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Link Stability and Energy Optimization by Excluding Self node for Mobile and Wireless Networks

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***Abstract*—MOBILE ad hoc networks (MANETs) have more popularity among mobile network devices and wireless communication technologies. A MANET is multihop mobile wireless network that have neither a fixed infrastructure nor a central server. Every node in a MANET will act as a router, and also communicates with each other. The mobility constraints in mobile nodes will lead to problems in link stability. Energy saving, path duration and stability will be two major efforts and to satisfy them can be difficult task. A self node which is present in the network may also consume little energy during the transmission. In order to minimize the energy consumption, we are detecting the self node presents in the network, because these nodes will provide the wrong information about energy and recent data access in the MANET. Construct the topology that do not contains self node then transmit the data from source to destination based on the joint metric of link stability and energy drain rate, it is based on the local topology knowledge and it will make use of a greedy technique. This model will optimize the routing with in MANET using energy consumption and maximize link stability*)**

***Index Terms*— Energy Consumption, Link Stability, Routing, Self node**

I. INTRODUCTION

Energy is important in order to improve the efficiency and life time of the network. When we are offering more stability under the node mobility will leads to selection of shorter routes. This shortest path may not be suitable in all the cases, because the selection of shortest path will optimize the energy and can leads to selection of more fragile node. Our model will minimize the energy consumption and maximize the link stability. The link stability probability is based on the random probability. Energy is important in order to extend the life time of the network. Link and path stability among the nodes can offer more benefits in terms of energy saving over MANET. The Description of some works related to link stability, energy metrics, and their respective protocols was given in this section [1] [2] [3] [4] [5] [6] [7]. This paper proposes an efficient routing scheme for link stability and energy optimization by the identification of self node in the topology. The contribution of this paper includes Minimize the energy and maximizes the link stability, Identify the self node in topology, Construct the topology with non self nodes.

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II. LITERATURE REVIEW

A. Mobility – Induced error on Geography Routing in MANET

In Geographic routing, the packet forwarding technique was solely based on the location information of neighbors [10]. Geographic routing in GPRS consist of two forwarding modes.1.Greedy packet forwarding, 2.perimeter forwarding. Initially the packet was forwarded by greed forwarding in which all the nodes were identified the location based on the neighbor nodes. The packet forwarding mode has been changed in to perimeter forwarding mode when the node was found out the maximum location Final Stage

B. Routing Protocols for MANET using Mobility Prediction

In the MANET the nodes can construct a path in the network using the routing capacity of the intermediate nodes. The communication was established in wireless multi-hop fashion. In other words the communication is established in a wireless multi-hop fashion. The node can also have other characteristics such as small size and battery powered, making the node not only mobile but also portable [11]. As a result MANET can operate in places and situations where traditional networks cannot work properly, such us in disaster recovery areas, rural zones, and third world countries.

C. Energy Efficient Routing Protocols for MANET

Energy efficient Routing will be the most important Design in MANET. Since mobile nodes are powered by batteries with limited capacity. Power failures of a mobile node not only affect the node alone, it will affect the entire network life time [12]. The routing protocols were proposed in MANETs are table-driven and on-demand driven routing. Routing in MANET includes new generation of on demand routing schemes (AODV, DSR, TORA, ABR etc) [13].Proactive routing schemes (OSPF, RIP) compute global routes in the background [14]. The Benefit of proactive routing includes low latency access, alternative paths for effective call acceptance control.

These protocols concentrate on the energy properties scheme of applications.

D. Greedy Perimeter Stateless Routing for MANET

GPRS routing algorithm uses geography to achieve small per node routing state, small routing protocol message capacity, robust packet delivery etc. GPRS will use immediate neighbor information in forwarding decisions [15]. Routing protocol will relay on end to end state delivery path between a forwarding router and packet's destination.

