Energy Efficiency Routing Technique Using Two Hop Transmission in MANET

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Abstract – Mobile Adhoc Network consists of petite sensor nodes with sensing, working out and wireless communication capabilities. Now a day, it is discovery wide applicability and increasing deployment, as it enables reliable monitoring and psychoanalysis of location. The design of routing protocols for MANET is influenced by many challenging factors like fault tolerance, energy efficiency, scalability, latency, power consumption and network topology. In this paper, focused on minimizing end to end latency and energy efficiency as primary design objectives of routing protocols for MANET without overshadowing the other design factors which can be present a survey of low latency, energy efficient and time critical routing protocols. Markov chain-based framework protocol, a reactive network protocol which is well suited for time critical data sensing applications is quite efficient in terms of energy consumption and response time. This is a hybrid network protocol which gives the overall picture of the network at periodic intervals in a very energy efficient manner. This is a Stateless, highly efficient and scalable protocol for sensor networks which achieves end to end soft real time communication by maintaining a desired delivery speed across the network through a novel combination of feedback control and non deterministic geographic forwarding.

Keywords: **Ad-Hoc Network, Energy Efficiency, Markov chain model,power consumption, Two Hop relay**

I. INTRODUCTION

A.Mobile Adhoc Network

Mobile Adhoc network methods belong to either one of two categories: distributed and centralized. The centralized approach assumes that the existence of a particular node is cognizant of the information pertaining to the other network nodes. Then, the problem is modeled as a graph partitioning problem with particular constraints that render this problem NP-hard. The central node determines clusters by solving this partitioning problem. However, the major drawbacks of this category are linked to additional costs engendered by communicating the network node information and the time required to solve an optimization problem.Mobile Adhoc Network consists of hundreds to thousands of sensor nodes that have the ability to communicate among themselves using radio antenna. These nodes are usually small in size with limited processing power, limited memory and limited energy source. Hence they all work together in collaboration as a network towards achieving a common goal of sensing a physical parameter over a large geographic area with greater accuracy. Because they are amenable to support a variety of real-world applications the MANET are considered as powerful sensing network to the present day world. Sensor nodes are constrained in energy supply and bandwidth. Thus, innovative techniques that eliminate energy inefficiencies that would shorten the lifetime of the network are highly required. Such constraints combined with a typical deployment of large number of sensor nodes pose many challenges to the design and management of MANET and necessitate energy awareness at all layers of the networking protocol stack.

B. Routing Design Issues in MANET

Routing in MANET is very challenging due to the inherent characteristics that distinguish these networks from other wireless networks like mobile ad hoc networks or cellular networks Due to relatively large number of sensor nodes; it is not possible to build a global addressing because overhead of ID maintenance is high. In contrast to typical communication networks, almost all applications of sensor networks require the flow of sensed data from multiple sources to a particular Base station (BS). This, however, does not prevent the flow of data to be in other forms (e.g., multicast or peer to peer). Sensor nodes are tightly constrained in terms of energy, processing, and storage capacities. Thus, they require careful resource management, which is not supported by other network protocol. Position awareness of sensor nodes is important since data collection is normally based on the location which is not addressed by legacy protocols. Hence traditional IP-based protocols may not be applied to MANET.

Many new algorithms have been proposed for the routing problem in MANET.These routing mechanisms have taken into consideration the inherent features of MANET along with the application and architecture requirements. The task of finding and maintaining routes in MANET is nontrivial since energy restrictions and sudden changes in node status (e.g., failure) cause frequent and unpredictable topological changes. To minimize latency and energy consumption, routing techniques proposed in this literature employ some well-known routing tactics e.g., data aggregation and clustering.

