An Efficient Routing Scheme for Wireless Sensor Networks

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ABSTARCT:

The multiplication of new online Internet administrations has generously expanded the vitality utilization in wired systems, which has turned into a basic issue for Internet specialist organizations. In this paper, we focus on the system wide vitality sparing issue by utilizing speed scaling as the vitality sparing methodology. We propose a disseminated directing scheme– HDEER– to enhance arrange vitality proficiency in an appropriated way immediately. HDEER is a two-organize steering plan where a straightforward conveyed multipath finding calculation is right off the bat performed to ensure circle free steering, and after that a conveyed directing calculation is executed for vitality productive steering in every hub among the numerous circle free ways. We direct broad trials on the NS3 test system and reenactments with genuine system topologies in various scales under various activity situations. Investigation comes about demonstrate that HDEER can diminish organize vitality utilization with a reasonable tradeoff between arrange vitality utilization and movementdelay.

I. INTRODUCTION

THE considerable power devoured by a system has turned into a basic issue for Internet Service Providers (ISPs). It has been accounted for that the aggregate vitality utilized by the Information and Communication Technology is in charge of a critical division of the world aggregate power utilization, extending in the vicinity of 2% and 10%. With the multiplication of new Internet administrations, for example, person to person communication and distributed computing, this extent has expanded quickly as of late. The colossal vitality utilization of substantial scale systems will turn into a hindrance to their further advancements unless vitality efficiencies can be altogether moved forward. A lot of research has been completed for organize vitality effectiveness in view of two components: speed scaling and shut down. These components are thought to be fundamental gadget level vitality sparing methodologies and have just been connected in industry

II. RELATED WORKS

Security and privacy in sensor networks

H. Chan and A Perris **-**
proposed network architecture.

III. OBJECTIVES

Our main contributions can be summarized as follows:

Sensor systems offer financially practical answers for an assortment of uses. For instance, current usage screen manufacturing plant instrumentation, contamination levels, turnpike movement, and the basic honesty of structures. Different applications incorporate atmosphere detecting and control in office structures and home natural detecting frameworks for temperature, light, dampness, and movement. Sensor systems are critical to the making of shrewd spaces, which insert data innovation in ordinary home and workplaces. The smaller than expected remote sensor hubs, or bits, created from ease off-the-rack segments at the University of California, Berkeley, as a component of its keen tidy undertakings, build up a self-sorting out sensor arrange when scattered into a domain. The protection and security issues postured by sensor systems speak to a rich field of research issues. Enhancing system equipment and programming may address a large number of the issues, yet others will require new supporting

advances. Inescapable, secure access to a various leveled based medicinal services observing engineering in remote heterogeneous sensor systems Y. M. Huang, M. Y. Hsieh, H. C. Chao, S. H. Hung, and J. H. Stop. This investigation displays a medicinal services observing engineering combined with wearable sensor frameworks and an ecological sensor arrange for checking elderly or constant patients in their home. The wearable sensor framework, incorporated with a texture belt, comprises of different restorative sensors that gather an opportune arrangement of physiological wellbeing markers transmitted by means of low vitality remote correspondence to portable registering gadgets. Three application situations are actualized utilizing the proposed organize engineering. The gathering based information accumulation and information transmission utilizing the specially appointed mode advance outpatient social insurance administrations for just a single medicinal staff part allocated to an arrangement of patients. Versatile security issues for information transmission are performed in view of various remote abilities. This investigation additionally introduces an observing application model for catching sensor information from remote sensor hubs. The actualized plans were checked as performing effectively and quickly in the

(i) We provide a bi-objective optimization formulation to address the problem of optimizing both energy consumption and traffic delay. We show that good trade-offs between the two objectives can be achieved by adopting Pareto optimal solutions.

(ii) While targeting the network energy-efficient routing problem from a distributed perspective, we observe that itwill make the issue easier to settle if we separately consider loop-free routing and optimal traffic allocation. Thus we divide the distributed energy-efficient routing problem into two subproblems and then propose a twostage distributed routing scheme (HDEER) to solve them accordingly.

