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A Study of Various QoS Multicast Routing Protocols for MANETS

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Abstract: The rapid growth in network multimedia equipments have allow additional real-time digital services such as video-conferencing, online games and distance education to grow to be the conventional internet tasks. These services frequently necessitate the fundamental system to provide multicast facility. The multicast describes the distribution of structures from just one single node to multiple destinations. These real-time services have a stringent inevitability of QoS factors like bandwidth, delay, jitter etc. to ensure dirt free, reliable, and reasonable sign to the receivers. In this paper, a survey on various meta-heuristic algorithms has been done along with routing protocols. From the survey it has been concluded that none of the technique performs effectively in all fields. Therefore the paper ends with the future scope to overcome these issues.

Keywords: -MANET, MULTICAST ROUTING PROTOCOLS, ACO, PSO

I. INTRODUCTION

MANET Stands for "Mobile Ad Hoc Network." A MANET is a type of ad hoc network that can change locations and organize itself on the take wing. Because MANETS are mobile, they use wireless links to connect to various networks. This can be a standard Wi-Fi connection, or another medium, such as a cellular or satellite broadcast.

Some MANETs are top secret to a local area of wireless strategy (such as a group of laptop computers), while others may be attached to the Internet. For example, A VANET (Vehicular Ad Hoc Network) is a type of MANET that allows vehicles to communicate with roadside equipment. While the vehicles may not have a direct Internet connection, the wireless roadside equipment may be connected to the Internet, allowing data from the vehicles to be sent over the Internet. The vehicle data may be used to measure traffic conditions or keep track of trucking fleets. Because of the dynamic nature of MANETs, they are typically not very secure, so it is important to be cautious what data is sent over a MANET.

II. MULTICAST ROUTING PROTOCOLS

MRP term multicasting compare to unicasting and broadcasting.

Unicasting: - In Unicast communication, there is one source and one destination. The relationship between the source and the destinations one to one. In this type of communication both the source and destination addresses. In unicasting, the router onwards the arriving data through only one of its interfaces.

Multicasting: - in multicast communication, there is one source and a group of destinations. The relationship is one too many. In this type of communication, the source address is a unicast address, but the destination address is group address, which defines one or more destinations. The group address identifies the members of the group.

Broadcasting: - in broadcast communication, there is one source and destinations one to all. The relationship between the source and destinations many too many. The internet does not explicitly support broadcasting

Broad Classification of Different routing protocols.

1. MRP (Multicasting routing protocol)
2. ODMRP(On-demand Multicast Routing Protocols)
3. ADMR(Adhoc demand driven multicast routing protocols)
4. DSR(Dynamic Routing Protocol)
5. DSDV(Destination-Sequence Distance Vector)
6. AODV(Adhoc on-demand distance vector)
7. OLSR(Optimized Link State Routing)
8. CAR(Capabilities Aware Routing)
9. LSR(Link State Routing)
10. ABSDPRA(Ant Colony Based Stable Disjoint Routing Algorithm)
11. PRP(Proactive Routing Protocol)
12. HRP(Hybrid Routing Protocol)
13. RRP(Reactive Routing Protocol)
14. LAR(Location Aided Routing)
15. SWR(Security aware Routing)

16. PPSEER(Privacy protecting secure and energy efficient routing)
17. Static Routing
18. Dynamic Routing
19. Swarn Intelligence Based Routing
20. Energy Efficient Routing

Link state routing:

Self-determination vector Routing was worn in a p ARPANET up to 1979. After that it was replaced by link state Routing. In link state Routing each router has to perform following five functions:-

1. Each router should discover its neighbor of its neighbor and obtain their network addresses.
2. Then it be supposed to evaluate the holdup or rate to each of its neighbor.
3. It should assemble a small package containing the network addresses and the delays of the neighbors.
4. Throw this packet to all further routers.
5. Work out the shortest path to each other router.

DVMRP (Distance Vector Routing Protocol):

The DVMRP is multicast routing protocol that can takes the routing decision considering the origin address from the packet. This algorithm constructs the routing tree to get a network. Every time a router gets a packet, it forwards to many ports in-line with the source address of packet. All of those other routing tree is expressed by downstream router. By doing this method, routing tree came to be from location to source**.**

ccomplishing this must achieve the Subsequent tasks:

1. It must prevent the formation of loops in the network.
2. It must prevent the formation of duplicate packets.
3. It must ensure that the path travelled by a packet used shortest route from its source to the router.
4. It should provide dynamic membership.

