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MINIMIZING DELAY AND MAXIMIZING LIFETIME FOR WIRELESS SENSOR NETWORKS WITH ANYCAST

Abhay Raman, Ankit Kr. Singh, Abhishek Rai

Institute of Technology & Management

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ABSTRACT:

In this paper, we are interested in minimizing the delay and maximizing the lifetime of event-driven wireless sensor networks, for which events occur infrequently. In such systems, most of the energy is consumed when the radios are on, waiting for an arrival to occur. Sleep-wake scheduling is an effective mechanism to prolong the lifetime of these energy-constrained wireless sensor networks. However, sleep-wake scheduling could result in substantial delays because a transmitting node needs to wait for its next-hop relay node to wake up. An interesting line of work attempts to reduce these delays by developing any cast.-based packet forwarding schemes, where each node opportunistically forwards a packet to the neighboring node that wakes up among multiple candidate nodes. In this paper, we first study how to optimize the any cast forwarding schemes for minimizing the expected packet-delivery delays from the sensor nodes to the sink. Based on this result, we then provide a solution to the joint control problem of how to optimally control the system parameters of the sleep-wake scheduling protocol and the any cast packet-forwarding protocol to maximize the network lifetime, subject to a constraint on the expected end to end packet-delivery delay. Our numerical results indicate that the proposed solution can outperform prior heuristic solutions in the literature, especially under the practical scenarios where there are obstructions, e.g., a lake or a mountain, in the coverage area of wireless sensor networks.

Keyword: *Anycast, energy efficiency, sleep wake scheduling, sensor network.*

I. INTRODUCTION:

Recent advances in wireless sensor networks have resulted in a unique capability to remotely sense the environment. These systems are often deployed in remote or hard-to reach areas. Hence, it is critical that such networks operate unattended for long durations. Therefore, extending network lifetime through the efficient use of energy has been a key issue in the development of wireless sensor networks. In this paper, we will focus on event-driven asynchronous sensor networks, where events occur rarely. This is an important class of sensor networks and has many applications such as environmental monitoring, intrusion detection, etc. In such systems, there are four main sources of energy consumption: energy required to keep the communication radios on; energy required for the transmission and reception of control packets; energy required to keep sensors on; and energy required for actual data transmission and reception. The fraction of total energy consumption for actual data transmission and reception is relatively small in these systems, because events occur so rarely. The energy required to sense events is usually a constant and cannot be controlled.

Hence, the energy expended to keep the communication system on (for listening to the medium and for control packets) is the dominant component of energy consumption, which can be controlled to extend the network lifetime. Thus, sleep-wake scheduling becomes an effective mechanism to prolong the lifetime of energy constrained event-driven sensor networks. By putting nodes to sleep when there are no events, the energy consumption of the sensor nodes can be significantly reduced. Various kinds of sleep-wake scheduling protocols have been proposed in the literature. Synchronized sleep-wake scheduling protocols have been proposed in these protocols, sensor nodes periodically or a periodically exchange synchronization information with neighboring nodes.

However, such synchronization procedure could incur additional communication overhead, and consume a considerable amount of energy. On-demand sleep-wake scheduling protocols have been proposed in, where nodes turn off most of their circuitry and always turn on a secondary low-powered receiver to listen to .wake-up calls from neighboring nodes when there is a need for relaying packets. However, this on demand sleep-wake scheduling can significantly increase the cost of sensor motes due to the additional receiver.

In this work, we are interested in asynchronous sleep-wake scheduling protocols such as those proposed in these protocols, the sleep-wake schedule at each node is independent of that of other nodes, and thus the nodes do not require either a synchronization procedure or a secondary low-power receiver. However, because it is not practical for each node to have complete knowledge of the sleep-wake schedule of other nodes, it incurs additional delays along the path to the sink because each node needs to wait for its next-hop node to wake up before it can transmit. This delay could be unacceptable for delay-sensitive applications, such as are detection or tsunami alarm, which require that the event reporting delay be small. Prior work in the literature has proposed the use of *any cast* packet-forwarding schemes to reduce this event reporting delay. Under traditional packet-forwarding schemes, every node has one designated next-hop relaying node in the neighborhood, and it has to wait for the next-hop node to wake up when it needs to forward a packet.

