A NOVEL APPROACH OF HYBRID MULTIPATH ROUTING PROTOCOL FOR MANETS USING RECEIVED SIGNAL STRENGTH

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Abstract

Mobile ad hoc networks (MANETs) are special kind of distributed networks that comprise wireless mobile nodes which can freely and dynamically self-organize into capricious and temporary manner. The demand for ubiquitous information access and spontaneous information exchange has multiplied considerably and with predictions to grow even more within the future. To satisfy this increasing demand, new protocols standards and merchandise addressing wireless networking have emerged. Designing an appropriate routing algorithm in MANETs is very complex because of dynamic mobility, resource constraints and limited battery power. For improving the performance of MANETs, we proposed new routing algorithm called Hybrid Multipath Progressive Routing Protocol (HMPRP). In this protocol we apply the most well-liked properties a famed MANETs the Ad-hoc On-demand Distance Vector routing protocol (AODV) using the received signal strength. Using this protocol we can reduce the routing overhead and overload will optimize the bandwidth capacity of MANETs. This routing protocol is compared with the standard AODV, OLSR, and ZRP protocol.

Keywords: *AODV; EXATA CYBER 1.1; HMPRP; MANETs; RSS; RTS/CTS;*

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1. INTRODUCTION

The Primary classification of wireless network is done in two broad areas: Infrastructure less and Infrastructure based. In Infrastructure less networks all nodes act as a router or host. In Infrastructure based wireless networks consists of a network with fixed and wired gateways.

A mobile ad hoc network (MANETs) is a special type of Infrastructure less networks which consist of wireless mobile nodes. Here network topology changes dynamically without relying on any wired network or fixed access point. Mobile ad hoc networks are constrained by their limited energy power, processing capacity, memory resources and dynamic mobility. It can be deployed quickly while not infrastructure support. Several routing protocols such as the AODV [1], Zone Routing protocol (ZRP) [2], and Optimized Link State Routing (OLSR) [3] are developed by several developers.

AODV and Dynamic Source Routing Protocol are the on demand reactive routing protocols which create a route between a source and destination when the source node wants to send packets to the destination. The benefits for using these protocols avoid network wide topology information exchange and communication overhead reduced. Whereas Proactive routing protocols such as DSDV [4] and OLSR consistently maintains routes to different nodes and update routing information in all node by propagating changes throughout the network. Because of broadcast nature of exchanging routing information, bandwidth overhead is a major issue with these protocols [5] [6]. Each node of mobile ad hoc networks (MANETs) is dynamically connected in an arbitrary manner, due to which there is possibility of create more than one path between a source and a destination node.

Rest of the research paper is described as follows: Section II discusses about the proposed protocol. Simulation Environments are discussed in section III. Performance analysis is discussed in section IV and section V concludes the research paper.

2. DESCRIPTION OF PROPOSED PROTOCOL

Motivated by the requirement to improve the performance of network and decrease the resource overhead concerned with AODV routing algorithms. The proposed routing algorithm that we have introduced is called Hybrid Multipath Progressive Routing Protocol (HMPRP) with node-disjoint propose in this paper that takes the advantages of Received Signal Strength (RSS) [7].

In this research paper, we have use AODV protocol as the base routing protocol therefore, the basic functionality of the proposed Hybrid Multipath Progressive Routing Protocol (HMPRP) with node-disjoint is similar to AODV protocol. We have modified AODV algorithm on the basis of (RSS) Received Signal Strength. In HMPRP at the time of route creation we have compared RSS of every routing packet with threshold value. We apply node disjoint, multipath and load balancing technique using hybrid approach. Our aim is to design and develop an algorithm that has a higher Packet delivery ratio (PDR) and throughput with lower end-to-end delay and control overheads. AODV modified on the basis of following steps.

Step 1: Whenever packet comes from top layer to network layer, check whether route to destination is available. If it is available send the packet from the given route otherwise broadcast Route Request then neighbors receives the Route Request, check the received signal strength with which Route Request is received. If it is less than the threshold, drop the request packet otherwise forward the packet to the destination node.

Step 2: Whenever the source node receives first Route Reply, it starts broadcasting a Link State Request (LSR) packet.

Step 3: The neighboring nodes which are part of route checks with what RSS is this LSR received. If it is less than a threshold, Link state reply is generated.

In this way propose hybrid multipath node disjoint algorithm will perform progressively then other existing routing protocol [8]. Multipath routing is the technique of spreading of traffic from a source node to a destination node over multiple alternative paths through the network. In HMPRP, a new route discovery operation is happened only when all the available routing paths in the network fail. Multipath routing technique has been proposed for ad hoc networks such as Mobile ad hoc networks. Although multipath protocols build multiple routes, the majority of them establish only node-disjoint multipath which is very useful in multipath approach [9].

3. SIMULATION ENVIRONMENT

Exata Cyber simulation tool is useful to run many simulations with these routing schemes examining the influence of the traffic load on the routing performances. The following simulation parameter are shown in table 1 used in our simulation.

