# Efficient And Stable On Demand Multicast Routing Protocol Inmobile Adhoc Networks

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Abstract:- A Mobile Ad-hoc Network (MANET) is composed of Mobile nodes(MNs) without any infrastructure. MNS self-organize to form a network over radio links. In this environment, multicast routing is faced with the challenge of producing multi hope routing under host mobility and bandwidth constraint. Multicasting is a type of group communication in which group membership is crucial task. There are a number of multicast routing protocols which are categorized into two types: tree-based protocols and mesh based protocols with proactive and reactive routing type

In this paper, proposes a energy aware approach to efficient and stable multicast routing protocols. By offering some modification in, both SODMRP and EODMRP We involve node energy information in the proposed protocol, increase node stability. The proposed protocol improves route stability, packet delivery ratio; longer route life time and detection efficiency. This Protocols provide gossiped based routing protocols ,higher data packet rate, efficient routing but also cope with efficient loop free routing and saving battery life of Node.

Key word: MANET, ODMRP, SODMRP, EODMRP, MAODV, AMRIS, BEMRP, DCMP, ACMRP

## I. Introduction

Mobile Ad –Hoc network (MANET) is a collection of easily deployable autonomous mobiles nodes that communicates with other over wireless links for short periods of time `the word Ad hoc refers to temporary. Nodes in MANETS will often undergo different topology due to the arbitrary movement of each node. Over period of time. A number of multicast protocols for ad-hoc network have been proposed. On the basis of the routing structure they can broadly be classified into two main categories tree based protocols and based protocols. A single path between any senders – receiver pair is existed in tree based protocols. They are capable of producing high multicast efficiency. Even though they have high packet delivery ratio tree- based protocols are not tolerant against dynamic topology changes and the packet delivery ratio and lacks in reliability Mesh based protocols are one of the type which provide routes for connectivity to group members. Because of these advantage the low packets delivery ratio problem caused by link failures can be compensated Mesh – based protocols can yield very high robust to node mobility. A single path between any sender- receive pair is existed in tree-based protocols. They are capable of producing high multicast efficiency. Even though they have high delivery ratio tree-based protocols are not fault tolerant against topology changes and the packet delivery ratio and lacks reliability .Mesh- based protocols are one of the types which provide alternative routes for lasting connectivity to groupmembers.Because of these advantages the low packet delivery ratio problem caused by link failures can be compensated.

In tree based multicasting, structure can be highly unstable in multicast ad- hoc routing protocols, as it needs frequent configuration in dynamic networks, an example for these type is multicast extension for ad-hoc on demand vector (MAODV) Adoptive Demand

**C. *BEMR BandwidthEfficient Multicast Routing Protocols***: BEMRP Is sender tree based protocols Which focus on high multicast efficiency Requires each new members to set up a branch with fewest new forwarding nodes being added to multicast tree. To detect and remove unnecessary forwarding nodes a route optimization technique is introduced. When a new node wants to join the group floods the message into network. The node response the joining request through shortest path between the node be joined and the route node. BEMRP uses two links repairing scheme namely local flooding and local rejoining scheme. In local flooding a separate multicast route recover packet is flooded locally. In later method a path is created using local flood using upstream direction. Fig, shows the working method of BEMRP

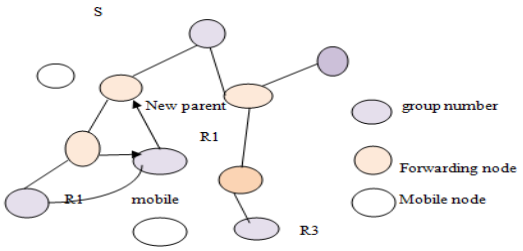


Fig.3 route optimization in BEMRP

**2. Mesh Based multicast routing:**

Mesh- based protocols are one of the types which provide alternative routes for lasting connectivity to group members.

