



AN EFFICIENT DATA TRANSMISSION USING RELAY NODE BASED OPPORTUNISTIC ROUTING

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Abstract - The WSN network contains the combination of Infra Structure Network and Ad hoc Networks. WSN network have high reliability as the network failure will be easily managed as the network will be well equipped. In this work, we mainly focus on minimizing end to end latency, energy efficiency and congestion control as primary design objectives of routing. It is implemented by three hops routing protocol which considers three hops to reach the destination. It uses at most two hop in the ad hoc transmission mode and one hop in the cellular transmission node. By implementing three hop routing the reliability of network will be more as the data failure will be highly addresses. So the node selection will be from both the network. In order to select the nodes we are considering the threshold value of each node. The threshold value is the unique code assigned to each node. The clustering of nodes will be based on the threshold value assigned to it. The threshold value is to maintain security in the network so that no unauthorized spoofing nodes may enter the network. This threshold distribution and data transmission will be performed using TAS protocol. This work also implements overhearing technique in which the sending node shares its content with one or more other nodes before transmission so that the failure of node may be addressed. The main objective of our work is to transfer the information in a WSN network in a safe and secure manner.

INTRODUCTION

A WSN network consists of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants and to cooperatively pass their data through the network to a main location. Provide a bridge between the real physical and virtual worlds. Allow the ability to observe the previously unobservable at a fine resolution over large spatio-temporal scales. It has a wide range of potential applications to industry, science, transportation, civil infrastructure, and security. The more modern networks are bi-directional, also enabling control of sensor activity. The development of Hybrid Networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on.

The WSN network is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth.

The topology of the WSN networks can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding. Hybrid Networks are more difficult to implement than PC or Web-based applications. There are three reasons for this that we found. First, the connection of computing to real world workflows makes such applications complex in the sense that current software development focuses on digital workflows. Second there is the lack of software support for distributed Hybrid Networks systems [6]. Third, programming and managing wireless sensor nodes are difficult and complex tasks. Some initial solution ideas have been published for these problems. Complex integration of multiple Hybrid Networks has been addressed by Wireless, which focuses on the networking aspect. Another proposal named FLOW focuses on the abstract software generation aspect. Both proposals have in common that they expect certain technical properties from their sensor nodes and thus show example implementations for one type of sensor network only. Also, both systems are complex in themselves, requiring a developer to learn a complex technical software system.



Attempts to lower complexity in sensor networks by providing more abstract approaches have been developed in the context of TinyOS. abstraction patterns and interfaces were developed for the design of sensor node software, but this approach only focuses on one sensor node.

In areas in which there is little or no communication infrastructure or the existing infrastructure is expensive or inconvenient to use, wireless mobile users may still be able to communicate through the formation of an ad hoc network. In such a network, each mobile node operates not only as a host but also as a router, forwarding packets for other mobile nodes in the network that may not be within direct wireless transmission range of each other. Each node participates in an ad hoc plus infrastructure routing protocol that allows it to discover "Three-hop" paths through the network to any other node is introduced in this work. The idea of ad hoc networking is sometimes also called infrastructure less networking, since the mobile nodes in the network dynamically establish routing among themselves to form their own network "on the fly". Most Wi-Fi networks function in infrastructure mode. Devices on the network all communicate through a single access point, which is generally the wireless router. For example, let's say you have two laptops sitting next to each other, each connected to the same wireless network. Even when sitting right next to each other, they're not communicating directly. Some examples of the possible uses of this networking include students using laptop computers to participate in an interactive lecture, business associates and sharing information during a meeting, soldiers relaying information for situation awareness on the emergency disaster relief and battlefield personnel coordinating efforts after a hurricane or earthquake[3].

Threshold based routing

Spread Code is commonly used for secured data transmission in wireless communication as a way to measure the quality of wireless connections. Typically the energy of a signal fade having distance. In wireless networks, this is commonly defined by path loss. But not like wired networks that where the existence of a wired path between the receiver and sender are determines the correct reception of a message, the wireless communication network has to take a lot of environmental parameters to account the examples are background noise and interfering strength of other simultaneous transmission. SINR attempts to create a representation of this aspect.

So we have implemented the TAS protocol by maintaining the details about the sender and receiver and the communication media in the network. We implement this through overhearing concept. This TAS implements grouping of nodes depending on the threshold value so that the communication will be easy.

In overhearing, the data will be clustered relevancy to it is node and the data transferred according to it. The cluster will be formed in such a way that, cluster head and gateway will be appointed to each cluster. The message will be transmitted from sender to receiver.

So the basic idea is to autonomously learn unknown and possibly random mobility parameters and to the group of mobile node with similar mobility pattern to the same cluster. The nodes in a cluster can then interchangeably share their resources for load balancing and overhead reduction, aiming to achieve scalable routing and efficient.