E. Minimum Energy Mobile Wireless Networks

Position based algorithm is used to maintain the minimum energy between the user. Each user will be denoted by nodes over two dimensional planes. Each mobile node has a portable transmission set, reception, processing capabilities [1]. This distributed protocol will find the minimum power topology in the Ad hoc networks

F. Stable Path Selection

Five Different Metrics have been proposed for stable path selection. the first technique is based on the local choice of the oldest link as the most stable link; the second class of metrics concerns the selection of the youngest links, because they are considered more resilient to breakage; the third criterion is based on the selection of the link with the highest average residual lifetime value; the fourth one makes selection of the link with the highest persistence probability; finally, the fifth metric focuses on the connection failure probability. The latter approach has been shown to be robust because it is based on the monitoring of the links lifetime of the mobile nodes in the wireless network, in the past and in the present, to predict its behavior, in the future without considering directly parameters depending by underlying mobility model such as node speed or direction. End-to-end delay of a source destination session is another considered performance metric, particularly for real-time applications.

III. EXISTING SYSTEM

Multiobjective Formulation for Routing

The multiobjective mathematical formulation of a routing scheme, which considers two metrics that, is stability and energy. However, in this first contribution, only the optimization problem was formulated, whereas no analysis on the protocol management and protocol performance has been carried out This local criterion permits a high scalability to be offered to the routing algorithm in terms of state info storage and control packets transmission sent by any underlying routing protocol to maintain the network state knowledge.

1. A multiobjective mathematical formulation for the joint stability and energy problem is presented.
2. Adoption of a novel stability metric based on the residual link lifetime concept. This metric is considered more robust than the metric proposed in because it is independent on the transmission radius and node speed parameters that can be affected by measurement errors.
3. A novel energy aware-metric, adopted in previous contributions, has been introduced in the proposed optimization model in order to consider not only the residual energy but also its time variation associated with the traffic load.
4. The multiobjective routing algorithm is integrated in the scalable routing protocol and its performance was tested through simulations and comparison with PERRA, GPSR and an enhanced version of GPSR called Ellipsoid algorithm-based GPSR (E-GPSR).

Link Stability and Energy Aware Routing

The LAER algorithm requires knowing the information about the link stability, rate of energy consumption and the link stability index for each node. Each node broadcasts packet to all its neighbors with the specified communication region. When the node receives the packet, it updates the information of neighbor node. The data forwarding technique of Link stability and Energy Aware routing in based on the Greedy forwarding technique [1].

The LAER forwarding presents high scalability property because only neighborhood and destination knowledge are necessary for forwarding. This protocol is more flexible. This means that if an application is more sensitive to the path stability, it is possible to give more importance to stability index. On the other hand, an application needs to reduce the energy consumption also selecting longer route with higher packet delay, the energy index is more considered.

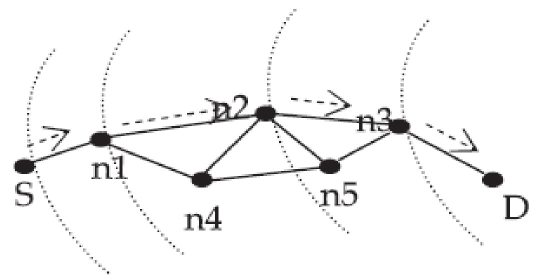

Fig: 1. GPRS Greedy Forward

Figure 1 shown that the packet forwarding under the greedy technique based on the euclidean distance and the forwarding scheme with the joint stability and energy aware metric. In the figure 1 the following situation is depicted: S falls in the transmission range of node n1, n1 in the transmission range of nodes n2, n4 in that of n3 and n5, and n3 in that of node D. The selected path can be different depending upon the metric is applied.

The GPRS scheme selects the path S-n1-n2-n3-D because all neighbor nodes that minimize the Distance towards D.

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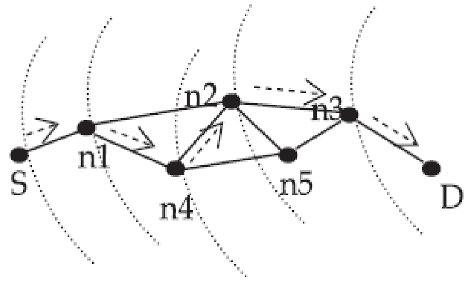

Fig: 2. LAER Greedy Forward

Figure 2 shown that the packet forwarding based on LAER scheme selects S-n1-n4-n2-n3-D path. This means that LAER selects a longer path but with higher residual energy.

