New Refresh Algorithm for Highly Adaptive Networks in Flavor of OLSR protocol

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Abstract

Many routing algorithms had been developed for highly adaptive networks [1],[2],[3]. They implement refresh algorithms to disseminate the topological changes to all other partners in the network. The process of refreshing need to be takes the bandwidth consuming into account. This work considers refresh algorithm depend on OLSR (Optimized Link State Protocol , were it depends on some points in the network as disseminating points to reduce the traffic at all. [4] proposed a highly adaptive routing algorithm, but with rout optimality drawbacks as the adaptation process proceeds. We add a refresh algorithm to maintain the optimality and stability of route through topological changes, stability factors associated with each disseminating node as an electing factor of the node, then establishment of info-message for route advertisement.

الخلاصة

لقد ظهرت العديد من بروتوكولات التوجيه في الشبكات المتغيرة الطوبوغرافية وبشكل عال [1],[2],[3] . جميع هذه البروتوكولات تقدم خوارزميات تحديث لغرض نشر معلومات التحديث للشبكة. هذا النوع من الخوارزميات يجب ان ياخذ بنظر الاعتبار عرض النطاق الترددي Bandwidth المتوفر للشبكة. يقدم هذا البحث خوارزمية تحديث تعتمد على التقنية المقدمة في بروتوكول(OLSR(Optimized Link State Protocol، حيث تعتمد عملية التحديث على مجموعة من النقاط تسمى مجموعة الجيران Neighbour من اجل تقليل كمية البيانات المرسلة.يستند العمل الحالي على خوارزمية التوجيه المقدمة من [4]. تقدم خوارزمية التحديث طريقة احتساب للفترة الزمنية الخاصة بعملية التحديث وفق مستوى التغيير الحالي للشبكة. اظهرت خوارزمية التحديث استقرارية في اختيارالمسار الامثل نحو الهدف ، في الوقت الذي اظهر محددات الخوارزمية في الفترات الزمنية القصيرة جدا لعملية التحديث.

Introduction

Routing protocols adopted for ad hoc networks, mainly seek for the compensation of the problem of high mobility nature of these networks. The real problem is how routing information should spread out through dynamic neighbors. There are two important considerations: 1) minimize the flooded routing information around the network, and 2) maximize the probability of rout path optimality in the presence of quick topology changes.

Routing protocols can broad grained categorized as 1) pro-active rote protocols depend on broad cast of fresh list of new route information, DSDV (Highly Dynamic Destination-Sequenced Distance Vector routing protocol [1], it is come as modification of Bellman-Ford routing algorithm. It highlights the drawbacks of RIP in the face of network splitting (as links fail down). OLSR Optimized Link State Routing Protocol [2], the protocol is an optimization of the classical link state algorithm to accommodate the requirements of a mobile wireless LAN. It produces a multipoint relays (MPRs) nodes which forward broadcast messages during the flooding process. This technique substantially reduces the message overhead as compared to a classical flooding mechanism. 2) Reactive routing protocols, these protocols depend on Route Request Packets as a backbone for gathering required information to maintain path changes. P. Appavoo and K. Khedo, produce SENCAST [3] a scalable routing protocols for large networks.

In this work we take a reactive highly adaptive routing protocol produced by [4] this algorithm can overcome the limitation of other algorithms in the problem of network partitioning due to links failure. The main limitations of the algorithm raised as route maintenance process proceed as shown in the following sections. Later we describe the suggested refresh algorithm to improve stability of optimum routing.

Highly Adaptive Protocol Assumptions

[4] assume the network is a directed graph consist of n nodes and L links which directed from node i to node j, then node i is an upstream node to that link and j is a downstream to it, with the proposition link directed from high to low nodes height.

Each node associated with height factor, which works as network splitting indication. Nodes marked as local minima (with minimum height or no outgoing links) will indicate that node has no route to a destination and need for route recovery; height re-computation can solve the problem by redirect the links. Nodes associated with height as quintuple quantity (ti,oidi,ri,Si,i), were the first three parameters represent the reference level of the node and the last two parameters represent the delta value .

ti: is a time tag set the link failure time
oidi: is the originator id, define the reference level of the node
ri: is a bit used to split the reference level to two sub levels
Si: is an integer delta reference level, used to order the node with respect to reference level.
i: is a unique id of node itself

Algorithm Steps

Step1: initialize each node height factor to null *HNi, j* = (t_j,oid_j,r_j,S_j,j) and destination height to *HNi, did* = (0, 0, 0, 0, *did*). Where did is destination id
Step2: for each node i

Maintain a link state array $L_{i,j}$ where take one of three values
(up) upstream, (dn) downstream, and (un) unmarked.

