FAST RETRIEVAL OF INFORMATION IN TREE STRUCTURED NETWORK

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Abstract: In tree based network, the data are collected from the children node towards the sink node. For effective data collection we need to minimize the scheduling time length. We propose two converge casting mechanisms A1-SHOT (aggregated and one-shot raw data convergecast). These two mechanisms are implemented using Breadth first search and local time slot algorithms. These algorithms are used to reduce time slots in the ratio of 2:1. The sink can collect all the information from the respective child quickly. It keeps the sink always busy, so that the data collection is fast enough. Hence the performance of the network and throughput can be increased.

***Index Terms* – TDMA, Time Slot Assignment, Converge Cast.**

I. INTRODUCTION

CONVERGECAST is an mechanism suited for tree based routing topology, uses the fundamental operation of tree based networks routine[1] to collect the data from the group of child nodes toward a common sink. In many applications, it is hard to guarantee on the delivery time as well as the increasing rate of such collection of data. For instance, the application prompted for safety and mission-critical scheme, nodes are deployed to detect the structural damage, identify the fault in actuators and controllers and sense the oil/gas leak one to receive data from all the nearly nodes within a specific deadline . Any elapse in the deadline may lead to unpredictable and catastrophic events. so in this paper, we considered such applications and focus on the following fundamental question: "*How fast can data are streamed from a set of nodes to a sink over a tree based topology?*". We propose to follow two types of data collection:

1) Aggregated convergecast where data packets are aggregated at each hop

2) *Raw-data convergecast* where data packets are individually relayed toward the sink.

These two types correlate with the two extreme cases of collection of data .

II. EXISTING SYSTEM

The issue of minimizing the schedule length for raw-data converge cast on single channel is NP (Non-Deterministic Polynomial Time)-complete on general. To improve the efficiency,we can use graph coloring concept in order to assign timeslots to children nodes.Greedy colorings (GC) uses the minimum number of color combination is possible. So in greedy coloring technique more number of time slots are required for collecting the data.

DRAWBACKS

1) It constructs the balanced trees and compares their performance with unbalanced trees. It has been observed that in both cases the sink mostly creates a high-degree bottleneck.

2) Since the sink remains as the bottleneck, sending data over different paths does not reduce the schedule length.

3) Number of time slots required to collect data is more.

4) Schedule length calculation when interference is completely eliminated is not calculated efficiently.

III. PROPOSED SYSTEM

In our proposed system, time Division multiple access method is used. TDMA allocates time slices to each device to send/receive data. It is in need of two algorithms, BFS Time Slot Assignment and Local Time Slot Assignment. The proposed system proves that, once the interference is eliminated, we can achieve lower bound of data collection time.

Hence the schedule length for aggregated converge cast is minimized by maximum node degree in routing tree and for raw-data converge cast by max (2nk −1, N), where nk is the number of nodes that are maximum on any branch in the tree and N is the number of source nodes. Then we can use optimal time slot assignment schemes.

IV. .ADVANTAGES

1) The sink node i.e., the root node collects data over different paths in reduced schedule length.
2) Number of time slots required to collect data is less.
3) Schedule length calculation when interference is completely eliminated is calculated efficiently.
4) Half duplex transmission is taken into account during all data transmissions between any two nodes.
5) Keep the sink node always busy and therefore data collection is fast enough.

V. DESCRIPTION OF AGGREGATED CONVERGE CAST

Node	S1	S2	S3	S4	S5
0	1	2	3	4	
1	5				
2	6	7			
3	11	12			
4	8	9			

Table 1: Fig1(b1) Initial Time slots

In this module, the scheduling problem is considered where packets are aggregated. Data aggregation is a widely used technique in WSN that can remove redundancy and reduce the number of transmissions, which saves energy and improves network lifetime. Aggregation can be performed in many ways, such as by suppressing duplicate messages; using data compression and packet merging techniques; or taking advantage of the correlation in the sensor readings.

MIN, MAX, MEDIAN, COUNT, AVERAGE are the basic aggregation functions.