II. OBJECTIVES AND PERFORMANCE METRICS

In this subsection, we define the performance objectives of the anycast policy and the sleep-wake scheduling policy that we intend to optimize. We remind the readers that, although the sleep-wake patterns and the anycast forwarding policy are applied in the operation phase of the network, their control parameters are optimized in the configuration phase.

End-to-End Delay: We define the end-to-end delay as the delay from the time when an event occurs, to the time when the first packet due to this event is received at the sink. We motivate this performance objective as follows: for applications where each event only generates one packet, the above definition clearly captures the delay of reporting the event information. For those applications where each event may generate multiple packets, we argue that the event reporting delay is still dominated by the delay of the first packet. This is the case because once the first packet goes through, the sensor nodes along the path can stay awake for a while. Hence, subsequent packets do not need to incur the wake-up delay at each hop, and thus the end-to-end delay for the subsequent packets is much smaller than that of the first packet.

When there is only one source generating event-reporting packets, the end-to-end delay of the first packet can be determined as a function of the anycast policy (A;B) and the sleep-wake scheduling policy ~*p*. One may argue that it may be desirable to design protocols that can potentially reduce the end-to-end delay by adjusting the anycast policy dynamically after the event occurs, e.g., according to traffic density. However, this dynamic adjustment is not possible for the first packet, because when the first packet is being forwarded, the sensor nodes have not woken up yet. Hence, to forward the first packet to the sink, the sensor nodes must use some pre-configured policies determined in the configuration phase (We remind the readers about the discussion of different phases at the end of the introductory section.) After the first packet is delivered to the sink, the sensor nodes along the path to the sink have woken up. Thereafter, they are able to adapt their control policies dynamically, e.g, according to the traffic density. In this paper, since we are mostly interested inreducing the delay of the first packet, these dynamic adaption policies are outside the scope of our paper. In other words, we mainly focus on the optimization of the anycast and sleepwake scheduling policies at the initial configuration phase.

III. Sleep and Wakeup Method

1.All the Router are inbuilt with sleep and awake up technology, that means if the router is not getting the packet for certain interval of time it will go to sleep mode, when need arise the routers are switch back to wake-up mode.

2.We need a monitoring program. It will check the routing table every 60 seconds.

a .If file_flag is 0 then make the status of respective router "sleep".

b. Reset the file_flag for all the router to 0.

IV. LITERATURE SURVEY:

In the process of tabulation of report and research work done in order to take up the project and work on it we referred to various papers and forms of literature related to the project. This was the most helpful and knowledgeable source. The information we gained from the paper referred to was really helpful in understanding the project, the way to handle it and the proceeding. A literature search has been carried out, to collect the information and data for various item. the required information and data has been collected from the standard book, monographs, internet sites and other CDROM database or sourcing material safety data sheets, information on and other database available on the internet and other data as required. Here are the papers thoroughly referred during the course of project study. Wireless Sensor Networks (WSN) consists of a large number of inexpensive, spatially distributed devices that collect sensor readings of their environment . It is well known that WSNs are constrained by limited battery life and once deployed battery power cannot be replenished. In general, communication between sensor nodes and a base station can take place directly in a single hop or over multiple hops. In the multi-hop communication model sensor nodes report data to a base station and cooperate to forward data packets from other sensor nodes positioned farther away from the base station. Such a many-to-one communication model gives rise to what is described as the reach back problem in networks in general and WSNs in particular (defines the reach back channel for multi-hop WSNs with a mobile base station. Nevertheless, we refer to the multi-hop channels with both mobile and stationary base stations as reach back channels). The generalized reach back problem applies to any network obeying a many-to-one communication model. Some sensors will be situated farther away from the base station than others. Such sensors cannot communicate directly with the base stations and employ multi-hop communication to send data to the base station using the intermediary sensors. Traffic flows from the edges of the sensor network towards the base stations. Thus, the volume of traffic relayed by nodes closer to the base station is significantly higher than that of nodes farther away. Lifetime per unit cost, defined as the network lifetime divided by the number of sensors deployed in the network, can be used to measure the utilization efficiency of sensors in a wireless sensor network (WSN). Analyzing the lifetime per unit cost of a linear WSN, we find that deploying either an extremely large or an extremely small number of sensors is inefficient in terms of lifetime per unit cost. We thus seek answers to the following questions: how many sensors should be deployed and how to deploy them to maximize the lifetime per unit cost. Numerical and simulation results are provided to study the optimal sensor placement and the optimal number of deployed sensors.

