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A Power Saving-Dual Busy Tone Multiple Access (PS-DBTMA) Protocol for MANETs

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Abstract— This paper presents a proposed method for PS-DBTMA (Power-Saving Dual Busy Tone Multiple Access) MAC layer protocol for MANETs which is based on DBTMA. Mobile ad hoc networks (MANETs) are autonomous network of mobile nodes connected by wireless link, basically without any infrastructure support. There is no specific topology defined for MANETs. It is based on layered architecture like other networks. We will discuss about the MAC layer of MANETs. Collision free transmission and power conservation are major issues of MAC Layer. Power conservation is important in MANETs because in these networks, mobile nodes work both as client as well as server i.e. totally self organized mode. There is no regular power backup possible in mobile nodes. So power conservation becomes important aspect to consider in MANETs. Some existing power conservation MAC layer Protocols are PAMAS, DPSM, PCM, PCMA, DCA-PC, EE-MAC Protocol etc.)

Keywords: - MANETs, Power, DBTMA, APTS, RPTS, PS-DBTMA

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I. INTRODUCTION

MANET is a wireless network of independent nodes without any infrastructure support. It is characterized as asynchronous, swift deployment, multi-hop topology etc. In MANET, each mobile node is an independent node. Each mobile node in MANET is capable to perform the task of transceiver as well as router. So, each mobile node requires being more capable and more reliable than in any other network.

MANETs 'applications: In battle fields, in hospital emergency, in official meeting, in any nature disaster situation etc.

MAC Layer in MANETs: Media Access Control (MAC) layer is the sub layer of the data link layer. MAC Layer protocols are basically of two types i.e. either contention based or contention free. MAC Layer protocols in MANETs are contention based. Contention means competition among nodes to access the channel for communication at the same time. So, MAC layer is responsible for collision free access of channel among nodes which are competing for that channel for data transfer. Basically, it is responsible for coordinating and proper scheduling of competing nodes. It is also responsible for proper utilization of channel. Some factors which effect MANETs' performance are number of nodes in the network, channel utilization, battery power utilization of nodes etc.

II. POWER UTILIZATION IN MANETS

In MANETs, basically mobile devices are used as nodes for communication. Battery power utilization is an important factor to manage in MANETs. As MANET is build up for emergency situations where immediate battery charge may not be possible, so optimum power utilization is necessary. To utilize the battery power of nodes in MANET in an optimum fashion power saving protocols exists. Different protocols use different mechanisms to save battery power.

Basic mechanisms of Power saving:

1. **ON/OFF** mechanism of nodes: - In this, any node can power off itself when there is nothing to do for that node or if any neighboring node is transmitting at that time. A node can power down itself for without affecting the performance of neighbor nodes.

2.**MAX./MIN**. Power saving mechanism:- In this, control messages are sent using maximum power available and data messages are sent using minimum or sufficient power required for transmission.

3. **Master/Slave nodes mechanism**: - In this, some nodes are declared as master nodes and other as slave nodes. Master nodes cannot power off them, but slave nodes can. This enhances channel utilization.

III. PROPOSED METHOD

PS-DBTMA (Power saving Dual busy Tone Multiple Access). It is based on the concept of DBTMA Protocol. DBTMA is a multiple channel Protocol.

DBTMA: The DBTMA scheme [14] uses out-of-band signaling to effectively solve the hidden and exposed terminal problems. It is a multi-channel protocol with two narrow band busy tones. Busy tones are used to solve the hidden and exposed terminal problem as much as possible. However data transmission takes place on the single shared wireless channel. It builds upon earlier work on the Busy Tone Multiple Access (BTMA) [21] and the Receiver Initiated-Busy Tone Multiple Access (RI-BTMA) [16] schemes.

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DBTMA Protocol decentralizes the responsibility of the network among nodes of managing access to the common medium and does not require time synchronization among the nodes. Many protocols of MAC Layer are based on RTS mechanism. It sends RTS packets on data channel to set up transmission requests. Subsequently, the two busy tones on a separate narrow channel are used to protect the transfer of the RTS and data packets. The sender of the RTS sets up a Transmit-Busy tone (BT_t). Correspondingly, the receiver sets up a Receive-Busy tone (BT_r) in order to acknowledge the RTS, without using any CTS packet in response to the RTS.

