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Improving Energy Efficiency under Non Uniform Load Distribution in Manet: A Survey

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Abstract: Mobile adhoc network (MANET) is a wireless network of mobile devices without any infrastructure. An important problem receiving increased consideration recently is load balancing. Many protocols are developed under non uniform load distributions for improving bandwidth, energy efficiency, throughput etc. This paper aims to survey research articles on energy efficient in mobile adhoc networks. Here various approaches are taken into account and literature key ideas are presented.

Keywords— Mobile adhoc networks, load balancing, non-uniform,nodes, Energy.

I. INTRODUCTION

Mobile ad hoc networks (MANETs) are self configuring mob ile devices with no infrastructure. Each node in a MANET acts as a router and has capability to deploy anytime and anywhere. The application of mobile adhoc network are military, disaster management, industry and many more. Some characteristics of mobile adhoc networks are dynamic topology, distributed operation multihop routing. Mobile nodes in the network move and change its topology frequently. MANET are becoming increasingly common, and typical network loads considered for MANETs are increasing as applications evolve. One of the fundamental issues in a mobile adhoc network is the *load balancing problem*. Load balancing is a method for distributing workloads across computing resources. Load balancing is to provide a single Internet service from multiple servers is the commonly used application. Load balancing is transfer load balancing is the the main field in mobile adhoc networks.

The protocols that are designed and developed for mobile ad hoc networks can be classified into three major divisions such as proactive or table-driven, reactive or on-demand and hybrid. In proactive routing protocols [5] the routes to all the destination nodes are determined at the start up, and maintained by using a periodic route update process. The proactive routing protocols are DSDV, WRP, GSR, FSR, STAR**,** DREAM, MMWN, CGSR, HSR, OLSR, and TBRPF. In reactive protocols, routes are determined when they are required by the source using a route discovery process. The reactive routing protocols[5] are AODV, DSR , ROAM , LMR, TORA , ABR , SSA , LAR , RDMAR , ARA , FORP , CBRP . Hybrid routing protocols combines the properties of the first two classes of protocols into one. Hybrid routing protocols are ZRP, ZHLS, SLURP, DST, DDR. That is, they are both reactive and proactive in nature. Each group has a number of different.

To improve the energy efficiency under non uniform load distribution several protocols and mechanism are used. Energy efficiency can be achieved by increasing the life time of mobile adhoc network. Even by minimizing the delay, jitter, and interference energy is made efficient. One of the key research areas in mobile adhoc networks. For reliable data Some mechanism has been used to improve the bandwidth under non-uniform load distribution. There are lot of approaches, mechanisms and protocols developed for energy efficiency in mobile adhoc networks. Inorder to improve the energy efficiency

in non uniform load distribution we had done a survey of literatures which deals with many approaches. In this research, energy efficiency can be improved under non uniform load distribution in mobile adhoc network.

II. LITERATURE SURVEY

This section defines the various energy efficient methods employed in mobile adhoc networks and their issues related to power and energy consumption.

a) MH – TRACE: Multihop Time Reservation Using Adaptive Control for Energy Efficiency

Bulent Tavli and Wendi B. Heinzelman proposed multi-hop time reservation using adaptive control for energy efficiency (MH-TRACE)[1]. It is a medium access control (MAC) protocol which combines fully centralized and fully distributed networks for energy efficiency. MH-TRACE [6] clusters are just for coordinating channels access and minimizing interference. Energy dissipation for receiving unwanted packets and collided data packets are avoided. By the use of transmission scheduling intra-cluster data collisions are completely eliminated and inter-cluster collisions are avoided. Two techniques is used to save energy. First technique is used to reduce energy dissipation at MAC layer. Second technique is to reduce energy dissipation by avoiding packet receptions that will be avoided at higher layer. Whenever possible nodes should be in sleep mode to avoid (1) dissipating energy in the idle state; (2) Overhearing transmissions initiated from nodes that are further than the successful transmission range (3) receiving corrupted packets due to collisions. When compared to existing CSMA-type broadcast protocols like 802.11. MH-TRACE provides energy efficiency due to the use of Time Division Multiple Access (TDMA). This allow node to go for sleep mode often. It also provides higher throughput due to coordinated channel access. Fig 1 shows a MH-TRACE clustering and medium access for a portion of an actual distribution of mobile nodes. Nodes C1 through C7 are cluster head node.