In our protocol, a secured code called threshold for on-line updating nodal contact probability with it is mean proven to converge to the true contacts probability. Subsequently, a set of functions are devised to form clusters and select gateway nodes based on nodal contact probabilities. Finally gateway nodes exchange the network information and perform routing. The results show that it is achieve higher delivery ratio and significantly lower overhead and end-to-end delay, compared with its non-clustering counterpart.

Overview of Three Hop Routing

Since BSes are connected with a wired backbone, we assume that there are no power constraints and bandwidth on transmissions between BSes. We use intermediate nodes to denote relay nodes that function as gateways connecting an infrastructure wireless network and a mobile ad hoc network. We assume every mobile node is dual-mode; that is, it has ad-hoc network interface such as a WLAN radio interface and infrastructure network interface such as a 3G cellular interface[1]. DTR aims to shift the routing burden from the adhoc network to the infrastructure network by taking advantage of widespread base stations in a WSN wireless network[2]. Rather than using one multi-hop path to forward a message to one BS, DTR uses at most two hops to relay the segments of a message to different BSes in a distributed manner, and relies on BSes to combine the segments. Demonstrates the process of DTR in a WSN wireless network. We simplify the routings in the infrastructure network for clarity. when a source node wants to transmit a message stream to a destination node, it divides the message stream into a number of partial streams called segments and transmits each segment to a neighbor node. Upon receiving a segment from the source node, a neighbor node locally decides between direct transmission and relay transmission based on the QoS requirement of the application.



The neighbor nodes forward these segments in a distributed manner to nearby BSes. Relying on the infrastructure network routing, the BSes further transmit the segments to the BS where the destination node resides.

The final BS rearranges the segments into the original order and forwards the segments to the destination. It uses the cellular IP transmission method to send segments to the destination if the destination moves to another BS during segment transmission. Our DTR algorithm avoids the shortcomings of ad hoc transmission in the previous routing algorithms that directly combine an ad-hoc transmission mode and a cellular transmission mode[7]. Rather than using the multi hop ad-hoc transmission, DTR uses two hop forwarding by relying on node movement and widespread base stations. All other aspects remain the same as those in the previous routing algorithms (including the interaction with the TCP layer). DTR works on the Internet layer. It receives packets from the TCP layer and routes it to the destination node, where DTR forwards the packet to the TCP layer. The data routing process in DTR can be divided into two steps: uplink from a source node to the first BS and downlink from the final BS to the data's destination. Critical problems that need to be solved include how a source node or relay node chooses nodes for efficient segment forwarding, and how to ensure that the final BS sends segments in the right order so that a destination node receives the correct data. Also, since traffic is not evenly distributed in the network, how to avoid overloading BSes is another problem. First section will present the details for forwarding node selection in uplink transmission and Second section will present the segment structure that helps ensure the correct final order of segments in a message, and DTR's strategy for downlink transmission. The other will present the congestion control algorithm for balancing a load between BSes.

A long routing path will lead to high overhead, hot spots and low reliability. Thus, DTR tries to limit the path length. It uses one hop to forward the segments of a message in a distributed manner and uses another hop to find high-capacity forwarder for high performance routing. As a result, DTR limits the path length of uplink routing to two hops in order to avoid the problems of long-path multi-hop routing in the ad-hoc networks. Specifically, in the uplink routing, a source node initially divides its message stream into a number of segments, then transmits the segments to its neighbor nodes.

The neighbor nodes forward segments to BSes, which will forward the segments to the BS where the destination resides. Below, we first explain how to define capacity, then introduce the way for a node to collect the capacity information from its neighbors, and finally present the details of the DTR routing algorithm. Different applications may have different QoS requirements, such as efficiency, throughput, and routing speed. For example, delay-tolerant applications (e.g. voice mail, e-mail and text messaging) do not necessarily need fast real-time transmission and may make throughput the highest consideration to ensure successful data transmission.

Some applications may take high mobility as their priority to avoid hot spots and blank spots. Hot spots are areas where BS channels are congested, while blank spots are areas without signals or with very weak signals[4]. High-mobility nodes can quickly move out of a hot spot or blank spot and enter a cell with high bandwidth to a BS, thus providing efficient data transmission. Throughput can be measured by bandwidth, mobility can be measured by the speed of node movement, and routing speed can be measured by the speed of data forwarding. Bandwidth can be estimated using the nonintrusive technique proposed[10]. In this work, we take throughput and routing speed as examples for the QoS requirement. We use a bandwidth/queue metric to reflect node capacity in throughput and fast data forwarding. The metric is the ratio of a node's channel bandwidth to its message queue size[5]. A larger bandwidth/queue value means higher throughput and message forwarding speed, and vice versa. When choosing neighbors for data forwarding, a node needs the capacity information (i.e., queue size and bandwidth) of its neighbors. Also, a selected neighbor should have enough storage space for a segment.