Limitation:

- No acknowledgement.
- No power utilization mechanism.

PS-DBTMA:

It is to overcome the limitation of DBTMA and to make it more reliable and more efficient. To make DBTMA a Power Saving Protocol, we can implement it with the basic power conservation concept. It has

Single shared Data channel*:* To transfer data packets and control packets.

Two Busy Tones*:*

BT_t: Transmitters Busy Tone.

BT_r: Receivers Busy Tone.

Power Saving Control Packets:

- RPTS
- APTS

RPTS (Request Power To Send): In PS-DBTMA instead of simple RTS message RPTS message is sent which does function of RTS and also carries information of power level which tells how much power is available and how much power is actually required for data transfer.

APTS (Accept Power To Send): This is response message of receiver or destination node to the sender node. It works as CTS and also carries information of power level. Both sender and receiver agree upon power level which is required.

RPTS and APTS based on the concept of maximum power and minimum power level i.e. RPTS and APTS message is to be sent with Maximum power available and Data is to be sent with Minimum power. In this way, power can be saved.

Working Steps:

1. Sender sense for BT_r and BT_t i.e. whether the receiver is free or not means the destination node to which he want to send is already in which state. There can be different states: Idle, Receiving, Transmitting etc.
2. Transmitter or sender turns ON BT_t.
3. If sender found the receiver free, then send RPTS [in all direction]. Else Back off [& can go into sleep mode] if it has nothing to do at that time. Before it goes into sleep mode it will calculate back-off time and according to that it decides the sleep state timer value.

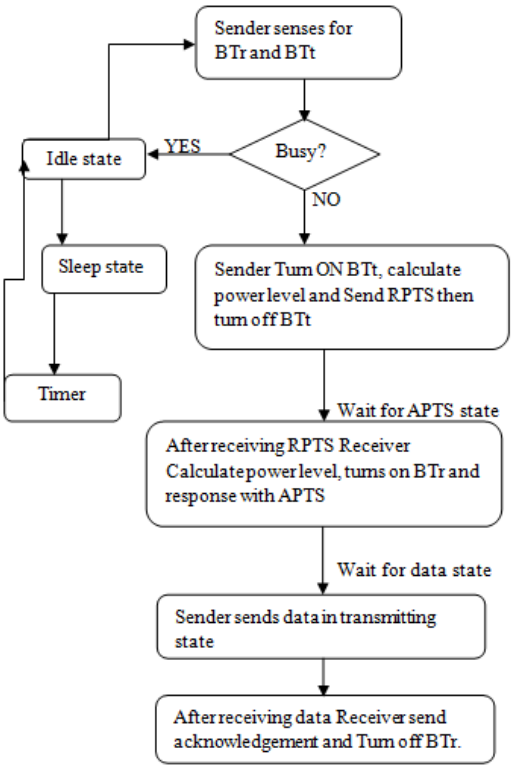

Fig 1 PS-DBTMA Flowchart

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1. Transmitter or sender turns OFF BT_t and wait for response.
2. Receiver or destination node turns ON BT_r [in all direction].
3. Response with APTS packet [in sender's direction].
4. Sender sends data and goes into sending Data state. After completion, sender goes into Wait for acknowledgement state. When it receives acknowledgement it can go into Idle state [can go into sleep mode if have nothing to do to save power].
5. After reception of data receiver response with acknowledgement and turns OFF BT_r go back to Idle state or sleep state if there is no data to send or receive & can save power.

Table 1 DBTMA Vs PS-DBTMA

DBTMA	**PS-DBTMA**
RTS	RPTS
NO CTS	APTS
Busy Tone Transmitter	Busy Tone Transmitter
Busy Tone Receiver	Busy Tone Receiver
No Acknowledgement	No Acknowledgement
No Power Saving	Power Saving

IV. CONCLUSIONS

In this paper, we have presented a comprehensive study of the research work conducted in the field of MANETs with respect to power conservation MAC protocols. In this, various power conservation protocols are studied with their salient features to understand the basic concept of power conservation and their effect on network throughput and other factors. We have proposed the method for PS-DBTMA which is Dual tone base power saving protocol. Future work includes its practical implementation and improvement of method with antenna to avoid congestion as much as possible.

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