



A Survey on Energy efficient protocols in Mobile Adhoc Networks

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ABSTRACT

Mobile adhoc network is an independent group of mobile nodes in which communicate over relatively bandwidth restricted wireless links. The nodes in mobile adhoc network are mobile so that the topology of the network may change quickly and unpredictably over time. In a mobile adhoc network it is very difficult to achieve significant improvement in the energy efficiency and enhance lifetime of the network. Because lacking of power in any wireless device become useless. In the physical layer, if a node is not involve in transmission, the transceiver keep on in an idle mode and to listen if there is any incoming transmissions. Because nodes consume less amount of energy for listening is lesser than for data communication. Suppose, if there is infrequent transmissions destined to the station, idle listening takes wastage of energy. Therefore, in order to reduce the energy without impacts in network connectivity, different types of wakeup schemes are used like operation of power saving protocols and different asynchronous Quorum based power conservation protocols. The power saving protocols allows mobile nodes to switch to a low power sleep mode. In the asynchronous wakeup protocols, uses instead of idle listening it permits station to sleep to suspend the transceiver when there is no transmission of data. Particularly, in the following survey to analyze the different wakeup methods how to improve the network lifetime.

Key terms: Mobile adhoc network, energy consumption, Lifetime of network, wakeup schemes

INTRODUCTION

Mobile adhoc network is one of the specific categories in wireless network. In this type of network, the set of mobile network interfaces may form a temporary network without depends on the central infrastructure system. The mobile adhoc network is decentralized in which all network movement which includes network topology identifying and message delivery must be performed by the nodes themselves. Adhoc network is applicable can be applied anywhere in which there is no particular infrastructure. There are many

applications in mobile adhoc networks. The day-to-day applications like electronic mail and file transfer are to be considered easy in adhoc network. Adhoc network is used in military battlefield which permits to military to take benefit of commonplace network technology to preserve an information network between soldiers, vehicles and the headquarters. Also it is used in emergency/rescue applications for disaster relief efforts like fire, flood and earthquake.

There is some uniqueness in mobile adhoc networks when compared to the conventional networks. In MANET each and every node acts as both host and router. Nodes in mobile adhoc network can leave or join the network at anytime. Mobile nodes are differentiated with less memory, power and light weight features. The consistency, effectiveness and stability of wireless links are lesser when compared to the wired links. MANETs are different types which includes InVANETs-Intelligent vehicular adhoc networks that make utilization of artificial intelligence to deal with unexpected circumstances like vehicle collisions and accidents. Vehicular adhoc networks are used in effectual communication with other vehicles to communicate with roadside equipments. Internet based Mobile adhoc networks aids to link fixed as well as mobile nodes.

It is very challenging to maintain an optimized lifetime of a routing path in mobile adhoc networks. Because the energy level of the node depends on the size, model, property and capability of the battery. Due to the node activities like transmission, reception and overhearing there is continuous depletion of energy in batteries. Depletion of energy in nodes particularly the intermediate ones interrupt communication and results in changes to the network topology. One of the important problem for all varieties of transportable devices supported by battery power is power saving. The battery power is a restricted resource and it is expected that battery technology is not likely to progress as fast as computing and communication technologies. Therefore, to lengthen the lifetime of the batteries is a significant problem specifically for mobile adhoc networks.

In the following survey, numerous wakeup methods have been proposed for improving network lifetime. The power saving mode operation is taken as follows [5]. For each station, the time axis is segregated into beacon intervals. For every beacon interval, the station is desirable to wait awake during the entire announcement traffic indication message window. To announce the station existence, a beacon frame is transmitted at the target beacon transmission time. But the power mode operations only when the timers on stations are synchronized. As synchronizing the clocks in Manet is high expensive. To extend the station's awake periods the Asynchronous Quorum-based method is used [4]. The quorum system is nothing but set of quorums. During the beacon intervals in which the numbers are precised in the quorum, a station must wait awake after the Announcement Traffic Indication Message window, even if there is no data communication. This awake/sleep schedule replicates every n beacon intervals which is called the cyclic pattern. But this scheme is not applicable for delay-tolerant networks.