Step3: create routes: a route is created by sending QRY packets and the whole process can follow four cases as shown in (figure 1) below:

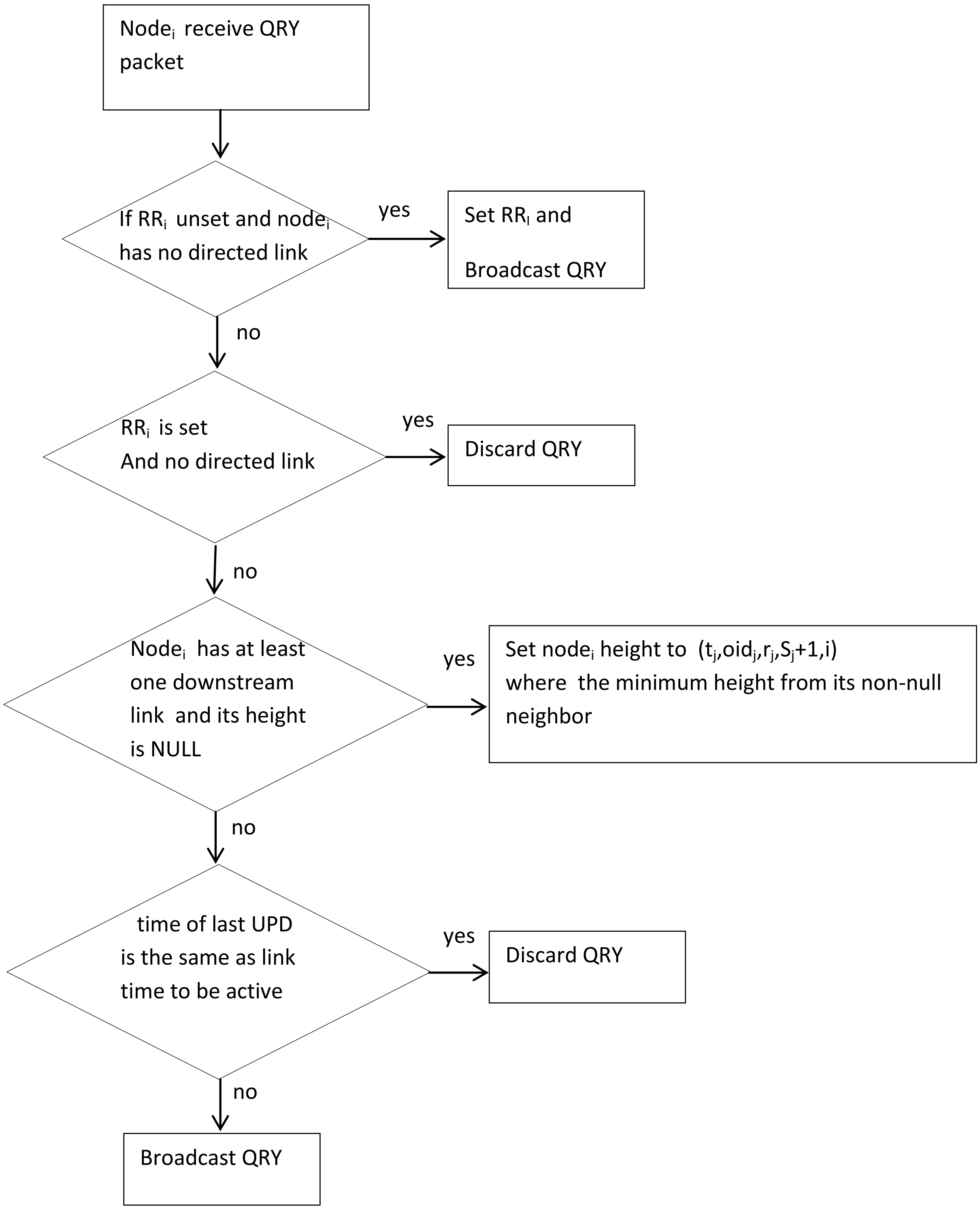

Figure 1: Route Create Process

Step4: Route maintain process depend on the indication of link failure, recomputation of reference levels figure 2 below show the main cases of route maintenance.

