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Providing a network encryption approach to reduce end-to-end delay in MANET

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Abstract:

A lot of research has been done on different coding techniques and benefits of their use in wired networks Since network coding was raised as a basic method for increasing network outpouring and reaching the capacity of networks. However, wireless networks are suffering from low operating power as the use of NC concept in MANET principally improves throughput rate in the wireless network .

The delay can be considered as an important parameter in networks and system delayed is not acceptable in these networks. However, the acceptable delay depends on the application although the efficiency and throughput leads to an increase in network coding , a reduction in bandwidth consumption, and a delay in sending packets is reduced by using network coding. In this study, a method is proposed for coding in the MANET, decreasing the number of sent packets, leading to a reduction in that delay .

Keywords: network coding, wireless ad hoc networks, simulation, directional antennas, simulation

1. INTRODUCTION

Mobile ad hoc wireless networks or more simply, Mobile ad hoc networks (MANET) is a set of nodes scattered geographically, which is linked with each other through a wireless medium [1]. A mobile ad hoc network does not have any wiring framework and communications are limited by battery power.

A mobile ad hoc network is a collection of mobile Telecommunications hosts, created without using a network infrastructure, and a temporary network is established by Such ad-hoc networks can be used in remote areas or areas with difficult conditions where there is no infrastructure. Furthermore, small ad-hoc networks are useful and affordable for stations in which the use of existing infrastructure is costly or provides a weaker performance than direct communication.[2].Network coding is a method used to enhance the communication networks power. Network coding is derived from the idea of hybrid packets and sending them to achieve higher throughput. Some of these methods send artificial delay to information packets [3]. The idea of network coding is derived from a clever combination of packets, from different altitude origins), and sending them in order to achieve higher throughput. At the earlier studies done on the area of network coding, improving wired networks was initially considered, although the concept of network coding could later attract the attention of researchers to improve throughput rates and optimum use of resources of wired networks. Before network coding, the intermediate nodes such as routers and switches was only responsible for storing, routing and sending the packets to the destination; therefore, in network coding, encoders are used instead of routers and switches, allowing us encode the packets and send them for intermediate nodes.

In Section two, the related works are reviewed andthe algorithm is proposed in section 3. This chapter also describes how to calculate sending packets to neighbor nodes and navigator node, as well as the coding messages received by the node navigator, and sending a message to all the nodes. Experimental results of simulation are compared with previous methods in section 4 . Finally, section 5 is related to the summary and conclusion about the material presented, and suggestions for further research.

2. Related works

In this section, the related works are briefly described.

SPIN method

The SPIN method is a family of adaptive protocols, which is able to scatter data among sensors in a sensor network effectively with the limited energy resources. The nodes run by SPIN communication protocol call their data by using a quasi-data which are descriptors with a high level.[4] Further,, in this method, nodes are using quasi-data negotiation to remove additional data on the network. In addition, nodes SPIN can decide to conduct their communications based on the information on the application and the information on the available resources . This makes the sensors be able to disperse the data efficiently in spite of their limited resources.

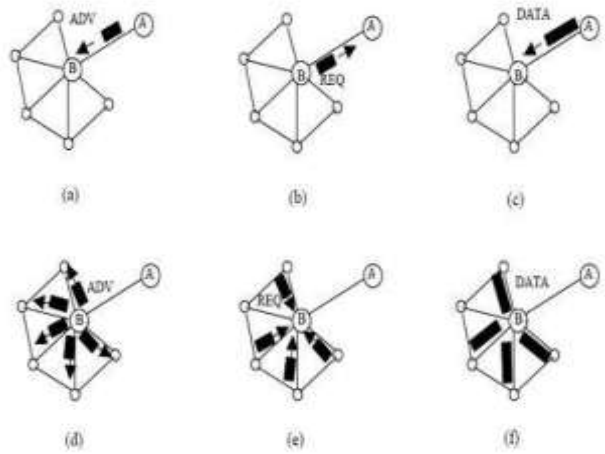

Figure 1: SPIN messages

Direct diffusion method

This protocol is considered as one of the most crucial of data-based protocols, which many protocols have been established based on . The protocol is designed so that each time a new application could be created, and the routing could start based on this new application. Each sensor receiving the request, keeps it in its memory for later use. Sensors combine data locally, leading to a reduction in the amount of transmitted information . Further, each sensor receiving a request, transfers it to its neighbors, so that gradient could be formed among them.[5]

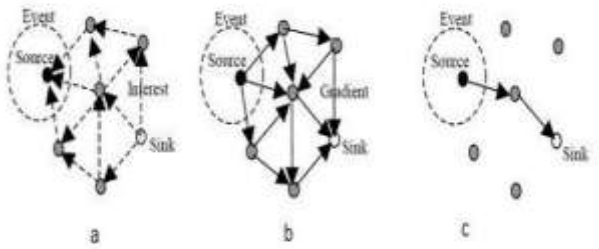

Figure 2: Direct diffusion method

Opportunistic summarizing

In general, numerous methods have been presented for summarizing the information. Among these methodsthe method of random summarizing was proposed based on the diffusion method. Based on this method, when the data are collected by sources and sent toward the recipients, intermediate nodes store information related to each other, by using filters at the application level. Then, the intermediate nodes eliminate duplicate information, or create a slight delay in sending information, and summarize the information collected from various sources. In this way, a tree of resources is formed toward a recipient as tree root. if the same data are collide with each other during the integration of the tree branches, only one of them will be sent to the root of the tree.