WAKE UP MECHANISMS

Atsushi Iwata et.al suggested scalable routing methods for mobile adhoc networks [1]. To consider the large number of mobile stations which are interrelated in multi-hop wireless networks. Some of the applications of wireless networks are recuperate the disaster information, law enforcement and military applications. The key characteristics of the system are large users, high mobility and without any fixed infrastructure it operates. To examine the routing methods that is applicable for large populations and can handle mobility. Furthermore, to address the requirement to support multimedia communications with less delay for interactive traffic and quality-of-service support for real-time streams. This problem is virtually pertinent while one can foresee that in the near future most of the commercial laptops and personal digital assistants (PDA's) will be equipped with radios enabling them to form ad hoc "virtual" wireless networks. This problem is very difficult due to the presence of both large numbers and mobility. If the nodes are stationary, the more population can be efficiently handled with traditional routing. In contrast, when nodes move the hierarchical partitioning must be simultaneously updated. If there is fixed infrastructure, the mobile IP solutions are work well. But this method is not applicable for all types of applications.

A. Bruce McDonald et.al suggested mobility based framework for adaptive clustering in mobile adhoc networks. [2] This method dynamically

organizes the mobile nodes in adhoc networks into clusters so the probability of the availability can be bounded. The main target of the clusters is to assist for decreasing the far-reaching impacts of topological modifications while balancing the requirement to support more optimal routing. In adhoc networks a mobility model is developed and it is used to derive expressions for the probability of path availability as a function of time. This model provides the basis for dynamically group the nodes into clusters by utilizing an effective distributed clustering method. However the criteria for the organization of the cluster depends on the path availability and the topology of the cluster. Subsequently, this method supports an adaptive hybrid routing architecture which can more responsive and effectual when mobility rates are low and more efficient when mobility rates are high.

Bong Jun Choi et.al suggested an adaptive asynchronous methods for delay-tolerant networks [3]. Delay-tolerant networks are characterized by recurrent disruptions and long delayed connections because of node failure, high mobility, sparse deployment of nodes etc. So, in the delay-tolerant many of the mobility situations depends on the mobile devices which have restricted energy and the main problem is decrease the lifetime of the network. In this method according to the density of the nodes and traffic load requirements the sleep schedules are decided. These adaptive protocols balance the energy consumption and network connectivity. Some of the power organization protocols are utilized for delay-tolerant networks. But these protocols require global organization of clocks that is complicated to complete in sparsely connected multi-hop networks. These are not better energy efficient because of frequent beacons and long idle listening. This protocol provides multiple levels of power saving and high efficiency of energy under intermittent connectivity for decreasing energy consumption. But the main drawback is high computation complexity.

Chih-Min Chao et.al suggested quorum based sleep/wake protocol to preserve energy and to improve network lifetime [4]. In the power saving mode, each and every node is assumed to be synchronized with the others. For this time is categorized into a series of beacon intervals. At the beginning of every beacon interval, every host must stay awake for a certain period of time called the Adhoc traffic indication message window. The Adhoc traffic indication message window is the time period used by hosts to announce to those in the doze state that there are packets pending. A node will listen to these announcements to decide if it requires

to remain in the awake state. But this scheme fails to regulate sleep duration of node according to the traffic. The opportunity of making a trade off between the delay and awake time of a node, in which a node wakes up less frequently with a small enlarge in delay in order to preserve energy. This scheme prolongs sleep duration and reduces energy consumption but it has high delay. A quorum based protocols are used to enlarge the lifetime of the battery of a node, by permitting the device to sleep during consecutive beacon intervals. Inheriting the features of a quorum the nodes are guaranteed to be awake during some of the concurrent beacon intervals. The main idea was to enlarge the duration of sleep of a node, in order to preserve energy and at the same time increasing the delay. Wake up frequency is generally decided by the traffic load of a node. For a different quorum size, to balance the efficiency and increase in latency. But in this method, there is high computation complexity.