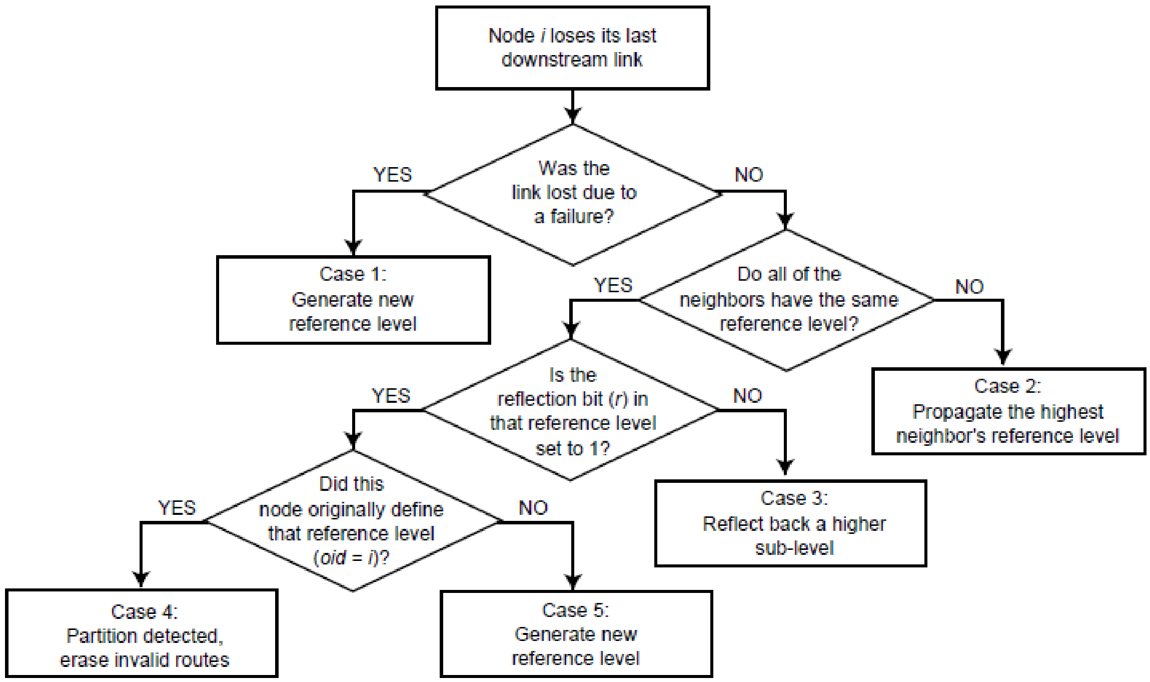

Figure 2 route maintenance

Step5: Erasing process

Erasing route start at the reception of CLR packet which consists of a *did* and the reflected reference level of node *i*, (t_i, *oidi*, 1). When a node *i* receives a CLR packet from a neighbor *j i,* it reacts as follows.

