Forward Aware Factor Based on Energy Balanced Routing Method

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ABSTRACT

Wireless sensor networks are prevalent and cost-effective. The limited energy and communication ability of sensor nodes, it seems especially important to design a routing protocol for WSNs. So that sensing data can be transmitted to the receiver effectively. However, they face mote failures, RF interference from environmental noise and energy constraints. The forward transmission area, defines forward energy density, which constitutes forward-aware factor with link weight, and propose a new energy-balance routing protocol. Based on routing protocols in fixed-power, multi hop WSNs use shortest-path routing, since operation is often over long unattended periods, the protocol must be energy efficient. The environment is also unpredictable and often disrupts operation. As such, routing protocols must ensure that the WSN can reconfigure the energy efficient and resilient to failures.

Keywords- Forward Aware Factor, Wireless Sensor, Energy balance, Routing.

INTRODUCTION

A wireless sensor network is a collection of nodes organized in a network. Each node consists of one or more microcontrollers, CPUs or DSP chips, a memory and a RF transceiver, a power source such as batteries and accommodates various sensors and actuators. The nodes communicate wirelessly and often self-organize after being deployed in an ad hoc fashion.

Components of Sensor Networks
Following are the components of sensor networks. Here components includes are mobilize, sensor, ADC, Processor, Storage, Transceiver, Power Generator.

**Fig 1.1 Components of sensor networks**

1.1.1 Sensing Unit
Sensing units are usually composed of two subunits: sensors and analog to digital converters (ADCs). The analog signals produced by the sensors are converted to digital signals by the ADC, and then fed into the processing unit.

1.1.2 Processing Unit
The processing unit which is generally associated with a small storage unit manages the procedures that make the sensor nodes collaborate with the other nodes to carry out the assigned sensing tasks.

1.1.3 Transceiver Unit
A transceiver unit connects the nodes to the networks.

1.1.4 Power Unit
One of the most important components of a sensor node is the power unit. Power units may be supported by a power scanning unit such as solar cells.

1.1.5 Sensor Nodes
Sensor nodes can be imagined as small computers, extremely basic in terms of their interfaces and their components. They usually consist of a processing unit with limited computational power and limited memory, sensors (including specific conditioning circuitry), a communication device (usually radio transceivers or alternatively optical), and a power source usually in the form of a battery. Other possible inclusions are energy
harvesting modules, secondary ASICs, and possibly secondary communication devices (e.g. RS-232 or USB). The base stations are one or more distinguished components of the WSN with much more computational, energy and communication resources. They act as a gateway between sensor nodes and the end user.

2. LITERATURE SURVEY

2.1 Robust and Timely Communications Over Highly Dynamic Sensor Networks

To provide robust and timely communication, exploit the concept of Lazy-Binding to deal with the elevated network dynamics. Based on this concept and the knowledge of the node positions, introduce Implicit Geographic Forwarding (IGF), a new protocol for highly dynamic sensor networks that is altogether state free. Here compare our work against several typical routing protocols in static, mobile and energy-conserving networks under a wide range of system and workload configurations. Here observe that the delay between the time when a physical network topology maps to the routing states and the time when these states are actually used for packet forwarding is the root cause of state invalidation and routing failures. The terms are delay as the binding delay. A long binding delay leads to a high probability that recorded states are invalid by the time they are used. This problem increases as the network dynamics increase. In addition, since routing states are volatile and become outdated at a much faster rate in highly dynamic networks, it is inefficient to maintain state proactively and eagerly.

2.2 Optimal Local Topology Knowledge for Energy Efficient Geographical Routing In Sensor Networks

To analyze the relationship between energy efficiency of the routing tasks and a extension of the range of the topology knowledge for each node. The leading forwarding rules for geographical routing are compared in this framework, Moreover Partial Topology Knowledge Forwarding, a new forwarding scheme, is introduced. Wider topology knowledge can improve the energy efficiency of the routing tasks but can increase the cost of topology information due to signaling packets that each node must transmit and receive to acquire this information, especially in networks with high mobility. The problem of determining the optimal Knowledge Range for each node to make energy efficient geographical routing decisions is tackled by Integer Linear Programming. It is demonstrated that the problem is intrinsically localized, a limited knowledge of the topology is sufficient to take energy efficient forwarding decisions, and that the proposed forwarding scheme outperforms the others in typical application scenarios. For online solution of the problem, a probe-based distributed protocol which allows each node to efficiently select its topology knowledge, is introduced and shown to converge to a near-optimal solution very fast.

2.3 Contention-Based Forwarding for Mobile Ad-Hoc Networks

Contention-based forwarding scheme (CBF) the next hop is selected through a distributed contention process based on the actual positions of all current neighbors. For the contention process, CBF makes use of biased
timers. To avoid packet duplication, the first node that is selected suppresses the selection of further nodes. In contrast, with CBF the responsibility for next-hop selection lies with the set of possible next hops. Furthermore, if no other interaction between forwarder and next hop is required, which is the case for two of the three presented strategies where MAC layer addresses become obsolete.