AdhocOn-demand Distance Vector Routing(AODV):

AODV is a reactive protocol in which the routes are created only when they are needed. It uses traditional routing tables, one entry per destination, and sequence numbers to determine whether routing information is up-to-date and to prevent routing loops. An important features of AODV is the entry not recently used is expired. In case of route is broken the neighbours can be notified. Route discovery is based on query and reply cycles, and route information is stored in all intermediate nodes along the route in the form of route table enteries. The following packets are used : routing request message(RREQ) is broadcasted by a node requiring a route to another node, routing reply message (RREP) is unicasted back to the source of RREQ, and route error message (RERR) is sent to notify other nodes of the loss of the link. HELLO messages are used for detecting and monitoring links to neighbours.

Dynamic Source Routing Protocol (DSR)

The dynamic source routing protocol is a reactive protocol and efficient routing protocol designed specifically for use in multi-hop wireless ad-hoc networks of mobile nodes. It used source routing which means that the source must know the complete hop sequence to the destination. Each mobile node keeps track of the routes of which it is aware in a route cache. Upon receiving a search request path, it refers to its route cache to investigate if it contains the required information. DSR uses more memory while reducing the route discovery delay in the system.

Destination Sequence Distance Vector (DSDV):

This protocol is based on classical Bellman-food routing algorithm designed for MANETS. Each node maintains a list of all destinations. Each entry is marked with a sequence number. It uses full dump or incremental update to reduce network traffic generated by route updates. Each mobile node maintains a routing table in which all the possible destinations and the numbers of hops to them in the network are stored. The entries in the table may change extremely dynamically so the advertisement might be made quite often.

III. ACO

Forward the actual packet relative to the course specified because of the source. It maintains the actual route cache. The course cache can certainly contain several paths to a node. Ant Nest Optimization was produced by Marco Dorigo (Italy) within his PhD thesis within 1992. Ant Colony was created by Gambardella Dorigo within 1997. The ant colony seo algorithm (ACO) is often a probabilistic way of solving computational problems which can be reduced to locating good routes through graphs. ACO utilized in looking for optimal path within the graph predicated about behavior of ants in search of a course between their own colony and source of food.

Meta-heuristic optimization: - Ants navigate from nest to food source. Shortest path was discovered via pheromone trails. Each ant moves randomly Pheromone is deposited on path more pheromone on path increases possibility of path being followed. **As Shown in** ACO was really a recently proposed Meta heuristic approach for solving hard combinatorial optimization problems. Artificial ants implement a randomized construction heuristic helping to make probabilistic decisions ACO shows great performance with the "ill-structured" problems like network routing.

ACO – Construct Ant Solutions.

An Ant will move from node i to node j with probability

$$P_{I,J} = \frac{(T_{I,J}^{\alpha})(n_{i,j}^{\beta})}{\sum(T_{I,J}^{\alpha})(n_{i,j}^{\beta})}$$

Where

$T_{I,J}$ Is the amount of pheromone on edge I,j

A is a Parameter to control the influence of $T_{I,J}$

$n_{i,j}$ is the desirability of egde i,j(typically $1/d_{i,j}$)

B is a Parameter to control the influence of $n_{i,j}$

ACO – Pheromone update

Amount of Pheromone is updated according to the equation

$T_{I,J}$ = (1-p) $T_{I,J}$ + $\Delta T_{i,j}$

Where

$T_{I,J}$ is the amount of pheromone on a given edge i,j

P is the rate of pheromone evaporation.

$\Delta T_{i,j}$ is the amount of pheromone deposited, typically given by

$\Delta T_{I,J}^{K}$ = $\int$ 1 / L_k if ant k travel on edge i,j

0 Otherwise

Where L_k is the cost of the k^{th} ant's tour (typically length)

APPLICATIOS OF ACO:

- Routing in telecommunication networks
- Travelling Salesman
- Graph Colouring
- Scheduling
- Constraint Satisfaction

Advantage of ACO Algorithm:

- Inherent parallelism
- Positive Feedback makes up about rapid finding of excellent solutions.
- Efficient for Travelling Jeweler Problem and also similar problem including for case new kilometers, etc

Problem of ACO:

- Theoretical evaluation is challenging.
- Sequences of random decisions (not independent)
- Probability submission changes by means of iteration
- Research is actually experimental in lieu of theoretical
- Time to be able to convergence unsure.

Disadvantage of ACO:

- Theoretical analysis is difficult.
- Sequences of random decisions (not independent)
- Probability distribution changes by iteration
- Research is experimental rather than theoretical
- Time to convergence uncertain.

