IOSR Journal of Computer Science (IOSR-JCE)
e-ISSN: 2278-0661, p-ISSN: 2278-8727
PP 51-58
www.iosrjournals.org

Perfomance Improvement in The Congested Sensor Network

Mr. Rakesh Z. Vaikunthi[1], Miss. Pradhnya A. Kemble[2]
[1]ME. (WCC Pursuing) Priyadarshini College of Engineering Hingna Road,
Nagpur- 440019(MH), India rvaikunthi123@gmail.com
[2]Asst. Professor, CT Dept. Priyadarshini College of Engineering Hingna Road,
Nagpur- 440019(MH), India Pradhnya_kamble@rediffmail.com

ABSTRACT: *Data generated in wireless sensor networks may not all be alike: some data may be more important than others and hence may have different delivery requirements. In this paper, we address differentiated data delivery in the presence of congestion in wireless sensor networks. We propose a class of algorithms that enforce differentiated routing based on the congested areas of a network and data priority Also it can find the shortest path to avoid congestion. The basic protocol, called Congestion-Aware Routing (CAR), discovers the congested zone of the network that exists between high-priority data sources and the data sink and, using simple forwarding rules, dedicates this portion of the network to forwarding primarily high-priority traffic. Since CAR requires some overhead for establishing the high-priority routing zone, it is unsuitable for highly mobile data sources. To accommodate these, we define MAC-Enhanced CAR (MCAR), which includes MAC-layer enhancements and a protocol for forming high-priority paths on the fly for each burst of data. MCAR effectively handles the mobility of high-priority data sources, at the expense of degrading the performance of low-priority traffic. We present extensive simulation results for CAR and MCAR, and an implementation of MCAR on a 48-node tested.*
Keywords :*Wireless sensor networks, routing, congestion, differentiated service shortest path.*

I. INTRODUCTION

Provisioning a wireless sensor network so that congestions a rare event is extremely difficult. Sensor networks deliver myriad types of trace, from simple periodic reports to un-predictable bursts of messages triggered by external events that are being sensed. Even under a known, periodic trace Pattern and a simple network topology, congestion occurs in wireless sensor networks because radio channels vary in time (often dramatically) and concurrent data transmissions over deferent radio \links" interact with each other, causing channel quality to depend not just on noise but also on trace densities. Moreover, the addition or removal of sensors, or a change in the report rate can cause previously uncongested parts of the network to become under-provisioned and con-jested. Last but not least, when sensed events cause bursts Of messages, congestion becomes even more likely. Sensor network deployments may include hundreds or thousands of nodes. Since deploying such large-scale networks has a high cost, it is increasingly likely that Sensors will be shared by multiple applications and gather various types of data: temperature, the presence of lethal Chemical gases, audio and/or video feeds, etc. Therefore, data generated in a sensor network may not all be equally important. With large deployment sizes, congestion becomes an important problem. Congestion may lead to indiscriminate dropping of data (i.e., high-priority (HP) packets may be dropped while low-priority (LP) packets are delivered). It also results in an increase in energy consumption to route packets that will be dropped downstream as links become saturated. As nodes along optimal routes are depleted of energy, only no optimal routes remain, further compounding the problem. To ensure that data with higher priority is received in the presence of congestion due to LP packets, differentiated service must be provided. In this work, we are interested in congestion that results from excessive competition for the wireless medium. Existing schemes detect congestion while considering all data to be equally important. We characterize congestion as the degradation of service to HP data due to competing traffic. In this case, congestion detection is reduced to identifying competition for medium access between HP and LP traffic. Congestion becomes worse when a particular area is generating data at a high rate. This may occur in deployments in which sensors in one area of interest are requested to gather and transmit data at a higher rate than others (similar to burst converge cast [25]). In this case, routing dynamics can lead to congestion on specific paths. These paths are usually close to each other, which leads to an entire zone in the network facing congestion. We refer to this zone, essentially an extended hotspot, as the congestion zone (canzone). In this paper, we examine data delivery issues in the presence of congestion. We propose the use of data prioritization and a differentiated routing protocol and/or a prioritized medium access scheme to mitigate its effects on HP traffic. We strive for a solution that accommodates Both LP and HP traffic when the network is static or near static and enables fast recovery of LP traffic in networks with mobile HP data sources. Our solution uses a differentiated routing approach to effectively separate HP traffic from LP traffic in the sensor network And As we are applied Single source shortest path Algorithm to find shortest path and avoid congestion in the network. HP traffic has exclusive use of nodes along its shortest path to the sink, whereas LP traffic is routed over uncongested nodes in the network but may traverse longer paths. Our contributions in this work are listed as follows:

Congestion-Aware Routing (CAR) :CAR is a network-layer solution to provide differentiated service in congested sensor networks. CAR also prevents severe degradation of service to LP data by utilizing uncongested parts of the network.

