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Simulation Analysis for Consistent Path Identification to Refine the Network Lifetime

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Abstract

As the demand for Mobile Ad hoc Network (MANET) applications grows, so does their use of many essential services where node consistent and stability of the communication paths are of great importance. In this scheme, we propose Simulation Analysis for Consistent Path Identification to Refine the Network Lifetime (CPIR). This technique offers more stable path and transmits the data through the consistent nodes. This article is focused on protecting the route from the inconsistent node in mobile communications to improve the network performance and reduce the energy consumption in the network. The simulation results demonstrate that CPIR provided reduce the energy utilization and improved both the longer lifetimes and increased number of packets delivered.

Keywords*: Consistent Path, Energy, Lifetime, MANETs*

1. Introduction

A MANET is a self-organized network with arbitrarily distributed nodes. MANET applications are not limited to areas such as emergency and crisis management, local-level, commercial and military battlefield applications [1]. Network users intended for Consistent delivery of information. But a topological change in MANET leads to Path failure which degrades the network performance. Routing in MANET has been a challenging task because of the high degree of node mobility [2]. Using alternative path may resolve this problem. Multiple paths between source and destination are determined by route discovery [3]. Routing protocol selects an alternative path based on some metrics such as hop count, a speed of path, time to deliver content, path reliability, and its bandwidth [4]. Routing protocols in conventional wired networks use either distance vector or link state routing algorithms, both of which require periodic routing advertisements to be broadcast by each router [5]. The Traditional shortest path algorithms work correctly only when all nodes maintain routes to all destinations. However, in on-demand routing protocols, a node need not maintain routes to all destinations [6].

In MANET single path routing may fail in most of the cases due to frequent node mobility [7]. Consequently, Multipath routing scheme has been employed. Multiple paths between the source node and the destination nodes could be found using Multipath routing protocol and the Secure and Efficient Distance Effect Routing Algorithm for Mobility (SE_DREAM) in MANETs [8]. These multiple paths make the transmission more consistent and more efficient. In prevention of Co-operative Black Hole attack in Manet on DSR protocol using Cryptographic Algorithm is presented in this research paper [9]. To transmit data only best path is selected among the available paths based on some metric such as delay, bandwidth availability, delivery ratio, route stability, etc. and the performance analysis of black hole attacks in geographical routing MANET [10].

2. Related Works

Consistency Evaluation of Mobile Ad Hoc Network [1] considers different mobility models along with the effect of different scenario metrics and different values of tuning parameter. The mobility considerations have no significant impaction reliability as the same results are obtained by just implicitly simulating the node locations. Considering no mobility models reduces computational burden, some random variables involved making the algorithm more efficient also reduced the number of random variables. However, this approach considers

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only uniform distribution.Bayesian model [2] is used to predict and classify the mobility of a node in MANETs. The outcome of Bayesian Classifier will help a node control its broadcast process by which a high mobility node or region is avoided to re-broadcast a request. Established routes using the proposed model are more stable than routes determined by existing routing strategies. This model is a distributed algorithm and independent of the mobility pattern. This model improves the routing performance and reduces flooding problem in MANETs.

Energy Efficiency Optimization scheme [3] using the mixed integer nonlinear programming (MINLP) formulation by jointly considering routing, traffic scheduling, and power control. The branch and bound (BB) algorithm to efficiently solve this globally optimal problem. The BBalgorithm include upper and lower bounding schemes and branching rule that are designed using the characteristics of the non-convex MINLP problem. This scheme provides valuable insights into not only the impact of routing strategy, transmission schedule, and power control. Energy-aware architecture multi-rate protocol [4] investigated the possibility of reducing energy consumption in 802.11 wireless networks.This scheme increases the network performance and decreases both the power consumption and control overhead.

Mobility, Energy and Congestion Aware Routing (MECA) [5] to improve routing performance for MANETs. In this model, a node monitors the mobility, energy consumption and traffic congestion based on a multi-metric named AEC (constructed by Average Encounter Rate, Energy Consumption Rate, and Congestion Factor) to choose the most stable, power-rich and congestion-free path for routing. As a result, packet delivery ratio of the proposed model improves almost 20% compared to that of original AODV protocol while the number of dead nodes and routing overheads decreases significantly.