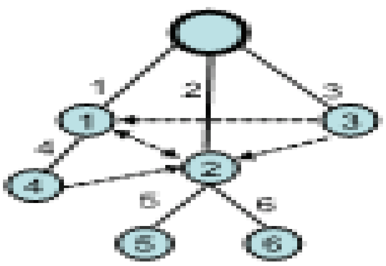

Fig1(a) Network Tree

In Fig. 1(a) and Fig.1(b1), we illustrate the notion of pipelining in aggregated converge cast and that of a schedule length on a network of 6 source nodes.

Edges are represented by solid lines and interfering links are represented by dotted lines. The numbers noted in links are time slots at which duration it can transmit the data. The numbers present in circles denote identifiers of the node.The entries in the table is the list of nodes from which packets are received by their corresponding receivers in each time slot(S).

We note that at the end of table1, the sink does not have packets from nodes 6 and 7; however, as the schedule is repeated, it receives aggregated packets from 2, 6, and 7 in slot 2 of the next table. Similarly, the sink also receives aggregated packets from nodes 1 and 5 starting from slot 1 of table 2. The entries {1, 5} and {2, 6, 7} in the table represent single packets comprising aggregated data from nodes 1 and 5, and from nodes 2, 6, and 7, respectively.

Table 1:

Fig1(b1) ***Time slots in initial***

Node	S1	S2	S3	S4
0	{1,5}	{2,6,7}	{3,11,12}	{4,8,9}
1	{5}			
2	{6}	{7}		
3	{11}	{12}		
4	{8}	{9}		

Fig1(b2) *After applying BFS algorithm*

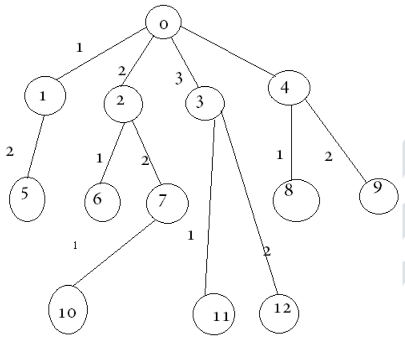

Fig1(c)

Schedule length of 3 using BFS-TIMESLOT ASSIGNMENT when all the interfering links are eliminated

Thus, a pipeline is established from table 2, and the sink continues to receive aggregated packets from all the nodes once every 6 time slots. Thus, the minimum schedule length is 6.In this module, a time slot assignment scheme in Algorithm1,called BFS- TIMESLOTASSIGNMENT is proposed, that achieves this bound.

For each repletion in BFS Time Slot technique (an edge) is selected from any node in BFS order and minimum time slot is allocated which is different from all of its adjacent vertices based on constraints.Note that, if the interfering links are present, the corresponding constraint in line 4 is checked; however, when interference is eliminated this check is redundant. The algorithm minimizes the schedule length when there are no interfering links, as proved in Theorem1. To illustrate, the same network of Fig. 1(a) in 1(c) is shown with all the interfering links removed, and so the network is scheduled in 3 time slots.

BFS- TIMESLOTASSIGNMENT

Algorithm

1. Input: $T = (V, ET)$
2. while ET _= φ do
3. By BFS order find next edge to e

4.Find minimum time slot t to e with respect to constraints

5.Add e to previously selected edges

where T= tree,V=vertex(node),ET=tree edges(links) and BFS=Breadth First Search (communication from child to parent)

VI. ONE-SHOT- RAW-DATA CONVERGECAST

In this module, one-shot data collection is considered where every node reading is equally important, and so aggregation may not be desirable or even possible. Thus each of the packets has to be scheduled one by one at each hop on the way to the sink.

The pipelining will take place and each of the tree edges is scheduled only once within each frame in periodic aggregated converge cast, but here the edges can be scheduled multiple number of times and there is no pipelining.

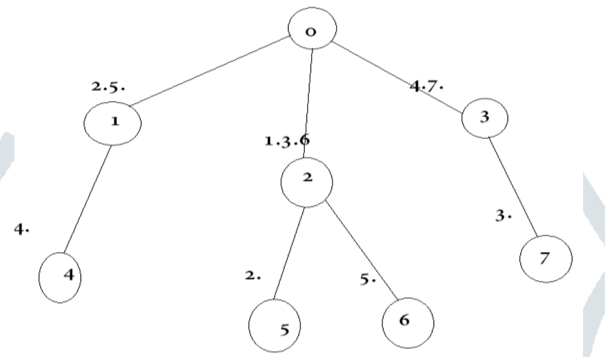

Fig2 (a)

The schedule length of 7 after all the interfering links are removed

A time slot assignment scheme in Algorithm 2, called **LOCAL-TIME SLOTASSIGNMENT** is described, which is run locally by each node at every time slot. The key idea is to: (i) schedule transmissions in parallel along multiple branches of the tree, and (ii) keeping the sink busy in getting the packets for many time slots.