MAC-Enhanced CAR (MCAR) :MCAR is primarily a MAC-layer mechanism used in conjunction with routing to provide mobile and lightweight canzone's to address sensor networks with mobile HP data sources and/or busty HP traffic. Compared to CAR, MCAR has a smaller overhead but degrades the performance of LP data more aggressively.We compare CAR and MCAR to an AODV scheme enhanced with priority queues (AODV+PQ). Both CAR and MCAR lead to a significant increase in the successful packet delivery ratio of HP data and a clear decrease in the average delivery delay compared to AODV+PQ. CAR and MCARAlso provide low jitter. Moreover, they use energy more uniformly in the deployment and reduce the energy consumed in the nodes that lie on the canzone, which leads to an increase in connectivity lifetime. In the presence of sufficient congestion, CAR also allows an appreciable amount of LP data to be delivered. We further show that, in the presence of mobile HP data sources, MCAR provides mobile canzones, which follow the HP traffic.We also present the implementation of MCAR on our sensor network tested. The implementation shows the feasibility of MAC-layer enhancements and differentiatedRouting on current hardware. We demonstrate that using an actual implementation, HP delivery rates similar to those seen in simulation can be achieved in a practical system.The rest of this paper is organized as follows: Section 2 presents related work. Details of CAR and MCAR are presented in Section 3. Node details and Congestion aware Algorithm and single source shortest path Algorithm 4. Section 5 performance evolution Finally, Section 6 presents conclusions and future directions.

II. RELATED WORK

To enhance service to HP data is to use priority queues to provide differentiated services. in such schemes, though HP packets get precedence over LP packets within a node, at the MAC layer, they still compete for a shared channel with LP traffic sent by surrounding nodes. As a result, without a routing scheme to address the impact of congestion and hotspots in the network, local solutions like priority queuing are not sufficient to provide adequate priority service to important data. QoS in sensor networks has been the focus of current research (e.g., [4] and [17]). SPEED [17] provides soft real-time guarantees for end-to-end traffic using feedback control and location awareness. It also concludes that local adaptation at the MAC layer alone is insufficient to address the problem of hotspots and that routing is essential to the solution. Akkaya and Younis [18] propose an energy-aware QoS routing protocol to support the delivery of real-time data in the presence of interfering non-real-time data by using multiple queues in each node in a cluster-based network; they do not consider the impact of congestion in the network and the interference that non-real-time traffic can cause to real-time data. Zhang et al. [3] propose a generic model for achieving multiple QoS objectives Data Transfer with Duty Cycles for Wireless. Though these schemes take important steps to mitigate congestion in sensor networks, they treat all data equally. These schemes are complementary to the capability provided by CAR and MCAR. Similarly, our solutions do not preclude the use of priority queues, which can be added as a simple extension. Existing work on congestion in sensor networks has two aspects: detection and mitigation. As mentioned earlier, we do not concern ourselves with congestion detection schemes in this work. Most mitigation schemes differ in how they invoke back pressure and rate limiting. Z. Fend, F. Hu, [10] enhanced event-to-sink reliable transport for wireless sensor networks. Wireless Communications and Mobile Computing