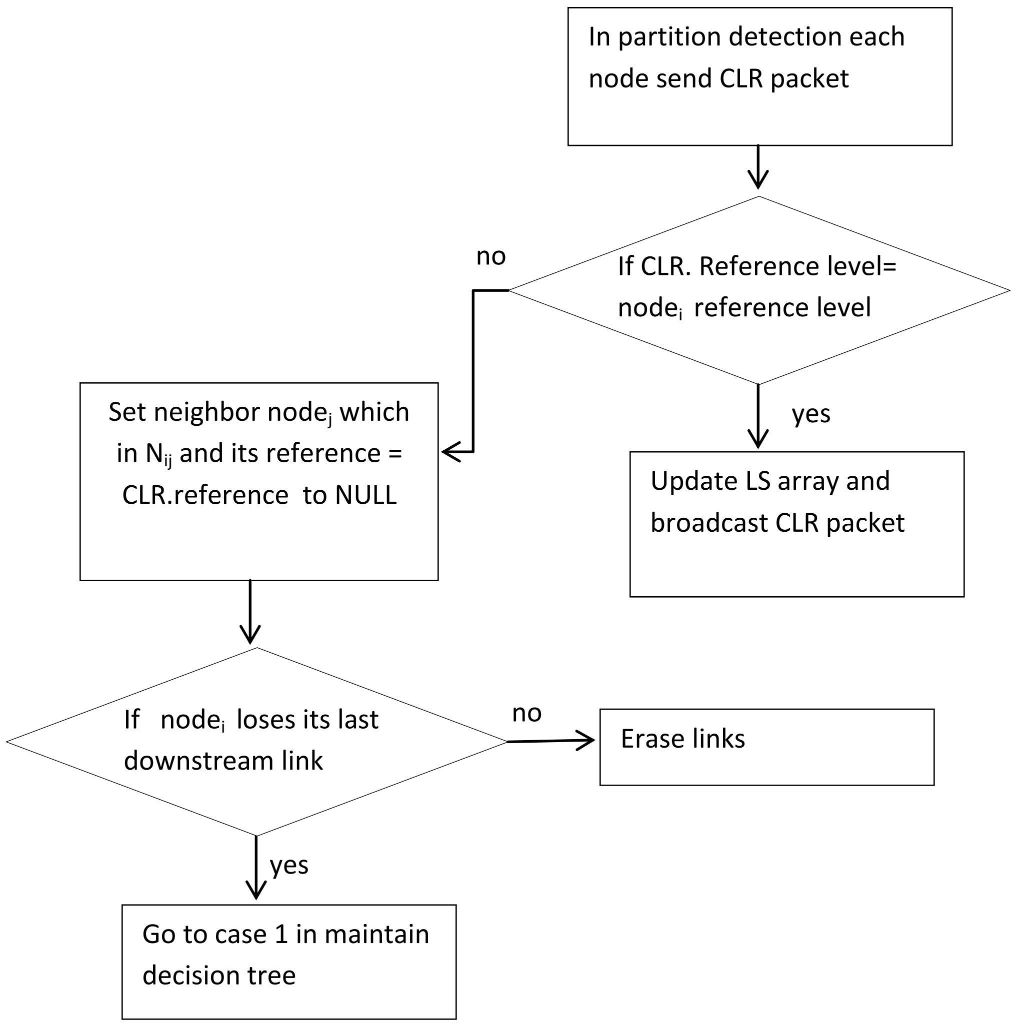

Figure 3: route erasing

Proposed Node object

The node object in the proposed algorithm should consist of

1- Set of N-neighbor nodes {N_{ij} :all nodes j can reached directly from node i}
2- Set of N2-neigbor nodes {N_{ik}: all nodes can reached from node i with two hop }
3- Willingness { an integer from 0 to 7 which indicate the current health (required resources to carry traffic for other nodes) of node. This integer can be set to the node according to resource monitors.
4- node stability factor

$$F\_stab = 1/ \text{frequency of neighbor} \quad (1)$$

Which can computed according to:

$$\text{Frequency of neighbor} = \text{distance from previous } N_{ij}=\sum d_{ij} \text{ (1 for each change)} \quad (2)$$

Election _set description

The proposed set to be selected as basic nodes for topological information forwarding, willingness proposed in OLSR protocol give good indication for well suited nods. High willingness erased from this work, whereas Nodes can have one of the four values below:

Default: each node belongs basically to election_ set to forward information to all other nodes.
Never : nodes with never will discarded from election_ set.
Always: stable nodes can regarded as always
Low **:** nodes prone to discarded from the election_ set

Refresh algorithm:

The core process of this work depends on precise time based refresh. From the link object perspective, as mentioned above each link is associated with time tag (expire time) rather than time which recorded the creation of that link. This tag can be used for refresh algorithm.

Ref_ messages would be forwarded in dynamic interval; the interval can be set as follows:
*T_new= (T_old * m * F_stab) where m can chose in range from 0.1- 0.9*

For each interval time T_new
For each nodes in elect_ set
{
Send information Ref_ message to all its
N_ neighbor and N2 _ Neighbor.
Re calculation of N_ neighbor and N2_ neighbor
}

