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TREE CONSTRUCTION OF MULTICAST DISTRIBUTED SYSTEMS IN WIRELESS SENSOR NETWORKS (WSN)

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ABSTRACT

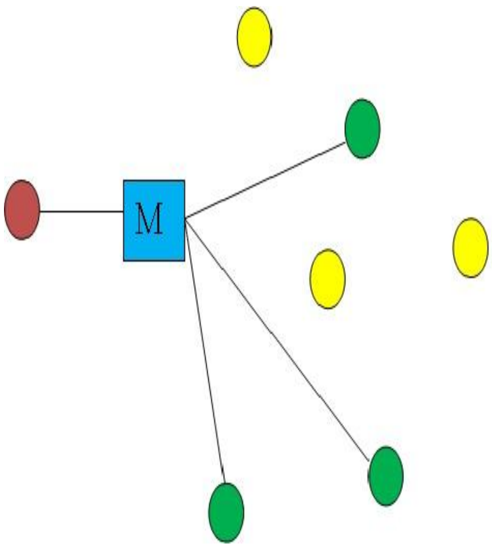
Multicast tree is a fundamental framework for data dissemination from one point to multiple recipients in wireless networks. Smallest length multicast modeled as the Steiner Tree Problem, and is determining to be NP-hard. Here, we explore how to efficiently generate smallest length multicast wireless sensor networks (WSNs), where only finite knowledge of network topology is usable at each node. We design and analyze a simple algorithm, which we call Toward Source Tree (TST), to build multicast trees in WSNs. We are going to show three types of metrics of TST algorithm, i.e., running and energy efficiency. We will prove its running time, the best among all existing solutions to our best knowledge. We are to prove that TST tree length is in the same order as Steiner tree, give a theoretical upper bound and use simulations to show the ratio when nodes are uniformly distributed. We calculate energy efficiency in terms of message complexity and the number of forward in prove that they are both order-optimal. We give an enormous way to construct multicast tree in support of transmission of numerous data.

INTRODUCTION

A wireless sensor network (WSN) is a wire-free network composed of spatially distributed unknown devices that utilizes sensors to view physical or environmental conditions. A WSN system employs a gateway which supports wire-free connectivity takes you to the wired world and distributed nodes. The wireless protocol you select depends on your application requirements.

Multicasting in distributed systems says that it send message to multiple nodes and a node can join a multicast group, and receives all messages sent to that group. The sender sends only once: to the group address but the network takes care of delivering to all nodes in the group. Here the groups are restricted to specific networks such as LANs & WANs.

Multicast

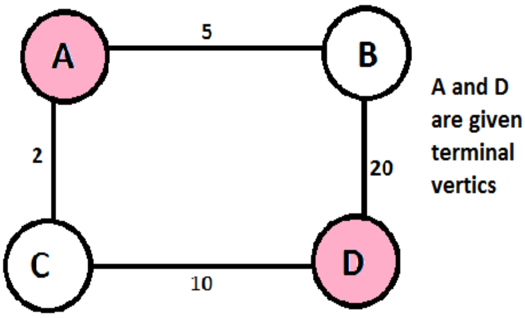


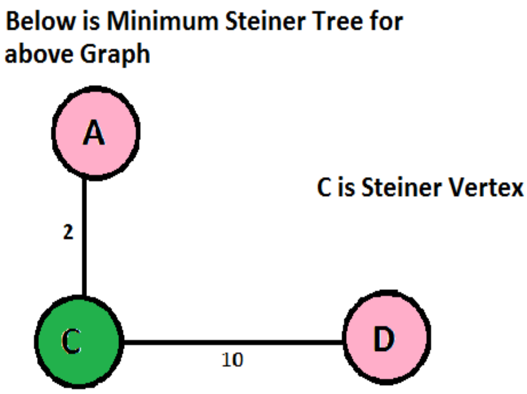
Multicast is a special version of broadcast (Restricted to a subset of nodes). In a LAN, Sender sends a broadcast and then the interested nodes accept the message and others rejects that. In larger networks we can use a tree which is used for broadcast. The interested nodes join the tree, and thus it gets messages. Here all nodes can use the same tree to multicast to the same group.