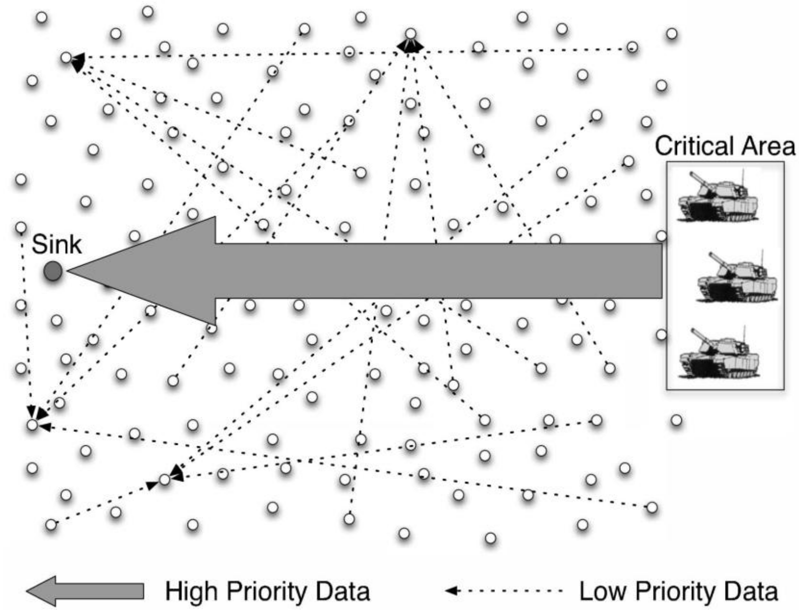

Fig. 1. A critical area of a sensor network may generate HP data at a high rate. This causes congestion in a part of the network exacerbated by the presence of LP data being routed in that area.

Mitigation scheme (other than back pressure and rate limiting) is assigning preferential medium access to parents in the routing tree. This assumes that all data in a network is Destined to a single sink, which might not always be the case. In contrast, in our scenario, LP data can be sent from any node to any other node. As a result, Fusion's preferential MAC scheme is not applicable. Also, congestion in Fusion occurs due to the accumulation of packets close to the sink. In contrast, we address the degradation of performance of HP data delivery due to an extended hotspot in the network resulting from competition for medium access between LP and HP data. Also, Fusion does not do data differentiation based on priorities or provide differentiated routing.

III. CONGESTION AWARE ALGORITHMS

In Section 3.1, we introduce the network scenario and present an overview of our schemes, which are then detailed in Sections 3.1, 3.2 and 3.3

3.1 Overview : An example of the problem scenario that we consider is shown in Fig. 1. An important event occurs in one portion of the sensor field, which we call the critical area. ThisCritical area will typically consist of multiple nodes. In such a scenario, there is a data processing center for collecting sensitive information from the critical area. Such data is assigned a higher priority than other data. There might also be several nodes collecting different types of LP information from other parts of the network. In the presence of thisBackground LP traffic, without differentiating between the two priority classes, congestion will degrade the serviceprovided to HP data. This may result in HP data being dropped or delayed so long that it is of no use to the data processing center. We refer to the area that contains the shortest paths from the critical area to the sink as the conzone. HP data would ideally traverse the conzone but will face competition for medium access due to LP traffic.Our basic solution, called CAR, operates solely in the network layer. Packets are classified as HP or LP by the data sources, and nodes within a conzone only forwardHP traffic. LP traffic is routed out of and/or around

IOSR Journal of Computer Science (IOSR-JCE)
e-ISSN: 2278-0661, p-ISSN: 2278-8727
PP 51-58
www.iosrjournals.org

the conzone. In effect, we segment the network into two parts by using forwarding rules. One limitation with this system is that it requires some overhead to discover the conzone. While this overhead is reasonable, it may still be too heavy weight if the data source is moving often and the conzone is changing frequently or if the HPTraffic is short lived. Hence, CAR is designed for static or nearly static networks with long-lived HP flows.To address a mobile conzone (i.e., the conzone formed when sources of HP traffic are mobile) and/or burst HP traffic, we define a MAC-layer-based protocol combined with routing to form conzones on the fly with each burst of data. This protocol handles mobility effectively but at the costof drastically degrading the delivery of LP traffic, because there is no opportunity to establish alternate routes for such data. We call this second protocol MCAR.The combination of CAR and MCAR allows us to accommodate HP and LP traffic as best as possible, given the type of HP data source and the duration of HP traffic.

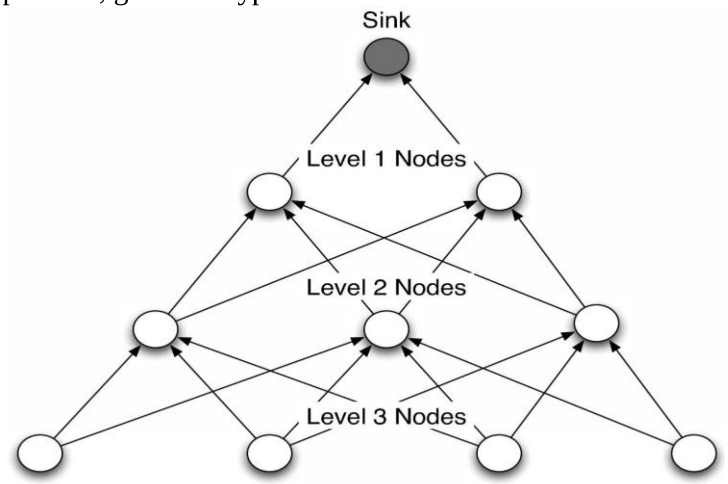

Fig. 2. In a dense deployment, multiple nodes can be parents of a node. Each parent lies on a different shortest path route to the sink. This structure is used for shortest multipath routing.

