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DISTRIBUTED SCHEDULING FOR MESH NETWORKS WITH CHAIN TOPOLOGY

Shabnam Azari*

Tooraj Samimi Behbahan*

Abstract: *The IEEE 802.11 DCF Protocol which is used in the Multi-hop networks based on the Bus Topology doesn't provide the sufficient through put for each node because of the exposed/hidden node problem or collision. Removing this variation from the hidden nodes and confronting the collision is a key to reach the high performance in the Mesh network.*

Keywords: *Wireless Mesh Network, Hyacinth, IEEE 802.11 DCF, TDMA, Token, NIC*

*Department of Computer Engineering, Behbahan Branch, Islamic Azad University, Behbahan, Iran

1- INTRODUCTION

The wireless mesh network is a technology used for reaching the broadband Internet. The mesh network is self-improved which means that the network can be run when one of the nodes is out of service or the connections are being destroyed. The result is that this model of the network is very reliable and guaranteed.

In this kind of the network each node needs just a single transmitter. Until it gets to the other node, each node operates as a repeater. This network is used for sending data, from the closest node to the parallel node in a remote and out of reach distance. As a result, this kind of network can have a wide range, and is suitable for places which are rough and there cannot be any electrical grounding and wire connections.

2- DISTRIBUTED TIME BASED ON TOKEN

In this part, we will first investigate the problems of the wireless mesh networks and in continue, will offer the solutions based on the Token.

2-1- Investigate Domain Collision Problem

For the efficient transfer timing in the bus topology we investigate the transfer behavior [1]. The main idea is making the transfers possible in the nodes which are 4 hops away from each other. In Figure 1 we suppose that all nodes are transferring some pockets in a 7-node bus network.

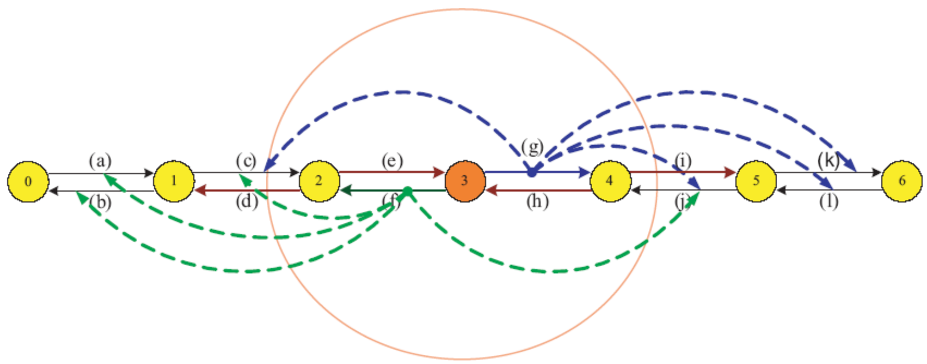

Figure 1: Domain Collision in 4 Hops

The traffic, which is specified in a one-direction connection, shows the movement of the data from one node to its adjacent node. We analyze this problem from the perspective of Node-3. For a successful traffic in the path G, from the node 3 to the node 4, nodes 2 and 5 must not send the K, J, E, and D traffics. This job is amplified by nodes 2 and 5 in "802.11" which perform the Virtual Transfer Sense. The Traffics I, H, and F are denied because nodes

3 and 4 are involved in receiving the traffic Y. Also traffics C and L may cause transfers from nodes 2 and 5. When the traffic C is generated by the node 1, these pockets intervene transfers from the node 3 so they are not differentiated in the node 2.