Table: 1 Simulation Parameters

Parameters	Values
Simulator	EXata CYBER 1.1 Emulator
Studied Protocol	AODV,OLSR,ZRP
Area	1500m x 1500m
No. of Nodes	150 Nodes
No. of Applications	20
Type of Sources	CBR
MAC Protocol	802.11
Packet Size	512 Bytes
Traffic Rate	1 Packet per second
Mobility Model	Random Waypoint
Simulation Time	100 seconds
Channel Type	Wireless Channel
Antenna Model	Omni Directional
Energy Model	MicaZ
Access Model	DCF (Distributed Coordinated Function) with CSMA/CA

4. RESULTS AND DISCUSSIONS

The EXata CYBER 1.1 simulator has been applied to evaluate the performance of Hybrid Multipath Progressive Routing Protocol (HMPRP). The performance metrics of HMPRP is compared with different category of routing protocols such as Zone Routing Protocol, Optimized Link State Routing Protocol and Ad-hoc On-demand Distance Vector Routing Protocol. The performance based analysis is shown in figure 2 to figure 4. We have done simulation on 150 nodes using 20 CBR (source nodes) applications.

Two parameters: Speed of nodes and number of applications are varied for performance analysis for HMPRP, AODV, OLSR and ZRP. The speed for two differently populated networks i.e. 150 nodes network having 20 sources is varied. Random Way Point mobility model is applied, and mobility is varied to evaluate network performance. The rate at which the packet was sent was 1 packet per second. The results are collected at fix speed of 0, 3, 6, 9, 12 and 15 meter per second.

4.1 Packet Delivery Ratio

Packet delivery ratio is the ratio of total number of packets received to total number of packet sent. Packet delivery ratio should always be high as is signifies the loss rate, which affects the packet transfer rate of the network. The performance comparison for packet delivery ratio of the four protocols HMPRP, AODV, OLSR and ZRP is shown in figure 1 below. It is prove from the figure 1 that while comparing packet delivery ratio of HMPRP, AODV, OLSR and ZRP with 0, 3, 6, 9, 12 and 15 meter per second speed at low velocity, PDR increases for all protocols but when the velocity is increased a sharp decrease in the performance. Rate of decrease in HMPRP is low and it outperforms other protocols, after HMPRP is the AODV next and OLSR and ZRP are in order.

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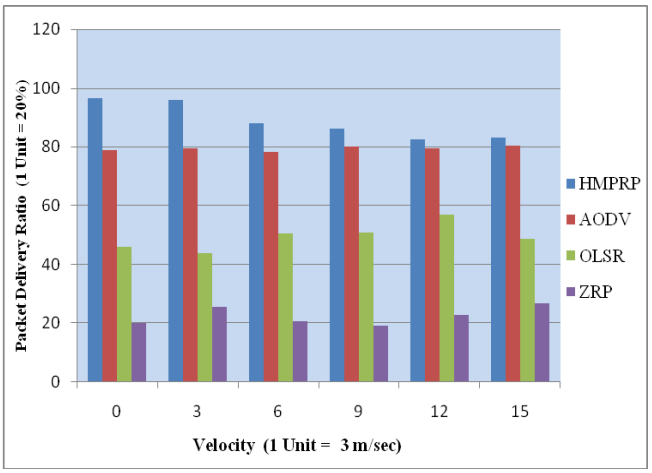

Fig 1: Packet Delivery Ratio vs. Velocity (150 nodes 20 sources)

It can be observed from figure 1 that as we increase the speed the performance of all the protocol decreases, the variation is clearly visible. At higher speed HMPRP has highest packet delivery ratio than reactive unipath protocol

AODV, the proactive protocol OLSR and hybrid protocol ZRP. The 96% to 83% data packets of HMPRP protocol can be sent to specified destinations in all mobility conditions in 150-nodes network.

4.2 Average End-to-End Delay of Data Packets

The average end-to-end delay includes all possible delays for the packet to be transmitted across a network from source to destination.

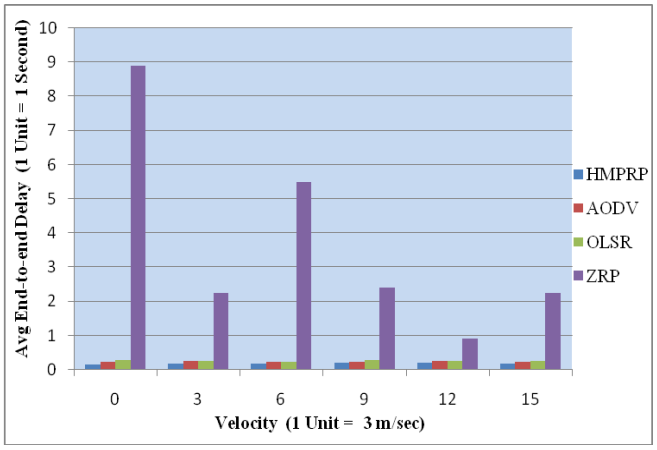

Fig 2: Avg. End-to-End Delay vs. Velocity (150 nodes 20 sources)

Figure 2 shows the variation of the average end-to-end delay as a function of speed of nodes. The main reason is high mobility of nodes which increased possibility of link breakage. Because of this may increase in the number of time route discovery. This proves data packets will wait for more time in its queue until a new routing path is discovered. The delay of HMPRP is almost stable with little variation in all mobile velocities.