C. Network Architecture

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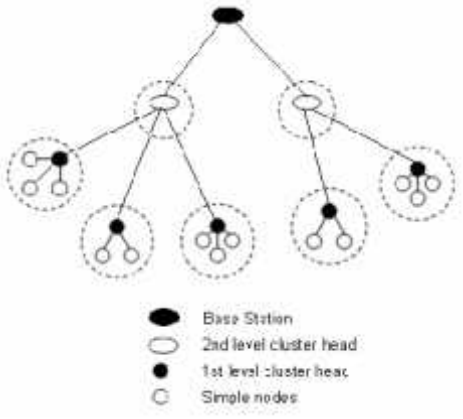
This system proposed an algorithm called 2HR (f, g) where f is the Threshold value of each node and g is the number of nodes in a cluster. It uses Markov chain model to determine the path between the source and the destination. A Markov chain, named after Andrey Markov, is a mathematical system that undergoes transitions from one state to another, between a finite or countable number of possible states. It is a random process usually characterized as memory less: the next state depends only on the current state and not on the sequence of events that preceded it. This specific kind of "memory lessness" is called the Markov property. Markov chains have many applications as statistical models of real-world processes.

It consists of a base station (BS), sensing nodes and cluster heads. BS is away from the sensing nodes, through which it can be used by the user that can also be delivered by end user who can access data from the sensor network. All the nodes in the network are homogeneous and begin with the same initial energy.



i.Hierarchical clustering

The BS however has a constant power supply and so, has no energy constraints. It can transmit with high power to all the nodes. Thus, there is no need for routing from the BS to any specific node. However, the nodes cannot always reply to the BS directly due to their power constraints, resulting in asymmetric communication. This model uses a hierarchical clustering scheme. In hierarchical clustering each cluster has a cluster head (1st level cluster head) which collects data from its cluster members, aggregates it and sends it to the BS. The 1st level cluster heads in turn form a cluster with 2nd level cluster head which reports directly to the BS. The BS forms the root of this hierarchy and supervises the entire network. Hierarchical clustering In Hierarchical clustering, as all nodes get a chance to become cluster head for a cluster period, the energy consumption is uniformly distributed.Hierarchical or cluster-based routing, originally proposed in wire line networks, are well-known techniques with special advantages related to scalability and efficient communication. As such, the concept of hierarchical routing is also utilized to perform energy-efficient routing in MANET.

In a hierarchical architecture, higher energy nodes can be used to process and send the information while low energy nodes can be used to perform the sensing in the proximity of the target. This means that creation of clusters and assigning special tasks to cluster heads can greatly contribute to overall system scalability, lifetime, and energy efficiency. Hierarchical routing is an efficiency way to lower energy consumption within a cluster and by performing data aggregation and fusion in order to decrease the number of transmitted messages to the BS. Hierarchical routing is mainly two-layer routing where one layer is used to select cluster heads and the other layer is used for routing.

II. LITERATURE SURVEY

A. A survey of Mobile Adhoc network

A mobile ad-hoc network is a self –configuring infrastructure less network of mobile devices connected by wireless links. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may be connected to the larger Internet.

MANETs are a kind of wireless ad-hoc networks that usually has a routable networking environment on top of a link layer ad hoc network. Due to a lack of infrastructure support, each node act as a router, forwarding data packets for other nodes. Most previous research in ad hoc networks focused on the development of dynamic routing protocols that can efficiently find routes between two communicating nodes.

Mobile AdHoc Network methods belong to either one of two categories: distributed and centralized. The centralized approach assumes that the existence of a particular node is cognizant of the information pertaining to the other network nodes. Then, the problem is modeled as a graph partitioning problem with particular constraints that render this problem NP-hard. The central node determines clusters by solving this partitioning problem. However, the major drawbacks of this category are linked to additional costs engendered by communicating the network node information and the time required to solve an optimization problem.