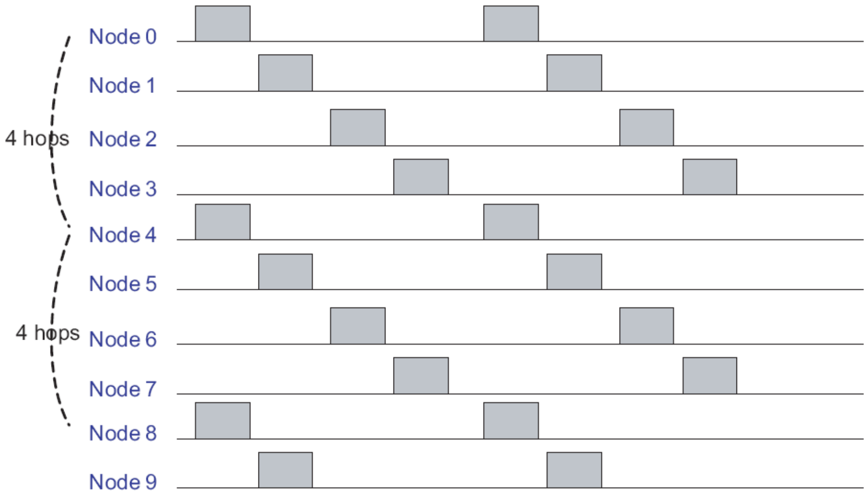

Figure 2: Bus Topology with 10 Nodes for Efficient Transfer Timing

In Figure 2, when the node 4 is trying to start a transfer, nodes 5 and 8, which are 4 hops away from the node 4, can start transfers. After the node 5, nodes 4 and node 8 send frames respectively. The next transfer time is given to nodes 1, 5 and then 9. The node 4 can transfer again after the node 7.

2-2- Assumptions and Configuration

Before explaining TDS we consider some assumptions:

- ✓ Network Topologies is a temporary network with Bus Topology.
- ✓ Each node knows its position in the Bus Topology
- ✓ Every node can send its pockets to the right destinations
- ✓ The size of the each pocket is fixed

RTS frames (Return-Token) must be added to “802.11MAC.” As shown in Graph 1, the Token-ID’s field is one byte and its range varies from 0 to 255. The Next-Node-ID’s field is 6 bytes and its value shows the physical address of the next node. Each node passes its token by filling the details of the Token and the address of the next node. The frame Return-Token is used to give the token back to the Boss [2].

2-3- Simulation Results

We modify the protocol “802.11” and for simulation scenarios, 512-byte pockets are used randomly and sent by a channel rate of 2mbps. Column 1 shows the results of a simulation for a 3-node to 8-node Bus Topologies with the protocol "802.11." Column 3 shows the whole capacity for 3 nodes to 9 nodes with a 512-Byte and 1000-Byte pocket. In all cases except the number 5 and the number 6 groups, TDS serves more acceptance capacity than "802.11."

Table 1: Frame Fields are modified

Frames	Added Field	Size
RTS	*Token_ID*	*1 bytes*
	Next_Node_ID	*6 bytes*
Return_Token	*Token_ID*	*1 bytes*
	Next_Node_ID	*6 bytes*

Table 2: The permittivity of each node in the TDS algorithm (Kb/sec)

Nodes	3	4	5	6	7	8
Thruput	421.42	307.59	307.54	307.60	307.60	307.59

Table 3: The permittivity of each node in 802.11 (Kb/sec)

Nodes	3	4	5	6	7	8
Node 0	273.45	155.73	539.03	550.01	375.03	275.50
Node 1	644.22	475.38	134.51	459.33	436.39	419.59
Node 2	290.16	424.67	292.62	52.67	241.99	304.33
Node 3		133.04	149.01	51.28	53.90	125.50
Node 4			540.51	462.11	273.86	121.73
Node 5				547.14	432.21	279.35
Node 6					335.87	437.53
Node 7						294.26
Average	402.61	297.20	331.14	353.76	307.04	282.23

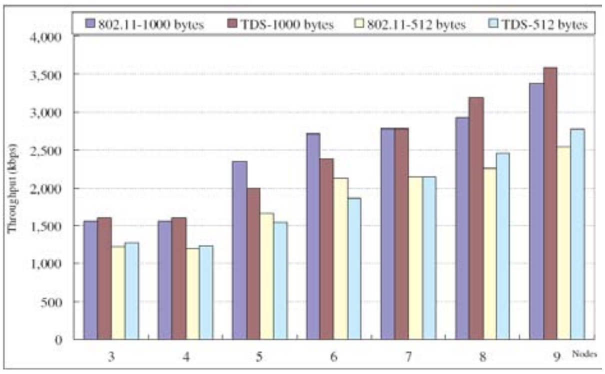

Figure 3: The comparison permittivity between TDS and 802.11

3- ARCHITECTURE OF A MESH NETWORK WITH HIGH CAPACITY

Most of the temporary Multihop networks based on "802.11" work in a channel. This matter greatly decreases the bandwidth for each node because of the interference between consecutive nodes on the same path and also adjacent paths. Shape 4 shows the intensity of this interference. So the ordinary Temporary One-Channel network architecture cannot be used for building a wireless mesh networks [3].