Topologic dynamics

This section focus on topological changes along with stability of best

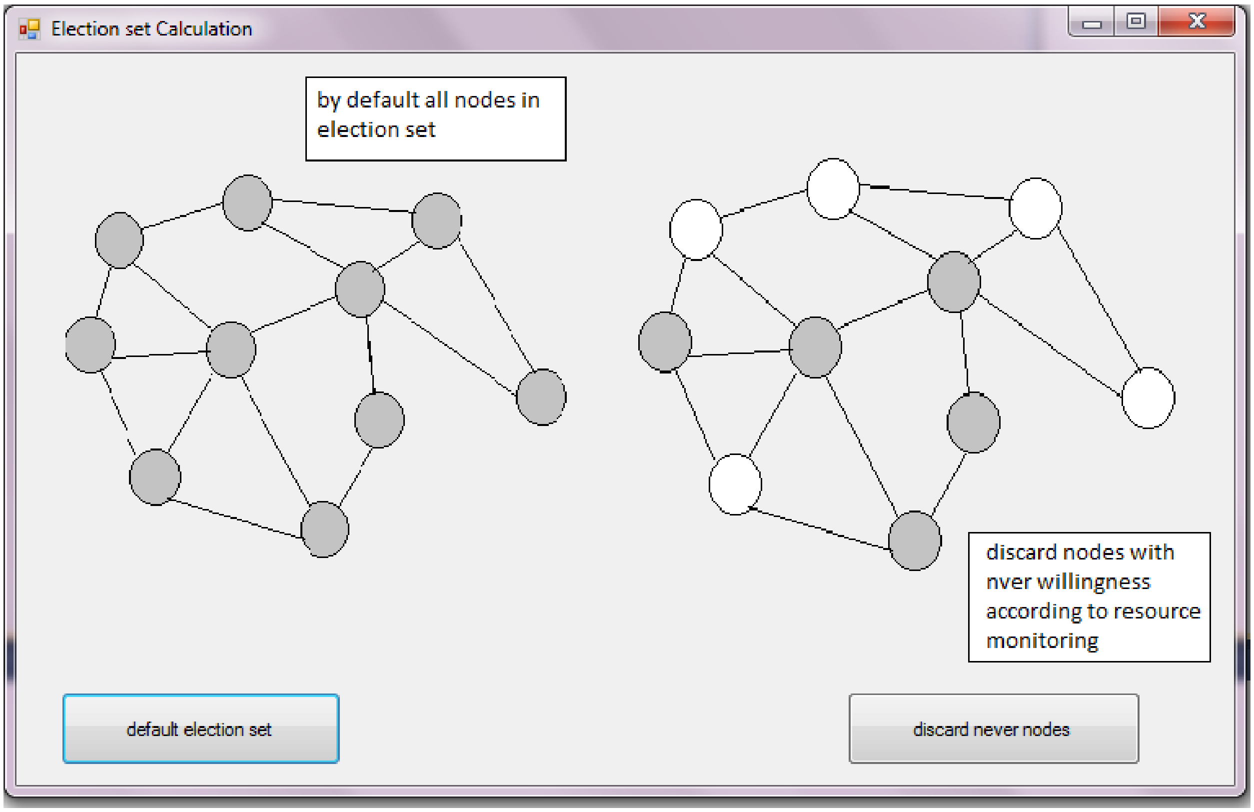

Figure 4 the network topology at left show that all network nodes start by default as belong to election set expire of election_ set. While the right side shows election _ set expired because of resource consumption.