Protocols considered for comparison

A scalable routing protocol called LAER is based on the joint metric of link stability and energy drain rate has been proposed. It is based on the local topology knowledge and it makes use of a greedy technique based on a joint metric and a modified perimeter forwarding strategy for the recovery from local maximum. Its performances have been compared with other three protocols such as GPSR, E-GPSR, and PERRA. LAER protocol inherits the scalability of GPSR and E-GPSR, improving the performance in terms of node selection with higher link duration when a higher weight is given to the stability index and a higher residual energy is given to energy aware index. LAER outperforms PERRA in terms of control overhead and in terms of a higher capability to balance traffic load due to the minimum drain rate metric included in the joint metric. Moreover, also the average link duration can be longer in comparison with PERRA and E-GPSR due to the capability to better discriminate the node behavior associated not only with the current node condition but also with the history of link lifetime.

Drawbacks of Existing System

- The network may contain few self nodes. These nodes will make of CPU power during the transmission from source node to Destination.
- The self node may consume the energy. This is not suitable for energy optimization.
- Every node will know about the neighborhood node only,
- Route looping can also occur while transmitting the longer packet. This is not suitable for energy optimization.

IV. PROPOSED SYSTEM

The challenging task is to minimize the energy and maximize the link stability in the MANET, but concentrate on these factors will be more difficult. At the same time we have to identify the self node, because these nodes will provide the wrong information about the resent data access and require little energy for transmission [18] [20]. The self node can be identified by the self replica allocation method.

Selfish replica allocation is based on the concepts of self-centered friendship tree and it is used to achieve high data accessibility with low communication cost in the presence of selfish nodes. The technical contributions can be given as follows [17] [19].

1. Recognizing the selfish replica allocation problem: We view a selfish node in a MANET from the perspective of data replication, and recognize that selfish replica allocation can lead to degraded data accessibility in a MANET.
2. Detecting the fully or the partially selfish nodes effectively: We devise a selfish node detection method that can measure the degree of selfishness.
3. Allocating replica effectively: We propose a set of replica allocation techniques that use the self-centered friendship tree to reduce communication cost, while achieving good data accessibility.
4. After self replica allocation each and every node knows about the information of the neighbor node. So that the path establishment can be improvised. This will minimize the energy.

Develop the MANET Network

A wireless network is simulated, with minimum of 30 nodes moving in defined area. Figure 3 shows the sample model of mobile nodes in wireless networks. Every node has a back up energy through the battery. Each node moves randomly in this area, with a speed selected in a range [0, vmax] with no pause time. Between mobile hosts there are 8 and 16 CBR/UDP sources generating 8 packets/s (with a packet size of 512 bytes). The duration of each simulation is 300 seconds.

The maximum speed of node is set to 10 m/sec. To have detailed energy-related information over a simulation, the ns-2 code was modified to obtain the amount of energy consumed (energy spent in transmitting, receiving) over time. In this way, accurate information was obtained about energy at every simulation time to evaluate the protocols from the energetic point of view.

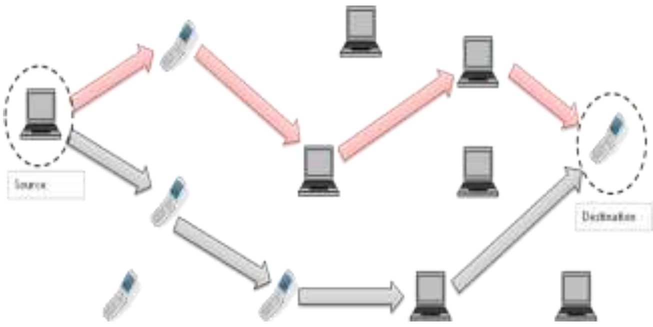

Fig: 3. Model of MANET

Link stability Aware Metric

A statistical-based approach has been adopted in order to discriminate among several links which are more stable for some periods of time without exactly predicting the residual link lifetime of each link. Thus, to enable mobile devices to make smart decisions in relationship to the stability, a practical method is used, based exclusively on observations related to the link, in previous time instants. As a result, this analysis produces an evaluation of the link residual lifetime of the link, since the stability of a link is given by its probability of persisting for a certain time span. The link residual lifetime represents the potential remaining time that the link can exist before breaking.