A. ***On Demand Multicast Routing Protocols***: We need protocols that capable enough to provide richer connectivity among group member at high mobility. It can be achieved through mesh based protocols like ODMRP. A forwarding group concept is introduced in it to construct the mesh and mobility prediction scheme to refresh the mesh only at the time of necessity. With help of piggyback method, the first sender floods a join message. To achieve the updated information about the network, the join message is periodically flooded and get refreshed. An entered node will respond to join message. Multicast paths constructed by this sender are shared with other sender. Fig. shows the principle of ODMRP

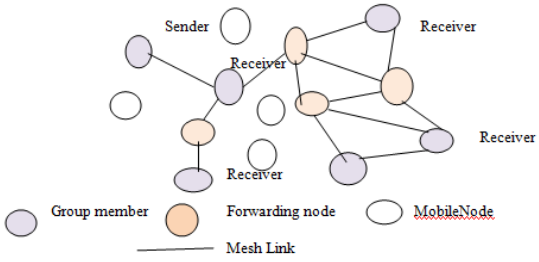


Figure 4 Multicast Meshes in ODMRP

**b.*Dynamic Core Based Multicast Routing Protocols : DCMP*** **.**WE Perceived a bit more control over head in ODMRP,With an aim at minimizing the high control over head problem in ODMRP. DCMP is introduced with different category of sender. Each one performs its own specific tsk in group membership management. They are namely active sender, core sender and passive sender. Active sender propagate join message at regular interval. Core Sender act as one of passive sender .A passive sender takes responsibility to construct a refresh the mesh. The working principle shows in fig5

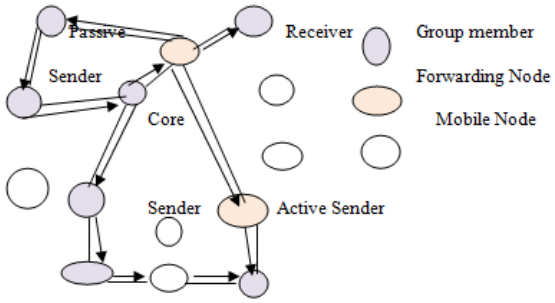


Figure .5.Packet transmission Path in DCMP

***C.Adoptive Core Multicast Routing Protocols, ACMRP***

It is well known that mesh type routing protocols provide high packet delivery ratio .ACMRPis as such one, it has a core node to take care of mesh creationandpupation.The failure is such as link failure, node failure is handled by core nodes, and Very first core node initiates group construction process by flooding join message. Interested nodes will reply JREP Message to core Node, Sometimes many forwarding nodes takes responsibility to forward JERP messages, Packets are encapsulated in ACMRP.Figure 6 Shows the working Principle of ACMRP.

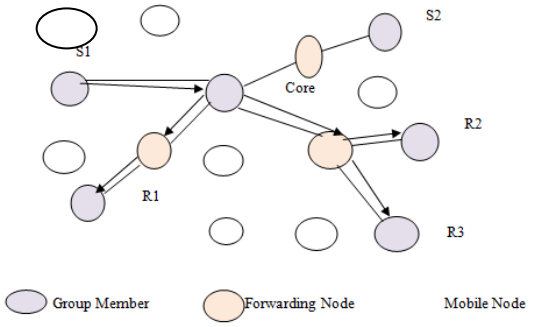


Figure 6. Packet transmission inACMRP

**III. Related work**

***A.ODMRP: On Demand Multicast Routing Protocols***

ODMRP is a mesh- based rather than a conventional tree based scheme and use a forwarding group concept .ODMRP uses two types of packets to establish and update route Join query and join reply. We can summarize route discovery phase of ODMRP as follows:

1. When multi cast route to destination nodes are unavailable, Join query message send to all nodes in the data packets are forwarded by the core node s to the destination nodes using DDM. DDM is state less multicast approach where multicast tree information is appended with each data packet header The key component of proposed Protocols are (a0 classifying core and normal node (b) separating out data forwarding path while sending join query request and sending data packet using DDM,(c) separate handling of received data packets coming through DDM path

(d) group membership update(e) normal functionality of ODMRP.

2. Multicast sources originate a join query packets. When location and movement information is utilized, it sets the MIN_LET (Link Expiration Time) Field of the packet to the MAX_LET_ValUE.
3. When Anode receives a join Query packet,checks if it is a duplicate. If duplicate, then discard the packet.
4. If it is not duplicate, insert an entry into message cache with the information of the received packets and insert/ update the entry for routing table.
5. Use movement information to predict the duration of time the link between the node and upstream node will remain connected Assume node I is the upstream node and node j is the current nodeLet (xi,yi)be the coordinate of node I and(xj.yj) be that of node j. Also let viand VIis the speed, and θi and θj is the moving direction of node I and j respectively. The information of I can be obtained from the join query and the current nodes location and mobility information can be provided by the GPS, The duration of time that link between the two nodes will stay connected i.e.LET, is given by the equation