Winston K.G. Seah et.al suggested a d-hop clustering algorithm based on mobility for mobile adhoc networks [6]. To overcome the problem of scalability clustering algorithm is used. To maintain effectual topology manet dynamically organized into groups called clusters. A mobility based d-hop clustering algorithm is utilized to form a d-hop clusters according to the mobility metric. To guarantee the stability of cluster the formation of clusters is decided by the mobility pattern. To examine that the mobile users in manet may move in groups. This is called group mobility. In this algorithm, firstly MobDhop forms non-overlapping two-hop clusters related to other clustering methods. After that these clusters instigate a merging process among each other if they could listen to one another via gateways. Only if the newly formed clusters accomplish particular level of stability, the merging process will be successful. Many of the clustering methods form two-hop clusters that may be not helpful in large MANETs. As a result, this d-hop clustering algorithm is designed to form d-hop clusters which are more flexible in diameter of the cluster. The diameter of clusters is adaptive to the movement pattern of the mobile nodes. This method is very simple and low overhead. During the cluster formations, cluster head changes and handovers are kept to be minimum.

Javed Aslam et.al proposed a binary sensor method for tracking issue [7]. Sensor networks are used for sensing and monitoring events and to track objects. Different sensing modalities which includes temperature, sound, light and vibrations may be used in the system depends on the target. In some of the

applications, the sensor may make as small as one bit of information at each and every point of time. In the binary model assumption in which each sensor network has number of sensors can find one bit of information and transmit this bit to a base station. To examine the minimalist binary sensor network in the situation of a tracking application and show that is applicable to obtain methodical constraints on the movement of the object and to derive tracking algorithm. The sensors in a binary sensor network model have only one bit of information which provides precise calculation about the direction of motion of the object but do not have information to find the exact object location. The tracking algorithm consists of three postulations. Firstly, the region can sense the target approach or moving away. The range of sensors mentioned that the size of the region in which the active evaluation of the sensor network takes place. In the second postulation, from each sensor the bit of information is obtainable in a centralized repository for processing. The third assumption is that an additional sensor which supplies proximity information as a single bit is obtainable. This kind of sensor may be urbanized as an IR sensor with thresholding which depends on the desired proximity range and can also derived from the same basic sensing element that provides the original direction bit of information. But this method is not applicable for multiple target tracking.

Laura Marie Feeney et. al suggested energy-aware design and evaluation of network protocols for reducing energy consumption in mobile adhoc networks. There are some new perspectives in the design of the protocol [8]. Firstly, it is clearly to understand the energy consumption and utilization of bandwidth is not same. It is essential to consider not only the cost taken for data transmitting and also for receiving and the discarding the data packets. Therefore, in the designation process to consider the proportions of broadcast and point-to-point traffic utilized by the protocol. Secondly the association between the speed of transmission and the whole energy consumption is difficult. To reduce the transmission and reception times only saves energy at packet level. There are some problems involved in this process. The reduced range of transmission leads the number of hops needed is higher in multi-hop environment. But it minimizes the number of neighbours affected by each and every transmission. Because the channel attainment overhead is huge, small packets have unreasonably high energy costs. Finally, in adhoc mode operation takes high idle cost when compared to operation in conjunction with a base station. But the main disadvantage of this

method is high energy consumption and overhead leads to high cost.

P. Basu et.al proposed a new mobility metric for mobile adhoc networks [9]. This metric is based on ratio between the received power levels of consecutive transmissions evaluated at any node from all of its neighbours. By utilizing this mobility metric is subsequently utilized for cluster formation. This can be used for enhancing scalability of services such as routing in such networks. Because clustering is a significant method for enforcing hierarchy and management of mobile adhoc networks. This helps in decreasing the complexity in management of information about the mobile nodes and therefore simplifies some of the necessary processes and allocation of bandwidth. Mobility of nodes causes clusters to get interrupted and thus triggers re-clustering. As a result, the utilization of mobility information for cluster formation is a sensible intention. A distributed clustering method is suggested based on the use of this mobility metric for choosing the cluster heads and demonstrate that it leads to more stable cluster formation than the lowest-ID clustering algorithm. The mobility metric is utilized for capturing and quantifying the motion of nodes. This metric is geometric in the sense in which the speed of a node is evaluated relative to other nodes. In a pair of nodes, the mobility measure is referred as the complete relative speed in an average over time.