Mobile Adhoc Network (MANET) , an element of pervasive computing, are presently being used on a large scale to monitor real-time environmental status. However these sensors operate under extreme energy constraints and are designed by keeping an application in mind. Designing a new wireless sensor node is extremely challenging task and involves assessing a number of different parameters required by the target application, which includes range, antenna type, target technology, components, memory, storage, power, life

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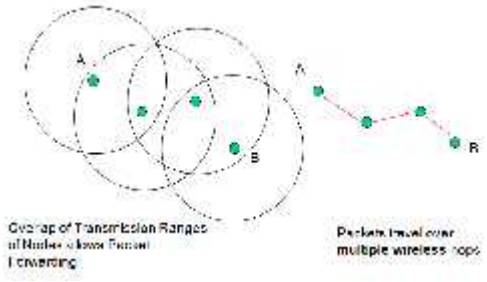
time, security, computational capability, communication technology, power, size, programming interface and applications. MANET are mostly used in, low bandwidth and delay tolerant, applications ranging from civil and military to environmental and healthcare monitoring.MANET as shown in figure generally consist of one or more sinks (or base stations) and perhaps tens or thousands of sensor nodes scattered in a physical space. With integration of information sensing, computation, and wireless communication, the sensor nodes can sense physical information, process crude information, and report them to the sink. The sink in turn queries the sensor nodes for information.

MANET have several distinctive features like:

- Unique network topology
- Diverse applications
- Unique traffic characteristics, and
- Severe resource constraints



ii. Typical MANET

MANET node is comprised of low-power sensing devices, embedded processor, and communication channel and power module. The embedded processor is generally used for collecting and processing the signal data taken from the sensors. Sensor element produces a measurable response to a change in the physical condition like temperature, humidity, particulate matter (e.g. CO2) etc. The wireless communication channel provides a medium to transfer the information extracted from the sensor node to the exterior world which may be a computer network and inter-node communication. However, WSN using IEEE 802.15.4 Wireless Personal Area Network protocol (WPAN) or Bluetooth is complicated and costly. Using RFID to implement wireless communication is relatively simple and cheap. Zigbee protocol can also be used for communication; alternatively the RS232 standard for wireless transmission of data can be adopted because the data rate of RFID and that of RS232 is same in terms of bits per second (bps).

Wireless sensing technology comprising self-reliant, battery-powered nodes is pushing sensing to the extreme.Sensor modules, motes, and ICs all have had a huge impact on the industry as parts of wide-ranging wireless sensor networks. In this section they compare the design of MANET sensor nodes proposed by a number of research groups. The comparison is broadly based on following technical features are Design Range, Antenna design, Target Technology, Components, Non Volatile Storage, Communication technology, Power, Security measure, Size, Programming.

B. Reactive Networking:

In this section, they present a new network protocol called *Markov chain protocol.* It is targeted at reactive networks and is the first protocol developed for reactive networks, to our knowledge. In this scheme, at every cluster change time, in addition to the attributes, the cluster-head broadcasts to its members.

Hard Threshold **(**HT**):** This is a threshold value for the sensed attribute. It is the absolute value of the attribute beyond which, the node sensing this value must switch on its transmitter and report to its cluster head.

Soft Threshold **(**ST**):** This is a small change in the value of the sensed attribute which triggers the node to switch on its transmitter and transmit.

The nodes sense their environment continuously. The first time a parameter from the attribute set reaches its hard threshold value, the node switches on its transmitter and sends the sensed data. The sensed value is stored in an internal variable in the node, called the sensed value (SV). The nodes will next transmit data in the current cluster period, only when both the following conditions are true:

1. The current value of the sensed attribute is greater than the hard threshold.
2. The current value of the sensed attribute differs from SV by an amount equal to or greater than the soft threshold.

Whenever a node transmits data, SV is set equal to the current value of the sensed attribute. Thus, the hard threshold tries to reduce the number of transmissions by allowing the nodes to transmit only when the sensed attribute is in the range of interest. The soft threshold further reduces the number of transmissions by eliminating all the transmissions which might have otherwise occurred when there is little or no change in the sensed attribute once the hard threshold.

C. Hybrid Networking:

In this work, we introduce this new technique developed for hybrid networks, CHs are decided, in each cluster period; the cluster head first broadcasts the following parameters:

Attributes: This is a set of physical parameters which the user is interested in obtaining data about.