$$LET= \frac{-(ab+CD) + \sqrt{(a^2+c^2)r^2 -(ad-cd)^2}}{(a^2+c^2)} \quad (1)$$

Where

C=VI Sin$\theta i$ –V j Sin $\theta$ j ,

d=Yi –Y j

B=Xi-X j, a =Vi Cos $\theta i$ – V j Cos$\theta j$

6. The minimum between the LET value and the indicated value in Mi-IN_LET field of join query is includedin the packet. Minimum LET in any route is known as RET(Route Expiration Time).

7. The receiver then chooses the most stable route and ttransmit a join- reply packet.

***B.SODMRP: Stable on Demand Routing Protocol***

1. To more carefully predict of route expiration time and hence improve route stability. We include reduces energy of nodes in over protocols. As the first step, let's define aparameter that plays important role in over work, namely residuesenergy. For any node, RESis the amount ofremaining of the node TO updated RES any node use Etx and Erx, that are amount of energy required to transmit and to receive of a packets. Thus node energy consumption (NEC) of the node is computed as follows for transmission of n packets by energy module.

NEC =n*(E tx + E rx) (2)

Now we can update RES of node by using equation

RES new= RES old- NEC

AS the first requirement of this protocol, we add a new field called MIN_RES to join query packet header, to carry minimum RES of the route. Now we can describe main operation of SODMRP

1, at the beginning, multicast source originate a join query packet and sets the MIN_ LET and MIN_RES field to the MAX_LET_VALUE and MIN_RES_VALUE respectively.

2. When a node receives a join query packet, check if it is duplicate, if yes, and then discard it.

3. If is not duplicate, insert an entry into message cache with the information of received packet.

4 Update MIN_LET and MIN_RES field of received join query packet.

a. Predict the duration of time the link between the node and upstream node will remain connected (LET), same as ODMRP by using equation (!). The minimum between this LET value and indicated value in MIN_LET field of the join query is included in the packet.
b. Compute RES value and indicates the minimum between this RES value and the value in MIN_RES field of the join query in the packet.

5. TO select the route, the receiver chose the most stable which isselected based on the weighted equation (4). In which Max RET and MAX RES received at source K each route has its own RESi

And RET I, hence receiver can compute WI by equation (4) finally receiver select most stable route.

$$WI= C1*\left[\frac{RETi}{Max\ RETk}\right]+ C2\left[\frac{RESi}{Max\ RESk}\right]$$

Equation (4) constant C1 and C2 represents the wright of RET and RES. C1 and C2 are positive constant, and we take C1+ C2=1. Thevalue of C1 and C2 should be chosen according to system requirements. Suitable selection of C1 and C2 provide better QOs for multicast application.

### *C.EODMRP: Efficient On Demand Multicast routing protocol*

Determining the number of node of group. The determination of number of group is critical for the efficiency of the routing protocols. The number of song et al: EFFICIENT ON –DEMAND ROUTING FOR MOBIL AD HOC WIRELESS ACCESS NETWOK 1377group is chosen as a tradeoff between the network connectivity and the amount of routing control overhead. To determine the number of groups, the gate has to obtain the following information: the number the source node, the number mobile nodes, and the size of network. Our aim to minimize the different between the optional number of mobile nodes and the variable, which is defined as the total the number of mobile node that can reply packet generated by each group. The rational is that optimal number gives the best performance without decreasing the network connectivity in a given network,

Given the number of source nodeS and the number of mobile node M, the total number of common node is equal to M-S. Given to total number of groups G assuming that each group has the same number of source node, the number of source nodes that belong to each group is S/G. The total number of mobile nodes T that relay packets generated by each group is given by M-S+ S/G. Therefore, the gateway chooses the number of group G such that the absolute difference between T and R is minimized

$$\mathrm{G} = \mathrm{agrmin}_{\mathbf{g} \in \{1,2,4.....s\}}[T - R] = \quad (1)$$

$$\underset{\mathbf{g} \in \{1,2,4.....s\}}{\mathrm{agrmin}} \; [\mathrm{M} - \mathrm{S} + \mathrm{S/G} - \mathrm{R}]$$

The number of group G is the function Value of M, s, and r as shown in (1)

1) If ($M \geq R + S$), then .G=S, because the number of common nodes M-S is greater than or equal to the optimal number of mobile node R in a given topology. A single source node per group will minimize [T-R]

2) $R<M<R+S$ .then G is equal to one of [S/R + (S-M)] or [S/(R+S-M)], which minimize [T-R].

