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# A Proposed Multicasting Routing Protocol for Manets Based on PSO Technique

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**Abstract:** In mobile ad-hoc network (MANET), nodes establish wireless connection among themselves without any centralized coordinators. The connections can be direct or multi hop. The bandwidth of a wireless link is an order of magnitude lower than that of wired links. Hence, new routing protocols are required for both unicast and multicast communications. This paper provides an insight knowledge about the existing protocols for routing in MANETS. A new proposed protocol for MANETS using PSO technique over On Demand Multicast Routing Protocol (PSO-O-ODMRP) improves the performance in routing the messages. PSO-O-ODMRP is well suited for mobile ad hoc networks in which the topology changes very frequently. The proposed protocol generates an efficient and optimized multicasting route and the shortest path is selected using PSO algorithm which is inexpensive in terms of memory and speed. The selected route proved to be an effective route.

**Key words:** Mobile Adhoc Networks · Particle Swarm Optimization · Packet Delivery Ratio · End-to-End Delay · On-Demand Multicast Routing

## INTRODUCTION

A MANET is a collection of wireless mobile nodes forming a dynamically temporary network without the use of any existing fixed network infrastructure or centralized administration. Even though the source and destination mobile nodes are not in the transmission range, data packets are routed and forwarded to the destination mobile host by relaying transmission through a series of other mobile hosts that exist between the two mobile hosts. Routing is the process of selecting paths in a network along which data packets are send. A routing protocol finds the path to be followed by the data packets from a source node to a destination node.

**Routing in Manets:** The existing distance-vector and link-state-based routing protocols are found difficult to yield better performance with frequent link changes in the ad hoc networks, which results in very poor route convergence and very lesser communication throughput. New protocols are needed to support the mobility [1].

**Multicast Routing:** Multiple communications are enabled through the presence of multicast routing protocols. They have to perform good even with the network mobility which results due to the migration of source nodes, multicast member nodes or intermediate nodes.

**Categories of Multicasting Routing:** Multicast routing protocols for mobile ad hoc networks can be classified based on their multicast delivery structures [2, 1]. The multicast delivery structure defines the structure that ultimately creates the path through which each multicast packet can transit to reach all intended multicast group members [1].

**Multicast Routing Protocols:** Based on the multicast delivery structures of a MANETS, Multicast routing protocols are classified [1]. The multicast delivery structure defines the structure that ultimate forms the path through which each multicast packet can transit to reach all intended multicast group members.

- Distance Vector Multicast Routing Protocol(DVMRP)
- Ad-Hoc On-Demand Distance Vector(AODV)
- Core-Assisted Mesh Protocol(CAMP)
- On-Demand Multicast Routing Protocol(ODMRP).

**Multicast Mesh Based Routing:** This group of multicast routing protocols use a mesh instead of a shared multicast tree for packet delivery, which provides redundant links

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among the members in the group [3]. They consume more bandwidth when comparing with the tree based routing protocols. Examples of mesh based routing protocols are On-Demand Multicast Routing Protocol (ODMRP) [4].

**Particle Swarm Optimization:** Particle swarm optimization (PSO) is a computational method which is used to optimize a problem. It is an iterative process to get an optimal solution with respect to the quality. It solves a problem by taking a set of candidate solutions called particles [5] and using a simple formulae these particles are moved around in the search-space [6]. The particles movements are guided obviously by their own best known position in the search-space along with the entire swarm's best known position. When new and improved positions are found, these will tend to guide the swarm movements. The process is repeated to find a optimal solution.

**PSO Based Multicast Routing:** Particle Swarm Optimization (PSO) is used to find solution for an optimization problem in a search space. It is an population based algorithm In PSO, each single candidate solution is an individual particle in the search space. Each particle is allotted with a separate memory and they use of its own individual memory and uses the knowledge gained by the swarm to find the best solution. These type of algorithms are designed based on the natural principle exists in the form of a fitness function. In a mobile ad-hoc network, the links can be added and removed depending on various physical and social attributes such as node mobility, terrain, weather, interference, or battery power.

