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A Hop Based Robust Routing Protocol in Wireless Sensor Network

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Abstract— Routing protocol design is an important research area in wireless sensor networks, reliability, low-cost and easy to maintain are design goals of WSN routing protocol, hop based routing protocol has been receiving extensive attention for its simple and effective design ideas. HBRRP (Hop Based Robust Routing Protocol for WSN) is proposed. In data transmission phase, HBRRP makes parents and siblings as forward selection; relying on a formula for evaluating the routing quality, routing mechanism has a comprehensive consideration of the forward selection trigger update mechanism is used to maintain dynamic network topology. Exploiting the intuition that a less dynamic route lasts longer, we propose a new metric, the Route Fragility Coefficient (RFC), to compare routes. RFC estimates the rate at which a given route expands or contracts. Expansion refers to adjacent nodes moving apart, while contraction refers to their moving closer. RFC combines the individual link contraction or expansion behavior to present a unified picture of the route dynamics.

Keywords— Hop Based Robust Routing Protocol, Route Fragility Coefficient, And Wireless Sensor Network.

I. INTRODUCTION

Mobile ad hoc networks (MANETs) promise to break many of the traditional requirements for building communication networks and make information exchange possible in a wide variety of situations. As such, there has been a lot of interest in the recent years to design and build efficient routing protocols to realize MANET's . Such protocols attempt to build routes that can perform best, given the fact that some of the nodes in the route may move out of range, causing route failure. In this scenario, a route is "good" if it is short and lasts longer than alternative routes to the destination.

The source broadcasts a route request packet which then ripples through the network till it reaches the destination. The destination replies to one or more of the requests depending on whether the protocol discovers multiple routes. Considering that a route may not be valid for a long time, there have been proposals to discover routes on demand instead of computing them pro-actively. Accordingly, routing protocols for ad hoc networks are frequently classified as being proactive or reactive. There have also been proposals which try to strike a balance between these two approaches by employing hierarchical routing and cluster based routing.

The performance of routing protocols depends on the quality of the routes chosen in terms of route longevity, the manner in which route failures are handled and the protocol and by a grant from Intel Corp. overhead introduced in the process. A protocol that discovers better routes also features a reduced rate of route failures and lesser route discovery traffic. Thus an important aspect of the decision process is to compare and pick the "better" route. Preemptive routing maintenance algorithms attempt to combine the best of on-demand and table-driven: the overhead is kept small since updates are only triggered by active paths that are likely to break, and hand-off time is minimized since corrective action is initiated early. While on-demand algorithms minimize the overhead by initiating route discovery only when needed, they do so reactively. Accordingly, when a path break occurs, the connectivity of the flow is interrupted and a hand-off delay is experienced by the packets that are ready to be sent.

II. RELATED WORKS

Wireless sensor networks (WSNs) are being developed actively and deployed widely for a variety of applications, such as public safety, environment monitoring, and citywide wireless Internet services. They have also been evolving in various forms (e.g., using multi-radio/channel systems to meet the increasing capacity demands by the above-mentioned and other emerging applications.

Due to heterogeneous and fluctuating wireless link conditions, preserving the required performance of such WMNs is still a challenging problem. For example, some links of a WMN may experience significant channel interference from other coexisting wireless networks. Some parts of networks might not be able to meet increasing bandwidth demands from new mobile users and applications. Links in a certain area (e.g., a hospital or police station) might not be able to use some frequency channels because of spectrum etiquette or regulation.

Before a packet can be sent, it is necessary to determine the position of its destination. Typically, a location service is responsible for this task. Existing location services can be classified according to how many nodes host the service.

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This can be either some specific nodes or all nodes of the network. Furthermore, each location server may maintain the position of some specific or all nodes in the network. We abbreviate the four possible combinations as some-for-some, some-for-all, all-for some, and all-for-all in the discussion of location services.

The forwarding decision by a node is primarily based on the position of a packet's destination and the position of the node's immediate one-hop neighbors. The position of the destination is contained in the header of the packet. If a node happens to know a more accurate position of the destination, it may choose to update the position in the packet before forwarding it. The position of the neighbors is typically learned through one-hop broadcasts. These beacons are sent periodically by all nodes and contain the position of the sending node. It is fairly obvious that both forwarding strategies may fail if there is no one-hop neighbor that is closer to the destination than the forwarding node itself.

