Power Resourceful Monitoring Of Cooperative Spectrum Sensing In Cognitive Sensor Network

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***Abstract*—** Spectrum sensing is the situation of opportunistic spectrum access in cognitive sensor networks as its consistency determine the success of diffusion. However, spectrum sensing is an energy-consuming formula that needs to be minimized for CSNs due to supply limitations. The cognitive sensors agreeably sense a qualified channel by using the CoMAC-based cooperative spectrum sensing scheme to resolve the incidence of primary users. Energy efficiency ,defined as the ratio of the typical throughput to the average energy consumption, is a very important performance metric for CSNs. EE-maximization problem for CSS in CSNs subject to the constraint on the detection performance. In order to address the non-convex and non-separable personality of the formulated problem, find the optimal expression for the recognition threshold and then propose an iterative solution algorithm to obtain an proficient pair of sensing time and the length of the modulate symbol sequence. Simulations demonstrate the junction and optimality of the proposed algorithm. It is also pragmatic in simulations that the combination of the CoMAC-based CSS scheme and the proposed algorithm yields much higher EE than conventional CSS schemes while guarantee the same detection routine

***KEYWORDS*- Cognitive radio, spectrum sensing, multiple-access channel, analog computation, energy efficiency**

1. INTRODUCTION

A **cognitive radio** (CR) is an intelligent radio that can be programmed and configured dynamically. Its transceiver is designed to use the best wireless channels in its vicinity. Such a radio automatically detects available channels in wireless spectrum, then accordingly changes its transmission or reception parameters to allow more concurrent wireless communications in a given spectrum band at one location. This process is a form of dynamic spectrum management. In response to the operator's commands, the cognitive engine is capable of configuring radio-system parameters. These parameters include "waveform, protocol, operating frequency, and networking". **Topology** directly affects the network lifetime in WSNs Depending on the application, CR wireless sensors may be deployed statically or dynamically. In any type of WSN, hardware failure is common due to hardware malfunctioning and energy depletion. The topologies for CR-WSNs may be the same as conventional WSNs, but they are prone to change more frequently than *ad hoc* CRNs. Reported that CR-WSNs have the following topologies: (i) *Ad Hoc* CR-WSNs; (ii) Clustered CR-WSNs; (iii) Heterogeneous and Hierarchical CR-WSNs; and (iv) Mobile CR-WSNs. Basically, the minimum output power required to transmit a signal over a distance δ is proportional to δn, where $2 \leq n < 4$. The exponent n is closer to four for low-lying antennae and near-ground channels, as is typical in wireless sensor network communication. Therefore, routes that have more hops with shorter hop distances can be more power efficient than those with fewer hops but longer hop distances, it is not always possible to find such a route in static sensor networks topology. Therefore, an adaptive self-configuration topology mechanism is important for CR-WSNs for obtaining scalability, reducing energy consumption and achieving better network performance. An adaptive self-configuration topology mechanism performs better than static topology, even though it is a challenging issue to design and implement.

The functions as an autonomous unit in the communications environment, exchanging information about the environment with the networks it accesses and other cognitive radios (CRs). A CR "monitors its own performance continuously", in addition to "reading the radio's outputs"; it then uses this information to "determine the RF environment, channel conditions, link performance, etc.", and adjusts the "radio's settings to deliver the required quality of service subject to an appropriate combination of user requirements, operational limitations, and regulatory constraints".

COGNITIVE RADIO (CR) technology has been proposed as an enabling solution to alleviate the spectrum underutilization problem with the capability of sensing the frequency bands in a time and location-varying spectrum

Environment and adjusting the operating parameters based on the sensing outcome, CR technology allows an unlicensed user (or, secondary user (SU)) to exploit those frequency bands unused by licensed users (or, primary users) in an opportunistic manner. Secondary users can form a CR infrastructure-based network or a CR ad hoc network. Recently, CR ad hoc networks have attracted plentiful research attention due to their various applications.

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II. EXISTING TECHONOLOGIES

Existing channels may be used for broadcasting and the exact time for all single-hop neighboring nodes to successfully receive the broadcast message is random, to avoid broadcast collisions (i.e., a node receives multiple copies of the broadcast message simultaneously) is much more complicated in SG (Stochastic Geometry) ad hoc networks, as compared to traditional ad hoc networks. In traditional ad hoc networks, numerous broadcast scheduling schemes are proposed to reduce the probability of broadcast collisions while optimizing the network performance. All these proposals are on the basis that all nodes use a single channel for broadcasting and the exact delay for a single-hop broadcast is one time slot.