The consistent routing scheme proposed complete routing using offline prediction algorithms is done. An augmented graph is created *AGW (VA, EA)* by adding landmarks into every road segment. The Landmark ID can uniquely identify a vertex on graph *AGW,* and the link is determined. The possibility of link duration is determined, and the duration prediction table can be computed offline once a waypoint graph is given. The waypoint graph and the analogous duration prediction table can be stored in every mobile node and used repeatedly. However, more are required for the prediction accuracy, and this leads to increase the time of computational complexity [6]. CHAMP uses cooperative packet caching and shortest multipath routing to reduce packet loss due to frequent route failures. The nodes rely on data packet acknowledgment to determine the link status and whenever the link declared "down" it indicates the absence of acknowledgment and the packets cannot be routed successfully to the destination. The alternative path is selected and forwards all affected packets through this alternative route. If there is no alternative route present, then RERR message is generated and sent to the base station with header information of all data packets. Every node in CHAMP maintains a First-In First-Out (FIFO) data cache for storing forwarded packets for future use (6). Neighbor Coverage Based Probabilistic Rebroadcast (NCPR) was proposed. This protocol completely relies on preset variables, which are required to be set by the system administrator based on the ad-hoc scenario. The routing overhead crisis caused by RREQ redundant packets could be overcome by applying the NCPR protocol. Based on the self-punning scheme, the number of redundant RREQ messages is reduced relying on all the nodes in the network. Basically, due to multiple varieties in node deployment, this number is insufficient when the network is congested [7].

3. Proposed Method

A MANETs consist of some mobile nodes connected by a set of links. In this scheme, the source communicates the data to the destination through consistent nodes in MANETs. This routing path provides better packet delivery in the networks.A source wants to transmit the data to a destination it first checks the routing table.If the destination is obtained in the routing table, the source node to establish the data transmission or it starts the Route Request (RREQ) to discover a new route to reach the destination. The destination received the RREQ from the source via intermediate hops then the destination sends the Route Reply (RREP) through the source.Owing to the node mobility, breakage of the link may arise, also the node that finds such an event issues RERR message to its neighbors to notice this breakage.In CPIR, the intermediate node elected based on the node consistency and residual energy.

In CPIR analyzes the node in the network using Node consistency measure. The period of every node within communication range is stored in a routing table. It ensures the node stability of node. Mean duration value provides the average amount of time that node spends in our range. The consistency calculation depends on Ratio among Mean period of data transmission rate.
The Node Consistency calculation is given below.

$$Node\,Consistency(NC) = \frac{\sum NC(t)}{T} \quad (1)$$

If the node consistency is greater than the threshold that node is consistent. The threshold value is 0.7
The Route stability is calculated given below.

$$Route\,Stability(RS) = \frac{\sum RS(t)}{n} \quad (2)$$

Where,
$RS(t)$ → Period of node availability in communication range
T →Time Request to transmit the data
n →Number of nodes in data transmission path

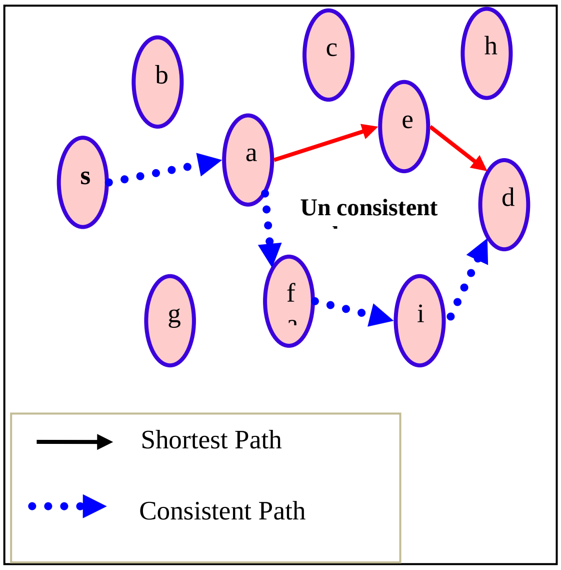

Figure 1. Consistency based node selection in network

The figure 1 indicate that the first path from the source to the destination is not reachable since the node is inconsistent and this node has dropped all packets. But the CPIR, transmit the data through the consistent path. As a result, the source data reach the destination via consistent nodes in a network.