For static sources, LP traffic finds alternate routes and suffers minor degradation using CAR. For networks with mobile nodes or burst HP traffic, LP traffic is effectively interrupted and dropped when in contention with an HP source using MCAR.

3.2. High-Priority Routing Network Formation : After the deployment of sensor nodes, the HP data collection center (the sink) initiates the process of building the HP routing network (Hi Net). This network covers all nodes, because at the time of deployment, the sink will usually have no information on the whereabouts of the critical area nodes. Also, based on the locations of events That can occur during the lifetime of the network, different nodes may constitute the critical area. Since all HP data is destined to a single sink, the HiNet is based on a minimum distance spanning tree rooted at the sink. As with TAG [16], this structure ensures that all nodes have shortest path routes to the sink. However, instead of every node having a single parent, as in other tree-based schemes, we allow nodes to have multiple parents. A node that has multiple neighbors with depths (the number of hops to the sink) less than its own considers them all as parents (see Fig. 3). We leverage this property to support multipath forwarding, thus providing load balancing and making the routing network more resilient to failures. Finally, the Build HiNet message is rebroadcast with the new depth value. In this fashion, the Build HiNet message is sent down the network until all nodes become to changes caused by the failure or addition of nodes.

3.3 Differentiated Routing :

Part of the conzone, all HP data will be generated inside the conzone. Hence, the routing of HP data is simple: a node always forwards the data to one of its on conzone parents. This parent is chosen randomly from the on-conzone parent list to balance the load among them. If, for some

Routing Low Priority Data:
if $P_{off} \neq \{\}$ **then**
send data to any $p \in P_{off}$
else if $\exists$ a sibling $s \in S_{off}$ **then**
send data to s
else
send data to the farthest parent p from dividing line

Routing High Priority Data:
if $P_{on} \neq \{\}$ **then**
send data to any $p \in P_{on}$
else if $\exists$ a sibling $s \in S_{on}$ **then**
send data to s
else
send data to any $u \in P_{off} \cup S_{off}$

Fig. 3. Routing algorithm for CAR for LP and HP data inside the conzone.

reason, the links to all parents are broken, for example, because of node failures, the node will forward the data to a sibling that is on the conzone. If that is impossible, it will forward the data to any of its neighbors, hoping that it can return to an on-conzone node. LP data generated inside the conzone is routed out using the following approach. When an on-conzone node gets an LP message, it forwards it to an off-conzone parent, if there are any. Otherwise, the LP data is forwarded to an off conzone sibling. If there are no parents or siblings that are off conzone, we resort to the following method. After discovering the conzone, the sink sends a message through the conzone, which contains the coordinates of a line that cuts the conzone in half. This line connects the sink to the center of the critical area. Using this information and its own coordinates, a node can determine on which half of the Conzone it lies and hence routes LP data to the parent that is closest to the conzone boundary, i.e., farthest from the line. With the assumption of uniform deployment density, this ensures that all LP data generated inside the conzone is routed out efficiently and along the shortest path. Keeping the routing out cost low. It is important to note here that to keep the routing overhead low, LP routing decisions inside the conzone are static. So, once a node decides to which neighbor it is going to forward LP data, it uses the same neighbor for all LP packets. If that neighbor fails, an alternative must be found using the same scheme. In-conzone routing for both LP and HP data is summarized in Fig. 3. LP data generated outside the conzone or routed out of the conzone has to be routed to the appropriate LP sink without using the conzone nodes. Hence, routing LP data outside the conzone can use any of the known routing schemes such as AODV, with modifications to prevent LP data from being routed from an off-conzone node into the conzone. We used AODV in the off conzone nodes to route LP data, with the modification that the on-conzone nodes do not propagate route request or reply messages for LP data Using this modified routing scheme, LP data generated outside or routed out of the conzone is routed to its destination via off-conzone nodes only.