Steiner Tree problem

Steiner tree problem is an umbrella term for a category of issues in combinatorial optimization. Whereas Steiner tree problems could also be formulated in a range of settings, all of them need an optimum interconnect for a given set of objects and a predefined objective function. Steiner tree problem in graphs offers an directionless graph with non-negative edge weights and a subset of vertices, sometimes referred to as terminals, the Steiner tree problem in graphs needs a tree of minimum weight that contains all terminals.

The Steiner tree problem in graphs may be seen as a generalization of 2 different famed combinatorial optimization problems: the (non-negative) shortest path problem and also the minimum spanning tree problem. If a Steiner tree problem in graphs contains precisely 2 terminals, it reduces to finding a shortest path. If, on the opposite hand, all vertices are terminals, the Steiner tree problem in graphs is similar to the minimum spanning tree. However, whereas each of the non-negative shortest path and also the minimum spanning tree problem are resolvable in polynomial time, the decision variant of the Steiner tree problem in graphs is NP-complete (which implies that the optimization variant is NP-hard). Most versions of the Steiner tree problem are NP-hard, however some restricted cases may be resolved in polynomial time.





The Steiner Tree could contain some vertices that aren't in given subset but are used to connect the vertices of subset. The given sets of vertices known as Terminal Vertices and different vertices that are used to construct Steiner tree are called Steiner vertices. The Steiner Tree problem is to search out the minimum value Steiner Tree.

Spanning Tree versus Steiner Tree

Minimum Spanning Tree may be a minimum weight tree that spans through all vertices.

If given subset (or terminal) vertices is equal to set of all vertices in Steiner Tree problem, then becomes Minimum Spanning Tree problem and if the given subset contains solely 2 vertices, then it shortest path problem between 2 vertices. Searching for Minimum Spanning Tree is polynomial time resolvable, however Minimum Steiner Tree problem is NP hard and related decision problem is NP-Complete.

LITERATURE SURVEY:

A Distributed Algorithm to Construct Multicast Trees in WSNs:

Multicast tree is a key structure for data dissemination from one source to multiple receivers in wireless networks. Minimum length multicast modeled as the Steiner tree problem, and is proven to be NP-hard. In this paper, we explore how to efficiently generate minimum length multi wireless sensor networks (WSNs), where only limited knowledge of network topology is available at each node. We design and analyze a simple algorithm, which we call toward source tree (TST), to build multicast trees in WSNs. We show three metrics of TST algorithm, i.e., running and energy efficiency. We prove that its running time is $O(\sqrt{(n \log n)})$, the best among all existing solutions to our best knowledge. We prove that TST tree length is in the same order as Steiner tree, which give a theoretical upper bound and use simulations to show the ratio be only 1.114 when nodes are uniformly distributed. We evaluate energy efficiency in terms of message complexity and the number of forwarding proves that they are both order-optimal. We give an efficient way to construct multicast tree in support of transmission of voluminous data.

Improved structures for data collection in wireless sensor networks:

In this paper we consider the problem of efficient data gathering in sensor networks for arbitrary sensor node deployments. The efficiency of the solution is measured by a number of criteria: total energy consumption, total transport capacity, latency and quality of the transmissions. We present a number of different constructions with various tradeoffs between aforementioned parameters. We provide theoretical performance analysis for our approaches, present their distributed implementation and discuss the different aspects of using each. We show that in many cases our output-sensitive approximation solution performs better than the currently known best results for sensor networks. Our simulation results validate the theoretical findings.

A unifying perspective on the capacity of wireless ad hoc networks:

We present the first unified modeling framework for the computation of the throughput capacity of random wireless ad hoc networks in which information is disseminated by means of unicast routing, multicast routing, broadcasting, or different forms of any casting. We introduce (n,m,k)-casting as a generalization of all forms of one-to-one, one-to-many and many-to-many information dissemination in wireless networks. In this context, n, m, and k denote the total number of nodes in the network, the number of destinations for each communication group, and the actual number of communication-group members that receive information (i.e., k lesm), respectively. We compute upper and lower bounds for the (n, m, k)- cast throughput capacity in random wireless networks. When m = k = ominus(1), the resulting capacity equals the well-known capacity result for multi-pair unicasting by Gupta and Kumar. We demonstrate that ominus(1/radic(mnlogn)) bits per second constitutes a tight bound for the capacity of multicasting (i.e., m = k < n) when m les ominus (n/(log n)). We show that the multicast capacity of a wireless network equals its capacity for multi-pair unicasting when the number of destinations per multicast source is not a function of n. We also show that the multicast capacity of a random wireless ad hoc network is ominus (1/n), which is the broadcast capacity of the network, when m ges ominus(n/ log n). Furthermore, we show that ominus (radicm/(kradic(n log n))),ominus(1/(k log n)) and ominus(1/n) bits per second constitutes a tight bound for the throughput capacity of multicasting (i.e., k < m < n) when ominus(1) les m les ominus (n/ log n), k les ominus(n / log n) les m les n and ominus (n/ log n) les k les m les n respectively.