III. DATA TRANSMISSION PHASE

One sensor node ls state goes into data transmission phase if the following conditions meet: HC_{self} is not NULL; alternative queue is empty. This can ensure that: current node has own HC; current node is two tables have been completed in part; current node will not process data packet before the condition above.

The sensor nodes will collect and send data periodically, and forward data packet whose relay node ID is themselves. When choosing relay node, source node considers parent nodes take priority of sibling nodes; in parent or sibling table, source node chooses only one optimal relay node considering rest energy, communication capacity and history record, which is defined in a formula, routeScore. Relay node needs to reply ack if it forwards data packet successfully. The routeScore formula likes equation (1):

$$\text{routeScore} = \alpha{*}\text{restEnergy} + \beta{*}\text{LQI} + \gamma{*}\text{successRate}.(1)$$

source node will choose relay node who has the highest routeScore in one table (parent or sibling). restEnergy and LQI are got from INIT or ack packets of related next hop node; successRate is transmission success rate (0-100), initialized as 100, the rate of related next hop node will be reduced by 1 if one time the source node doesn't get ack reply. α, β and γ are weighted coefficients. The sum of weights, α, β and γ, is set to 1, and α has highest weight because current rest energy of relay node is the most critical index of evaluating node capacity. Sensor node selects unique relay node to forward data at one time, which avoids redundancy of data packets; ack mechanism not only offers transmission reliability, but also helps source node update tables timely; rest energy and LQI value represent current capacity of relay node, successRate represents history forwarding record of relay node, so considering these two aspects, source node can have a more optimal choice.

IV.TOPOLOGY MAINTENANCE AND UPDATE

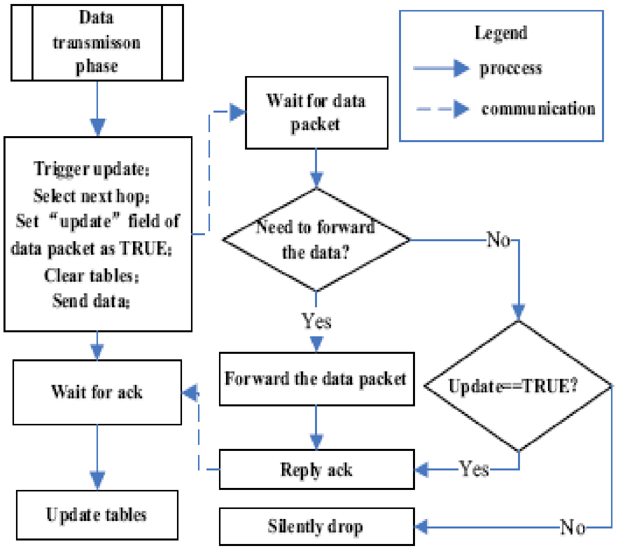

Figure 1. Flow chart of HBRRP routing update.

Network topology will change with the node energy consumption and other factors, so the initial routing tables can not reflect the current network topology. In HBRRP, data packet has a new bool field: update, and the default value is FALSE

IV. IMPLEMENTATION OF AODV

There are many AODV routing protocol implementations, including ad-hoc, AODVUCSB, AODV-UU, Kernel-AODV, and AODV-UIUC [11]. Each implementation was developed and designed independently, but they all perform the same operations. The first publicly available implementation of AODV was Mad-hoc. The Mad-hoc implementation resides completely in user-space and uses the snooping strategy to determine AODV events. Unfortunately, it is known to have bugs that cause it to fail to perform properly. Mad-hoc is no longer actively researched.

The first release of AODV-UCSB (University of California, Santa-Barbara) used the kernel modification strategy. AODV-UU has the same design as AODV-UCSB. The main protocol logic resides in a user-space daemon, in addition, AODV-UU (Uppsala Univerisity) includes Internet gatewaying support. The AODV-UIUC implementation is similar to AODV-UCSB and AODV-UU except it explicitly separates the routing and forwarding functions. Routing protocol logic takes place in the user-space daemon, while packet forwarding is handled in the kernel. This is efficient because forwarded packets are handled immediately and fewer packets traverse the kernel to user-space boundary. All of the implementations discussed use HELLO messages to determine local connectivity and detect link breaks. In addition, all implementations (except Mad-hoc) support the expanding ring search and local repair optimizations.