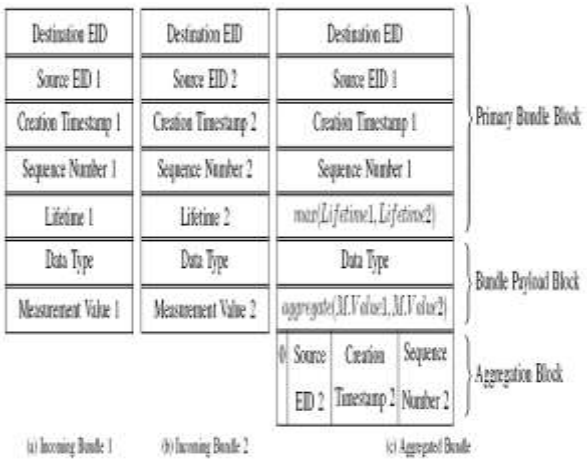

Figure 3: Opportunistic summarizing

Cope Method

Network encryption was the first architecture , which supported unicast traffic encryption, from different altitude origins, before sending them on a wireless network. Network programming as a modern technology can improve the performance of network communications. In such a network programming, hybrid packets are related to the network performance. Accordingly, several methods were proposed for the purpose of increasing throughput, based on the network programming. Many of these techniques of delay in sending the packet are used to increase throughput. However, this method is not appropriate for the applications sensitive to delay. In order to solve this problem, some methods were proposed for tradeoff between delay and throughput. A packet which is able to tolerate delays more than others has a higher priority for programming based on end-to-end delay, and programming with higher priority. Each node places packets from different flows in the virtual queue based on its next node.[6,7]

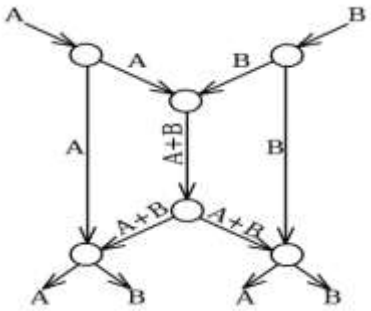

Figure 4: COPE coding

EBCD Method

EBCD algorithm takes the advantage of directional antennas for coding, and tries to reduce the number of packets sent, and for this purpose it stores the packets until the timer is expired, and is coded base on the order of their arrival.

Proposed algorithm

In this study, a new algorithm for coding is presented, aiming to reduce the number of packets sent and reduce delay. The algorithm is based on this idea that, while coding, each node can determine its neighbors, and when the packets are received uses the table for this kind of activity. Network coding allows the navigator nodes to merge incoming data, and then send it, through which the total number of packets sent is reduced. In this new design, each node sends its message to its adjacent nodes and navigator node.[8]

How does the proposed algorithm work?

The proposed algorithm works as follows:

Using the following equation, the lowest-cost distance between nodes with navigator node is selected, in order to select the set of nodes covered by the navigator node.

$$\min of \ \sum_{(i,j)\in A} a_{(i,j)} z_{(i,j)}$$

Input of this algorithm is the status of the group / message table, which is sorted in an ascending order.[9]

