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TOWARD RELIABLE DATADELIVERY FOR HIGHLY DYNAMIC MOBILE AD HOC NETWORKS

Kanchana.J[1], N.Aparna[2]

[1]Student, Department of CSE, Arcot Sri Mahalakshmi Womens College, Vellore, Tamilnadu, India

[2]Assistant Professor, Department of CSE, Arcot Sri Mahalakshmi Womens College, Vellore, Tamilnadu, India

Abstract

This paper addresses the problem of delivering data packets for highly dynamic mobile ad hoc networks in a reliable and timely manner. Most existing ad hoc routing protocols are susceptible to node mobility, especially for large-scale networks. Driven by this issue, we propose an efficient Position-based Opportunistic Routing (POR) protocol which takes advantage of the stateless property of geographic routing and the broadcast nature of wireless medium. When a data packet is sent out, some of the neighbour nodes that have overheard the transmission will serve as forwarding candidates, and take turn to forward the packet if it is not relayed by the specific best forwarder within a certain period of time. By utilizing such in-the-air backup, communication is maintained without being interrupted. The additional latency incurred by local route recovery is greatly reduced and the duplicate relaying caused by packet reroute is also decreased. In the case of communication hole, a Virtual Destination-based Void Handling (VDVH) scheme is further proposed to work together with POR. Both theoretical analysis and simulation results show that POR achieves excellent performance even under high node mobility with acceptable overhead and the new void handling scheme also works well.

CHAPTER 1

Introduction

The wireless sensor network technologies are increasingly being implemented for modern precision agriculture monitoring. The privileges of wireless sensor network in agriculture are for several causes: high performance, increase the production efficiency while decreasing cost, low-power consumption and collected

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distributed data. A wireless sensor network (WSN) consists of spatially distributed autonomous sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance. They are now used in many industrial and civilian application areas, including industrial process monitoring and control, machine health monitoring, environment and habitat monitoring, healthcare applications, home automation, and traffic control.

In addition to one or more sensors, each node in a sensor network is typically equipped with a radio transceiver or other wireless communications device, a small microcontroller, and an energy source, usually a battery. 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 hundreds of dollars to a few pennies, depending on the size of the sensor network and the complexity required of individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and bandwidth.

The forwarding scheme is to design which is to be to be reactive to the network dynamics and to elect the next hop with extremely low overhead through online optimal strategies. For these reasons, the routing with a contention-based MAC not requiring time synchronization (unscheduled and stateless) is integrated. The algorithm can be seen as a generalization and as contentions are carried out by considering cost-dependent access probabilities instead of geographical or transmission power-aware priority regions. Moreover, the optimization performed in the present work is a nontrivial extension. In particular, the channel contention follows an optimization process over multiple access slots and, for each slot, over a two dimensional cost-token space, this considerably improves the performance of the forwarding scheme. In addition, the contention strategy devise here is optimal rather than heuristic, and add a new dimension to carry out the optimization (i.e., the node “cost,” to be defined shortly). Also ,the solution provides a method to locally and optimally elect the next hop for a given knowledge range (transmission power), note that it can be readily coupled with previous work. Finally, the technique can be used in conjunction with advanced sleeping behavior algorithms. This is possible due to the stateless nature of our scheme, which makes it well adaptable to system dynamics.

MOBILE ad hoc networks (MANETs) have gained a great deal of attention because of its significant advantages brought about by multihop, infrastructure-less transmission.