3) If $M \leq R$ , then G =1, Since total number mobile node M is less than the minimum required number of mobile node R, all the mobile node have to join the same group to minimize [ T-R] .

Example: The network topology 1500*300m$^2$, the location of all nodes is uniform ally distributed in the network. The module setdesk in network simulator (ns2) can be used to calculate R. Such that the average number of neighbor is 7. Based on this calculation R is equal to 30. In this case, if the number ofsource node is equal to 30. In this case, if the number of source node is 25 and the number mobile node is 50. Then from (1) number of group is 5.And the number of mobile nodes is 50, and then from (2), the number of groups is equal to 5.

EHMRP is modified version of ODMRP. This separate the data forwarding path from join query forwarding path, when multicast route to destination nodes are UN available. Rest of protocols works in the same way as ODMRP. WE reduced the control overhead for large network size at high network load and solve the scalability issue of ODMRP.

## IV. On demand multicast routing protocol with efficient route and link stability:

The proposed model that manages the flooding method of query message in the contributing nodes based on their delay point and link stability within the network. The efficient route method IN ODMRP consists of two segments. The query segment occurs when a source node desire to transmit multicast data. The query segment is performed by periodical broadcasting of member requesting message. The reply segment supports the route found by join query message. When the source has to send, it adds the join query message rebroadcast the message to its neighboring nodes. The join query message is forwarded by relaying nodes until they are delivered by multicast receivers. The multicast receiver sends ajoin table message carried by forwarding nodes all the towards the node. The key plan following this work is that the join query messages are flooded only by nodes that can satisfy the single hope delay requirements. A method is recommended that facilities the estimation of single hope delay in each node. Another important implication is that it saves the network bandwidth in a sense that when an intermediate node satisfies the delay requirement. It keeps the upstream node address and floods the network with join query message, otherwise it drops the incoming join query message, and the proposed method avoids the node with large single hope delay values to broadcast the query messages. Thus, the flooding message is efficiently managed by minimizing network bandwidth wastage and high packet overhead.

***Delay method***

Asif at el.(2008)proposed the delay requirement for high throughput application such as voice over IP and video conferencing, the packet should be delivered by multicast receivers before the maximum threshold of 250 m.thr delay over a single hope consist of multiple elements. The delay over link lab from node 'a' to 'b' is represented as

$$d_{lab} = d_{lab}^{Q} + d_{lab}^{L} + d_{lab}^{C} \quad (1)$$

Where queuing delay is defined as Q lab d. It is the time interval between the time the packet enters in the queue of node 'a' and the time packet reaches the head of the line of the queue. The average contention delay indicate by C lab d is the time interval between the time packet becomes the head of line packet and time packet is sent by the physical medium .Link stability indicate by L lab d is that stores link and node related data for establishing and maintaining multicast mesh an stable path from source to multicast destination. Queuing and contention delay

$$P_{i-1}\ \gamma = P_i\ \mu$$

$$Pi=(\gamma/\mu)\ Pi_{-1}$$

$$\frac{\lambda}{\mu}= \rho \Rightarrow \left(\frac{\lambda}{\mu}\right)^{K} p_{0} = \rho^{K} P_0$$

Where ρ denotes the utilization factor. We know that

$$\sum_{i=0}^{k} P_I = 1 \Rightarrow \sum_{i=0}^{k} \rho\, iP0 = 1$$

$$P0 = \frac{1}{\sum_{i=1}^{k} \rho i} = \frac{\rho-1}{\rho k+1\ -1}$$

For $\rho \neq 1$

$$Pi=\frac{\rho(\rho-1)}{\rho i+1\ -1} \quad (2)$$

For ρ=1

$$\rho\sum_{i=1}^{k} \rho\, i\ = k+1 \Rightarrow Pi = \frac{1}{k+1} \quad (3)$$

If $\rho \neq 1$ ,then then the expected no of packets in the node's queue given by

$$N=\sum_{i=0}^{k}\ np\, i = \sum_{i=0}^{k}\ n\rho ip0$$

$$\Rightarrow \frac{\rho(\rho-1)}{\rho i+1\ -1}\rho\sum_{i=0}^{k}\ n\rho\, n - iN = \frac{\rho(\rho-1)}{\rho i+1\ -1}\rho\frac{\partial}{\partial\rho}\sum_{i=0}^{k}\rho^{k}$$

$$N=\left(\frac{(k+1)\rho k+1}{\rho k+1} + \frac{\rho}{\rho+1}\right) \quad (4)$$