(iii)We propose two Distributed, Loop-free, Multi-path Finding Algorithms (D_LoopFree and D_LoopFree-TA) foreach node to guarantee distributed loop-free routing. We perform a theoretical analysis of the loop-freeness and connectivity of the generated DAGs.

(iv) We develop two Distributed Routing Algorithms (D_Routing-S and D_Routing-D) for each node to distribute thetraffic to the next-hop nodes according to the loads on current node’s egress links in these loop-free paths. Using the proposed algorithms, global optimal solutions for the bi-objective optimization can be obtained.

(V) We conduct comprehensive experiments with NS3 simulators to evaluate the performance of HDEER in terms ofenergy savings, traffic delay, and convergence properties using real network topologies at different scales under different traffic scenarios (generated traffic and real traffic traces).

IV. DISTRIBUTED LOOP-FREE ROUTING SCHEME

In this section, we develop a energy efficient routing scheme by deriving optimal routing conditions for minimum CT .Based on these optimal routing conditions, we propose a Hop-byhop Distributed Energy-Efficient Routing Scheme (HDEER). HDEER consists of two stages. We first provide a Distributed Loop-free Multi-path Finding Algorithm (D_LoopFree) to guarantee loop-free routing. Then we propose an optimal Distributed Routing Algorithm (D_Routing)for each node to guide the traffic distribution on these multiple loop-free paths built by D_LoopFree.

A. OVERVIEW OF HDEER

The proposed scheme is illustrated in Figure 1. At the beginning, the D_LoopFree algorithm is called to compute aDAG for each sink node. Each node in the network only needs to send traffic to its neighbors according to the DAG. Consequently, loop-freeness can be guaranteed. When a new time window starts, the D_Routing process will be called to distribute traf- fic among its neighbors at each node. Then, each node adjusts its processing speed according to its real-time traffic load. Both D_LoopFree and D_Routing operate in a totally distributed manner

B. DISTRIBUTED LOOP-FREE MULTIPATH FINDING (D_LOOPFREE)

As mentioned in Section II, we perform the distributed routing by letting each node in the network choose its own φ-value independently. Once the routing variable has been selected, the corresponding amount of traffic will be routedthrough the corresponding output link. This process happens at every node in the network simultaneously, thus unless done carefully, loops are likely to occur.

Paths with loops will bring about the following consequences:

(1) The distributed routing algorithm fails to converge,

(2) Additional energy and delay costs are produced due to the cumulative feature of the total cost function.

All these situations should be avoided. Therefore, we must carefully choose the next hops for each node to provide aguarantee of loop-free routing. It is not difficult to see that for a particular destination vt , all multiple loop-free routing paths originating from every node in the network to the destination vt form a DAG. Leveraging this feature, we find the next hop at each node for each destination, which maintains the loop-free property by generating a DAG for each destination, including all nodes in the network topology. In this work, we first devise a “height-based” algorithm to generate a connected graph GEN_G(t) from G(V, E) for each destination node vt . Then, we prove that each GEN_G(t)is one of the largest DAGs of G. The main principle behind our algorithm is to distinguish all the nodes with regard toeach destination vt by labeling them with different heights. If network traffic always flows from higher nodes to lower nodes based on their heights, loops will never be generated. The algorithm takes the graph of the network and the destination node vt as the input. Then, it returns a DAG, denoted as GEN_G(t), corresponding to vt after performing the three steps listed below. Now, we describe these three steps in detail.

Step 1: Generating a shortest path tree.

We first build a DAG that can cover all the nodes in the network. We construct a shortest path tree based on theoriginal graph G with root vt as the destination to form a DAG. Note that every directed graph with no directed cycles is a DAG. We select the shortest path tree because it has the following advantages:

(1) A shortest path tree based on theoriginal graph G covers all the nodes in G,

(2) A shortest path tree can be constructed in a distributed manner using thedistributed Dijkstra algorithm.

Step 2: Labeling all nodes with different heights.

For each destination node vt , we label all the nodes in the corresponding DAG with integer values. For the sake ofbrevity, we denote the height of node vi by ht i . First, we label the destination node vt with 0. Then, we label eachnode with its node height (distance to vt) in the shortest path tree. This process terminates when all nodes in the DAGhave been labeled. Nevertheless, only considering the shortest path routing will not produce an energy-efficient schemebecause some paths that exhibit substantial energy savings may be neglected [12]. We extend the DAG with thefollowing:

Step 3: Adding alternative links.

