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Dynamic Routing Services In Wireless Sensor Networks For Processing Data Integrity And Delay Differentiated Services

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Abstract: **Applications running on the same Wireless Sensor Network (WSN) platform usually have different Quality of Service (QoS) requirements. Two basic requirements are low delay and high data integrity. However, in most situations, these two requirements cannot be satisfied simultaneously. Based on the concept of potential in physics, IDDR is proposed, which is a multi-path dynamic routing algorithm, to resolve this conflict. By constructing a virtual hybrid potential field, IDDR separates packets of applications with different QoS requirements according to the weight assigned to each packet, and routes them towards the sink through different paths to improve the data fidelity for integrity-sensitive applications as well as reduce the end-to-end delay for delay-sensitive ones.**

I. INTRODUCTION

WSNS, which are used to sense the physical world, will play an important role in the next generation networks. Due to the diversity and complexity of applications running over WSNs, the QoS guarantee in such networks gains increasing attention in the research community. As a part of an information infrastructure, WSNs should be able to support various applications over the same platform. Different applications might have different QoS requirements. For instance, in a fire monitoring application, the event of a fire alarm should be reported to the sink as soon as possible. On the other hand, some applications require most of their packets to successfully arrive at the sink irrespective of when they arrive. For example, in habitat monitoring applications, the arrival of packets is allowed to have a delay, but the sink should receive most of the packets. WSNs have two basic QoS requirements: low delay and high data integrity, leading to what are called delay sensitive applications and high-integrity applications, respectively.

Generally, in a network with light load, both requirements can be readily satisfied. However, a heavily loaded network will suffer congestion, which increases the end-to-end delay. To improve the fidelity for high-integrity applications and decrease the end-to-end delay for delay-sensitive ones, even when the network is congested.

The basic idea is to find as much buffer space as possible from the idle and/or under-loaded paths to cache the excessive packets that might be dropped on the shortest path.

II. RELATED PROBLEM

Most QoS provisioning protocols proposed for traditional ad hoc networks have large overhead caused by end-to-end path discovery and resource reservation. They are not suitable for resource-constrained WSNs.

RAP exploits the notion of velocity and proposes a velocity monotonic scheduling policy to minimize the ratio of missed deadlines. However, the global information of network topology is required. Implicit Earliest Deadline First (EDF) mainly utilizes a medium access control protocol to provide real-time service. The implicit prioritization is used instead of relying on control packets as most other protocols do. SPEED maintains a desired delivery speed across the network through a novel combination of feedback control and non-deterministic QoS-aware geographic forwarding. A two-hop neighbor information-based gradient routing mechanism is proposed to enhance realtime performance. The routing decision is made based on the number of hops from a source to the sink and the twohop information.

Adaptive Forwarding Scheme (AFS) employs the packet priority to determine the forwarding behavior to control the reliability. ReInforM uses the concept of dynamic packet states to control the number of paths required for the desired reliability.

However, both of AFS and ReInforM require to know the global network topology. LIEMRO utilizes a dynamic path maintenance mechanism to monitor the quality of the active paths during network operation and regulates the injected traffic rate of the paths according to the latest perceived paths quality. However, it does not consider the effects of buffer capacity and service rate of the active nodes to estimate and adjust the traffic rate of the active paths.

MMSPEED extends SPEED for service differentiation and probabilistic QoS guarantee. It uses the same mechanism as SPEED to satisfy the delay requirements for different types of traffic, and uses redundant paths to ensure reliability. The MAC layer function is modified to provide prioritized access and reliable multicast delivery of packets to multiple neighbors.

However, when the network is congested, all the source nodes still continuously transmit packets to the sink along multipaths without taking some other mechanisms, such as caching packets for some time.

Energy-Efficient and QoS based Multipath Routing Protocol (EQSR) improves reliability through using a lightweight XOR-based Forward Error Correction (FEC) mechanism, which introduces data redundancy in the data transmission process.