IV. PSO

The PSO has been proposed by Eberhart and Kennedy in 1995, subsequently developed in thousands of scientific papers, and applied to many diverse problems, for instance neural networks training, data mining, signal processing, and optimal design of experiments.

The purpose of PSO

The usual aim of the particle swarm optimization (PSO) algorithm is to solve an unconstrained continuous **minimization problem**: find x* such that f(x*)<=f(x) for all n-dimensional real vectors x. The objective function f: Rn -> R is called the **fitness function**.

PSO is particle swarm **intelligence** meta-heuristic inspired by the group behavior of animals, for example bird flocks or fish schools. Similarly to genetic algorithms (GAs), it is a population-based method, that is, it represents the state of the algorithm by a population, which is iteratively modified until a termination criterion is satisfied. In PSO algorithms, the population P= {p1,…,pn} of the feasible solutions is often called a **swarm**. The feasible solutions p1,…,pn are called **particles**.

PSO applications

- Training of neural networks
  – Identification of Parkinson's disease
  – Extraction of rules from fuzzy networks
  – Image recognition
- Optimization of electric power distribution networks
- Structural optimization
  – Optimal shape and sizing design
  – Topology optimization
- Process biochemistry
- System identification in biomechanics

Advantages of PSO

- Insensitive to scaling of design variables
- Simple implementation
- Easily parallelized for concurrent processing
- Derivative free
- Very few algorithm parameters
- Very efficient global search algorithm

Disadvantages

- Slow convergence in refined search stage (weak local search ability)

V. HYBRID ACO/PSO ALGORITHM (HACOPSO)

To begin with, perceptive alternative habits are usually made randomly. These habits are usually packed in the grids from the research place of dimensions ok _ m, where each and every design refers one grid while using purchase of these technology. Next and particle agents are usually made as well as uniformly spread to the research place, where by each and every particle real estate agent consumes one particular grid. Right now, the actual time set off, and for every one moment in time, 1st every one and all particle real estate agent obtain the health and fitness price from the woods design from the money necessary for the actual woods, whereby it's at present based. While using the ACO formula, pheromones are usually transferred about each and every capability determined by their particular capability price from the particle agents.

VI. TABU SEARCH

Tabu search was an increased level heuristic means of solving optimization problem. It was made to steer other methods to escape the trap of local optimality. Tabu search has obtained optimal and near optimal solution wide selection of classical and practical problems in applications including scheduling to telecommunications and from character recognition to neural networks. It uses flexible structures memory conditions for strategically constraining and freeing the search Process and memory functions of varying time spans for intensifying and diversifying the search. Tabu search could b integrated with branch and bound and cutting plane procedures, and it has the capability to begin with a straightforward implementation which can be upgraded over time and energy to incorporate more complex or specialized elements.

VII. LITERATURE SURVEY

Rajeev Agrawal(2001) [1] adopted probabilistic modeling to model the effect because of multipath fading and shadowing. The BER for each one connection exaggerated by the vanishing is estimated utilising the proposed model. Wireless Routing Protocol (WRP) maintains the BER associated with a particular link, a packet/ data is routed with optimum BER route from some discovered route by protocol. It absolutely was found that the proposed model is effective at reducing how many retransmission for the packet, saves battery energy and also reducing overloading of a certain path by routing the packet via an optimal path (in terms of BER).

B.Malarkodi et al. (2009) [2] the force of dissimilar mobility models on Multicast Routing Protocols. The outcomes revealed that the throughput of ADMR is more than of ODMRP at high mobility. That is achieved at the expense of escalation in delay and communication over head. underneath low down mobility, ODMRP has higher throughput than AMDR. One of the three mobility models considered, the throughput of ODMRP was the best at low mobility. The outcomes exposed that the protocols performances vary widely across the different mobility models.

I.Vijaya and Pinak Bhusan Mishra (2003) [3] has attempted to compare the performance of two prominent on-demand reactive routing protocols for mobile adhoc networks: DSR and AODV, along with the traditional proactive DSDV protocol. A simulation model with Media Access Control (MAC) and physical layer models were used to study interlayer interactions and their performance implications. The On-demand protocols, AODV and DSR perform better than table-driven DSDV protocol. Although DSR and AODV share similar on-demand behavior, the differences in the protocol mechanism can lead to measurable amount of variation in performance. A variety of workload are characterized by mobility, load and size of the ad hoc network in a given scenario were simulated which helped to analyze the performance. The main reason for degradation in performance as a result of node mobility was due to traffic control

overhead required for maintaining accurate routing tables in case of table-driven protocols and maintaining routes in on-demand protocols.