Shouwen Lai et.al suggested heterogeneous quorum based wakeup scheduling scheme for wireless sensor networks [10]. To preserve energy, quorum based wakeup scheduling schemes are used for asynchronous wakeup scheduling. In this method time axis for each node is categorized into beacon intervals. For a specified integer n , a quorum system describes a cycle pattern that denotes the awake/sleep scheduling pattern during n simultaneous beacon intervals for every node. This is called cycle length on the other hand the pattern recurs every n beacon intervals. During every beacon interval a node may wake or sleep. This method can assure in which at least one awake interval overlaps between two adjacent nodes. But this has high latency. The schemes can make sure that two nodes assume dissimilar quorum systems for their wakeup schedules. These wakeup schedules can attend to each other at least once in enclosed time intervals. To suggest two methods such as cyclic quorum system pair and grid quorum system pair. The cyclic quorum system pair includes two cyclic quorum systems which gives significant energy saving ratio for asynchronous wakeup scheduling. A cyclic quorum

pair is rapidly assembled and to present a fast construction scheme that is based on the multiplier theorem and the difference pair defined as follows. In the grid system pair, to establish that any two grid quorum systems will routinely form a grid quorum pair.

Ting-Chao Hou et.al suggested an access based clustering methods for mobile adhoc networks [11]. In this work, cluster heads are to be selected for large-scale adhoc networks and a new access-based clustering protocol is used. The main difference in the existing method is the operation of clustering is performed in protocol point of view. That is nothing but providing the rules for communication. Also design the multiple access scheme and the affects of clustering operations are taken into account. The main objective is to provide generic, flexible, quickly deployed and stable cluster structure for upper-layer protocols. The performance of an access based clustering protocol in terms of overhead of clustering and stability of clustering can also to be considered. In this design, the broadcast scheduling of control messages also considered. In this scheme, the overhead is minimized in cluster formation. But the drawback is high computation and expensive.

Wenli Chen et.al proposed a protocol for managing mobile wireless adhoc networks [12]. Network management is one of the significant process of domineering a complex data networks so that to increase the efficiency and productivity. In this method, there are four processes such as Collection of data, process the data, analyzing the data and problem fixing. To complete this process, network management can be classified into five areas. There are fault management, configuration management, safety management, presentation management and accounting management. In the fault management it involves discovering, isolating and fixing issues in the network. This management of network is taking accountable for certifying smooth and continual operation of the network. Configuration management involves initialization and shutdown of the network. This process involves maintaining, adding and updating new network components. Security management is taking responsible for controlling network components and information of the network. Performance management is responsible for gathering network statistics and improve performance of the network. Accounting management involves tracking network utilization and it can be used to allocate network resources. This method is flexible and it can be used in adhoc networks in which the features of the devices are diverse.

Xiaoyan Hong et.al suggested a group mobility method for mobile adhoc networks. This mobility model in MANET is application dependent relative [13]. Additionally, to except that the numerous mobility patterns which impacts the performance of different network protocols in different ways. Therefore, to develop a flexible mobility framework that permits us to model different applications and network scenarios and to discover the impacts of mobility of different scenarios. This mobility structure is nothing but Reference point group mobility model. In this model, the mobile nodes are prearranged by groups according to their local relationships. To observe the special effects of mobility on (a) network topology and connectivity (b) routing protocols. The clustering method can minimize the topology modifications on routing.

CONCLUSION

A mobile adhoc network is group of mobile nodes which has no fixed infrastructure. In mobile adhoc networks energy is a limited resource. So, to extend the lifetime of the network is an important concern. Without energy any wireless device is useless. So, in order to preserve energy several wakeup schemes such as power saving protocols, quorum based protocols are proposed. In a quorum based scheme the time is categorized into a series of beacon intervals. The Adhoc traffic indication message window is the time period utilized by the nodes to proclaim to those in the doze state that there are packets pending. A node will listen to these announcements to decide if it requires to remain in the awake state. But this scheme fails to regulate sleep duration of node according to the traffic. At the end of the survey we conclude that the effective wakeup scheduling scheme is proposed to improve network lifetime and to enhance the network connectivity.

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