Design and Implementation of ND Pre-Handshaking Protocol for Wireless Ad Hoc Networks

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Abstract

Neighbors Discovery (ND) is a basic and step for initializing wireless ad hoc networks. A fast, accurate, and dynamic clustering based time efficient protocol has significant importance to subsequent operations in wireless network. However, many on hand protocols have high probability to generate idle slots in their neighbor discovering processes, which prolong the execute duration, with therefore concession their recital. within this method, recommend a novel randomized protocol FRIEND, a pre-handshaking neighbor finding protocol, to initialize synchronous full duplex wireless ad hoc networks. By introduce a handshaking approach to help each node be aware of activities of its neighbor hood, we significantly reduce the probabilities of generate redundant slot along with collision. in addition, among the improvement of single channel full duplex communication technology, promote shrink the dispensation instance required into companion, also construct the first full duplex national discovery protocol. Our academic analysis proves that FRIEND can decrease the duration of ND by up to 48% in comparison to the classical ALOHA-like protocols. In addition, propose HD-FRIEND for half duplex networks and variant of FRIEND for multi-hop networks and duty cycle network. Both theoretical analysis and simulation results show that FRIEND can settle in to a range of scenario and significantly decrease the duration of ND.

Keywords: Wireless Networks, Ad Hoc Networks, Multi pack response, Network Management, Aloha-like computation, HD-FRIEND

I. INTRODUCTION

Self-Organization and Multi-Hop communication are two key individuality of a classic Wireless Ad-Hoc network. To realize Self-Organization and Multi-Hop communication, it is imperative for a given node to discover its neighbors. In the most of the advantages of wireless ad hoc networks, the communication pattern is multi-hop. Multi-hop communication is ideal by the steering protocols because of energy competence. However, for achieving multi-hop communications a joint is believed to first recognize those nodes around the agreed node which are exactly one hop away, such nodes are termed as neighbors of the given node and the process requested by the given node to identify such one hop far adjacent nodes is called as Neighbor Discovery (ND). Information of neighbors is an essential to start proper operation for the MAC protocols and steering protocols. However, it is expected that the ND process should not only be accurate and precise but also resource efficient and quick. Discussed about the Neighbor discovery algorithms. They can be classified into two categories, viz. randomized. In a randomized strategy neighbor discovery, starts with randomly chosen times and discovers all its neighbors by a given time.
In a deterministic neighbor discovery algorithm, each node send according to a pre-determined transmission schedule that allows it to discover all its neighbors by a given time with prospect one. Guaranteed neighbor discovery typically comes at the cost of increased running time and often requires idealistic assumptions such as synchronization between nodes and a priori knowledge of the number of neighbors. Therefore, choose to examine randomized neighbor discovery algorithms. The performance can be analyzed in terms of instant taken for ND, power consumed by ND process, system resources spent, accuracy or reliability of result. The uniqueness of a typical ND process are:

- Nodes have either a prior information of neighbors or not.
- Nodes are either clash aware or not.
- ND method is done either in a synchronous or in an asynchronous manner.
- Nodes are either awake about initialization and termination criterion or not.

Introduce a pre-handshaking strategy to help each node be awake of activities of its neighborhood before usual transmissions, such that the system can have higher probabilities to evade collisions and idle slots. To perform this pre-handshaking, we add some tiny sub-slots before each normal slot. With the aid of full duplex technology, at both sub-slot, every node will decide whether to transmit the discovery message in a usual slot by transmitting. An unidentified election signal and catch its neighbors’ signals simultaneously. With different transmitting-receiving scenarios, design an effective strategy for each node to determine how to behave in usual slots. Correspondingly, we allot the behaviors of each node in the normal slots to complete the ND process. On the additional hand, the reception rank feedback mechanism is ameliorated by using full duplex wireless radios. Originally in, a sub-slot is added after the usual slot, and receivers will give response signals to transmitters in this sub slot. In our propose this overhead can be removed by using full duplex nodes. If a receiver finds that two or more nodes are transmitting concurrently, it will transmit a caution message immediately to inform other transmitters the failure of their transmissions.