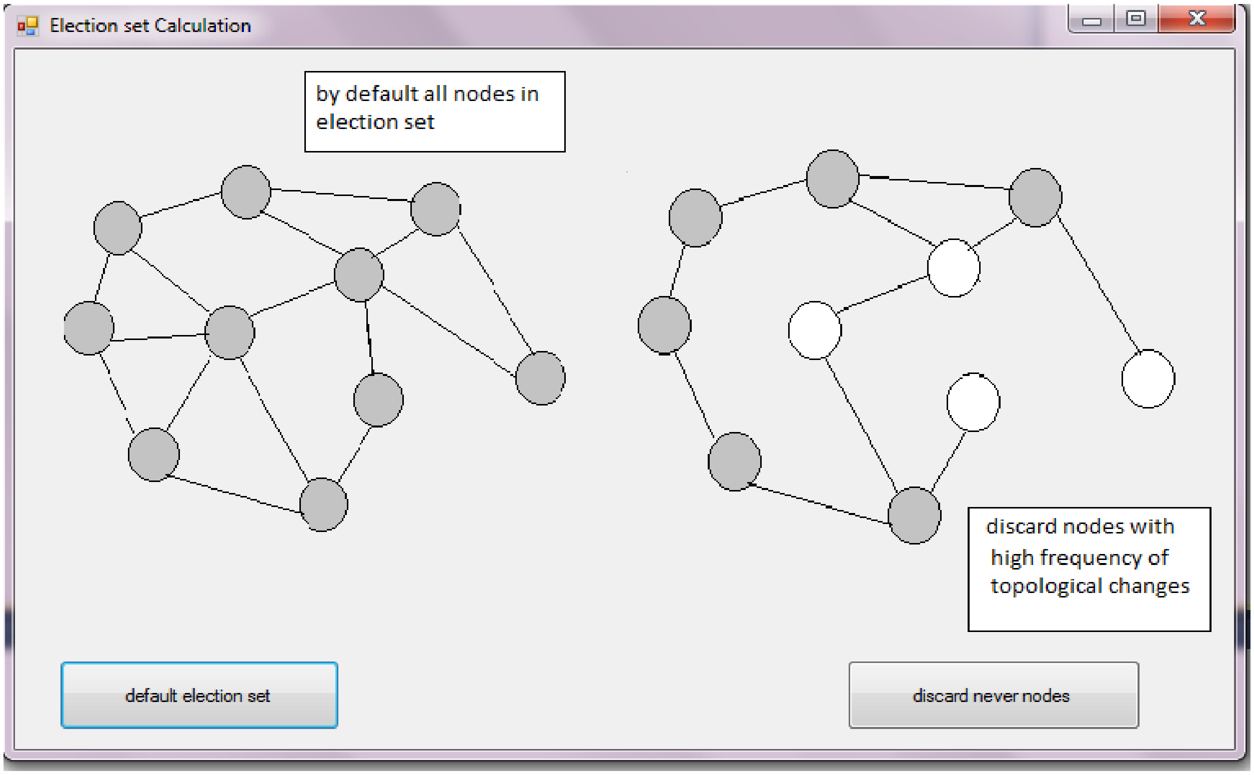

Figure 5: election set selection based on frequency topological changes

Rout selection

Rout to destination start with QRY packet transmission to all nodes in network, reference level calculation, and link direction will determined at this stage as shown in figure 6.