Multicast capacity of wireless ad hoc networks:

In this paper, we study the multicast capacity of wireless ad hoc networks with infrastructure support. The network under study is termed as hybrid wireless network, where L-Maximum-Hop resource allocation strategy is adopted. There are n uniformly deployed normal wireless nodes and m regularly placed base stations dividing the network region into m cells. We show that the maximum capacity O(n1/2/k1/2(log n)1/2 W1) + O(mW2) is achieved when the hop number L = Θ (n1/4/(k1/4(log n)3/4)) with the number of destinations k = O (a2/r2), where a is the side length of network region and r is transmission range of wireless terminals. This result provides a meaningful guide for the design of hybrid wireless networks. Moreover, we demonstrate that it is more efficient to adopt Infrastructure Mode than Ad Hoc Mode when k = Ω(a2/r2), because infrastructure nodes can cover the whole cell and broadcast to nodes more efficiently. In this case, maximum capacity is O (W1) + O(mW2), when L = Θ(1). Furthermore, we reveal that the per-node capacity does not vanish to zero only if the number of base stations m = Ω(n).

EXISTING SYSTEM

As wireless sensor networks are principally information centric, users got to query for data and broadcast it within the network. To spread the query in a network as energy-efficient as attainable, we want to make a minimum multicast tree and route the information following the trees topology. To attain this, some existing works apply a Steiner tree-based approach.

In the Existing systems, still the developers are performing on constructing efficient multicast trees. They need proposed a number of algorithms therefore on minimize the routing complexness furthermore as attain the time and energy efficiency, however most of them failed to focus on a crucial performance measure: the tree length. This is a vital metric since larger tree length clearly leads to longer delay.

Disadvantage:

Most of the drawbacks of the multicast framework come from the centralized entity that induces control overhead and is inherently a critical point of failure. This entity is needed since storing the multicast tree set altogether the border routers. Multicast might cause additional broadcast-and-prunes (in dense mode). Multicast application should not expect trusted delivery of information and will be designed according to the need. The inadequate of the TCP windowing and "slow-start" mechanisms will result in network congestion. If it is possible, multicast applications should commit to find and avoid congestion conditions.

PROPOSED SYSTEM

The proposed TST algorithm in our work is a distributed algorithm, and the analysis is performed within the setting of random networks. By taking the advantage of the Steiner tree property, we tend to style a unique distributed algorithm to construct an approximate minimum-length multicast tree for wireless sensor networks, aiming at achieving energy efficiency, simple implementation and low process complexness, at a reasonable value on the sub-optimality of tree length. In what follows, we call our design Toward Source Tree algorithm, or TST for brief. We quantitatively measure TST algorithm performance beneath general node distribution, and show that TST has the satisfactory metrics.

Advantage:

Multi-cast tree not only been used for multicast capacity analysis in wireless networks but in practice, multicast supports a wide range of applications like distance education, military command and intelligent system.

TST algorithm exhibits an apparent advantage for multicast routing over other algorithms in the sense that the sender does not need to have any prior knowledge of geographical locations of intended destinations before the tree construction. These locations can be acquired in the first phase of TST algorithm.

Advantages of using Multi-cast Tree:

1. Quick deployment.
2. All multicast state in end systems.
3. Computation at forwarding points simplifies support for higher level functionality.

4. Energy efficiency.

IMPLEMENTATION:

Distributed Multicast

This problem has been proven to be NP-hard and has not been visited for a long time. Former forms of its approximate implementation were not appropriate for constructing multicast trees in WSNs for various reasons.