AODV and OLSR also perform consistency in result and gives less delay as compared to ZRP protocol but it is still higher as compared to HMPRP. Delay in ZRP increases rapidly initially as velocity increases but at higher speed it comes down and perform better but beyond 6 meter per second velocity it again shows a higher trend.

4.3 Energy Consumptions

Battery consumption in HMPRP is very less than other routing protocols. It is not necessary of frequently route discovery in HMPRP because of node disjoint multipath. In AODV node does not try to save battery once route is established.

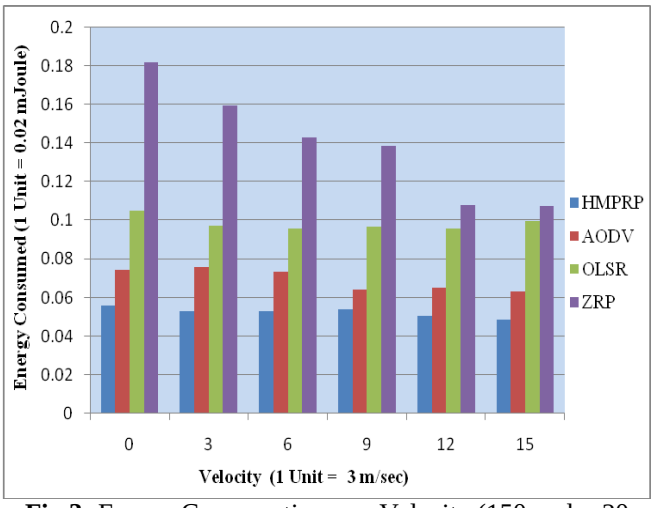

Fig 3: Energy Consumptions vs. Velocity (150 nodes 20 sources)

Figure 3, presents the energy consumptions of the 150-node networks. From the figure it is clear that battery utilization in HMPRP is much better than AODV, OLSR and ZRP protocols.

4.4 Throughput

Throughput can be defined as the quantity of data transferred by the communication channel in a particular time frame. Throughput is very important metric since it shows the overall performance of the network. The result of throughput of the four protocols HMPRP, AODV, OLSR and ZRP is shown in Figure 4.

It is proved from the figure 4 that while comparing throughput of HMPRP, AODV, OLSR and ZRP with 0,3,6,9,12 and 15 meter per second speed, with increase in velocity initially the throughput increases but with higher speed of nodes the throughput starts reducing for all protocols. For ZRP the drop is highest. In high mobility it is reduced to about 20% in case of HMPRP even than it is performing better than other protocols of all classes.

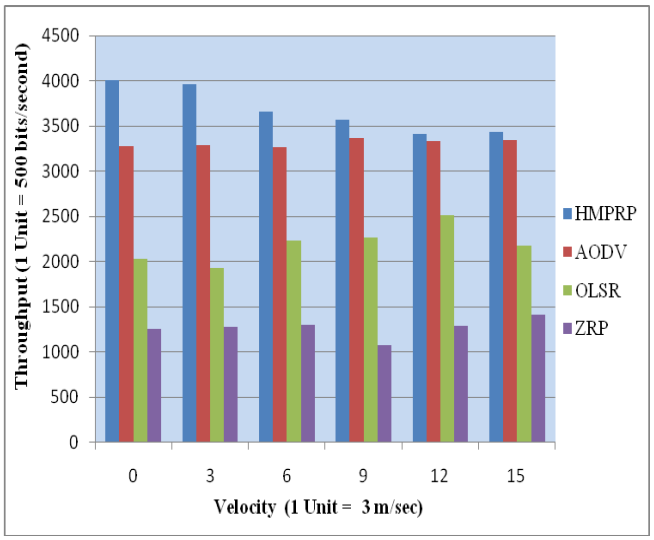

Fig 4: Throughput vs. Velocity (150 nodes 20 sources)

5. CONCLUSION

In this paper we have designed and developed a novel routing protocol HMPRP for Mobile ad-hoc networks which depend on collected received signal strength. In this work we have taken into consideration the properties of Proactive and Reactive routing protocols. We have considered two well known MANETs routing protocols: AODV (Reactive) and OLSR (Proactive) and combined these properties to develop a new Hybrid routing protocol. The performance of HMPRP is analyzed with AODV, OLSR and ZRP routing protocols for stationary and mobile nodes are studied by varying the mobility (0, 3, 6, 9, 12 and 15) using Exata Cyber 1.1 simulator.

From simulation and results it can be observed that the proposed protocol is performing better than other three well known routing protocols in the appeared performance metrics. HMPRP gains this improved performance by eliminating unessential message exchanges and route requests and route replies. In future we would like evaluate the performance of this routing protocol over IPv6 networks and sensor networks. We would also like to evaluate the performance of this protocol over large number of nodes.

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BIOGRAPHIES

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