However, due to the error prone wireless channel and the dynamic network topology, reliable data delivery in MANETs, especially in challenged environments with high mobility remains an issue. Traditional topology-based MANET routing protocols (e.g., DSDV, AODV, DSR) [1]) are quite susceptible to node mobility. One of the main reasons is due to the predetermination of an end-to-end route before data transmission. Owing to the constantly and even fast changing network topology, it is very difficult to maintain a deterministic route. The discovery and recovery procedures are also time and energy consuming. Once the path breaks, data packets will get lost or be delayed for a long time until the reconstruction of the route, causing transmission interruption. Geographic routing (GR)[2] uses location information to forward data packets, in a hop-by-hop routing fashion. Greedy forwarding is used to select next hop forwarder with the largest positive progress toward the destination while void handling mechanism[3] is triggered to route around communication voids. No end-to-end routes need to be maintained, leading to GR's high efficiency and scalability. However, GR is very sensitive to the inaccuracy of location information[4]. In the operation of greedy forwarding, the neighbor which is relatively far away from the sender is chosen as the next hop. If the node moves out of the sender's coverage area, the transmission will fail. In GPSR[5] (a very famous epidemic routingprotocol), the MAC-layer failure feedback is used to offer the packet another chance to reroute. However, our simulation reveals that it is still incapable of keeping up with the performance when node mobility increases.

CHAPTER 2

Literature Survey

2.1 ENERGY AND COST OPTIMIZATIONS IN WIRELESS SENSOR NETWORKS: A SURVEY

We present a survey of some of the recent work on energy and cost optimizations in wireless sensor networks. Sensor nodes are characterized by severe energy budget due to limited battery life. We focus on two main problem areas, namely routing and design. In sensor networks in which the nodes use multi-hop communication, routing is a major issue. The routing problem in the context of sensor network retains some of the features of the routing problem in ad-hoc networks, but also has some specific characteristics to it, in particular with respect to data-aggregation, addressing, and the many-to-one paradigm (each sensor node wanting to send the collected data to a single basestation). We first discuss the work done on energy efficient routing, and the corresponding optimization problems for maximizing the lifetime of the network. We then discuss some of the optimization problems in the design and dimensioning of sensor networks. Since most potential applications envisioned for sensor networks require high node density, node heterogeneity and hierarchical clustering could be used for better scalability of the protocols. We discuss the results obtained on energy and cost minimization problems in the context of such clustered sensor networks.

Disadvantages

- The problem of network lifetime maximization has been addressed in several other works which are not related to routing, but which use network tools.
- The nodes around the base station have the highest energy drainage burden due to excessive relaying of packets.

In a homogeneous sensor network, all the nodes are identical in terms of their hardware and battery energy

2.2 AN ADAPTIVE ENERGY-EFFICIENT MAC PROTOCOL FOR WIRELESS SENSOR NETWORKS

In this approach, we describe T-MAC, a contention-based Medium Access

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Control protocol for wireless sensor networks. Applications for these networks have some characteristics (low message rate, insensitivity to latency) that can be exploited to reduce energy consumption by introducing an active/sleep duty cycle. To handle load variations in time and location T-MAC introduces an adaptive duty cycle in a novel way: by dynamically ending the active part of it. This reduces the amount of energy wasted on idle listening, in which nodes wait for potentially incoming messages, while still maintaining a reasonable throughput. We discuss the design of T-MAC, and provide a head-tohead comparison with classic CSMA (no duty cycle) and S-MAC (fixed duty cycle) through extensive simulations. Under homogeneous load, T-MAC and S-MAC achieve similar reductions in energy consumption (up to 98 %) compared to CSMA. In a sample scenario with variable load, however, T-MAC outperforms S-MAC by a factor of 5. Preliminary energy-consumption measurements provide insight into the internal workings of the T-MAC protocol.

Disadvantages

- Limited amount of energy has been the primary concern in designing
- AC protocol for WSNs Mostly through acknowledgement (ACK) messages and retransmissions when necessary.
- Power over the amount of errors present it uses error detection or error correction codes

2.3 RELIABLE MULTICHIP ROUTING IN SENSOR NETWORKS

Wireless sensor network (WSN) is the network for the physical situation with the digital world. WSNs were made with the formation and advances of cheap, low power, multifunctional sensor nodes. WSNs are consumed as a part of diverse modern, military, home monitoring and ecological monitoring applications and give several benefits. The IETF received the new working group to standardized an Ipv6-based routing answer for IP smart object networks, which planning to another planning group called ROLL (Routing Over Low Power & Lossy) network. The ROLL working group conducted enquiry of the routing applications like urban network including brilliant lattice, current mechanization, and home and building computerization. The main goal of WG was to outline a routing protocol for LLNs, supporting a mixed bag of link layers, qualities of bandwidth, Lossy & low power. So the routing protocol is used to evaluation on the link layer, which could be wireless like IEEE 802.15.4, IEEE 802.15.4g, (low power) Wi-Fi