The authors took the first step to utilize the Steiner tree for constructing multicast trees in WSNs, achieving routing scalability and efficiency. This approach can potentially reduce the tree length but this very simple form of utilization only considers the hop count in a weighted graph but not the total length of the multicast tree in a weighted graph.

Tree Construction

Besides a notable trend in sensor network study is to adopt the IPv6-based architecture in which multicasting is frequently used for scope addressing, discovery and configuration.

Based architectures TST algorithm exhibits an apparent advantage for multicast routing over other algorithms in the sense that the sender does not need to have any prior knowledge of geographical locations of intended destinations before the tree construction. These locations can be acquired in the first phase of TST algorithm.

Multiple receivers

The TST algorithm is a simple and distributed scheme for constructing low-cost and energy-efficient multicast trees in the wireless sensor network setting. We prove its performance measures in terms of tree length time complexity, and energy efficiency.

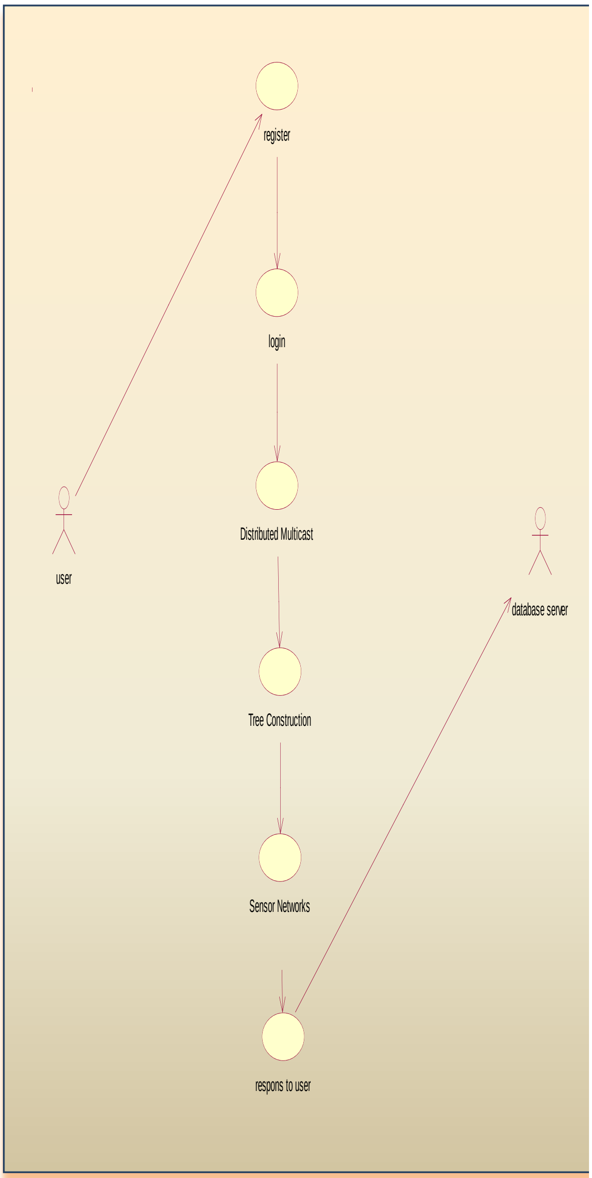
We prove its running time is the shortest among all existing solutions. We prove that its message complexity and the number of nodes that participate in forwarding are both order-optimal, yielding high energy efficiency for applications.

Multicast tree

Our present work mainly focuses on the optimization of path length, energy and computation costs in multicast of wireless sensor networks.

It is also interesting to develop an algorithm which optimizes other metrics jointly such as the throughput load balancing and congestion control.

The idea that utilizes multiple multicast trees to provide backup routing paths for load balancing is particularly enlightening.



CONCLUSION

We have proposed a unique algorithm, that we planed Toward supply Tree, to come up with approximate Steiner Trees in wireless sensor networks. The TST algorithm could be a straightforward and distributed theme for constructing affordable and energy-efficient multicast trees in the wireless sensor network setting. We have a tendency to prove its performance measures in terms of tree length, time quality, and energy potency. We have a tendency to show that the tree length is in the same order as, and it is observed terribly close to, the Steiner tree. We have a tendency to prove its period of time is the very smallest among all existing solutions. We have a tendency to prove that its message quality and therefore the variety of nodes that participate in forwarding are both order-optimal, yielding high energy potency for applications.

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