For each destination node vt , we extend the corresponding DAG by performing the following processes:

(1)We find all the links (i, j), such that, ht i> ht j , then we add the link (i, j) to the DAG,

(2) We find all the links (i, j),such that, ht i = ht j ∧ i> j,

then we add the link (i, j) to the DAG. Each node generates DAGs in a distributed way. The above process is only dependent on the network topology, and in particular, it is independent on any traffic load distribution in the network. Thus, every node can execute the process in a distributed manner. Also, it does not need tobe executed often but only needs to be executed only when the scheme starts. Therefore, the entire process of our loopfreemulti-path finding algorithm can be realized in a distributed manner. The entire process is illustrated in Figure 2.
Assume that the original graph is connected and that it does not include parallel links. We now introduce the following theorem on the features of the DAG generated by our algorithm.

C. DISTRIBUTED ROUTING (D_ROUTING)

In this section, we first discuss our sufficient and necessary conditions for minimizing CT . Then a distributed routingalgorithm (D_Routing) based on the conditions is proposed. With the network model provided in this paper, a given input traffic set r and a certain configuration of the φ-value will result in a unique distribution of traffic t in the network. **V.**

IMPLEMENTATION DETAILS

In this section, we discuss the details of the implementation of our distributed routing scheme in realistic networks.Fractional routing is assumed in the scheme, where the flow may be split among multiple paths . The scheme can be conveniently implemented in an Autonomous System of network (AS). Speed-scaling mechanism is provided as an architectural support, thus we assume that the routers in the network are equipped with the Adaptive Link Rate (ALR).

To enable an efficient hardware implementation, we should first address the following issues:

(1) How do we build the Routing Information Base (RIB) in each router?

(2) How do we implement multipath routing in the network? and

(3) How do we adapt our algorithm to both static and dynamic traffic scenarios? We answer these questions in thefollowing.

□RIB

RIB with hop-by-hop routing involves at least three information fields:

(1) the Network Id of the destination subnet;

(2)the Next Hops to which the packet is to be sent on the way to its final destination; and

(3) the Cost of the path throughwhich the packet is to be sent. Note that we leave the first field the same as usual RIB.

We replace the Next Hops withNext Hops Efficient in our scheme, which is determined by the D_LoopFree algorithm. Besides, we replace the last one with the Routing Variable, which is defined in Section II. Specifically, assume that RIBiis the routing table of node vi and that routing entry ribijk is a record in RIBi .

□TRAFFIC SCENARIOS

The traffic scenarios considered in our paper involves static traffic scenario and dynamic traffic scenario. The statictraffic scenario refers to the situation where traffic demands in the nodes are considered to be constant. It happens when a day is partitioned into several time intervals according to the traffic volume. During each time interval, routing variables are computed according to constant peak traffic demands in the nodes. The dynamic traffic scenario refers to the situation where traffic demand in each node changes over time. The routing variables should be adjusted accordingly thus to react to the traffic fluctuation. Link traffic of each interface is measured periodically using the widely applied Simple Network Manager Protocol (SNMP) or other similar protocols

1) Static Traffic Scenario:

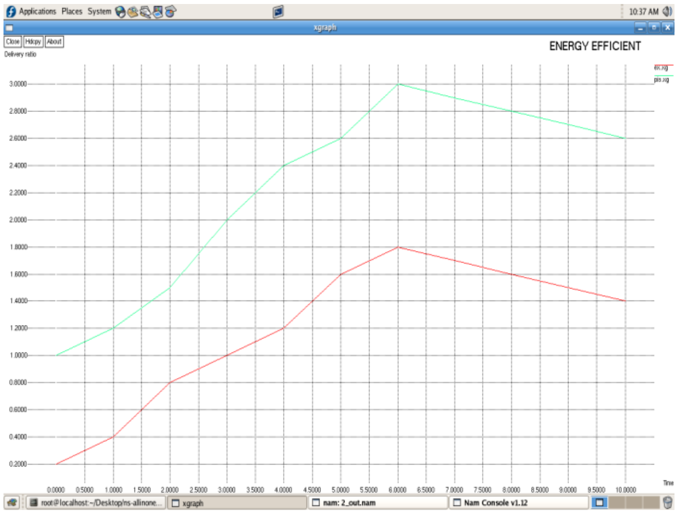
In this scenario, each node will first run D_LoopFree to find the next-hop set Si j for eachsink node v j , then run D_Routing iteratively to modify the routing variables. Because the updating stage is iterative,we set a threshold θ to control the iteration. When the average distance between vector $(\varphi i\ j)\kappa$ and $(\varphi i\ j)\kappa-1$ becomes no more than θ, node vi will stop updating its routing variables. Then, it will notify its neighbors with its latest state and stop sending update information to its neighbors. When all nodes in the network stop updating, the algorithm terminates.