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or power line communication (PLC) exploiting IEEE 802.15.4 for example, IEEE P1901.2. Link Estimation RPL usage combines a library of link monitoring procedure. Our library incorporates a detached monitoring plan that cleverly misuses data packets sent by neighbors as test packets. Sometimes, parcel catching may prompt incorrect link-quality evaluations in light of the fact that: 1. It is by and large intertwined for asset compelled gadgets to process all overhead traffic; 2. Most MAC protocols for LLNs don't support retransmission arrangement. 3. Packet losses happen on the overhead link from the monitoring node & neighborhood bundle. Solve the packet loss rates by numbering the quantity of first time retransmission. To address the data driven link monitoring library can help dynamic examining over estimation windows. The RPL controller misuses library to help a hybrid link monitoring system that chooses one of the estimation plans (detached, catching, & dynamic) based on the node status & attributes.RPL node can be one of the below three states: 1) Not joined if the RPL neighbor table is invalid; 2) Joining if the node is assembly link measurements however it is not related to a DODAG; 3) Joined if the node is associated to a DODAG. Administration of Neighbor Tables In a dense network a node may have few neighbors and several low quality links. Administration approaches are necessary to choose whether to measurement to recent nodes. A measure issues for the especially verifiable data to improve substitution choices. In this manner, to each time a node is reinserted, it needs to be reexamined. This could be a safe method in very dynamic networks. Reliability-Aware Topology Construction For routing security, the hysteresis instruments are used as portrayed. The normal number of physical retransmission, which is measured through the ETX metric does not so much states to a right measure of the routing consistency for monitoring applications. Packet loss rates measured at the MAC layer can be altogether not quite the same as the ones saw at the IP level or application layer. Depending on the loss designs. Data transporting reliability can be improved by routing data traffic "around" links that are IP level packet losses. This is done by the RPL neighbor table that encounters an IP level packet loss rate more significant than a threshold, called as max loss. To maintain a strategic distance from this, a node starts the pruning process just when the RPL neighbor table contains no fewer than two neighbors with great link qualities.

2.4 PRINCIPLES OF COST MINIMISATION IN WIRELESS NETWORKS

The Minimum Connector Problem (MCP) for cabled networks has been understood well for many years and applied in a variety of situations (Du & Pardalos, 1993). Given a number of nodes, or vertices, we seek to find the optimum set of edges (an edge is a link between two nodes) that fully connects the node set in question. (A network is connected if a path exists between each pair of nodes.) To this end, a cost matrix is applied to the nodes requiring interconnection with the cost element between each node pair - i.e. the cost of that edge - reflecting the expenditure, distance, difficulty, etc. involved in joining the two. Finding the Minimum Spanning Tree (MST) for the cost matrix will then result in the optimal solution across the nodes – i.e. the minimum cost set of connecting edges.

2.5 INTEGRATED WIRELESS SENSOR/ACTUATOR NETWORKS IN AN AGRICULTURAL APPLICATIONS

Providing an initial setup of the Lofar Agro project that concentrates on monitoring micro-climates in a crop field. In addition to the agronomic experiment, Lofar Agro aims at gathering statistics on the wireless sensor network itself. These statistics will form the basis for simulations of algorithms in wireless sensor networks and will be distributed.