3. PROBLEM STATEMENT
RF interference from environmental noise energy constraints, Network traffic, link disruptions and node failure rates are high.

4. PROPOSED SYSTEM
The procedural design of EAR may be divided into three phases: setup, route selection, data dissemination. These are detailed in the following sections.

4.1 Setup Phase
When a hub is powered on, it broadcasts an Advertisement (ADV) packet indicating that it wants to receive RPT packets. When a neighbouring node around the hub receives this ADV packet, it will store the route to the hub in its routing table. Nodes do not propagate the ADV packet received. When a node is powered on, it delays for a random interval of time before starting an initialisation process. A node starts the initialisation process by broadcasting a Route Request (RREQ) packet asking for a route to a hub. When a hub receives a RREQ packet, it will broadcast a Route Reply (RREP) packet. Similarly, when a node receives a RREQ packet, it will broadcast a RREP packet if it has a route to a hub. Otherwise, it will ignore the RREQ packet. Nodes do not propagate RREQ packets. When a node receives a RREP packet, it will store the route in its routing table. When it has at least one route to the hub it skips the initialisation process. By introducing random delay for each node to begin initialisation process, a portion of nodes will receive a RREP packet before they have begun their initialisation process. This enables faster propagation of routes and saves on the amount of control packets generated in the setup phase. A node may store more than one route to the hub. A route in the routing table is indexed using the next hop node’s ID - that is the ID of the neighbouring node. The selection of best routes is described next.

4.2 Route Selection Phase
Ideally, the best route is the shortest as it incurs the lowest latency and consumes the least energy. In an actual environment, the performance of an RF link varies with physical distance and the terrain between nodes and should be accounted for in routing decisions. In EAR, shortest routes are initially admitted into the routing table based on hop-count. As RPT packets flow through these links, less desirable ones will start to exhibit high packet loss rate and are eventually blacklisted and omitted from the routing table. Links that are omitted from
the routing table may be re-admitted again only after a period of time. Some RF links are affected by temporary external disruption and should be given the chance to be readmitted. Link Score then takes on a value from 0 to 100 and a higher value indicates a better link. An arbitrary value is initially assigned to $PT$ as the link performance is unknown. $PT$ rises (or drops) when subsequent packet transmissions succeed (or fail). $PE$ starts at 100 and drops as a node consumes its energy resources. Link Score is used when there are two links of different routes with the same hub distance competing to be admitted to the routing table. When a new link is received and the routing table is full, link replacement is initiated. The search ignores blacklisted links and targets the link with the lowest Link Score to be replaced. When there is more than one entry with the same Link Score, the entry with the longest length is chosen to be replaced. This worst route is then compared against the incoming route and the shorter route is admitted into the routing table. If there is a tie in route length, then the route with the higher Link Score is admitted.

4.3 Data Dissemination
Sensor nodes generate RPT packets at periodic intervals or sleep, waiting for some event to happen. An RPT packet contains information of interest to network users and has two fields in its header: Exp Path Len and Num Hop Traversed. The first field is the expected number of hops the packet will have to traverse before it reaches the hub. It is defined as:

$$\text{Exp Path Len} = NH \times \alpha,$$

where $0.0 < \alpha \leq 1.0$.

$NH$ is the number of hops from this node to the hub for the route selected.

The route selected need not be the shortest but Exp Path Len is bounded by the network diameter. $A$ is an assigned weight such that $0.0 < \alpha \leq 1.0$ since the minimum number of hops to reach the hub is at least 1. Num Hop Traversed is the distance a packet has traversed and is initialized as 0. The packet is forwarded to the next node in the route. When the next node receives the packet, it will increment Num Hop Traversed by one and compare it with Exp Path Len.

5. CONCLUSION
An energy-balanced routing method FAF-EBRM based on forward-aware factor is proposed in this paper. In FAF-EBRM, the next-hop node is selected according to the awareness of link weight and forward energy density. Reconstruction Mechanism for local topology is designed additionally. In the experiment, FAF-EBRM is compared with LEACH and EEUC, and experimental results show that FAF-EBRM outperforms LEACH and EEUC, which balances the energy consumption, prolongs the function lifetime, and guarantees high QOS of WSN. Also, they show that the distributions of node degree, strength, and edge weight follow power law and represent “tail,” so the topology has robustness and fault tolerance, reduce the probability of successive node break down, and enhances the synchronization of WSN of IA. For future research, we plan to
extend our work by exploring the effect of hop number and hop distance on other network metrics such as latency, communication overhead etc. Also, we plan to further extend network lifetime by combing clustering mechanism.

5. REFERENCE