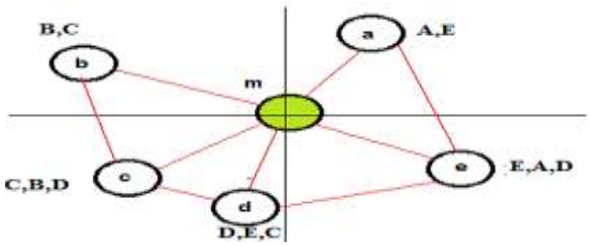

Figure 5: The network sub-graph with domain

Table 1: Table of node / Messages sorted

	A	B	C	D	E
a	1	0	0	0	1
b	0	1	1	0	0
c	0	1	1	1	0
d	0	0	1	1	1
e	1	0	0	1	1

- This table is sorted by the number of incoming packets nodes.
- To make a coded packet, the node which has received the lowest packet is prioritized.
- A not-received packet is selected from the selected node and is placed in the P set, followed by the next node.
- In the new node, an unknown packet is selected and is added p in accordance with the following conditions.
- If the selected packet already exists in P, a packet is not selected from the above node, and the next node is followed.
- If the selected packet did not exist in P, it is added to P,if all nodes can be decoded after addition ; in such cases, it is added to P, otherwise another packet in that node is taken.
- Each node can only decode those packets having at least one of the packets beforehand.
- The above steps are repeated until p sets are aerated for coding; and all packets are in the coding set.
- After coding packets, the navigator node checks to see which node should be done for sending.
- After receiving the packet, decoding operations are per[illegible]ed by nodes, and each node sends a messag 1 ts neighbors.

```
Sorting matrix;
While (zero in matrix)
Begin
        for i=1 to n /* I row number
        begin
                A= select zero in matrix;
                for j=I to n
                begin
                        B=  select zero in matrix;
                        coding=A+B;
                        if all nodes can receive (A+B)
then
                        begin
                                A+B is current coding;
                                Break;
                        End
                end
                Update matrix(coding)/* zero convert
one for all coding item
        End
end
```

Simulation

MATLAB software is used for simulation, by which a network with up to 100 nodes was considered, and the proposed method was compared with S-EBCD. For comparison, the items of packets sent, sending and delay time is used.

Simulation Scenario

In the simulation, each node has a packet to send, and the packet must be received by other nodes. In each sub-graph, there is a navigator node, which is responsible to send packets. In the proposed method, each node sends the relevant packets to adjacent and navigator nodes.[10,16]

The number of packets sent

In this case, the number of nodes up to 10 are taken into account, which increases up to 100 and the number of packet sent is computed every step, resulting in the following figure.[11]

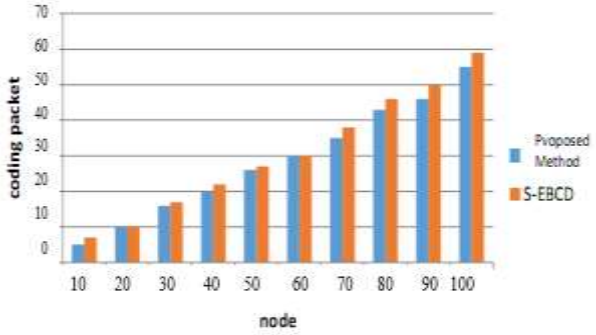

Figure 6: A Comparison of the number of packets sent

As it is evident from the simulation results in Figure 6 , in the proposed method, the number of sent packets has dropped to 11% , which can be regarded as the main reasons for the suitable coding of the Proposed method. This kind of reduction takes less time to send all packets, and there is not much delay.[13,14]

The time related to send packets

In Figure 7, the time related to send packets are compared. As it is observed from this figure , the time has reduced in the Proposed method.

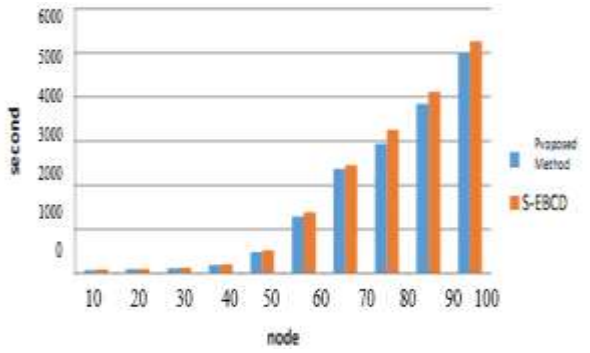

Figure 7: A Comparison of sending time

In the proposed method, the time has declinedto 13% . In Figure 8, the coding and sending time has been compared in conditions in which the number of nodes are fixed and the number of messages sent by each node are increased.[12,15]

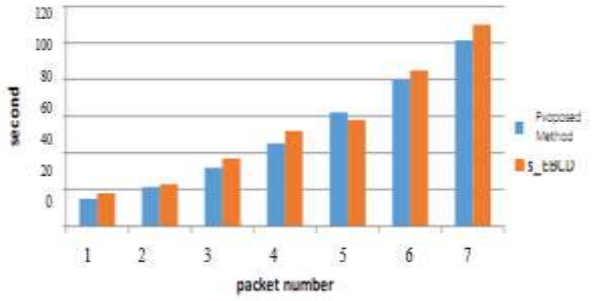

Figure 8: Comparison of sending time

In Table 2, the proposed method and S-EBCD method are compared.

Table 2- Comparison of Prposed and S-EBCD methods

	The number of packets sent	Sending time	Computational overhead	Memory used
New Method	Low	Low	Medium	Medium
S-EBCD	High	High	High	Medium

3. Conclusion

The proposed method in the current study acts in such a way that the coding packets are created in the best possible way. Based on this new method the number of packets sent are reduced, leading to a reduction in delay. The concept of network coding has attracted the attention of all the researchers, interested in improving the use of wired and wireless networks resources. Network coding networks were proposed as a solution to improve the wired networks. However, wireless networks are suffering from low operating power. Further, the concept of NC on wireless networks has improved wireless networks fundamentally throughput rate. To date, many solutions have been proposed in order to improve the performance of network coding. Finally, coding tree messages, and reducing the time and the number of packets can be considerd as a new area of research in future.

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