III. PROBLEM ANALYSIS

First task is to find these idle and/or under loaded paths, then the second task is to cache the packets efficiently for subsequent transmission.

IDDR constructs a potential field according to the depth1 and queue length information to find the under-utilized paths.

The packets with high integrity requirement will be forwarded to the next hop with smaller queue length. A mechanism called Implicit Hop-by-Hop Rate Control is designed to make packet caching more efficient and decrease end-to-end delay for delay-sensitive applications.

Each application is assigned a weight, which represents the degree of sensitivity to the delay. Through building local dynamic potential fields with different slopes according to the weight values carried by packets, IDDR allows the packets with larger weight to choose shorter paths. In addition, IDDR also employs the priority queue to further decrease the queuing delay of delay-sensitive packets.

IDDR inherently avoids the conflict between high integrity and low delay: the high-integrity packets are cached on the under loaded paths along which packets will suffer a large end-to-end delay because of more hops, and the delay-sensitive packets travel along shorter paths to approach the sink as soon as possible. Packet caching more efficient Decrease end-to-end delay for delay-sensitive applications

IV. IMPLEMENTATION

Nodes

Sensor nodes are created with ‘N’ number of nodes. A commonly used routing algorithm will choose the optimal path for all the packets. Sensor nodes can transmit packets via delay sensitive and integrity sensitive.

Resource Discovery

In a under-utilized WSN, the queue length is very small, the hybrid potential field is governed by the depth potential field. IDDR performs like the shortest path algorithm, that is, a node always chooses one neighbor with lower depth as its next hop. However, in a over-utilized WSN, the shortest paths are likely be full of packets. Therefore, new coming packets will be driven out of the shortest paths to find other available resource. If a node knows the queue length information of its neighbors, it can forward packets to the underloaded neighbors to stand against possible dropping.

Delay sensitive routing

Delay-sensitive packets occupy the limited bandwidth and buffers, worsening drops of high-integrity ones. Delay sensitive packet forwarding takes shortest pacth or less hop relay path to transmit the packets.

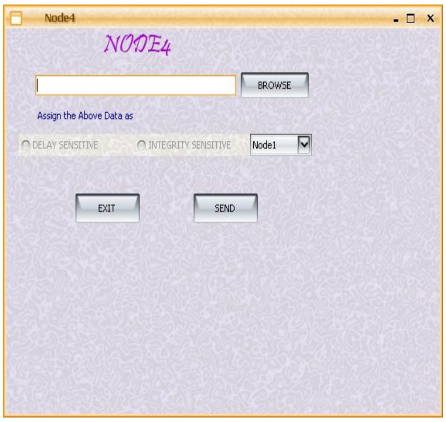
Integrity sensitive routing

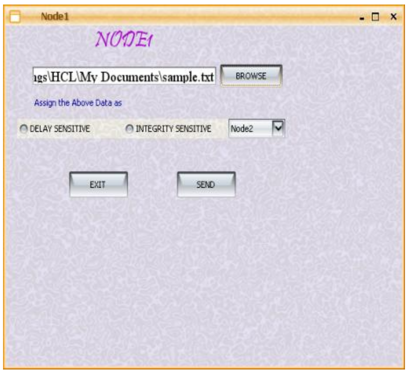
High-integrity packets block the shortest paths, compelling the delay-sensitive packets to travel more hops before reaching the sink, which increases the delay. High-integrity packets occupy the buffers, which also increases the queuing delay of delay-sensitive packets. To overcome the above drawbacks, a mechanism is designed, which allows the delay-sensitive packets to move along the shortest path and the packets with fidelity requirements to detour to avoid possible dropping on the hotspots. In this way, the data integrity and delay differentiated services can be provided in the same network. Integrity sensitive packet forwarding takes longest route, less traffic route to route the packets.