Throughput: It is the average of successful messages delivered to the destination.The average throughput is calculated using Equation (6).

$$Throughput = \frac{\sum_{0}^{n} Pack\,Received\,(n) * Pack\,Size}{1000} \quad (6)$$

Residual Energy: The amount of energy remaining in a node at the current instance of time is called as residual energy. A measure of the residual energy gives the rate at which the network operations consume energy.

4. Results and Discussion

Evaluation of the protocols NCPR andCPIR is achieved using simulations in the network simulator. Such simulations use the standard parameters indicated in Table 1. Performance evaluation of the NCPR, CPIRprotocols are provided by estimating the Throughput, Residual Energy in the network.

Table 1. Simulation Parameters of CPIR

Parameter	Value
Channel Type	Wireless Channel
Antenna Type	OmniAntenna
MAC type	802.11
Simulation Time	50 s
Number of nodes	50
Routing schemes	NCPR, CPIR
Transmission range	250m
Traffic model	CBR
Simulation Area	700x700
Mobility Model	Random way point

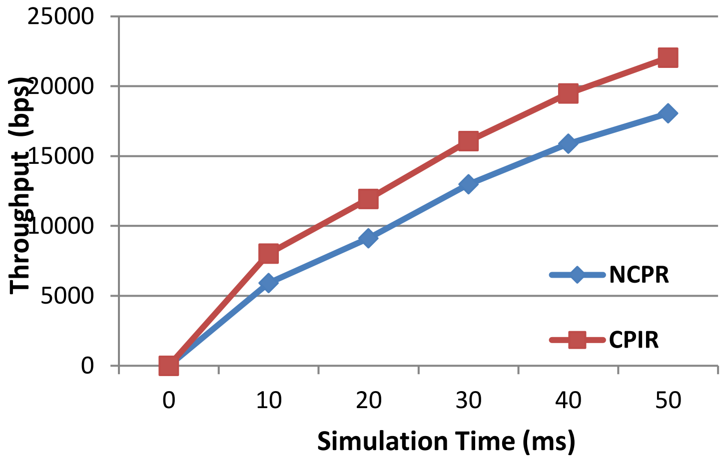

Figure 2. Throughput

Figure 2 shows the performance of throughput of CPIR and NCPR protocols. The throughput of NCPR is lesser than the CPIR. It represents the increase in efficiency of the CPIR protocol in the network.

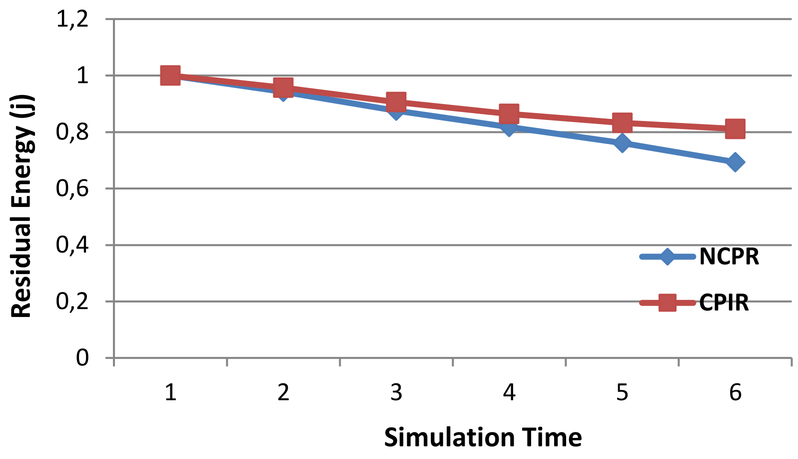

Figure 3. Residual Energy

Figure 3 shows the comparison of the residual energy of the CPIR and NCPR. The energy consumption of CPIR is lower than NCPR, therefore, proposed scheme increase the network lifetime.

5. Conclusion

We propose a new protocol that allows for the establishment of a stable and consistent path in MANETs. In CPIR, the intermediate node selected based on the node consistency and residual energy to improve the network performance. The consistent path selection enhances the network lifetime and increases the network performance. The simulation analysis results show that CPIRreduce energy consumption also increases the throughput.

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