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Thresholds: This parameter consists of a hard threshold (HT) and a soft threshold (ST). HT is a particular value of an attribute beyond which a node can be triggered to transmit data. ST is a small change in the value of an attribute which can trigger a node to transmit data again.

D. ACCESS Methods

It maintains a desired delivery speed across sensor networks by both diverting traffic at the networking layer and locally regulating packets sent to the MAC layer.
It consists of the following components:

- An API
- A neighbor beacon exchange scheme
- A delay estimation scheme
- The Stateless Non-deterministic Geographic Forwarding algorithm (SNGF)
- A Neighborhood Feedback Loop (NFL)
- Backpressure Rerouting
- Last mile processing

SNGF is the routing module responsible for choosing the next hop candidate that can support the desired delivery speed. NFL and Backpressure Rerouting are two modules to reduce or divert traffic when congestion occurs, so that SNGF has available candidates to choose from. The last mile process is provided to support the three communication semantics mentioned before, exchange provides geographic location of the neighbors so that SNGF can do geographic based routing. The details of these components are discussed in the subsequent sections, respectively.

III. PROBLEM DESCRIPTION

A MANET consists of hundreds to thousands of sensor nodes that have the ability to communicate among themselves using radio antenna. These nodes are usually small in size with limited processing power, limited memory and limited energy source. Hence they all work together in collaboration as a network towards achieving a common goal of sensing a physical parameter over a large geographic area with greater accuracy. Because they are amenable to support a variety of real-world applications the MANET are considered as powerful sensing network to the present day world.The flexibility in its use is also the cause for it to be a challenging research and engineering problem, with sensing computation and wireless communication capabilities. Now days, it is finding wide applicability and increasing deployment, as it enables reliable monitoring and analysis of environment. The design of routing protocols for MANET is influenced by many challenging factors like fault tolerance, energy efficiency, scalability, latency, power consumption and network topology.

IV. DATA MODEL

A.2HR Algorithm

This work proposes a new 2HR- (f, g) algorithm, where each packet is delivered to at most distinct relay nodes and can be accepted by its destination if it is a fresh packet to the destination and also it is among packets of the group the destination is currently requesting. This algorithm is general and covers all the available two-hop routing protocols. To capture the complex packet delivery process in a MANET with 2HR, we further develop a general theoretical framework based on the multidimensional Markov chain, which covers the available frameworks for conventional two-hop relay analysis as special cases.

Without loss of generality, focus on a tagged flow and denote its source node and destination node as S and D, respectively. It is illustrated that with the 2HR- algorithm, the source node will deliver at most copies of a packet to distinct relay nodes, while the destination may finally receive the packet from one relay node. Notice that each node can be a potential relay for other (n-2) flows (except the two flows originated from and destined for itself). Thus, to support the operation of the 2HR- algorithm, we assume that each node maintains individual queues at its buffer.One local queue for storing the packets that are locally generated at the node and waiting for their copies (up to copies for each packet) to be dispatched, one already-sent queue for storing packets whose copies have already been dispatched but their reception status are not confirmed yet (from destination node), and parallel (n-2) relay queues for storing packets of other flows (one queue per flow).

The theoretical framework is powerful in the sense it enables not only the mean value, but also the variance of packet delivery delay to be derived analytically with a careful consideration of the important medium contention, interference, and traffic contention issues. Extensive simulation and theoretical results are provided to validate the 2HR algorithm and the Markov chain theoretical framework. These results indicate that the theoretical framework is very efficient in packet delay analysis, and more importantly, the new 2HR algorithm makes it possible for us to flexibly control the packet delivery delay in a large region through the proper settings of f and g. The clustering will be done on slotted system and a fast mobility scenario, where only one-hop transmissions are possible within each time-slot, and the total number of bits transmitted per slot is fixed and normalized to one packet.At the beginning of each time-slot, each node independently and uniformly selects a cell among all m cells and stays in it for the whole time-slot. The protocol model with guarding factor in is adopted as the interference model here. We further assume a permutation traffic pattern in the saturated case, where each node is a source and at the same time a destination of some other node, and each source node always has packets waiting for delivery. For a given source–destination pair, we call the traffic between them as a flow.