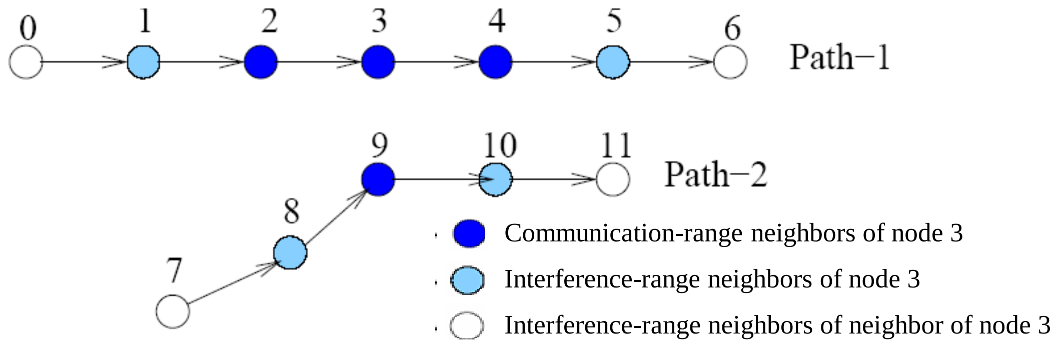

Figure 4: Interfere with the path and the path in a network of ad hoc multi-hop single-channel

nodes 1, 2, 4 and 5, the amplitude of the interference node 3, and so could not when node 3 is activated the send / receive. Nodes 8, 9 and 10, which belong to the non-connected there are other 3 nodes, are in interference range. Therefore none of the wireless link cannot form simultaneously when node 3 to node 4 will move to work

4- TOPOLOGY

We concentrate on the linear Bus Topologies. An N-Hop wireless mesh network has N+1 nodes and N links. N= {0, 1, 2,…, n} shows the Set of the nodes. The link between nodes I-1 and I is the link I. I= {1, 2,…, n} shows the set of the nodes. The node 0 is the origin of the TCP that owns unlimited data to send. The node N is the receiver of the TCP. Shape 5 shows the sample of the network topology [4].

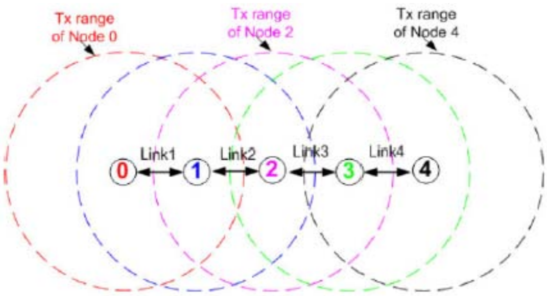

Figure 5: Colors to characterize nodes and their transfer domain-all nodes work in a same channel

5- CONCLUSION

Because of preventing from the collision by using more than a single network adaptor, the Multihop method can provide us a suitable bandwidth and release us from the problem of the adjacent nodes. However, based on the studies, a combination of the both TDS and Multichannel is recommended. For solving the problem of these methods, we will talk in the next article.

REFERENCES

[1] I. Rhee, A. Warrier, J. Min and L. Xu, “DRAND: Distributed randomized TDMA scheduling for wireless Ad-Hoc networks,” in Proc. 7th ACM International Symposium on Mobile Ad Hoc Networking and Computing, pp.190-201, Florence, 2006

[2] Ting-Chao Hou, Chien-Yi Wang, and Ming-Chieh Chan, ” A Token-based Distributed Scheduling for Mesh Networks with Chain Topologies”. AINA 1, page 327-332. IEEE Computer Society, (2006)

[3] Yong Huang, Weibo Gong, Don Towsley, “Application layer relays for wireless 802.11 mesh networks”- Proc of the 2 nd IEEE Workshop on Wireless Mesh Networks (WiMesh , 2006)

[4] A. Raniwala and T.-c. Chiueh, ”Architecting a High-Capacity Last-Mile Wireless Mesh Network”, MobiCom, Philadelphia, USA. New york, NY: ACM (2004). 25.