And if ρ=1 and$Pi = \frac{1}{k+1}$ then $\sum_{i=0}^{k}\ \frac{1}{k+1} I = \frac{k}{2}$(5)

And the mean waiting time from the time a packet arrives at the relaying mode to the time the packet reaches the head of line of the queue the node'I'is

$$D_{Q+C} == \frac{N}{\lambda}$$

For $\rho \neq 1$, we have

$$D_{Q+C}=\left(\frac{(k+1)\rho k+1}{\rho k-1} + \frac{\rho}{\rho-1}\right)\frac{1}{\lambda} \quad (6)$$

And for ρ=1, we have

$$D_{Q+C} = \sum_{i=0}^{k}\ \frac{1}{k+1} I = \frac{k}{2\lambda} \quad (7)$$

Due to the fact that a node' queue size is upper bounded by a maximum queue size, say k the maximum queuing and contention delay can be estimated. The maximum value of $Q_{C+D}$ denoted by $d_{up\ bound}$. Can be calculated

$$D_{up\ bound} \lim_{\rho \to \infty} DQ + C$$

$$D_{up\ bound} \approx \frac{K\rho k+1}{\rho k\lambda},$$

Therefore$D_{up\ bound}$ is approximately defined as

$$D_{up\ bound} \approx \frac{k}{\lambda} \quad (8)$$

This equation reveal that the maximum value for queuing and contention delay can be estimated as the ratio of maximum queue size over the service time in a node.

**V. Stability based multicast routing**

It is a process of creating a mesh of multicast route request and route repeat packet. To create mesh

network and stable route in mesh from source to destination, many type of control packet SUCH AS ROUTE REQUEST,ROUTE REPLY AND ROUTE ERROR PACKET ARE USED.thr route request packet containing source address, multicast group address, sequence number, route reply flag, previous node address, power antenna gain and route reply.

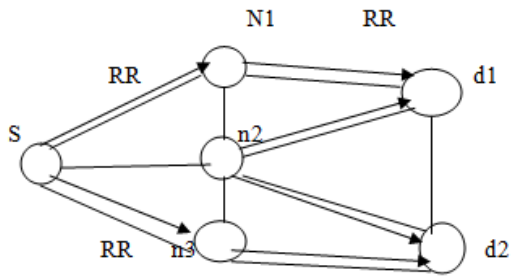


Fig 7.Route request path from source S to d1 and d2

***a.Stable link quality***

A major part decides the link stability to from multicast route. BER is defined as as the ratio of bits in error to the total number of bit received. It is calculated by determining how many bits transmitted are sufficient for the desired estimate quality. The assurance level can be determine by the equation

AL =Prob [TBER≤ BERS] (9)

The true bit error ratio (TBER) between nodes i and j within Al is given by following equation. The specified error can be calculated if S is average of standard deviation of many bit errors and a is the accuracy of the bits received.

$BER_y = \frac{S2}{a2}$ (10)

The link quality qij between two neighboring node I and j inversely proportional to bit error ratio (BER), an improved estimation of link quality with proportionality constant k is given by equation

$Qij = Kx\frac{1}{BERi\ j}$ (11)

Whereqij is quality depending on paprmeter, such as the interference effect of the wireless parameter

***b.Stable link table***

Every node maintain SLT (Gt=1, Gr=1, L=1, power level 400m w,dij=174,BER=10-4) that store link and node related messages for establishing and maintaining multicast mesh and stable route between source and destinations The stable link table contain following parameter

NodeID – (it contains the neighbore node id) Antenna related information (Gt, Gr,L)

Power Level (PWij)- Whenever a packet is received from its neighbore,this field stores the ratio of p[ower.PWij is measured value of the power received(Pr)at the node to the power transmitted(Pr) by neighbor node.