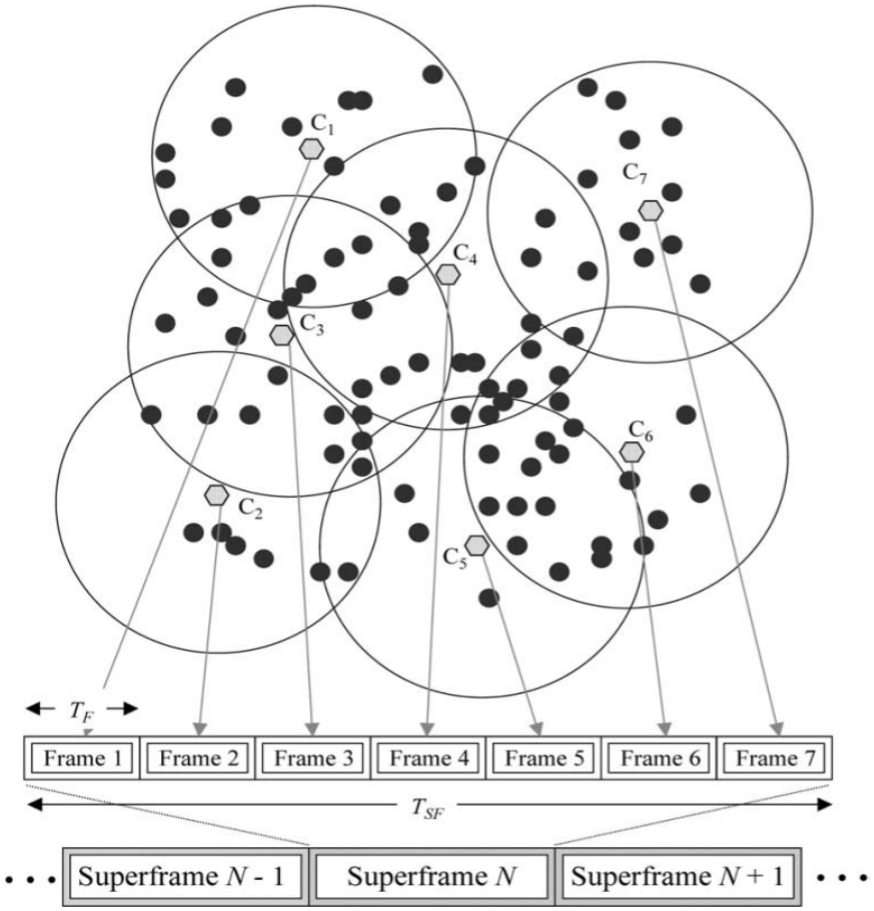

Fig. 1 MH-TRACE clustering and medium access for a portion of an actual distribution of mobile nodes. Nodes C through C are cluster head nodes.

b) Improving the Network Lifetime of MANETs Through Cooperative MAC Protocol Design

Jie Li and Xiaoyan Wang proposed a novel cross-layer Distributed Energy-adaptive Location-based CMAC protocol (DEL-CMAC). DEL-CMAC is designed based on the IEEE 802.11 Distributed Coordination Function (DCF).DCF is a widely used standard protocol for most of wireless networks. DEL-CMAC [2] is used to improve the performance of MANET in network lifetime and energy efficiency. To deal with the complicated medium access interactions an efficient Cooperative Medium Access Control(CMAC) protocol is needed. The existing CMAC protocol mainly focus on the throughput enhancement and not on energy efficiency.Effective relay selection strategy is introduced for best relay terminal and a cross layer optimal power allocation. Cooperative Communication (CC) is a technique for conserving the energy consumption in MANET. Spatial reuse is enhanced to minimize the interference among different connections by using novel NAV settings. When compared with IEEE 802.11 DCF and Coop MAC at relatively low throughput and delay degradation cost. cross-layer cooperative diversity-aware routing algorithm together with our DEL-CMAC is also used to conserve energy.

c) DELAR: A Device-Energy-Load Aware Relaying Framework For Heterogeneous Mobile Adhoc Networks

Wei Liu et al., proposed Device-Energy-Load Aware Relaying framework (DELAR) is used to achieve energy conservation. Energy conservation is the fundamental issue in heterogeneous mobile adhoc networks. It consist of powerful nodes (ie. P-nodes) and normal nodes (ie B-nodes). B-nodes are equipped with limited power sources like batteries. P-nodes have unlimited power supplies like solar cells. A hybrid transmission scheduling scheme, combining both the reservation-based and contention based medium access control schemes, to coordinate the transmissions among P-nodes and B-nodes. Mini-routing technique and the novel Asymmetric MAC (*A-MAC*) protocol[3] is introduced enable the MAC layer acknowledgements over unidirectional links due to the use of asymmetric transmission power levels between P-nodes and B-nodes. A multi packet transmission technique tofurther improve the delay performance. Energy conservation techniques such as power saving modes, transmission power control and power aware routing can be integrated to jointly achieve better energy conservation. DELAR reduce energy conservation and increase the lifetime of the network.

d) Energy Efficient Task Allocation over Mobile Networks

Carmela Comito et al, introduced a heuristic algorithm that balances the energy load among all the devices in the network. To consume energy and maximize network lifetime this algorithm is introduced. Energy-Aware Scheduling strategy[4] that assigns computational task over a network. Scheduler is used to find the task allocation. When compared to time-based traditional schedulers the proposed scheduler enhance the performance of the system. Energy-Aware Scheduler (1) is effective in prolonging network lifetime by reducing the energy consumption (2) is able to complete a greater number of tasks in the same experimental settings (3) in all the experiments performed, is able to keep alive all the devices.