Algorithm 2:

LOCAL TIME SLOT ASSIGNMENT

1. *node*.buffer = *full*

2. **if** *{node* is sink*}* **then**

2.1 Among the eligible top-sub trees, choose the one with the largest number of total (remaining) packets, say top-subtree *i*

2.2 Schedule link (*root*(*i*), *s*) respecting interfering constraint

else

3. **if** *{node*.buffer == *empty}* **then**

3.1 Choose a random child *c* of *node* whose buffer is *full*

3.2 Schedule link(*c*,*ode*) respecting interfering constraint

4. *c*.buffer = *empty*

5.. *node*.buffer = *full*

end if

end if

We run through an example shown in Fig. 2(a) to explain the algorithm. In the first time slot, since the eligible top-sub tree containing the largest number of remaining packets is *{*2, 5, 6*}*, we schedule the link (2, *s*), In Slot-1, node 2 sends a packet to the sink .In the second time slot, the eligible top-sub trees are *{*1, 4*}* and *{*3, 7*}*, both of which have 2 remaining packets. One of them at random is chosen , Example*{*1, 4*}*, and schedule the link (1, *s*).

Also, in the same time slot since node 2's buffer is empty, it chooses one of its children at random, say node 5, and schedule the link (5, 2). In the third time slot, the eligible top-sub trees are *{*2, 5, 6*}* and *{*3, 7*}*, both of which have 2 remaining packets. The the first one at random is chosen and link (2, s)is scheduled, and so the sink receives node 5's packet (relayed by node 2). In the third time slot the link (4, 1) is scheduled since the node 1's buffer is empty at this point. This process will continue till all the packets are delivered to the sink, which yields an assignment that would require 7 time slots. In this example, $2nk - 1 = 5$, so that max $(2nk-1, N) = 7$.

VII. HYBRIDMETHOD

The Hybrid method is intensive on combination of aggregated converge cast and one shot raw data converge cast. In this, the nodes in the network will collect data using Aggregated converge cast and One-Shot Raw-Data Converge cast based on the respective schedules. The result is shown in figure

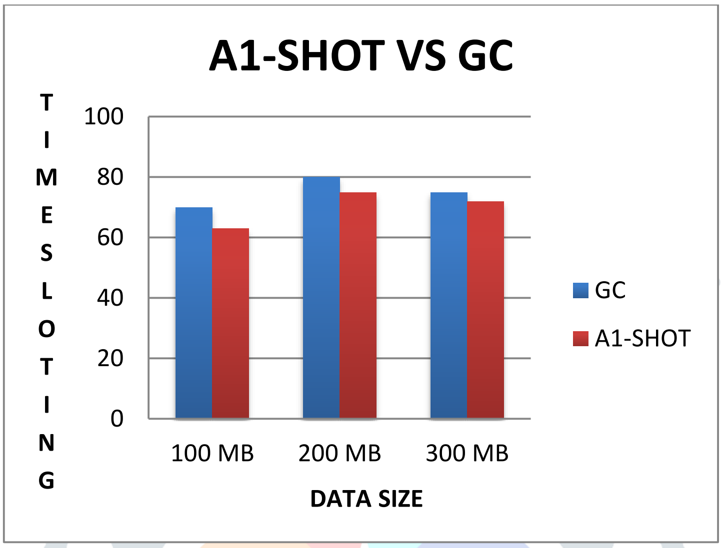

Figure 3- Time slot minimized

Using a timer, the nodes shifted based on two algorithms and execute accordingly.

VIII. CONCLUSION

In this paper nodes communicate using a TDMA protocol ,. TDMA is a technology used in nodes communication that divides each channel into three time slots for increasing the amount of data that could be carried. Once interference is completely eliminated, we proved that with half-duplex ratios the achievable schedule length is lower-bounded by the maximum degree in the routing tree and thereby we showed that the lower bounds are achievable using our algorithm.

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