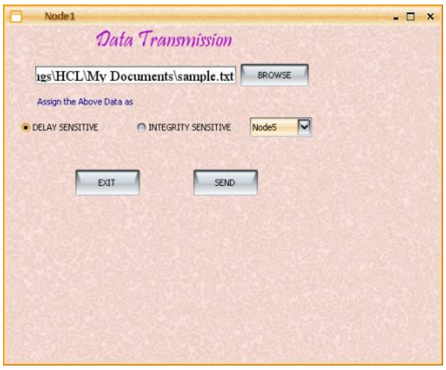
Data delivery

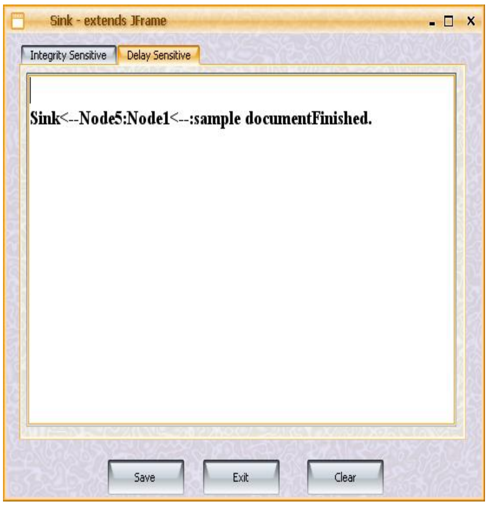
The basic idea of IDDR is to consider the whole network as a big buffer to cache the excessive packets before they arrive at the sink. Data from sensor nodes delivered to sink node via two different routing techniques such as delay sensitive and integrity sensitive. One of the options of these two can be chosen by user. Finally data from node arrive sink node. For security purpose, the data is encrypted at sensor nodes and sent to sink, whereas sink can decrypt and get the packets.

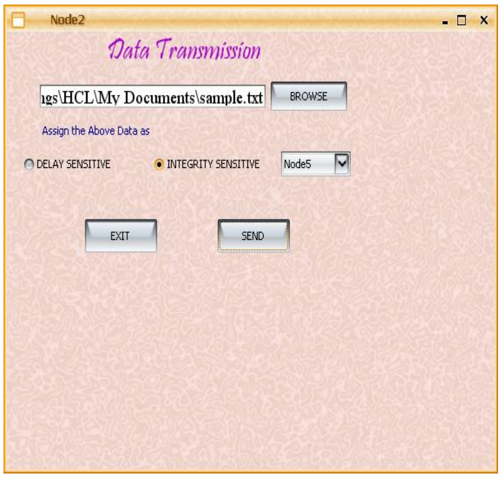
V. RESULT ANALYSIS

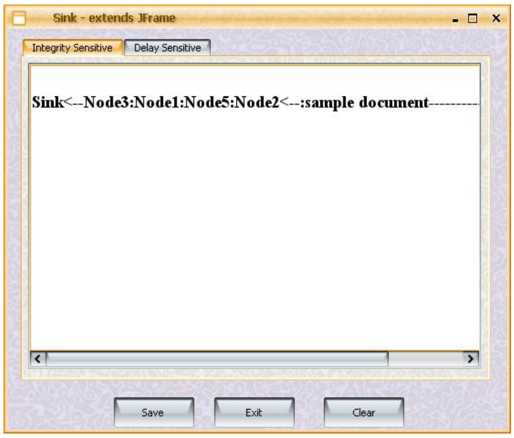












VI. CONCLUSION

A dynamic multipath routing algorithm IDDR is proposed based on the concept of potential in physics to satisfy the two different QoS requirements, high data fidelity and low end-to-end delay, over the same WSN simultaneously. The IDDR algorithm is proved stable using the Lyapunov drift theory. Moreover, the experiment results on a small testbed and the simulation results on TOSSIM demonstrate that IDDR can significantly improve the throughput of the high-integrity applications and decrease the end-to-end delay of delaysensitive applications through scattering different packets from different applications spatially and temporally.

IDDR can also provide good scalability because only local information is required, which simplifies the implementation. In addition, IDDR has acceptable communication overhead.

VII. REFERENCES

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