V.A Gajbhiye and R. W.Jasutkar(2013) [4] showed that Swarm Intelligence based routing protocol indicates promising consequences in VANET. for the reason that of this they compared and evaluated the performance of AODV, OLSR, and Swarm Intelligence based routing protocol when it comes to throughput, latency and data packet delivery ratio for VANET. Simulation results have shown that SWARM Intelligence based routing protocol showed promising results in VANETs as compared to AODV and OLSR.

Nathaniel Gemelli et al. (2003) [5] Launched Bluetooth wifi technology, examine existing routing methodologies and present the targets and considerations for your design of any new Wireless routing project. The project design would take into account the capabilities on the devices (nodes) in the range on the network. It had been envisioned of which capabilities Mindful Routing (CAR) project would create routing decisions dependant on such. Aspects as device power constraints. Memory, Location and indication strength.

E.Ahila Devi and K.Chitra(2014)[6] unveiled a Level of privacy Protecting Secure and Energy Efficient Direction-finding Protocol (PPSEER) had been proposed. In this protocol, first the actual classifications connected with network node take place while using energy degree. From after that on encryption had been done dependant on group signature bank. It contains additional risk-free parameter like secret crucial and utmost transmission power which has been known and the sender in addition to recipient node. The main advantage of the recommended routing protocol was it increases privacy of the message and also it maintains the facility efficiency of the node.

Hiba Hachichi et al. (2011) [7] created and looked after locally a hierarchy that is well ideal for routing packets within an Ad hoc circle. The contribution with this particular work had been mainly judging by the construction of the digital topology where cluster heads and gateways work with others for browsing the location node. Consequently, inter-cluster in addition to intra-cluster course-plotting are mutually used. The internet logo platform has become investigated with regard to constructing within an asynchronous manner a digital topology. Results showed an important decrease inside the exchanging messages. In comparison on the existing approaches, their info was in addition able to discover the shortest journey between a source as well as a destination.

Istikmal et al. (2013) [8]offered about investigation consequence of AODV, DSR along with DSDV which applied a Ant-algorithm that have been AODV-Ant, DSR-Ant, along with DSDV-Ant. DSDV shows of aggressive routing form protocol determined by table pushed, while AODV along with DSR shows of reactive direction-finding protocol type determined by demand. Performance investigation included end to finish delay, throughput, direction-finding overhead along with hop count number for a variety of scenario regarding node rate, pause occasion and network traffic. The effect showed which proactive direction-finding protocol could improve performance compared to the reactive direction-finding protocol and much more suitable along with Ant-algorithm. On the other hand, applied a Ant-algorithm in routing process was cause to elevated of direction-finding overhead along with need additional computation of nodes to be able to resulted the top route.

Sikkandar Ali and Vashik Ali et al. (**2012)[9]** displayed routing with wireless mobile ad-hoc sites using Location Sequenced Mileage Vector (DSDV) in addition to Ad-hoc in demand Mileage Vector (AODV) methods. The effectiveness of bandwidth, throughput in addition to packet decrease in DSDV in addition to AODV continues to be modeled under various network configurations in addition to mobility disorders. These mechanics can cause significant effectiveness differentials. The results were warranted through NS-2 simulation.

Istikmal(2004) [10] used optimized routing protocols in mobile ad hoc network (MANET), the optimization was done on the routing protocol DSR (Dynamic Source Routing) which was reactive routing protocol using ant algorithm. Then they analysis and evaluated the performance of this routing protocol in various scenario and compared the result with standard DSR routing protocol. The results of this research indicate the performance of DSR-ant has a better performance. In all the scenario, DSR-ant has 48% smaller delay, 1.37 times smaller hop count, and throughput up to 3.6 times larger, but DSR-ant has routing overhead 58% larger than standard DSR. The result in velocity, pause time, and traffic connection scenario, show the result consistency, DSR optimization using ant algorithm can improved performance with a smaller delay and the number hop to transfer information between node. DSR-ant gain larger throughput but resulting in higher routing overhead than DSR standard due the effort of DSR-ant to find the best path.

Geethu Mohandas(2013) [11] This Mobile Ad hoc Networks (MANET) tend to be networks along with self-configuring potential of mobile phones interconnected through wireless back links. During the previous few years, research in various aspects regarding MANETs continues to be prominent, caused mainly through military, tragedy relief, and police force scenarios. An instinctive footstep was to consider up this kind of location-based functioning to MANETS. In various applications, including army and police force, node identities are not virtually because helpful because node locations. In shady MANETs, nodes usually do not even trust one another; hence identities have to be hidden. This paper attempted to contribute research and comparability on course-plotting protocols with mobile ad hoc networks.