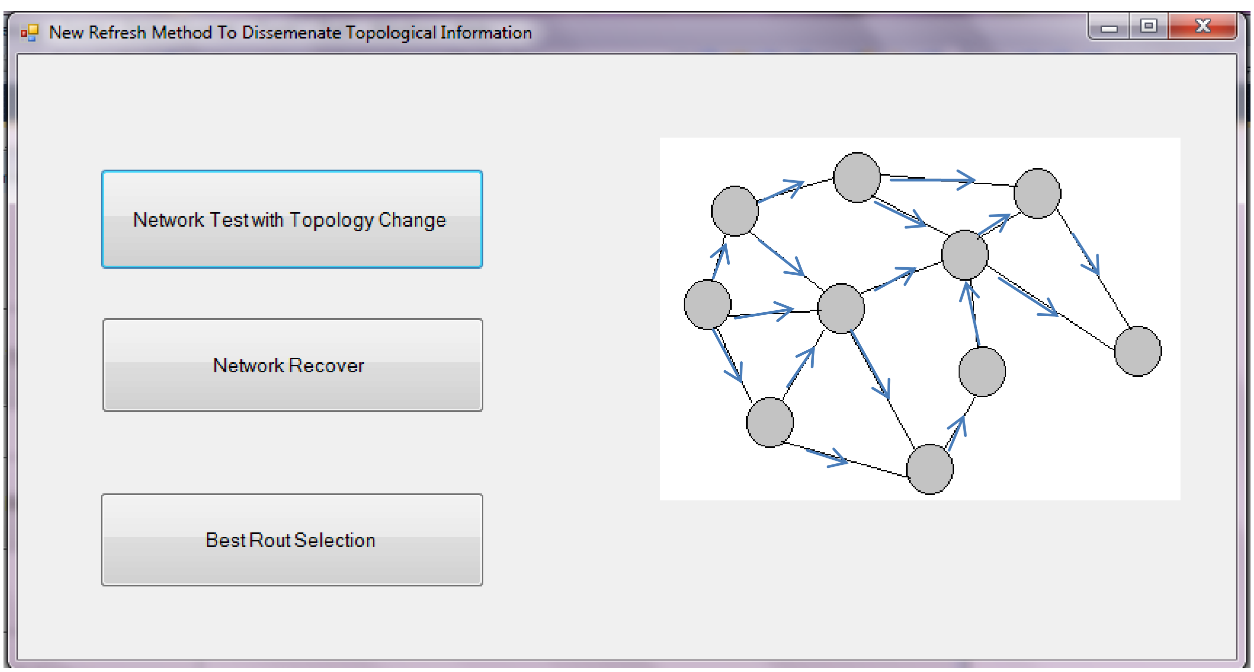

Figure 6 rout creation using QRY packet

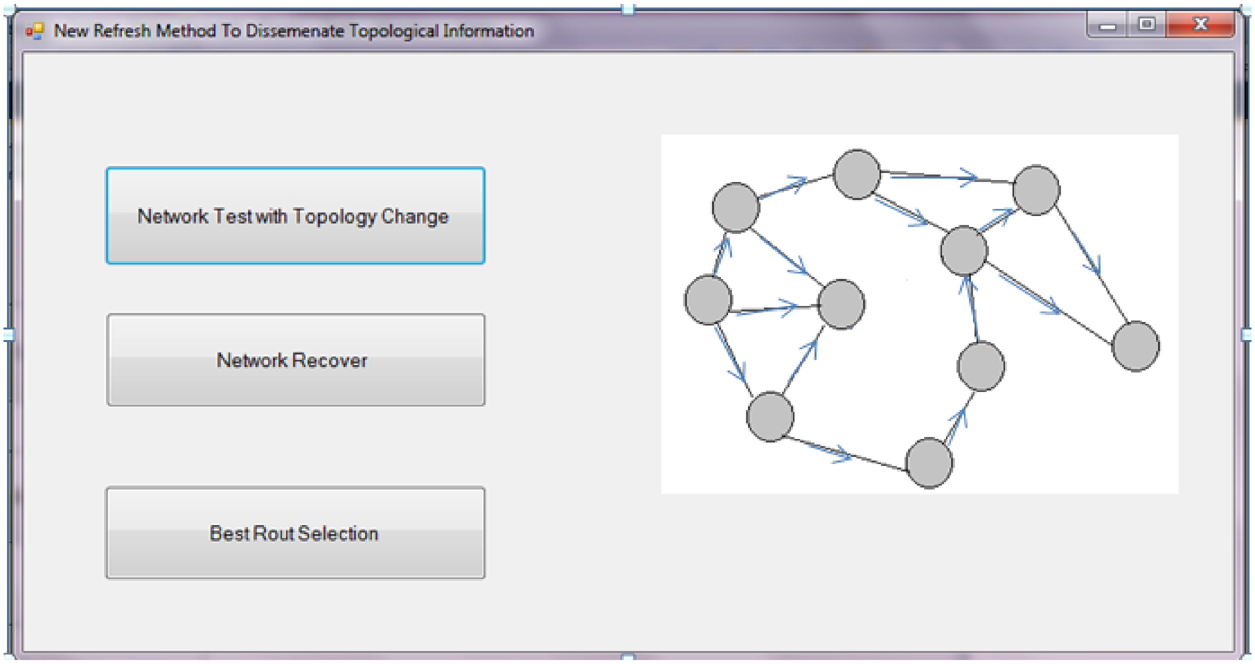

Figure 7 rout fail and network partition

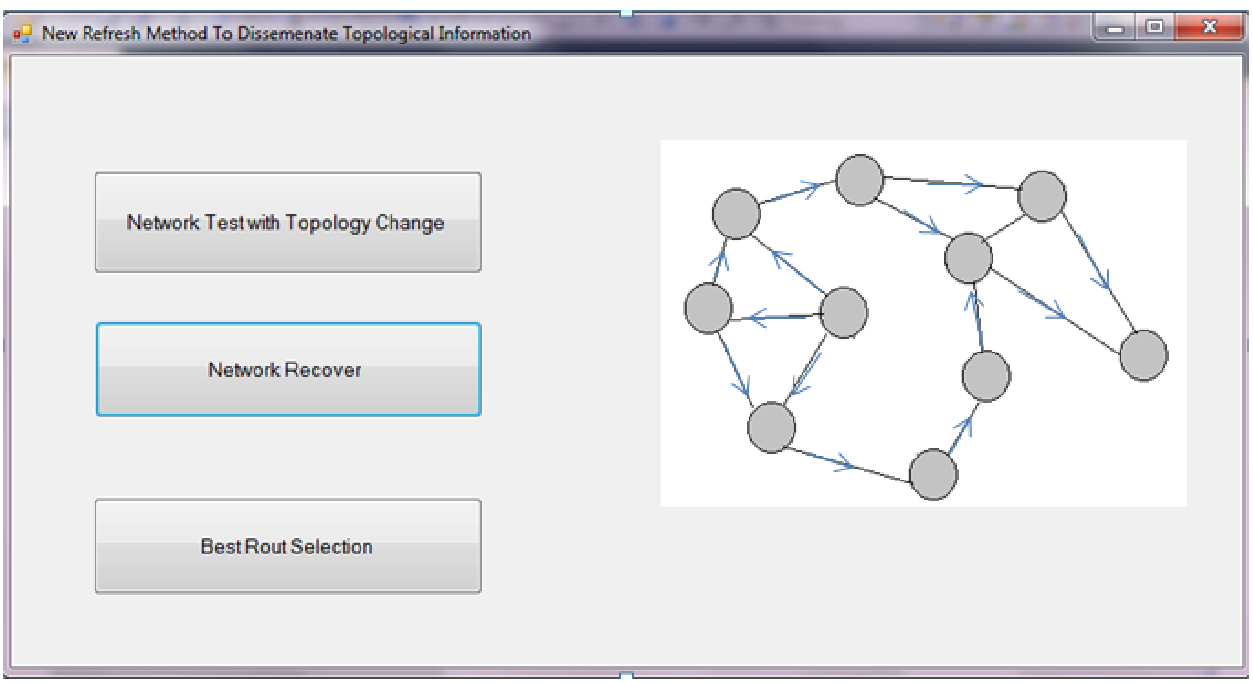

Figure8 network recover from fail

Route Optimality

Route optimality depend basicaly on the frequency of network topology changes according to (1). As network faced high topological changes its refresh period time be narrowed to accommodate the need of announcement of new informations to all other partners in the network. Figure 9

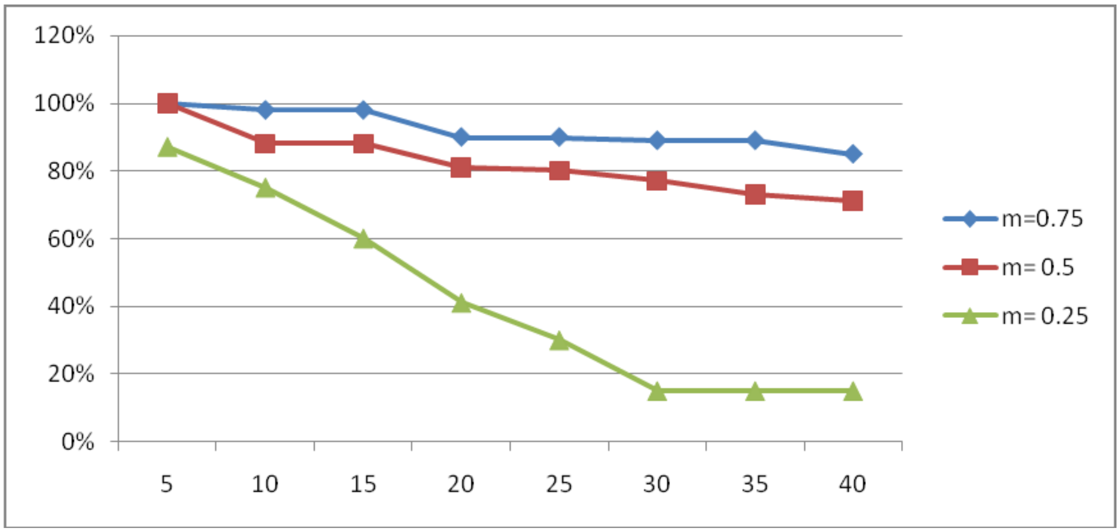

Figure (9) recovery percentage with m=0.75, m=0.5, and m=0.25

From figure (9) it recognized that the refresh methode work well with m=0.75. also the test had been made with links fail in the range (5-40) fails.

Conclusion

The new refresh algorithm presented in this work can maintain well for rout optimality with high stability factor as shown in figure 9, the refresh messeges can adopt information disseminating through all network nodes in a dynamic intervals. The dynamic refresh interval act well for mobility of network, but intervals less than 15 seconds, came with the problem of network flooding, and packet erasing. So the algorithm can put a stop condition to prevent the priods of time to overwelming the entire network. Based on the periodic updates of routing tables enable to reach routes optimality stability in 40 simulated cases from 65. This work can be improved using TCP window like to adjest on the sence of link state.

References

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