we have proposed the SMED in Multi-hop Wireless Sensor Networks. The proposed scheme is designed to have variable active duration of nodes according to their variable traffic load. The variable active durations are assigned to the nodes based on node distance from the sink node, node topological importance, and occurrence of event in its vicinity. It will enable the nodes to gracefully handle the traffic, as nodes are dynamically assigned active durations according to their expected traffic load. It minimizes delay at the nodes near to the sink node, node having critical topological position, and nodes in vicinity of event occurrence. This ensures rapid dissemination of data to the sink node and hence reduces the end-to-end delay. Simulations are carried out to evaluate the performance of the proposed protocol, by comparing its performance with S-MAC and Anycast protocols. Simulation results demonstrated that the proposed protocol has significantly reduced the end to- end delay, as well as improved the other QoS parameters of average energy per packet, average delay, packet loss ratio, throughput, and coverage throughput. In future our plan is to extend the simulations to consider other parameters and scenarios, such as fault tolerance, impact of aggregation, etc. Other important future extension is to evaluate the performance of SMED in clustered-based WSNs.

An improved method of dynamic route establishment between sensors and sinks is proposed for wireless sensor networks. The method is based on the use of an anycast-based restricted flooding technique and does not require the accumulation and maintenance of state information in network nodes. The proposed scheme is implemented as a simulation model in terms of extended Petri nets. The developed model was investigated in extensive simulation experiments. The behavior of the model was evaluated with the use of a few practically important performance metrics.

V. WORK DONE:

EXISTING SYSTEM:

Existing mechanism to prolong the lifetime of energy-constrained wireless sensor networks, it incurs an additional delay for packet delivery when each node needs to wait for its next-hop relay node to wake up, which could be unacceptable for delay-sensitive applications. Prior work in the literature has proposed to reduce this delay using any cast, where each node opportunistically selects the first neighboring node that wakes up among multiple candidate nodes. Joint control problem of how to optimally control the sleep-wake schedule, the any cast candidate set of next-hop neighbors, and any cast priorities, to maximize the network lifetime subject to a constraint on the expected end-to-end delay. We provide an efficient solution to this joint control problem. Our numerical results indicate that the proposed solution can substantially outperform prior heuristic solutions in the literature, especially under the practical scenarios where there are obstructions in the coverage area of the wireless sensor network.

PROPOSED SYSTEM:

We are interested in minimizing the delay and maximizing the lifetime of event-driven wireless sensor networks, for which events occur infrequently. Optimize the any cast forwarding schemes for minimizing the expected packet-delivery delays from the sensor nodes to the sink. Based on this result, we then provide a solution to the joint control problem of how to optimally control the system parameters of the sleep-wake scheduling protocol and the any cast packet-forwarding protocol to maximize the network lifetime, subject to a constraint on the expected end to end packet-delivery delay.

We develop any cast packet-forwarding scheme to reduce the event-reporting delay and to prolong the lifetime of wireless sensor networks employing asynchronous sleep-wake scheduling. Specifically, we study two optimization problems. First, when the wake-up rates of the sensor nodes are given, we develop an efficient and distributed algorithm to minimize the expected event-reporting delay from all sensor nodes to the sink. Second, using a specific definition of the network lifetime, we study the lifetime-maximization problem to optimally control the sleep-wake scheduling policy and the any cast policy, in order to maximize the network lifetime subject to a upper limit on the expected end-to-end delay. Our numerical results suggest that the proposed solution can substantially outperform prior heuristic solutions in the literature under practical scenarios where there are obstructions in the coverage area of the wireless sensor network.

6.CONCLUSION:

We develop an anycast packet-forwarding scheme to reduce the event-reporting delay and to prolong the lifetime of wireless sensor networks employing asynchronous sleep-wake scheduling. Specifically, we study two optimization problems. First, when the wake-up rates of the sensor nodes are given, we develop an efficient and distributed algorithm to minimize the expected event-reporting delay from all sensor nodes to the sink. Second, using a specific definition of the network lifetime, we study the lifetime-maximization problem to optimally control the sleep-wake scheduling policy and the anycast policy, in order to maximize the network lifetime subject to a upper limit on the expected end-to-end delay. Our numerical results suggest that the proposed solution can substantially outperform prior heuristic solutions in the literature under practical scenarios where there are obstructions in the coverage area of the wireless sensor network.

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