Neighbor Discovery in Wireless Networks

Abstract—**The abstract goes here.**

I. Introduction

II. Related Work

III. Preliminaries

In this section, we first give some notion definitions and introduce the collision detection mechanis. Then we formulate the Neighbor Discovery problem formally.

A. Sensor Node Model

In the wireless sensor networks, the deployed sensor nodes keep their most time in sleep mode to avoid quick energy consumption.

For the sensor nodes, time is divided into slots. In each time slot, a node transform its state according to a pre-defined duty schedule.

Definition 1: **Duty schedule** is a pre-defined sequence $S = \{s^t\}_{0 \leq t < T}$ of period T and

$$s^t = \begin{cases} 0 & sleep \\ 1 & wake \end{cases}$$

Each node repeats its duty schedule until finding all the neighbors.

Definition 2: **Duty circle** represents the fraction of one period T where a node turns its radio on. It can be formulated as:

$$\theta = \frac{|\{0 \leq t < T : s^t = 1\}}{T}.$$

When the sensor is in

Notice that the neighbor discovery process is not bidirectional, which means a node discover one of its neighbor do

B. Collision Detection Mechanism

C. Problem Definition

Before we formulate the problem, we introduce three important metrics of the performance of rendezvous methods. These metrics are often used to measure the performance of rendezvous between two users. To begin with, we define **Time to Rendezvous (TTR)** as:

Definition 3: Time to rendezvous is the number of time slots to select the same available channel simultaneously.

This metric is commonly used in existing rendezvous algorithms. Both *maximum time to rendezvous (MTTR)* and *average time to rendezvous (ATTR)* are used to evaluate the performance of the worst case and the average case respectively [**?**], [**?**], [**?**], [**?**], [**?**].

The second metric, **Rendezvous Degree (RD)**, is also widely used. It evaluates the number of channels that the users can rendezvous on.

Definition 4: Rendezvous degree is the percentage of possible rendezvous channels relative to the total number of the jointly available channels.

As interference exists for each available channel, communications between the users could be inefficient if they rendezvous on a channel with a lot of interference. Therefore, we introduce a new metric **Rendezvous Interference (RI)** as:

Definition 5: Rendezvous interference is the product of the users' interference measurement at the channel that they rendezvous on.

Problem 1: For any channel set C^* and interference set I^*, design the channel hopping algorithm $f : t \mapsto C^*$, such that for $C_a, C_b \subseteq C$, $C_a \bigcap C_b \neq \emptyset$, and any time drift δ, there exists T_δ and channel $c \in C_a \bigcap C_b$ satisfying:

$$f_{C_a,I_a}(T_\delta + \delta) = f_{C_b,I_b}(T_\delta) = c$$

The algorithms for continuous rendezvous can be different from those for the initial rendezvous. But the target is also to choose a quiet channel soon (small RI, small TTR and large RD).

IV. A

V. B

VI. Evaluation

VII. Conclusion

The conclusion goes here.