The expected residual life time $R_{i,j}(a_{i,j})$ of a link (i, j)of age $(a_{i,j})$ is determined from the collected statistical data as follows [1]

$$R_{ij}(a_{i,j}) = \frac{\sum_{a=a_{ij}}^{A_{max}} a.\, d[a]}{\sum_{a=a_{ij}}^{A_{max}} d[a]} - a_{i,j}\ \forall (i,j) \epsilon A,$$

Where a_{max} represents the maximum observed age of the links and d is an array of length $a_{max} + 1$ used to store the observed data.

In particular, d is determined through a sampling of the link ages every fixed time interval and its generic component d[a] represents the number of links with age equal to a. The coefficient $R_{i,j}(a_{i,j})$ is defined as the ratio between the sum, on all links with age equal or greater than $(a_{i,j})$ of the products of the age a and the number of links with age equal to a (that is d[a]), over the total number of links with age greater or equal to $a_{i,j}$.

Energy Aware Metric

It is assumed that each wireless node has the capability of forwarding an incoming packet to one of its neighboring nodes and to receive information from a transmitting node. In addition, each node is able to identify all its neighbors through protocol messages. It is assumed that each node does not enter in standby mode and each node can overhear the packet inside its transmission range and it is not addressed to itself.

The energy needed to transmit a packet p from node i is $E_{tx}(p,i)= I.v.t_b$ Joules, where I is the current (in Ampere), v the voltage (in Volt), and t_b the time taken to transmit the packet p (in seconds). The energy E (p,i) spent to transmit a packet from node i to node j is given by [1]

$$E(p,i) = E_{tx}(p,i) + E_{rx}(p,j)$$

Where E_{tx} and E_{rx} denote respectively, the amount of energy spent to transmit the packet from node i to node j and to receive the packet at node j; to the energy spent to overhear the packet has been avoided in this context. The power dissipated by mobile nodes to exchange beaconing messages and/or to remain always in active modality is also considered.

Finding Self node

At a specific period, or relocation period, each node executes the following procedures:

- Each node detects the selfish nodes based on credit risk scores
- Each node makes its own (partial) topology graph and builds its own SCF (Self Centred Friendship) -tree by excluding selfish nodes.
- Based on SCF-tree, each node allocates replica in a fully distributed manner.

The CR score is updated accordingly during the query processing phase to effectively measure the degree of selfishness. The Key strength of SCF based replica based allocation is used to minimize the communication cost while achieving the high data accessibility [8] [9] [16].

SELFNODE DETECTION

/* N_k detects the self node with this algorithm

Detection ( )

{for (each connected node N_k)

{CR= ER /EV;

if ($nCR_i^k < \delta$)

N_k is marked non selfish;

else N_k is marked as selfish;

wait until allocation done;}}

Where ER represents the expected risk, EV represents the expected value, N_k, is the set of neighbour nodes , nCR_i^k is the credit risk of all the connected nodes, δ is the threshold value of the risk factor [where δ =1]. This algorithm will fails when no self node in the connected neighbors.

Figure 4 shows the system flow diagram for SCF topology. Identification of credit risk is used to detect the self node in the topology for energy minimization process. The credit risk value is lesser than threshold; the nodes are identified as self node. Node creates its topology graph and SCF tree by excluding self node. This can minimize the communication cost, while achieving high data accessibility.

TABLE I. FIELDS ADOPTED IN SELF NODE IDENTIFICATION

Field	Function
CR	Credit Risk
ER	Expected Risk
EV	Expected Value
N_k	Set of Connected Node