The steps involved are:

Select all possible routes
Until there is stopping criteria do
Find the number of routes for a node
Select the best route and update it
Repeat the process for all nodes

**PSO-O-ODMRP:** A multicast mesh is then built on the basis of the minimal cost tree obtained [6]. The proposed approach reduces the data overhead considerably and manages to offer greater performance than the ODMRP at a lower cost, in terms of forwarding efficiency.

The process of PSO algorithm in finding optimal values works for individual nodes which does not requires any leader. Particle swarm optimization consists of a swarm of particles, where these particles represents a potential and optimal solution.

The simulation is done for ODMRP and PSO-O-ODMRP protocols to evaluate their performance in terms of the metrics identified. The packet delivery ratio, latency, control overhead are taken as the metrics for finding out the performance of this protocol. This proposed protocol is more appropriate and suitable for the MANETs in which topology changes are very frequent and they are power constrained.

## RESULTS AND DISCUSSION

The simulations are conducted to investigate the performance of the PSO-O-ODMRP

Table 1: Simulation Parameters

| Parameter | Values |
|---|---|
| Number of wireless nodes | 20 |
| Protocols | ODMRP, PSO-O-ODMRP |
| Area | 500m X 500m |
| Type of Traffic | Constant bit rate |
| Transmission Power | 0.05w |
| Bandwidth | 2Mbps |
| Network Load | 2 to 20 packets |

Figure 1 shows the performance of protocols on packet delivery ratio according to mobility of nodes.

Figure 2 shows the performance of end-to-end delay

Figure 3 shows the performance of control overhead. The ODMRP, PSO-O-ODMRP algorithms send data through two paths simultaneously. The results are displayed in figure 3.

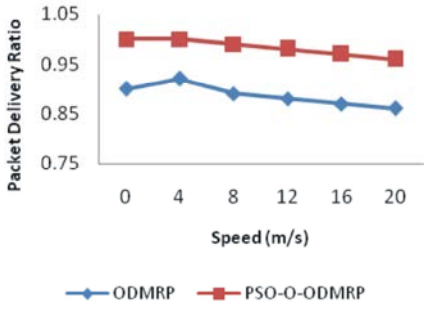


Fig. 1: Impact on Packet Delivery Ratio

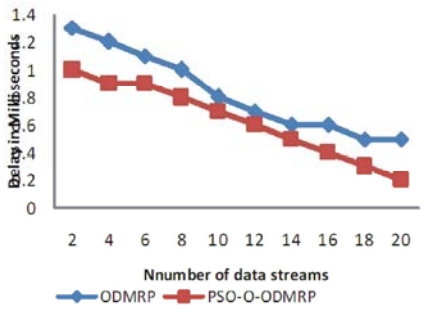


Fig. 2: Impact on End-to-End Delay

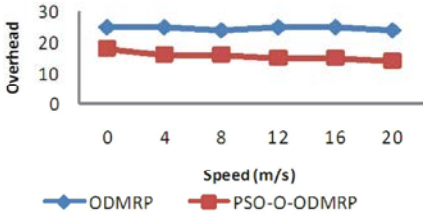


Fig. 3: Impact on Control Overheads

The simulation results are more promising for PSO-O-ODMRP than ODMRP. It is also found that the performance of proposed protocols is even good in high mobility. This proposed protocol is more appropriate and suitable for the MANETs where topology changes are very frequently and also they are power constrained.

## CONCLUSION

The proposed protocol generates multicasting routes and an optimized shortest path is selected from the set using PSO algorithm which is inexpensive in terms of memory and speed. The selected route seems to be an effective route. As multiple path exists to reach the destination, we select a best shortest path using PSO technique. PSO-O-ODMRP is proved to be an optimal solution when compared to ODMRP. This protocol found to be appropriate for MANETS in terms of packet delivery ratio, end-to-end delay and control overhead.

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