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To support the group-based transmission in the 2HRalgorithm, the source node divides packets waiting at its local queue into consecutive groups, packets per group, and labels each packet with a send group number and a sequence number. Similarly, the node also maintains a request group number and an indicator vector. The is a -bit binary vector that records the reception status of current requesting group at , where the th bit is set as 0 (resp. 1) if the th packet of the current requesting group has (resp. has not) been received. To simplify the analysis, we assume that each relay node will carry at most one packet for any particular group.

V. SYSTEM MODEL

A.Cluster Formation

The sensors will be grouped in order to transfer data. This will be done with refer to spread code. Spread code is a unique code that will be assigned to every node in the network in order to detect the sensor in the network. This code will be the prime factor for clustering in the AdHoc network.

B.Spread code

Spread code is used to strengthen the signal. This secrete code scheme is used for on-line updating of nodal information, with its mean proven to converge to the true position. Based on nodal contact probabilities, a set of functions including Sync (), Leave (), and Join () are devised for cluster formation and gateway selection. Finally, the gateway nodes exchange network information and perform routing.

C.Data Transmission

The path selection, maintenance and data transmission are consecutive process which happen in split seconds in real-time transmission. Hence the paths allocated priory is used for data transmission. The first path allocated previously is now used for data transmission. The data is transferred through the highlighted path. The second path selected is now used for data transmission. The data is transferred through the highlighted path. The third path selected is used for data transmission. The data is transferred through the highlighted path.

D.2hr- Algorithm

The clustering will be done on slotted system and a fast mobility scenario, where only one-hop transmissions are possible within each time-slot, and the total number of bits transmitted per slot is fixed and normalized to one packet. The nodes independently roam from cell to cell, following the bi dimensional i.i.d. mobility model. At the beginning of each time-slot, each node independently and uniformly selects a cell among all m cells and stays in it for the whole time-slot. The protocol model with guarding factor in is adopted as the interference model here. We further assume a permutation traffic pattern in the saturated case, where each node is a source and at the same time a destination of some other node, and each source node always has packets waiting for delivery..

E. ICI Management

The inter cell communication is the best way of sharing information between co ordinates. The cells should be sharing their information with each other so that the node failure can be detected easily. Also the routing table will be easy to build if making this type of decomposition in the network. The decomposition needs a parameter called secret code.

VI. CONCLUSION

Proposed system is sensor technology called 2HR which allow better, cheaper, and smaller sensors to be used in both military and civilian applications, especially when the environment is harsh, unreliable, or even adversarial. A large number of sensors are usually deployed in order to achieve quality through quantity. On the other hand, sensors typically communicate through wireless networks where the network bandwidth is much lower than for wired communication. These issues bring new challenges to the design of DWSN (Distributed Wireless Sensor Networks). First, data volumes being integrated are much larger. Second, the communication bandwidth for wireless network is much lower. Third, the environment is more unreliable, causing unreliable network connection, noisy background, and increasing the likelihood of input data to be in faulty.

The results in this paper indicate that the control parameters and of the 2HR- algorithm may affect the packet delay and its variance in very different ways, and a target packet delay (and delay variance) requirement can be actually achieved through various combinations between f and g. Thus, a careful tradeoff among packet delay (and delay variance) requirement, packet redundancy, and node buffer limitation (related to) should be examined for the efficient support of a target application.

Resource optimization plays vital role in Mobile Ad hoc network since such type of network are not having resources in ample amount. Working with limited resources like bandwidth, battery power, buffer space etc. create problems during data transmission in the network this work presents methods for data gathering in sensor networks. The method is based on the flexible setting of thresholds and the analysis on the content to be sent over the network. The sensor network is more unreliable, so the data should be secured from loss through this type of clustering activity.

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