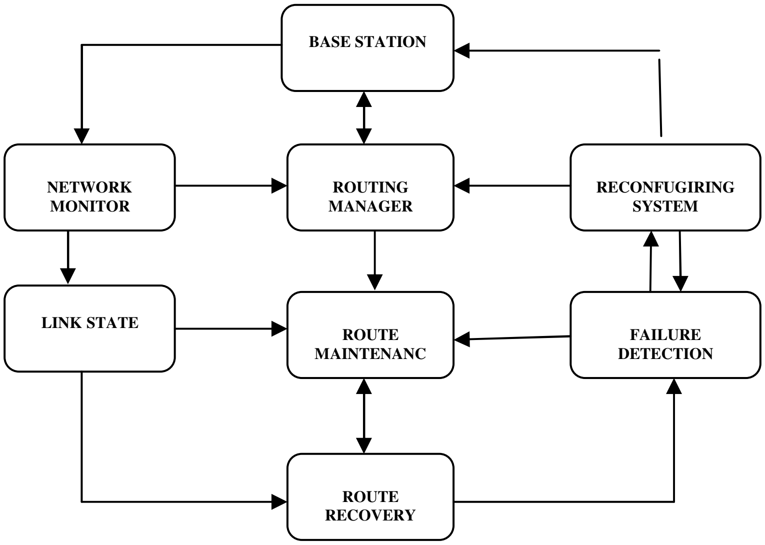

Figure 2. Data flow diagram

Route Recovery

Route recovery scheme in ad hoc networks to reduce the time delay and control overhead in the route recovery process. Maintaining connectivity with the sink node is a crucial issue to collect data from sensors without any interruption. While sensors are typically deployed in abundance to tolerate possible node failures, a large number of such failures within the same region simultaneously may result in losing the connectivity with the sink node which eventually reduces the quality and efficiency of the network operation.

The idea of this distributed heuristic is based on maintaining the route information at each node to the sink and then utilizing such information for the relocation of the sensors .Route recovery scheme to solve the link failure problem caused by node movement, packet collision or bad channel condition. Since it considers a backup node mobility and conduct route recovery implicitly, it can support fast route recovery and then provide reliable and stable route for routing protocols.

Failure Detection

A node along the path fails, causing other nodes to fail or there are collisions along the path. The whole network appears to be failing when it is the sink that has failed. Failure at the sink may be due to bad sink placement, changes in the environment after deployment, and connectivity issues. Find link state of the neighbour node to communicate with the base station

Reconfiguring System

A reconfiguration plan is defined as a set of links' configuration changes necessary for a network to recover from a link failure on a channel, and there are usually multiple reconfiguration plans for each link failure. ARS systematically generates reconfiguration plans that localize network changes by dividing the reconfiguration planning into three processes—feasibility, QoS satisfiability, and optimality—and applying different levels of constraints. ARS first applies connectivity constraints to generate a set of feasible reconfiguration plans that enumerate feasible channel, link, and route changes around the faulty areas, given connectivity and link-failure constraints. Then, within the set, ARS applies strict constraints (i.e., QoS and network utilization) to identify a reconfiguration plan that satisfies the QoS demands and that improves network utilization most.

VI. SIMULATION RESULTS

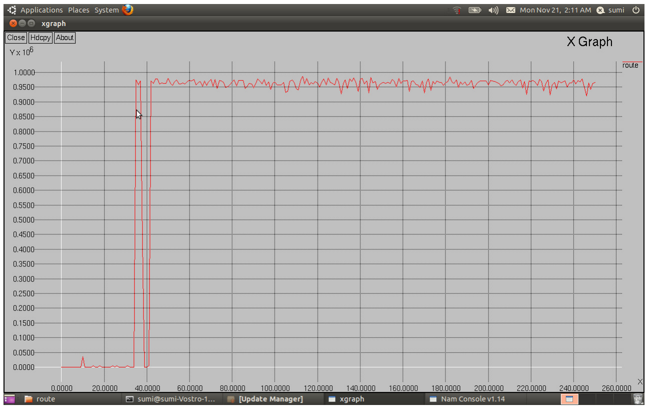

Figure 3.

VII.CONCLUSION

In this paper we recovered the routes between source and destination then find shortest path among them using Ad hoc On-Demand Distance Vector (AODV) protocol and Dijikstra's Algorithm. If there is any packet loss between source and destination. It is identified using failure detection technique and the packet loss is reconfigured.

This paper summarizes the status of hop based routing protocols for WSN, and analyses strengths and weaknesses of them, then designs a new routing strategy, HBRRP. HBRRP has advantages in extending network life time, load balance and low routing maintenance.

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