IV. SINGE SOURCE SHORTESTH PATH ALGORITHMS

A network $N = (V, E, C)$ is a directed graph $G = (V, E)$ (where $|V| = n$, $|E| = e$) together with a real-valued function $C : E \to \mathbb{R}$. The length of a path $w = v_1 \ldots v_m$ is defined

$$l(w) = \sum_{i=1}^{m-1} C(v_i, v_{i+1}).$$

Let us denote the minimal length of any path from x to y (with respect to $W \subset V$) by

$$\mathrm{Min}(x,y;W) = \inf \{ \, l(w) \; ; \; w=v_1 \ldots v_n \text{ is a path from } x \text{ to } y \text{ and for } 1 \leq i \leq n \text{ we have } v_i \in W \, \} .$$

IOSR Journal of Computer Science (IOSR-JCE)
e-ISSN: 2278-0661, p-ISSN: 2278-8727
PP 51-58
www.iosrjournals.org

The single source shortest path problem is defined by

(SSSP): Let N = (V, E, C) be a directed network and let s be a designated vertex in V.
Compute Min(s,x;V) for every vertex x∈V.

The most popular solution to SSSP is the Bellman/Ford algorithm
It solves SSSP in time $O(n \cdot e)$.

Using this Algorithm we find out shortest path during congestions in the network it will help to avoid congention in the sensor network.

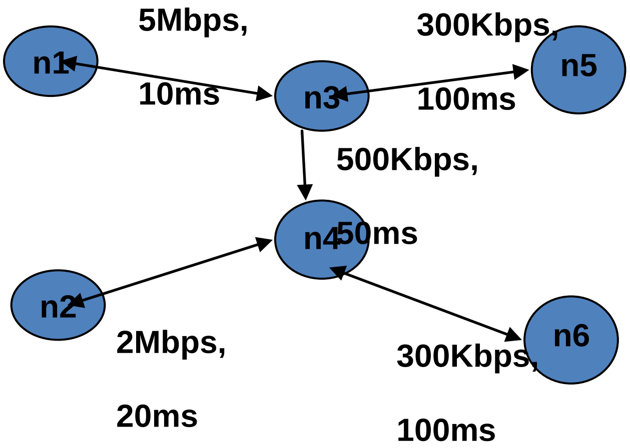

Fig. 4. Data Transfer between nodes

V. PERFORMANCE EVALUATION

In this section, we describe our simulation setups used to test CAR and MCAR and discuss the results in detail. Table 1 provides a brief summary of our proposed schemes. Since our implementation tested consists of only 48 nodes, we use larger setups in simulations to gather insights about CAR-based schemes and MCAR. Hence, we present extensive simulation results in this section, which are complemented by implementation results in Section 5 to complete the picture.

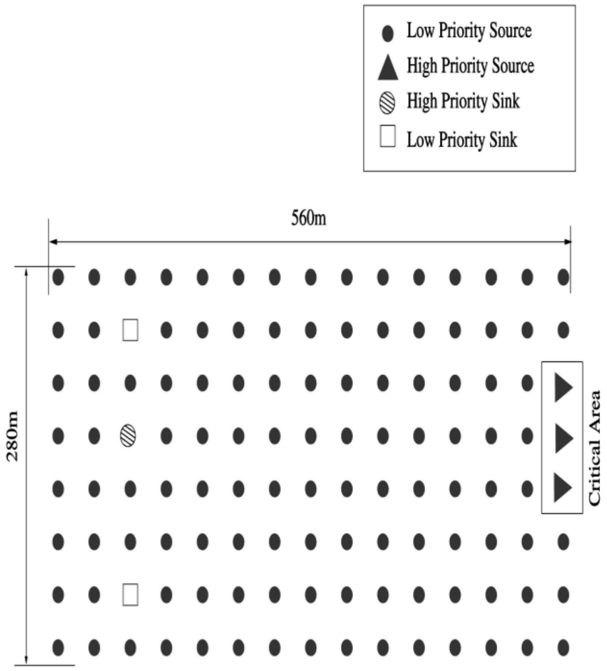

Fig. 5. Simulation scenario.