To keep track of the capacity and storage space of its neighbors, each node periodically exchanges its current capacity and storage information with its neighbors. In the ad hoc network component, every node needs to periodically send "hello" messages to identify its neighbors. Taking advantage of this policy, nodes piggyback the capacity and storage information onto the "hello" messages in order to reduce the overhead caused by the information Exchanges. If a node's capacity and storage space are changed after its last "hello" message sending when it receives a segment, it sends its current capacity and storage information to the segment forwarder. Then, the segment forwarder will choose the highest capacity nodes in its neighbors based on the most updated information. When a source node sends out message segments, it chooses the neighbors that have enough space for store a segment to choose neighbors that have the highest capacity[8]. In order to find higher capacity forwarders in a larger neighborhood around the source, each segment receiver further forwards its received segment to its neighbor with the highest capacity. That is, after a neighbor node m_i receives a segment from the source, it uses either direct transmission or relay transmission. If the capacity of each of its neighbors is no greater than itself, relay node m_i uses direct transmission.



Otherwise, it uses relay transmission. In direct transmission, the relay node sends the segment to a BS if it is in a BS's region. Otherwise, it stores the segment while moving until it enters a BS's region. In relay transmission, relay node m_i chooses its highest-capacity neighbor as the second relay node based on the QoS requirement.

The second relay node will use direct transmission to forward the segment directly to a BS. As a result, the number of transmission hops in the ad-hoc network component is confined to no more than two. The small number of hops help to increase the capacity of the network and reduce channel contention in ad-hoc transmission. Algorithm 1 shows the pseudo-code for neighbor node selection and message forwarding in DTR. The purpose of the second hop selection is to find a higher capacity node as the message forwarder in order to improve the performance of the QoS requirement. As the neighborhood scope of a node for high capacity node searching grows, the probability of finding higher capacity nodes increases. Thus, a source node's neighbors are more likely to find neighbors with higher capacities than the source node. Therefore, transmitting data segments to neighbors and enabling them to choose the second relays help to find higher capacity nodes to forward data.

If a source node has the highest capacity in its region, the segments will be forwarded back to the source node according to the DTR protocol. The source node then forwards the segments to the BSes directly due to the three-hop limit. Though sending data back and forth leads to latency and bandwidth wastage, this case occurs only when the source nodes is the highest capacity node within its two-hop neighborhood[9]. Also, this step is necessary for finding the highest capacity nodes within the source's two-hop neighborhood, and ensures that the highest capacity nodes are always selected as the message forwarders. If the source node does not distribute segments to its neighbors, the higher capacity node searching cannot be conducted. Note that the data transmission rate of the ad hoc interface is more than 10 times faster than the cellular interface example 3G and GSM. Thus, the transmission delay for sending the data back and forth in the ad-hoc transmission is negligible in the total routing latency. By distributing a message's segments to different nodes to be forwarded in different directions, our algorithm reduces the congestion in the previous routing algorithms in the WSN wireless networks.

When a node selects a relay to forward a segment, it checks the capacity of the node. Only when a node, say node m_i , has enough capacity, the node will forward a segment to node m_i . Therefore, even though the paths are not node-disjoint, there will be no congestion in the common sub-paths. In which the source node is in the transmission range of a BS. The value in the node represents its capacity. There exist nodes that have higher capacity than the source node within the source's two-hop neighborhood. If a routing algorithm directly let a source node transmit a message to its BS, the high routing performance cannot be guaranteed since the source node may have very low capacity. In DTR, the source node sends segments to its neighbors, which further forward the segments to nodes with higher capacities. The source node has the highest capacity among the nodes in its two-hop neighborhood. After receiving segments from the source node, some neighbors forward the segments back to the source node, which sends the message to its BS. Thus, DTR always arranges data to be forwarded by nodes with high capacity to their BSes. DTR achieves higher throughput and faster data forwarding speed by taking into account node capacity in data forwarding.

SYSTEM MODEL

Network Establishment

In the network establishment module, the network setup will be made such that the node will be divided among cells and each group of cells will form clusters. The clusters are the group of similar nodes formed in order to make the data transmission easier. So cluster will be formed such that each cluster will have Cluster Head, Gateway and other nodes. So by this way the nodes will transfer data among them. The first criterion in wireless medium was to discover the available routes and establish them before transmitting. The network consists of n nodes in which two being source and destination others will be used for data transmission. The selection of path for data transmission was done based on the availability of the nodes in the region using the ad-hoc on demand distance vector routing algorithm. Using the Ad-hoc in Demand Distance Vector routing protocol, the routes are created on demand that is only when a route was needed for which there is no "fresh" record in the routing table. To facilitate determination of the freshness of routing information.