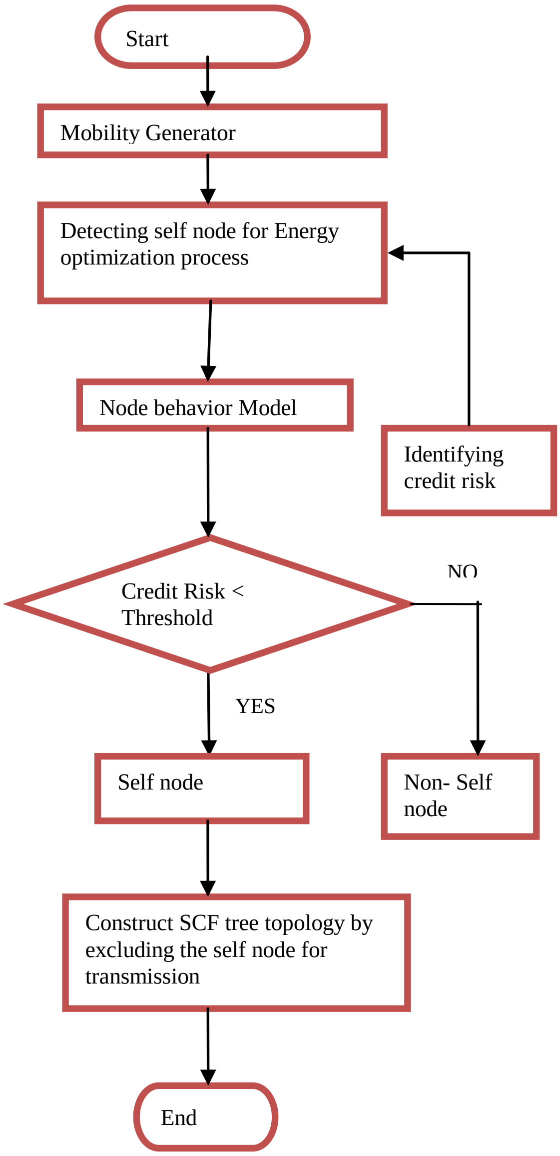

Fig: 4. System Flow Diagram for SCF Topology

Routing by excluding self node

The routing topology was constructed by excluding the self node in the topology. The packet P was transmitted from Source S to Destination D in the time interval T.

Figure 5 shows the system flow diagram for routing the packet information in the non selfish topology. Each node has to calculate the distance, age, energy required to transmit and receive the packet between the neighbor nodes. The packet will be forward from source to destination based on the energy aware metric value and the Link Residual time between the nodes.

TABLE II. FIELDS ADOPTED IN ROUTING

Field	Function
T	Time
S	Source Node
D	Destination Node
P	Packets
N	Connected Non self node
E(p,i)	Energy Aware Metric
$R_{i,j}$	Residual Life Time

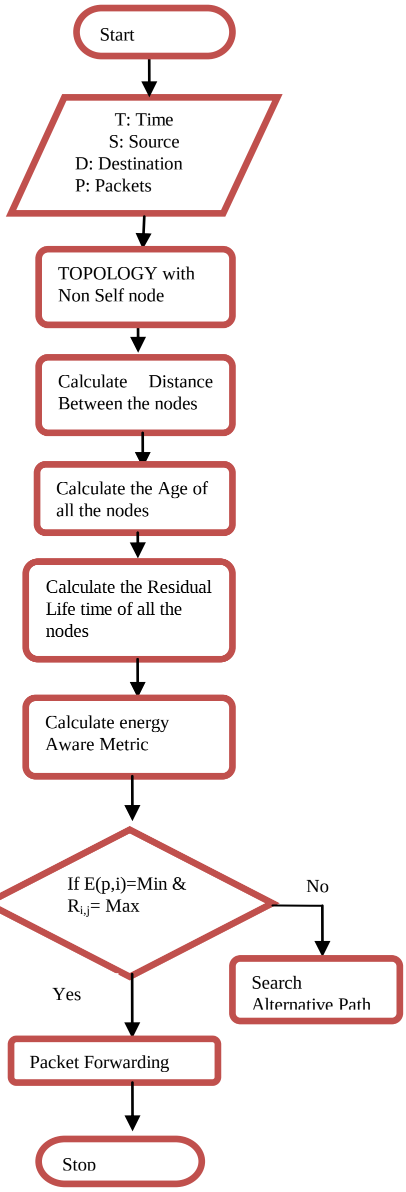

Fig: 5. System Flow Diagram for Routing

V. PERFORMANCE EVALUATION

Performance analysis of Link Stability and Energy Optimization by Excluding Self node topology based routing was carried out using NS-2 simulator. The Table -3 shows the parameters used for the simulation. The performance metrics obtained were, Packet Delivery ratio, Residual energy Consumption, Stability weight and Energy Consumption.

Parameter	Range /Values
Simulation time	700 seconds
Simulation Area	700 m x 700 m
Bandwidth	2 Mbps
Number of Nodes	30
Radio Range	200 meters
Data	512 Data Packets
Speed of Packets	20 packets /sec
Mobility Model	Random way point

The Performance results are compared with LAER and GPRS protocols.