VI. CONCLUSION AND FUTURE WORK

In this paper, we addressed data delivery issues in the presence of congestion in wireless sensor networks. We proposed CAR, which is a differentiated routing protocol and uses data prioritization. We also develop MCAR, which deals with mobility and dynamics in the sources of HP data. Our extensive simulations show that as compared to AODV and AODV+PQ, CAR and its variants increase the fraction of HP data delivery and decrease delay and jitter for such delivery while using energy more uniformly in the deployment. Both CAR and MCAR support effective HP data delivery in the presence of congestion. CAR is better suited for static networks with long-duration HP floods. For bursty HP traffic and/or mobile HP sources, MCAR is a better fit. We also presented the implementation of an environmental monitoring system that uses MCAR as its MAC and routing layer. Our experiments on the tested verify the conclusions drawn from the simulation study and show That MCAR is suitable for implementation on currently available hardware. Because of the low jitter rates and maintainable delay, CAR and its variants appear suitable to real-time data delivery. To ensure QoS for video streams, reactive Dropping methods could be combined into the routing protocol. Our future work looks at the effectiveness of such techniques in sensor network environments. Also, while MCAR merges multiple conzones naturally; we are now exploring the interactions of differentiated routing and multiple conzones, which may be overlapping or disjoint in CAR and its two enhancements. Also provide shortest path during congention finally, we will also explore the impact of different sizes and shapes of conzones on data delivery in the future.

REFERENCES

[1]] “Congestion Performance Improvement in Wireless Sensor Network”, Junjie Xiong and Michael R. Ly 2012 IEEE.
[2] “On Reliable Broadcast in Low Duty-Cycle Wireless Sensor Networks” IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 11, NO. 5, MAY 2012
[3] “Reliable Sensor-to-Sink Data Transfer with Duty Cycles for Wireless Sensor Networks” IEEE, Conference on Local Computer Networks 2011.
[4] “Self-Adaptive On-Demand Geographic Routing for Mobile Ad Hoc Networks” IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 11, NO. 9, SEPTEMBER 2012.
[5] “A Congestion Mitigation Approach using Mobile Nodes in Wireless Sensor Networks”, IEEE April 12–14, 2011
[6] “Packet Delivery Performance of Simple Cooperative Relaying in Real-World Car-to-Car Communications” IEEE WIRELESS COMMUNICATIONS LETTERS, VOL. 1, NO. 3, JUNE 2012

[7] Mukesh Kumar Rathi, Saim Ghafoor, Jong-Kyu Lee, "Data Dissemination in Low Duty-cycle Multi-channel Multi-hop Wireless Sensor Networks", International conference on Computer engineering and technology, IEEE 2010.
[8] "Mitigating Performance Degradation in Congested Sensor Networks" IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 7, NO. 6, JUNE 2009.
[9] J. Ruiz, J. R. Gallardo, L. V. Gonzalez, D. Makrakis, and H. T. Mouftah. QUATTRO: QoS-capable cross-layer MAC protocol for wireless sensor networks. IEEE GLOBECOM, 2009.
[10] S. Kumar, Z. Fend, F. Hu, and Y. Xiao. E2SRT: enhanced event-to-sink reliable transport for wireless sensor networks. Wireless Communicationsand Mobile Computing, 9:1301–1311, 2008.
[11]S. Kumar, Z. Fend, F. Hu, and Y. Xiao. E2SRT: enhanced event-to-sink reliable transport for wireless sensor networks. Wireless Communications and Mobile Computing, 9:1301–1311, 2008.
[12]" A. Dunkels, F. Osterlind, and Z. He. An Adaptive Communication Architecture for Wireless Sensor Networks. In Fifth ACM Conference on Networked Embedded Sensor Systems (SenSys), 2007..
[13] K. Karenos and V. Kalogeraki. Facilitating Congestion Avoidance in Sensor Networks with a Mobile Sink. In RTSS, pages 321–332, 2007.
[14] W. Wu, J. Cao, J. Yang, and M. Raynal, "Design and Performance Evaluation of Efficient Consensus Protocols for Mobile Ad Hoc Networks," IEEE Trans. Computers, vol. 56, no. 8, pp. 1055-1070, Aug. 2007.
[15] Y. Zhou and M. Medidi. Energy-efficient Contention-Resilient Medium Access for Wireless Sensor Networks. *IEEE ICC*, June 2007.
[16] F. Osterlind, A. Dunkels, J. Eriksson, N. Finne, and T. Voigt. Cross-Level Sensor Network Simulation with COOJA. Annual IEEE Conference on Local Computer Networks, pages 641–648, 2006.
[17] C. Perkins, E. Belding-Royer, and S. Das, "Ad hoc On-Demand Distance Vector (AODV) Routing," Experimental RFC 3561, July 2003.
[18] K. Akkaya and M.F. Younis, "An Energy-Aware QoS Routing Protocol for Wireless Sensor Networks," Proc. 23rd IEEE Int'l Conf. Distributed Computing Systems (ICDCS '03), pp. 710-715, 2003.