number of the restrictive(that use the minimization operator) and maximum representative (that use the maximization operator) metrics. If the cost vector comprises two or more additive metrics (other than the hop count) then the algorithm is exponential. The complication considerations make some (polynomial) algorithms interesting even though they underperform some other (exponential) algorithms. As a result the MAX/MIN (Energy-Interference and Mixed) algorithm (Eq.2) is exponential.

V. PERFORMANCE COMPARISON

A. Simulation

Simulations play a dynamic role in the development and testing of ad hoc networking protocols. However, the simulation of large networks is still a tedious task that consumes a lot of computing power, memory, and time. The changes were made to the implementation of ABR written for NS2. A 75 nodes network in a field size of 700mx 700m was used. The mobility model used was random waypoint in a square/rectangular field. In random waypoint, each node starts its journey from its current location to a random location within the field. The speed is randomly chosen to be between 25m/s. The pause time is set to 10 seconds and to set the simulation time is 500 seconds. Once the destination is reached, another random destination is embattled after a specified pause. Used here 10-second pause time, the simulation parameters used for the experimental set are shown in Table 1.However, in practice, found that the running times of the non-polynomial algorithms were also acceptable, at least for the network sizes used in the simulations. In all cases, the algorithms first find cost parameters (h, T, I, d, R), and then use the corresponding optimization function f (h, T, I, d, R) to select the optimal path with respect to ABR. In other words the computation of algorithm and the ABR routing path is done at the end in a way proposed. The function to be optimized at the last step may depend on the QoS requirements of the user.

Table 1 Simulation Parameters for node mobility

Parameter	Values
Simulation area	800 m * 800 m
Number of nodes	75
Speed of nodes	25 meter/second
Number of packet	40
Constant bit rate	2 (packets/second)
MAC protocol	802.11 DCF
Initial energy/node	100 joules
Antenna model	Omni directional
Simulation time	500 sec

B. Proposed Improvements

The following performance metrics are conferred with ABR and M-ABR: PDR, RO, AE, E-to-E D and Throughput are calculated by dividing the number of packets received by the destination through the number of packets originated. The better the delivery ratio, the more complete and correct is the routing protocol. The projected improvements in this research paper to construct the enhancements in routing protocol of ABR with multi-cost parameters.

The M-ABR with multi-cost parameters, where the cost parameters of multi-cost algorithm h, d, R, T∞ and I∞ are carefully examined with ABR protocol and are combined in various optimization functions only at the end to improve the PDR and Throughput and reduces RO, AE, E-to-E D in wireless ad-hoc networks. In ABR, when a host wants a route to another host, the route request packet (RREQ) is flooded to the network and the transitional nodes record the neighbor from which they get the route request packet (RREQ) first, so as to establish inverse paths back to the source.

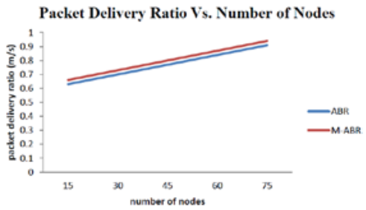

Fig 2Packet delivery ratio Vs. when node velocity various

From Fig 2 it's clear that the proposed scheme M-ABR surpasses ABR performance by 3% when there are 15 to 75 nodes in the network. From the results, it is concluded that M-ABR schemes, able to improve delivery ratio presence of internal attacks.

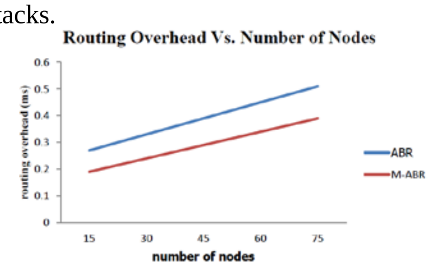

Fig 3 Routing overhead Vs. Number of nodes

Simulation results of RO are shown in Fig 3 It's clear that M-ABR scheme achieves the best performance and lowest congestion of about 15 to 75 although M-ABR requires cryptography techniques for father improve network performance and detect attacks.

Figure 4 shows the graph of E-to-E delay when the topology size is 800m, number of nodes is increased from 15 to 75.

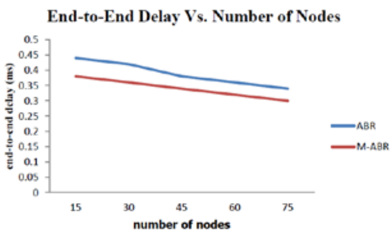

Fig 4 End-to-End Delay Vs. Number of nodes

It is observed from Figure 4 that when compared with ABR routing protocol, M-ABR decreases the delay by 4% with the increase in the number of nodes from 15 to 75.

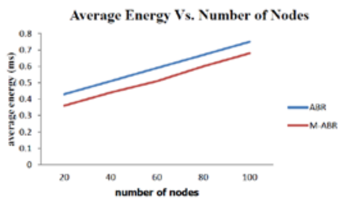

Fig 5 Average Energy Vs. Number of nodes

Fig 5 proves that the proposed M-ABR provides lower performance of the Average energy that is 15 to 75 nodes compared to the existing ABR.

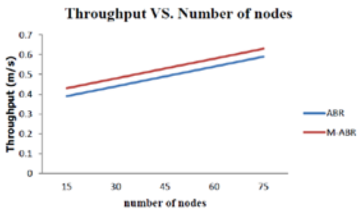

Fig 6 Throughput Vs. Number of nodes

It is observed from Figure 6 that when compared with SPA algorithm, M-ABR shows throughput increased with increase in the number of nodes from 15 to 75.

VI. CONCLUSION

In this paper, the performance of the wireless routing protocols such as ABR and M-ABR was analyzed using NS-2 Simulator. Deliberated complete simulation results of throughput, average delay and packet delivery ratio over the routing protocols ABR and M-ABR with multi-cost parameters by varying node velocity and simulation time. Data packet exchange will increase each time network topology changes since ABR protocol maintaining each node with timer-based states regarding deployment of individual routing table entries. Though comparing M-ABR protocol (added multi-cost parameters) with basic ABR, it performs better in case of packet delivery ratio but it performs slowly down in terms of throughput when increases node velocity in the network. Overall, M-ABR protocol outperforms is better because it has high PRD and throughput when nodes increase have high mobility and considering with the Energy-Interference multi-cost algorithm and reduces RO, AE, E-to-E D. In future the same concept to implement different protocols and use various security models to develop and detect internal attacks.

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