CHAPTER 3

SYSTEM REQUIREMENTS

HARDWARE CONFIGURATION

Processor	-	Pentium –IV
Speed	-	1.1 Ghz
RAM	-	256 MB(min)
Hard Disk	-	20 GB

SOFTWARE CONFIGURATION

Operating System - LINUX

Tool - Network Simulator-2

Front End - OTCL (Object Oriented Tool Command Language)

CHAPTER 4

Existing System

MOBILE ad hoc networks (MANETs) have gained a great deal of attention because of its significant advantages

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brought about by multihop, infrastructure-less transmis-sion. However, due to the error prone wireless channel and the dynamic network topology, reliable data delivery in MANETs, especially in challenged environments with high mobility remains an issue. Traditional topology-based MANET routing protocols (e.g., DSDV, AODV, DSR) are quite susceptible to node mobility.

One of the main reasons is due to the predetermination of an end-to-end route before data transmission. Owing to the constantly and even fast changing network topology, it is very difficult to maintain a deterministic route. The discovery and recovery procedures are also time and energy consuming. Once the path breaks, data packets will get lost or be delayed for a long time until the reconstruction of the route, causing transmission interruption.

Geographic routing (GR) uses location information to forward data packets, in a hop-by-hop routing fashion. Greedy forwarding is used to select next hop forwarder with the largest positive progress toward the destination while void handling mechanism is triggered to route around communication voids . No end-to-end routes need to be maintained, leading to GR's high efficiency and scalability. However, GR is very sensitive to the inaccuracy of location information . In the operation of greedy forwarding, the neighbor which is relatively far away from the sender is chosen as the next hop. If the node moves out of the sender's coverage area, the transmission will fail.

4.1 Disadvantages of Existing

Each node in a MANET requires a unique address to participate in routing, through which nodes are identified. However, in a MANET there is no central authority to verify these identities. An attacker can exploit this property and send control packets, for example RREQ or RREP, using different identities; this is known as a Sybil attack. A Sybil attack is essentially an impersonation attack, in which a malicious device illegitimately fabricates multiple identities, behaving as if it were a larger number of nodes (instead of just one). This is an impersonation attack where the intruder could use either random identities or the identity of another node to

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create confusion in the routing process, or to establish bases for some other severe attack.

The Sybil attack in P2P networks first mentioned by Douceur (2002) shows that, if a single malicious entity can present multiple identities this entity can control the whole network. He argues that under realistic assumptions of resource distribution and coordination only a central organized authority can prevent from a Sybil attack. But he says that implicit identification authorities like ICANN (Internet Corporation for Assigned Names and Numbers) can be sufficient for Sybil resistance if they are mindfully used. Figure 3.1 depicts the scenario of Sybil attack with multiple identities.

ARCHITECTURE

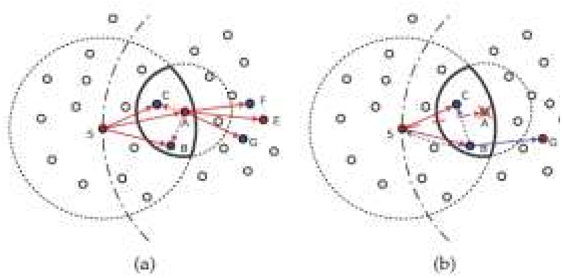

Fig. 1. (a) The operation of POR in normal situation. (b) The operati POR when the next hop fails to receive the packet.

Figure 4.2 Architecture

CHAPTER 5

PROPOSED SYSTEM

Position-based Opportunistic Routing (POR) protocol is proposed, in which several forwarding candidates cache the packet that has been received using MAC interception. If the best forwarder does not forward the packet in certain time slots, suboptimal candidates will take turn to forward the packet according to a locally formed order. In this way, as long as one of the candidates succeeds in receiving and forwarding the packet, the data transmission will not be interrupted. Potential multipaths are exploited on the fly on a per-packet basis, leading to POR's excellent robustness.

The concept of in-the-air backup significantly en-hances the robustness of the routing protocol and reduces the latency and duplicate forwarding caused by local route repair.

The design of POR is based on epidemic routingand opportunistic forwarding. The nodes are assumed to be aware of their own location and the positions of their direct neighbors. Neighborhood location information can be exchanged using one-hop beacon or piggyback in the data packet's header. While for the

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position of the destination, we assume that a location registration and lookup service which maps node addresses to locations is available . It could be realized using many kinds of location service . In our scenario, some efficient and reliable way is also available. For example, the location of the destination could be transmitted by low bit rate but long range radios, which can be implemented as periodic beacon, as well as by replies when requested by the source.