e) Designing Energy Routing Protocol With Power Consumption Optimization in MANET

Golla Varaprasad et al, proposed Efficient power aware routing (EPAR). To improve the communication energy efficiency at individual nodes power aware is a important challenge. EPAR is used to increases the lifetime of network in MANET. EPAR must be able to handle high mobility of the nodes that often causes changes in the network. EPAR protocol [5] is compared with three other protocols (1) Proactive Energy-Aware Routing (2) Reactive Energy-Aware Routing (3) DSR protocol. In small size network the energy and throughput does not show any significant changes but in large networks DSR performance is inefficient. In medium and large networks EPAR and MTPR produced good result and good throughput. EPAR identifies the capacity of the node not by its residual battery power but by expected energy spent when forwarding the data packets. EPAR selects the path that has the largest packet capacity at the smallest residual packet transmission capacity. EPAR reduces for more than 20% total energy consumption and decrease the mean delay for high load networks. EPAR algorithm outperforms the original DSR algorithm by 65%

f) Cooperative Load Balancing and Dynamic Channel Allocation for Cluster-Based Mobile ad Hoc Sensor Networks

Bora Karaoglu et al, proposed lightweight dynamic channel allocation mechanism and cooperative load balancing strategy. In Dynamic Channel Allocation (DCA)[6] the channel controllers continuously monitor the power level in all the available channels in the network and assess the availability of the channels by comparing the measured power levels with a threshold. The channel coordinator starts using an additional Channel If the load on the channel controller increases beyond Capacity. Cooperative load balancing algorithm is that the active nodes can continuously monitor the load of the channel coordinators and switch from heavily loaded coordinators to the ones with available resources. Coordinated channel access protocols are well suited for uniform load distributions. This protocol is not suited for non-uniform load distribution as uncoordinated channel access. It is due to the Lack of on-demand dynamic channel allocation. In order to address this problem lightweight dynamic channel allocation mechanism and cooperative load balancing strategy are introduced in cluster based MANET. Here these two algorithms are implemented in coordinated MAC protocol named as MH-TRACE [1] for managing non uniform load distribution and propose CDCA-TRACE Before proposing CDCA-TRACE these two algorithms are incorporated in TRACE framework leading to DCA-TRACE and CMH-TRACE . In wireless network MAC protocol is classified as uncoordinated MAC and coordinated MAC protocol. In uncoordinated protocols such as IEEE 802:11, nodes contend with each other to share the common channel. Coordinated MAC protocols the channel access is regulated. Fixed or dynamically chosen channel controllers determine how the channel is shared and accessed. MAC protocol providing support for non-uniform load distributions. Integrating spatial reuse into a MAC protocol drastically increases bandwidth efficiency. This protocol utilized to improves throughput, energy consumption and inter-packet delay variation (IPDV). DCA-TRACE[6] includes two additional mechanisms on top of MH-TRACE: i) a mechanism to keep track of the interference level from the other CHs in each frame; and ii) a mechanism to sense the interference level from the transmitting nodes in each data slot in each frame. In this paper bandwidth is improved by using those algorithms. Energy must be made efficient by any of the algorithms.

g) QOS Topology Control With Energy Efficiency For MANET

Fujian Qin proposed an efficiently QoS algorithm. This algorithm dynamically adjusts the transmission power of mobile nodes to construct new topology which meets bandwidth and end-to-end delay constraints. This also minimizes the total energy consumption in network. It aims to construct a topology so that all traffic flows can meet the QoS requirement and decrease the total transmission power in network as more as possible. If the traffic on the given node pair can be divided along different paths, it is actually a problem about multi-commodity flows. For each node pair in network, once the bandwidth and delay cannot be met, the transmission power of nodes and add new links into the topology is adjusted so as to meet the QoS requirement. Two algorithms are proposed to construct QoS topology. (1) MST based QoS topology control algorithm (2) MIP based QoS topology control algorithm.

MST based QoS topology control algorithm

A minimum spanning tree (MST) is used for QoS topology controlling. Aim is to reduce the total transmission power; the minimal power will be chosen to add a new link. All node pairs are sorted in ascending order according to the distances between nodes. Then choose the shortest link which does not exist in the current topology and increase transmission power of the node until it can connect with another node along the link. Finally, the flows can meet the QoS requirement in the new topology.

MIP based QoS topology control algorithm.

A minimum incremental power (MIP) tree is also used for QoS topology controlling. Same like MST, new nodes are added to the tree one at a time until all nodes are included in the MIP tree. However, it is based on the standard Prim algorithm with fundamental difference. Whereas the inputs to Prim's algorithm are the link costs, MIP must dynamically update the costs at each step to reflect the fact that the cost of adding new nodes to a transmitting node's list of neighborhoods is the incremental cost.

III. CONCLUSION

Energy efficiency in non uniform load distribution is one of the issues in the area of research in the field of mobile adhoc network. To overcome this issue several protocols and algorithms are discussed in this survey. This paper presented various approaches and researches in design and development of energy efficiency for mobile ad hoc networks.

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