Distance dij-it stores the distance between the neighboring nodes, The distance is calculated by using the free space propagation model given in the equation.

$Pr(d) = \frac{PtGr\lambda}{4\pi d2L}$ (12)

Where Gt and Gr denote the antenna gains of the transmitterand receiver respectively, L is the system loss, λ is the wavelength and d is the distance between two MANETs.

Stability Link(Sij)- The value is calculated for a link to a neighbor based on power level, link and distance quality. Link stability Sij of a link between node I and j is defined by the following equation

$Sij = \frac{PwijXqij}{dij}$ (13)

Where PWij and dij is denotes the sgnal strength and distance between node I and j respectively,Q is the stable link quality. Substituting the qij value withBERij between node iandj, we get sij as given below

$$Sij = \frac{PwijXKx \ \frac{1}{BERi\ j}}{dij} \quad (14)$$

Now the single kope delay to transmit a packet from node I to its neighboring node can be represented as

$$Dj = D_{upbound} + Sij = \frac{k}{\lambda} + \frac{PwijXKx \ \frac{1}{BERi\ j}}{dij} \quad (15)$$

By applying the above equation in contributing nodes, each node can estimate the delay interval from the time packet arrives at the node to the time packet is completely inserted into the network. The delay evaluation in a node can be representative of a certain characteristic of node. The nodes that are situated in a traffic congested aregenerally show higher delay due to higher packet arrival rate delay at a node. In addition, higher latency can also represent longer waiting time that the nodes should use to access the channel due to neighboring interferences.Therfore, the node with high single hope latency may be located in congested area where bit error rate isconsiderably high due to shared wireless bandwidth. When these nodes receive a join query message. They verify single hope delay requirement within the join query message, based on their one hope delay estimation, if the node can satisfy the delay requirement, it floods the network with query message,. This message shows the stable link process only to the nodes that can assure one hope delay required. The stable link avoids node located in congests area or where nodes are occurrence high delay.

## VI. PerformanceEvaluation:

Performance of our proposed technique and original ODMRP under different simulation scenarios are compared.

***Different type of protocol derived from ODMRP***

A. ODMRP-LR- Link failure detection and recovery
B. RODMRP- Offers more reliable forwarding paths in face of link failure and node failure.
C. SC-ODMRP-Tries to increase scalability of ODMRP.
D. CODMRP- Attempts to improve PDR efficiency by minimizing the data redundancy.
E. PSO- ODMRP- Uses nature principle exists in the form of fitness function.
f. IODMRP- improves ODMRP by decreasing control overhead in case of increased multicast group
G. EDOMRP- Uses motion Adoptive refresh technique for the route local recovery to achieve minimum overhead.
H. RDTODMRP- Cuts down the unnecessary redundant route and their data transmission for obtaining better result.

I. E -DOMRP-Use local recovery technique for decrease link breakage.

J. SODMRP -Use residues energy of nodes for obtaining route expire time for select stable route by route weight

K.ES -ODMRP - It enhances the Link Stability, reduces link breakage and reduce packet drop and achieve better performance in compare with SODMRO.

## VII. Simulation set up

The simulation setting used is based on NS2.

**Through put**: The network throughput is the average rate of successful data delivery over a communication channel. Through put is usually measured in data packet per second.

**Average –end to end delay**: The delay of data packet delivery contains queuing, propagation and data transfer delay

| | |
|---|---|
| 1200×800m area | Network size |
| 150 | Number of node |
| 1-20 m/s | node speed |
| 250 | Radio propagation range |
| 2 mbps | Channel capacity |
| 512bytes | Packet size |
| 50kb | queue |
| Drop cell queue | Queuing policy |
| 900s | Duration of experiments |
| ODMRP,SODMRP,EODMRP | Routing protocol |
| 1-50 | Multicast group size |
| 1-6 | Number of source |

## IX.Conclusion

This paper proposed an efficient stable On Demand multicast routing scheme. This scheme finds efficient and stable multicast route to receivers by considering nodes residues energy. It uses a route weighted function in SODMRP route discovery process, to consider efficient network in both movement of nodes and energy information and select a shortest and better routing path for transmission. By shortening the length of paths used to transmit data and control packet, this protocol can reduce network loads and repair link failure due to high speed of nodes in short time. It also improve packet delivery ratio, Better Through put and control overhead.

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