When a source node wants to transmit a packet, it gets the location of the destination first and then attaches it to the packet header. Due to the destination node's move-ment, the multihop path may diverge from the true location of the final destination and a packet would be dropped even if it has already been delivered into the neighborhood of the destination. To deal with such issue, additional check for the destination node is introduced. At each hop, the node that forwards the packet will check its neighbor list to see whether the destination is within its transmission range. If yes, the packet will be directly forwarded to the destination, similar to the destination location prediction scheme . By performing such identification check before greedy forwarding based on location information, the effect of the path divergence can be very much alleviated.

5.1 ADVANTAGES OF PROPOSED

The suitability of a node to be the relayed by means of locally calculated and generic cost metrics is represented. A contention-based MAC and forwarding technique, called Cost- and Collision-Minimizing Routing is proposed. To elect the next hop for data forwarding by jointly minimizing the amount of signaling to complete a contention and maximizing the probability of electing the best candidate node in dynamic selection.

CHAPTER 6

MODULES

6.1 FRAMEWORK DESIGN

Sensors are assumed to know the state of the nodes within their communication range only. Their goal is to optimally tune, based on the local topology, the communication range (local view) at each sensor in order to approach globally optimal routing. Need a platform independent component based simulator with wireless sensor network framework. Ns2 is the simulator which supports wireless sensor network by configures some supporting files.

6.2 FORWARDING METHODOLOGY

The forwarding scheme is to design which is to be reactive to the network dynamics and to elect the next hop with extremely low overhead through online optimal strategies. For these reasons ,the routing with a contention-based MAC not requiring time synchronization (unscheduled and stateless) is integrated. Contentions are carried out by considering cost-dependent access probabilities instead of geographical or transmission power-aware priority regions. The contention strategy devised here is optimal rather than heuristic, and a new dimension to carry out the optimization (i.e., the node "cost," to be defined shortly)is added. Also, the solution provides a method to locally and optimally elect the next hop for a given knowledge range (transmission power),should note that it can be readily coupled with previous work.

6.3 IMPLEMENTATION OF CCMR PROTOCOL

An integrated channel access and routing scheme that is named as CCMR is presented. The cross-layer design relies on the definition of the costs, which are used in the channel access to discriminate among nodes. This is achieved by accounting for routing metrics such as the geographical advancement, right in the cost calculation.

The main contributions are listed as follows:

- The joint routing and relay election problem is analytically characterized in finding optimal online policies.
- These results are used for the design of a practical solution for WSNs, which we call CCMR.
- CCMR is compared against state-of-the-art solutions belonging to the same class of protocols, showing its effectiveness.
- The software implementation of the algorithm and the present experimental results to demonstrate the feasibility of the approach is described.

CHAPTER 7
Conclusion

The problem of reliable data delivery in highly dynamic mobile ad hoc networks where Constantly changing network topology makes conventional ad hoc routing protocols incapable of providing satisfactory performance. In the face of frequent link break due to node mobility, substantial data packets would either get lost, or experience long latency before restoration of connectivity. Inspired by opportunistic routing, a novel MANET routing protocol POR which takes advantage of the epidemic routing and broadcast nature of wireless medium. Besides selecting the next hop, several forwarding candidates are also explicitly specified in case of link break. Leveraging on such natural backup in the air, broken route can be recovered in a timely manner.

.FUTURE WORK

With no nodes distributed between the Source and the Destination, where the destination is out of the range of the source a VDVH(Virtual Distance void Handling) technique along with POR may be adopted .

The existing system is limited to support for limited number of nodes. The approach is further enhanced to support the wide area nodes by using the multiplexing technique. The network availability and coverage is splitted in to different partitions, then the MIMO technique is equally implemented to each different partitions. And the final outcome is processed to next subdivision. It is expected to be efficient and powerful network through put.

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