SG ad hoc networks, without the information about the channel used for broadcasting and the exact delay for a single-hop broadcast, to predict when and on which channel a broadcast collision occurs is extremely difficult. Hence, to design a broadcast protocol which can avoid broadcast collisions, as well as provide high successful broadcast ratio and short broadcast delay is a very challenging issue for multi-hop SG ad hoc networks under practical scenarios. Simply extending existing broadcast protocols to SG ad hoc networks cannot yield the optimal performance.

DISADVANTAGES:

- ❖ Previous technology is regarded as a promising solution to the spectrum scarcity problem. Due to the spectrum varying nature of SG networks, unlicensed users are required to perform spectrum handoffs when licensed users reuse the spectrum handoff process in a SG ad hoc network under homogeneous primary traffic.
- ❖ Stochastic Geometry (SG) networks, unlicensed users may observe heterogeneous spectrum availability which is unknown to other users before broadcasts are executed. Thus, it is extremely challenging that broadcasts can be unsuccessfully conducted without the spectrum availability information.
- ❖ In addition, since broadcast collisions (i.e., simultaneous receipt of broadcast messages at the same node) often lead to the waste of network resources, they should be efficiently mitigated in multi-hop scenarios.

III. PROPOSED METHOD

Fully-distributed broadcast protocol in a multi-hop CR ad hoc network, broadcast cognitive radio, is proposed. We consider practical scenarios in our design: 1) no global and local common control channel is assumed to exist; 2) the global network topology is not known; 3) the channel information of any other SUs is not known; 4) the available channel sets of different SUs are not assumed to be the same; and 5) tight time synchronization is not required. Our proposed broadcast cognitive radio protocol can provide very high successful delivery ratio while achieving very short broadcast delay. It can also avoid broadcast collisions. To the best of our knowledge, this is the first work that addresses the broadcasting challenges specifically in multi-hop CR ad hoc networks with a solution for broadcast collision avoidance.

The proposed broadcast protocol for multi-hop CR ad hoc networks, broadcast cognitive radio. There are three components of the proposed broadcast cognitive radio protocol: 1) the construction of the broadcasting sequences; 2) the distributed broadcast scheduling scheme; and 3) the broadcast collision avoidance scheme. We assume that a time-slotted system is adopted for SUs, where the length of a time slot is long enough to transmit a broadcast packet . In addition, we assume that the locations of SUs are static. We also assume that each SU knows the locations of its all two- that this is a more valid assumption than the knowledge of global network topology term “sender” to indicate a SU who has just received a message and will rebroadcast the message. In addition, we use the term “receiver” to indicate a SU who has not received the message.

ARCHITECTURE

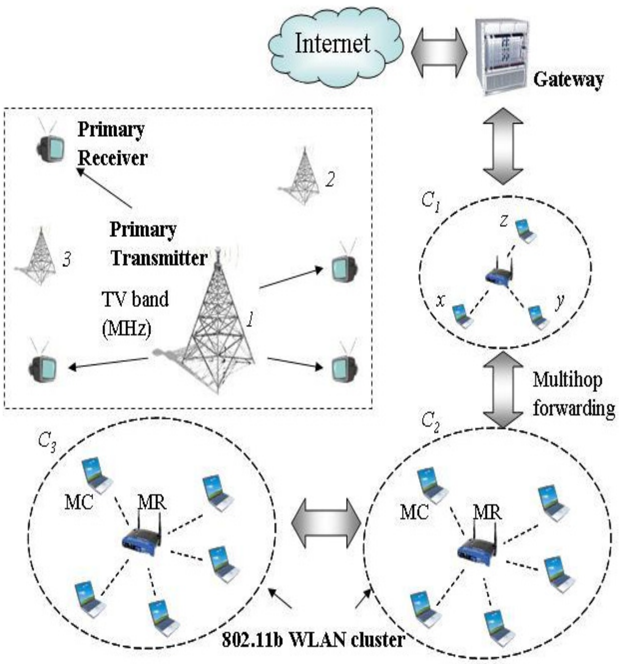


FIG 1. Cognitive Radio Protocol

CSS in cognitive sensor networks (CSNs) that are referred to as wireless networks of low-power radios gaining secondary spectrum access according to the CR paradigm previously discussed. CSNs can be particularly used in industrial sensor networks which have recently been considered as an opportunity to realize reliable and low-cost remote monitoring systems for smart grids , and their performance has been investigated for various application domains of smart grids in .The cognitive sensors (CSs) of CSNs are typical powered by batteries, which must be either replaced or recharged when or before out of energy.