II. RELATED WORK

Sensor networks considered with more number of sensor nodes that process in single primary station. Recent technology can be urbanized for doing this type process in wireless sensor networks. Sensor node take signal from special other nodes present in WSN. Each sensor node is capable of only a limited amount of processing. But when synchronized with the information from a large number of other nodes, they have the ability to measure a given physical surroundings in great feature. Thus, a sensor network can be described as a collection of sensor nodes which organize to perform some exact action. Unlike traditional networks, sensor networks depend on dense deployment and organization to carry out their responsibilities.

These networks have the potential to enable a large class of applications ranging from supplementary elderly in public spaces to limit protection that benefit from the use of numerous sensor nodes that carry multimedia content. In the sensor network model considered in this work, the nodes are placed randomly over the region of interest and their first step is to notice their immediate neighbors - the nodes with which they have a through wireless communication - and to set up routes to the gateway. The lack of servers hinders the use of centralized addressing schemes in ad hoc n/w. In distributed addressing schemes, however, it is hard to avoid duplicated addresses as a random choice of an address by all node would answer in a high collision probability, as demonstrated by the birthday absurdity. Though, if the amount of bits in the address suffix is smaller than amount of bits in the MAC address, which is forever true for IPv4 address, this resolution must be modified by hashing the MAC address to well in the address suffix. The MAC address, nevertheless, is similar to a random address choice and does not guarantee a collision-free
address portion. The primary node in the network, called prophet, chooses a seed for a random sequence and assigns addresses to any fusion node that contacts it. The joining nodes start to assign addresses to other nodes from diverse points of the random series, constructing an address task tree. Prophet does not flood the network and, as a result, generates a low run load. The protocol, nevertheless, requires an address range much larger than the preceding protocols to support the identical number of nodes in the network. Moreover, it depends on the quality of the pseudo-random generator to evade duplicated addresses. The wireless ad hoc network paradigm enables a new kind of network in which collaborating strategy relay packets from one device to another across multiple wireless links in a self-organizing method. A figure of applications based on this type of network have been established or are predictable in the near future, such as ecological and building monitoring, disaster relief and military battlefield communication. Due to the organizing temperament of ad hoc networks, each node in the network can be alternately functioning as transmitter or a receiver. A node can communicate openly with only several other nodes around itself, which are called its “neighbors”. In lack of a central controller, each node has to realize its neighbors before efficient routing is possible. The procedure for a node to classify all its neighbors is known as neighbor discovery, which is a crucial first step of developing reliable wireless ad hoc networks. ND in ad hoc networks is a critical and non-trivial mission. Algorithms such as “birthday protocol” [1], directional antenna neighbor finding [2], [3] and slotted random broadcast and reception [4] have been projected to enable all nodes in a network to discover out their neighbors both synchronously or asynchronously. These algorithms can be represented as random access discovery, which need nodes to be arbitrarily in a “transmitting” or “listening” state in every time slot so that every node gets a possibility to hear every neighbor once in a sufficient amount of time. Such random access discovery schemes permit one transmission to be booming at a time, and hence generally require a huge number of time slots until trustworthy neighbor discovery is achieved.

Neighborhood of node 0. The problem of neighbor discovery is to collect the index of the nodes which are in the zone of node 0. An ALOHA type of random access discovery scheme is frequently considered, where each user sends its index through random access of the channel upon receipt of a beacon signal from node 0. Usually, it takes a amount of transmissions to resolve contention and finish the discovery process. In order for added rapid discovery, one can get benefit of the multiple access channel and let nodes simultaneously drive their coded identity data in response to a beacon signal from node 0. The neighbor discovery problem is basically a multiuser detection problem. Let X k is a neighbor of node 0, i.e., X indicates whether node k =denote that node k is openly connected with node 0, whereas X k =0 denotes otherwise. Suppose X k 1,...,X independent distributed (i.i.d.) Bernoulli random variables with factor p. We also assume that node 0 typically has no additional than a small amount of neighbors, so that the vector X =is sparse. The goal of neighbor discovery is to conclude about the fundamentals of X based on the observation.