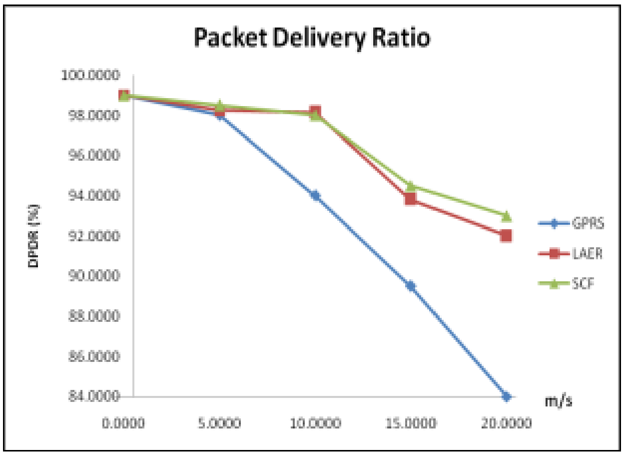

Fig: 6. Packet Delivery Ratio

Figure 6 shows the performance evaluation of LAER and GPRS and SCF topology based on packet delivery ratio. The packet delivery ratio of LAER and SCF is more over similar to each other

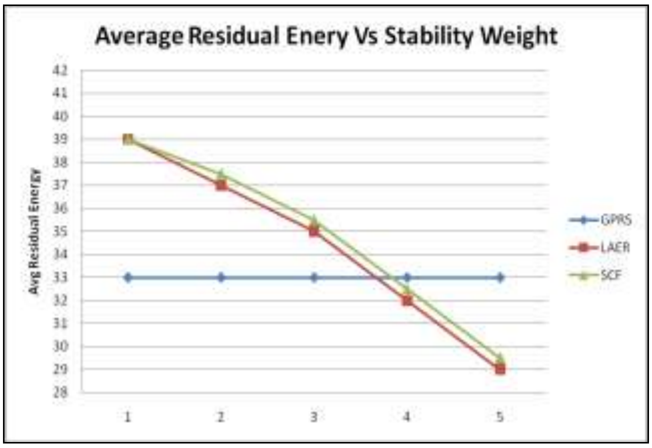

Fig: 7. Average Residual Energy Vs Stability Weight

Figure 7 shows the performance evaluation of LAER and GPRS and SCF topology based on Average residual energy and stability weight attribute.

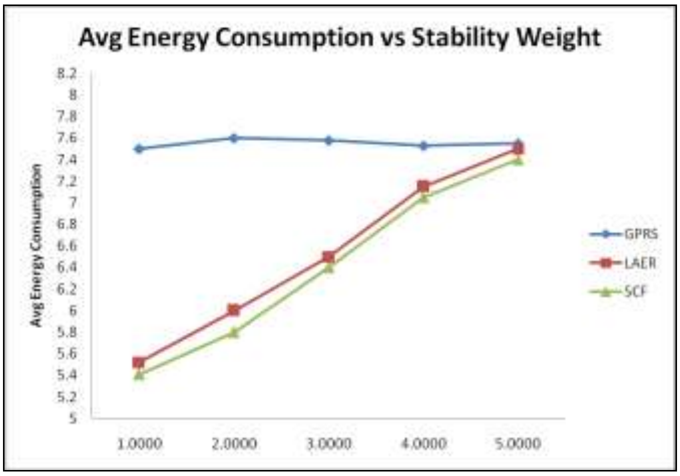

Fig: 8. Average Energy Consumption Vs Stability Weight

Figure 8 shows the performance evaluation of LAER and GPRS and SCF topology based on average energy consumption. The Energy consumption of SCF topology is comparatively lesser than LAER and GPRS.

VI. CONCLUSION AND FUTURE WORK

The Scalable routing protocol called LAER is based on Joint Metric of link stability and Energy Aware Routing has been implemented. It is based on the local topology knowledge and it makes use of a greedy technique. The self node identification based on risk factor can also used to improve the data accessibility. This approach will minimize the energy consumption. The performance has been compared with other protocols such as LAER, GPRS. We applied the notation of credit risk to detect self node. Each node will calculate the risk factor on other connected nodes individually to measure the self node. Further we plan to identify and handle false alarm for self node identification.

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