2) Dynamic Traffic Scenario:

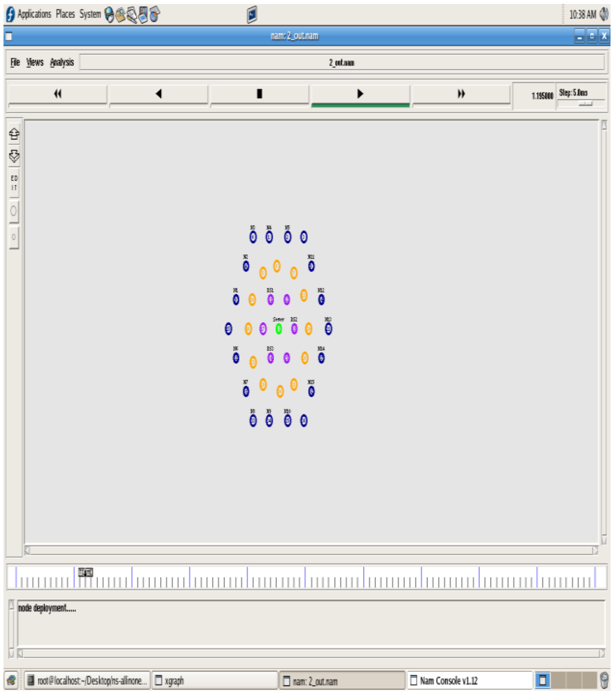
In this scenario, as traffic demands fluctuate over time, we should periodically modify the optimal $(\varphi i\ j)*$ accordingly. However, D_Routing is unable to react to dynamic traffic because the speed of convergence to the optimal routes depends on a global constant. As stated in Section III-C, a small γ guarantees the convergence of D_Routing but leads to slow convergence, while a large γ may cause the algorithm not to converge

Screen Shots:

Screen shot 1



Screen Shot 2



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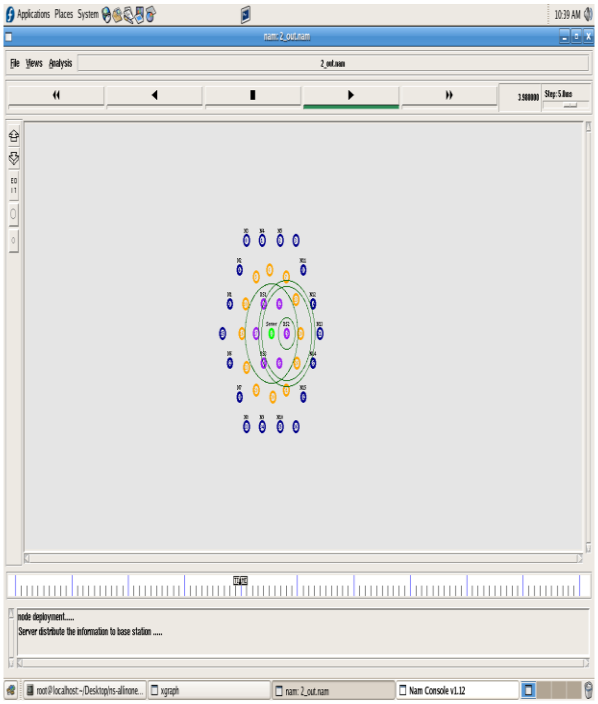
node deployment.....
```

Screen Shot 3



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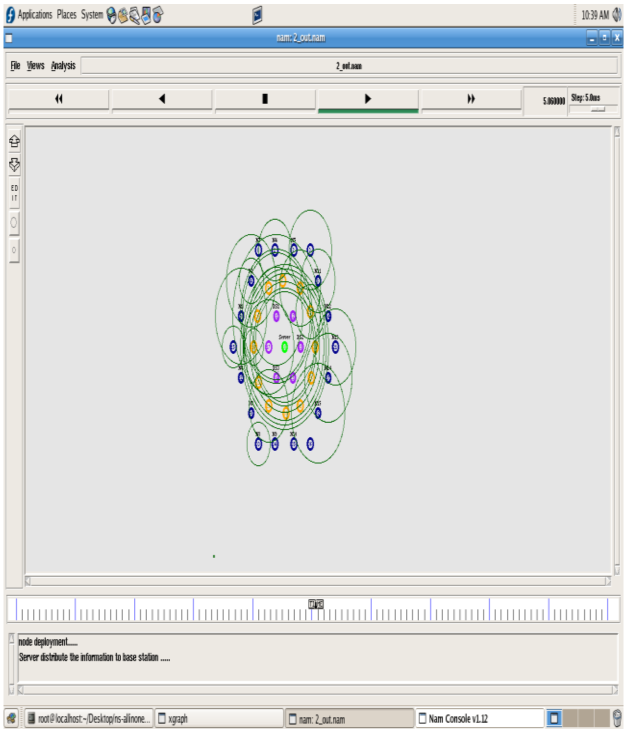
node deployment.....
Server distribute the information to base station .....
```

Screen Shot 4



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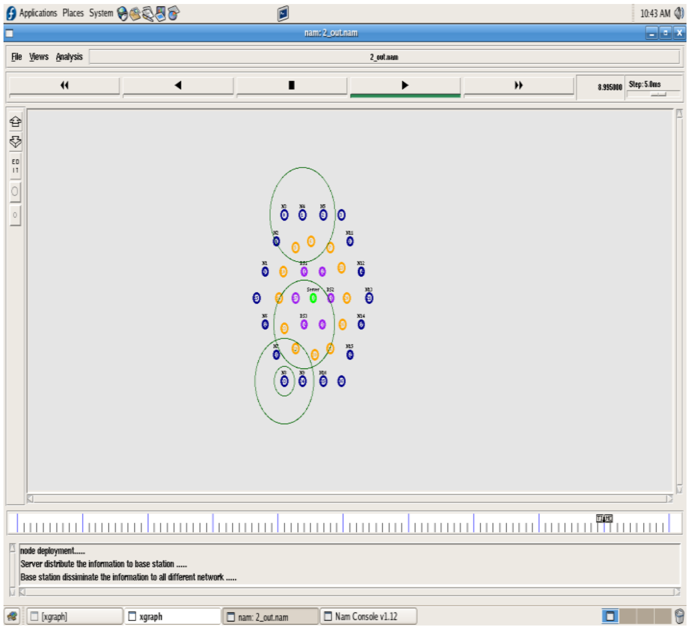
node deployment.....
Server distribute the information to base station .....
```

Screen Shot 5



node deployment.....
Server distribute the information to base station .....
Base station dissiminate the information to all different network .....

VI. CONCLUSIONS

In this paper, we address the problem of achieving energy efficiency in wired networks from a routing perspective.Unlike most existing green networking solutions, we aim at reducing energy consumption over entire networks withtraffic delay considered. We model this problem and provide a bi-objective optimization formulation for it. Through theoretical analysis, we identify the necessary and sufficient conditions for achieving a global optimal solution. Based on the observed conditions, we propose a fully distributed routing scheme that can provide near global optimalsolutions. The proposed scheme consists of two stages. First, we generate DAGs for each destination node to ensure loop-freeness of the routing paths. Then, we develop algorithms to allocate traffic in the DAGs under static and dynamic scenarios to save energy. Extensive simulations based on both real network topologies and a generated topology with power law show that the proposed routing scheme can obtain significant energy saving while bringing

Negligible traffic delay overheads compared to shortest path routing

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