III. FRIEND

A novel randomized protocol FRIEND is used. In which a pre handshaking Neighbor Discovery (ND) protocol is worn. Neighbor discovery is planned to know about a node’s neighbor’s state and these important and crucial for configuring wireless n/w. Nodes can be of three states Silent
- Listen
- Transmit
- By reducing the unused slots of the node, the ND time will reduce tremendously. In exisint approach the key idea is twofold.
  - Pre handshaking
  - Reception status feedback

A. Pre Handshaking:
Before the normal transmission of a node it helps the node to identify about the neighbor node actions. So, to evade collisions and unused slots can be of superior probabilities. To conduct pre handshaking, we add some sub slots before each normal slot. By transmitting an anonymous election signal both node will make a decision to transmit discovery message on normal slot or not and identifies its neighbor’s signal concurrently.

B. Reception Status Feedback:
Reception status feedback can be simply achieved. By adding full-duplex nodes reception feedback condition can be achieved successfully.

IV. ALGORITHMS

The following two algorithm shows how Pre handshaking and Neighbor Discovering.

A. Algorithm 1
FRIEND-GR (Pre handshaking)
1) : If Af = 1 then >A has successfully sent Md.
2) : A will keep soundless in TR and exit.
3) : end if
4) : Node A decides to send Ms by probability 1/An and keep listening by probability 1 − 1/An.
5) if A sends Ms then A hopes to send Md in TR.
6) if A does not receive Ms during GR then
7) A will transmit Md in TR;
8) else A receives Ms from other nodes
9) A will transmit Md in TR by probability 1/2.
10) end if
11) else A does not send Ms
12) if A does not receive Ms during GR then
13) A will transmit Md in TR by probability 1/An;
14) else A receives Ms from other nodes
15) A will keep silent in TR.
16) end if
17) end if

B. Algorithm 2:
FRIEND-TR (Neighbor Discovering)
1) if A plans to send Md then
2) A sends Md and monitors the channel meanwhile.
3) if A does not receive Md during TR then
4) Af = 1. A will keep silent from now on
5) else A receives Md from other nodes
6) Current iteration is invalid.
7) end if
8) else A does not plan to send Md
9) A keeps listening.
10) if A does not receive Md during TR then
11) Current iteration is invalid.
12) else if A receives a single Md then
13) Record the ID in Md.
14) An = An − 1. A records one of its neighbors.
15) else there is a collision at A
16) Current iteration is invalid.
17) end if
18) end if

Notations: A= Node A.
GR= Greeting Process
TR= Transmission Process
Ms= Message of election signal
Md= Message discovered
Af= Flag Variable
An= Undiscovered Neighbors

By implementing the pre handshaking and neighbor discovery algorithms the time taken for discovering the neighbor can be reduced terrifically. In this advance no Multipacket Reception (MPR) technique is used.

There are two drawbacks that have to be enhance in this regard.
1) In a clique setting, when a node i, hears its ID back, it knows that all other nodes in the set have discovered i, thus allowing it to drop out. In the multi-hop case, however, the presence of hidden terminals may cause a subset of its neighbors to not receive its transmission. Thus, cannot drop out in spite of hearing its ID back.
2) In the multi-hop setting, it’s dropping out needs to be signaled to its neighbors allowing them to amplify their transmission probabilities, which appears nontrivial.

V. Conclusion

Neighbor discovery algorithms do not need estimates of node density and allow asynchronous operation. Furthermore, our algorithms allow nodes to begin implementation at different times and also allow nodes to detect the termination of the neighbor discovery phase. A number of avenues for future work remain open. Our analysis shows a gap between the lower and upper bounds on the running time for neighbor discovery in the network case. Clearly, the quest for an order-optimal neighbor discovery algorithm remains an intriguing prospect. We design and analyze several algorithms for neighbor discovery in wireless networks. Starting with the site of a single-hop wireless network of n nodes, we propose a ALOHA like neighbor discovery algorithm once nodes cannot notice collisions, and an order-optimal (n) receiver feedback-based algorithm when nodes can sense collisions.
REFERENCES