Threshold Distribution

Threshold distribution is done using Teen, Aptein and Speed protocol.

a. Threshold-sensitive Energy Efficient sensor network protocol (TEEN)

TEEN is a reactive protocol proposed for time-critical applications. In this node is arranged in hierarchical clustering scheme in which some nodes acts as 1st level and 2nd level cluster heads. After forming the cluster head it is get the data. Once the data is received the cluster head broadcasts the data to this cluster members. The sensor nodes are started sensing and transmits the sensed data. The main objective of this technique is to generate this threshold value to each node in the network.



b. Adaptive Periodic Threshold-sensitive Energy Efficient sensor network protocol (APTEEN)

APTEEN is a WSN protocol proposed for both time periodic data collection and critical events. In this, cluster is formed with 1st level and 2nd level cluster heads. In this APTEEN technique, the threshold value of each node in the cluster will be communicated with other cluster. Number of clusters will be there and number of APTEEN values will be there. So in order to communicate each node's threshold value we are using APTEEN.

c. SPEED PROTOCOL

SPEED is a stateless protocol proposed which provides real time communication by maintaining desired delivery speed is across to the network. It provides unicast, area multicast and area anycast communication services. In this protocol whenever source nodes are transmits a packet, the next hop neighbor is identified using Stateless Non deterministic Geographic Forwarding. The SNGF identifies a node as next hop neighbor, if it belongs to neighboring set of nodes, lies within the range of destination area and having speed larger than certain desired speed.

OVERHEARING IMPLEMENTATION

The path selection, maintenance and data transmission is consecutive process which happen in split seconds in real time transmission. Hence the path allocated priority is used for data transmission. The first path allocated previously is now used for data transmission. The data was transferred through the highlighted path. But the transmission path may fail some times. The second path selected now to used for data transmission. The data is transferred through the highlighted path. The third path selected to used for data transmission. The data was transferred through the highlighted path.

In order to the address overhearing was used. The overhearing is the concept in which the data should be maintained more securely. On order to maintain the security of the data will be sent more than one times to the nodes near to them. So that the failure of node can be easily rectified. Also the node which is failed will be substituted by other node which is being alive. By this way the overhearing was implemented.

THREE HOP ROUTING

Our main objective is to construct a minimum energy multi cast tree rooted at the source node using three hop routing. We explore the following two problems related to energy efficient multi casting in WANET using a source-based multicast tree wireless multicast and the concept of wireless multi cast advantage. Because the problem of constructing the optimal energy-efficient broadcast or multicast tree is hard and several heuristic algorithms for building a source based energy efficient broadcast/multicast tree have been developed recently. Among all other we have established a method which consists of two slots of nodes. Once is from infrastructure wireless network and another one is mobile ad hoc network. The usage of this combination is such that the reliability will be highly improved in this. So on the failure of one node we can easily use the other node.

In this technique, the network is silent until a connection is needed. At that point the network node that needs a connection broadcasts establish connection. The other nodes forwarded this message, and record the node that they heard it from, creating an explosion of temporary routes are back to the needed node. When a node receives such a message and already has a route to the desired node it will send the message backwards through a temporary route to the requesting node. The needy node then begins using the route that is the least number of hops through other nodes. Unused entries in the routing tables are recycled after a time.

CONCLUSION

WSN wireless networks have been receiving increasing attention in recent years. AWSN wireless network combining an infrastructure wireless network and a mobile ad-hoc network leverages their advantages to increase the throughput capacity of the system. However, current WSN wireless networks simply combine the routing protocols in the two types of networks for data transmission, which prevents them from achieving higher system capacity. In this paper, we propose a Distributed Three-hop Routing (DTR) data routing protocol that integrates the dual features of WSN wireless networks in the data transmission process.

In DTR, a source node divides a message stream into segments and transmits them to its mobile neighbors, which further forward the segments to their destination through an infrastructure network. DTR limits the routing path length to three, and always arranges for high-capacity nodes to forward data. It is not like most existing routing protocols, DTR produces significantly lower overhead by eliminating route discovery and maintenance. It has distinguishing characteristics of short path length, short-distance transmission, and balanced load distribution provides high routing reliability with high efficiency.



DTR also has a congestion control algorithm to avoid load congestion in BSEs in the case of unbalanced traffic distributions in networks. Theoretical analysis and simulation results show that DTR can dramatically improve the throughput capacity and scalability of WSN wireless networks due to its high scalability, efficiency, and reliability and low overhead.

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