BROADCAST COLLISION AVOIDANCE:

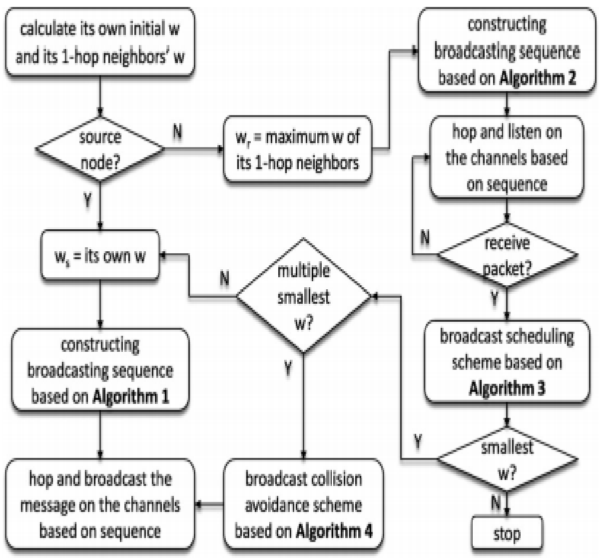
The Broadcast Collision Avoidance Scheme from Algorithm 3, if there are multiple intermediate nodes with the same child node, only the intermediate node with the smallest should rebroadcast. However, if more than one intermediate node with the same smallest w, all these intermediate nodes should rebroadcast and a broadcast collision may occur if these nodes deliver the messages on the same channel at the same time. For instance, where node A is the source node, node B and C have the same w, which may lead to a broadcast collision when they rebroadcast simultaneously. Most broadcast collision avoidance methods in traditional ad hoc networks assign different time slots to different intermediate nodes to avoid simultaneous transmissions.

CR ad hoc networks because the exact time for the intermediate nodes to receive the broadcast message is random. As a result, to assign different time slots for different intermediate nodes is very challenging. In addition, since the intermediate nodes use multiple channels for broadcasting, the channel on which the broadcast collision occurs is also unknown. To the best of our knowledge, no existing collision avoidance scheme can address these challenges in CR ad hoc networks. Abroadcast collision avoidance scheme for CR ad hoc networks. The main idea is to prohibit intermediate nodes from rebroadcasting on the same channel at the same time. Our proposed broadcast collision avoidance scheme works in a scenario where the intermediate nodes have the same parent node

BROADCAST COGNITIVE RADIO PROTOCOL:

Broadcast protocol for multi-hop CR ad hoc networks, broadcast cognitive radio. There are three components of the proposed broadcast cognitive radio protocol: 1) the construction of the broadcasting sequences; 2) the distributed broadcast scheduling scheme; and 3) the broadcast collision avoidance scheme. We assume that a time-slotted system is adopted for SUs, where the length of a time slot is long enough to transmit a broadcast packet. In addition, we assume that the locations of SUs are static that each SU knows the locations of its all two-hop neighbors. We claim that this is a more valid assumption than the knowledge of global network topology.. In the rest of the paper, we use the term “sender” to indicate a SU who has just received a message and will rebroadcast the message.

BROADCAST COGNITIVE RADIO PROTOCOL



Flow chart of Broadcast Cognitive Radio Protocol

The goal of the proposed distributed broadcast scheduling scheme is to intelligently select SU nodes for rebroadcasting in order to achieve the shortest broadcast delay. First, Fig. 4 shows the simulation results using the parameters given in that the single-hop broadcast delay increases when w increases. Therefore, in a multi-hop broadcast scenario, if there are multiple intermediate nodes with the same child node, the intermediate node with the smallest w is selected to rebroadcast. If there is more than one intermediate node with the smallest w, all these nodes should rebroadcast and a broadcast collision avoidance scheme

ADVANTAGES:

- An advantage of our proposed c protocol is that it does not require tight time synchronization. This special advantage is essential since tight time synchronization is extremely difficult to achieve in a real ad hoc network system.
- We define tight time synchronization as the scenario where time slots of different nodes are precisely aligned. This means that the proposed broadcast cognitive radio protocol can guarantee the successful reception of a whole broadcast message even if the time slots of the sender and the receiver have an offset.

CONCLUSION

The problem of gateway placement in WMNs for enhancing throughput was investigated continuously in this paper. A gateway placement algorithm was proposed based on particle swarm optimization. A non-asymptotic analytical model was also derived to determine the achieved throughput by a gateway placement algorithm. Based on such a model, the performance of the proposed gateway placement algorithm was evaluated. Numerical results show that the proposed algorithm has achieved much better performance than other schemes. It is also proved to be a cost-effective solution. Optimizing gateway placement together with throughput maximization is our next research goal.

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