KomalPatel et al. (2006) [12] Recommended a mix layer method that uses the APPLE PC layer web page link stability information to raise the redirecting efficiency. Signal strength of the link ended up being captured on the MAC Covering and utilized at community layer to be able to predict one's destiny signal toughness value using double Hugh smoothing type. This fact was accustomed to categorize the web link as secure or shaky. The recommended MAC Covering aware secure link redirecting protocol (MACSLR) promotes only these distance vectors as their next go links tend to be stable. They have simulated the particular protocol in comparison its effectiveness with On-Demand Mileage Vector[l]and

Location Sequenced Mileage Vector [2] methodologies. Results showed that regarding lower typical overhead, each of our protocol provides higher box delivery rate and scales well along with mobility.

S.Preethi and B. Ramachandran(2003)[13] proposed an energy efficient route discovery process for AODV based on ERS. Their approach saves energy of the nodes by avoiding the redundant rebroadcasting of the route request packets. The relaying status of the node was decided based on the broadcasting of its RREQ packets by its neighbors. And it helped in reducing routing overhead incurred during the route discovery process. Simulations were performed to study the performance of Energy Efficient AODV (E2AODV) protocol using GloMoSim, the Global Mobile Simulator. This E2AODV reduces energy consumption by 75-85% compared to AODV. It also reduces routing overhead of around 65-75% and thereby reducing 60-70% collisions.

Rashmi Rohankar et al. **(2012) [14]** Analyzed the consequence of hit-or-miss based ability to move models around the performance involving Proactive Routing Protocol (DSDV Location Sequence Mileage Vector) and also Reactive Routing Protocol (AODV- on Demand Mileage Vector, DSR- Powerful Source Routing). Performance analysis was done regarding end-to-end wait, throughput and also Packet supply ratio regarding varying node densities.

P.ChennaReddy and Dr.P.ChandraSekhar(2006)[15] Reddy did the comprehensive performance analysis of the routing protocols using ns2 simulator considering most of the metrics as suggested by RFC 2501. Results indicate reactive routing protocols more ideal for adhoc networks.

Vinay Rishiwal(2008)[16] proposed an efficient algorithm, which maximized the network lifetime by minimizing the ability consumption during the foundation to destination route establishment. As an incident study proposed algorithm has been incorporated combined with the route discovery course of action of AODV and by simulation it was observed that proposed algorithm's performance is better as compare to AODV in terms of packet delivery ratio and network lifetime for different network scenarios.

Shobha.K.R and Dr.K.Rajanikanth(2009)[17] an enhancement technique for Dynamic Source Routing protocol (DSR) using relay routing and flooding alternately was proposed. DSR was a well-liked on demand reactive routing protocol in Mobile Ad hoc Networks (MANET) that used flooding for route discovery and route maintenance when only a node has data to be transmitted. Flooding causes serious redundancy, contention and collision in the network which increased the overhead of transmission in a energetic network where the nodes have different mobilities. In order to reduce this routing overhead they have used relay routing technique which selects merely a miniature number of nodes in the neighbourhood of the source node for route discovery and route maintenance. Selection of the nodes was done based on the mobility of the neighbourhood nodes at that instant of time. Simulation results on DSR demonstrate that technique can reduce redundant flooding to a vast extent thus making DSR more efficient.

Yudhvir Singh(2010)[18] executed simulation centered experiments were performed to be able to analyzed the particular performance involving On Requirement Multicast Routing Protocol simply by evaluating Supply Delivery Proportion, End to separate delay and also average throughput. These results were balanced with AODV and also FSR redirecting protocols simply by varying volume of nodes and also mobility. The comparability showed of which ODMRP for ad hoc networks executes better when compared with AODV and also FSR.

VIII. CONCLUSION AND FUTURE SCOPE

In this paper, the main problem of QoS routing has been discussed which setup a multicast hierarchy that may meet particular QoS constraint. Nevertheless, the situation of making a multicast tree below several constraints is available to be NP Complete. Therefore, the issue is often settled by heuristics or smart optimization. Lately, some meta-heuristic algorithms including the ant colony algorithm, genetic algorithm and compound swarm optimization have been employed by the analysts to eliminate the multi-constrained QoS routing problem which have been discussed in this paper.

In near future, in order to reduce the constraints of the earlier work a new improved technique which eliminate the issue of multi-cast tree using clustering based technique will be proposed.

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