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Utilizing the unbalanced radio verify location in manet spotted

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ABSTRACT

Future wireless networks will progressively displace service provisioning towards the edge to accommodate increasing growth in traffic. This paradigm shift calls for smart policies to efficiently share network resources and ensure service delivery. In this paper, we consider cognitive dynamic network architecture (CDNA) where primary users (PUs) are rewarded for sharing their connectivities and acting as access points for secondary users (SUs). CDNA creates opportunities for capacity increase by network-wide harvesting of unused data plans and spectrum from different operators. Different policies for data and spectrum trading are presented based on centralized, hybrid, and distributed schemes involving primary operator (PO), secondary operator (SO), and their respective end users. In these schemes, PO and SO progressively delegate trading to their end users and adopt more flexible cooperation agreements to reduce computational time and track available resources dynamically. A novel matching-with-pricing algorithm is presented to enable self-organized SU-PU associations, channel allocation and pricing for data and spectrum with low computational complexity. Since connectivity is provided by the actual users, the success of the underlying collaborative market relies on the trustworthiness of the connections. A behavioral-based access control mechanism is developed to incentivize/penalize honest/dishonest behavior and create a trusted collaborative network. Numerical results show that the computational time of the hybrid scheme is one order of magnitude faster than the benchmark centralized scheme and that the matching algorithm reconfigures the network up to three orders of magnitude faster than in the centralized scheme.

INTRODUCTION

ONE of the core technologies used in cognitive radios is spectrum sensing to identify the availability of the spectrum for improving utilization. In cognitive radio networks (CRNs), secondary users (SUs) perform spectrum sensing to detect chunks of unused spectrum licensed to primary users (PUs). After detection, they deploy a secondary CRN in the available spectrum. Sensing may be performed regularly or occasionally to verify if the channel is vacant and/or to verify that the channel quality is acceptable. If one of these conditions is violated, the CR node decides either to change its configuration (e.g., transmission power) to decrease the interference level and compensate for the channel effects, or to switch to

a new vacant channel. However, SUs do not always provide perfect sensing results, i.e., an SU may determine that the sensed spectrum is occupied by a PU when the spectrum is actually free (false alarm) or that the spectrum is free when a PU is actually present in the sensed channel (miss detection). Many factors such as multipath fading, shadowing, and the receiver uncertainty problem may result in the above problems. In order to overcome these problems, SUs can cooperate and share their sensing results with other SUs (cooperative sensing). The spatially collected sensing results help determine whether the detected spectrum is actually vacant [4].

Cooperative sensing techniques for CRNs have been for many years. These techniques are classified into two categories: (1) centralized and

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(2) distributed [4]. In centralized techniques there is a fusion center (FC) collects the sensing information from SUs. After gathering the sensing information, the FC computes the sensing schedule for a channel of each SU and disseminates a sensing task to the SUs. In the distributed approach, the SUs share sensing information among themselves and determine sensing parameters based on collected neighboring sensing information. Most previous cooperative spectrum sensing techniques have used omni-directional antennas. The SUs that use an omni-directional antenna cannot determine the sensed PUs exact location. If SUs sense the locations of PUs, they can efficiently utilize the geographic information of the spectrum. Some localization schemes such as the direction of arrival, triangulation or other similar methods used in omnidirectional antennas exchange to message of PU detection among SNs. As a result, it causes harmful interference to the PU. To detect the PUs location more accurately and without harmful interference, a directional antenna can be used for spectrum sensing. Compared with the omni-directional counterpart, the directional technique which needs more radio units has several benefits such as a longer sensing range over the same amount of energy, lower energy consumption with the same sensing range, and fine-grained sensing. In this paper, we propose a directional sensing technique for cognitive radionetworks. If we use a directional antenna for spectrum sensing, sensing overhead (sensing time, sensing energy, etc.) can be reduced, and more precise sensing is possible since directional antennas can identify the orientation of the PU. Moreover, the purpose of directional sensing is to identify fine-grained spectrum holes to improve spatial reuse. The rest of this paper is organized as follows. In Section II, relevant spectrum sensing techniques are discussed. Section III describes the basic assumptions for our proposed scheme. Section IV presents the proposed centralized directional spectrum sensing technique. In Section V, we describe the optimization of sensing parameters using the nonlinear optimization technique. The performance of our scheme is evaluated and analyzed in Section VI. Finally, we draw conclusions and suggest future directions in Section VII.

ANTENNA MODEL

PUs are assumed to be equipped with an omni-directional array based on multiple quasi-omni-directional antennas and they communicate omni-directionally [22]. We assume that each secondary node including the FC is equipped with a directional antenna, and the antenna is based on a switched beam system with M beam patterns. The secondary node has a single transceiver for the associated directional antenna sector. Furthermore, the PU signal can be detected on the side lobes and thus secondary nodes may cause inaccuracy in determining the direction of the PU. To take this into consideration, we introduce the probability of miss detection and false alarm. Sectors can be used to realize an omnidirectional reception function by receiving information from all sectors simultaneously or they can be individually switched for a specific direction. An antenna controller is assumed and to keep track of the direction from which the maximum signal power is received. It then informs the higher layers about the sector of the received signal. Switching within the antenna controller can be achieved by using very fast analog CMOS multiplexers/demultiplexers, which have a transition time less than 217 ns and less than the signal propagation delay. Therefore, the short inter-frame space (SIFS) defined in the 802.11 standard is long enough for an antenna to be switched between transmitting and receiving modes.

PRIMARY USER DETECTION

For primary user detection, several schemes, including matched filter, feature detection, and energy detection, generally have been used. In our scheme, we assume that secondary users exploit an energy detection scheme to minimize hardware cost. However, this does not imply that our scheme excludes the use of any other detection scheme for the PU. In energy detection, the i th secondary node SN_i senses the presence/absence of PUs based on the energy of the received signal. The received signal is squared and integrated over the observation interval. Finally, the output of the integrator divided by noise power (SNR) is compared with a certain threshold (or PU detection sensitivity) to decide if a PU is present. In other words, if the SNR is higher than the PU detection

sensitivity, SN_i decides that a primary user is present [3]. Without loss of generality, an energy detection scheme can generate a miss detection since it is susceptible to uncertainty in noise power. In our scheme, we introduce a PU detection margin R_i , which is defined by the SNR at which a secondary node should alert the primary signal. Therefore, R_i is set to be less than the PU detection sensitivity to accommodate the miss detection probability. For the above reason, we use R_i instead of the PU detection sensitivity in our scheme. Moreover, in the directional sensing scheme, the secondary user can detect the PU signal from more than 2 directions. In this case, the secondary user determines the direction that receives the largest SNR level.

Data and Control Channels

In the proposed scheme, we assume that the spectrum of interest is divided into K data channels that are licensed to PUs. To communicate using a data channel, we assume SN_i performs channel sensing during its sensing time for one of K channels to identify any spectrum hole. Let C_i ($C_i \in \{1, \dots, K\}$) represent the channel index to be sensed for SN_i . In the proposed scheme, we also assume an underlay control channel that uses the entire frequency band (i.e., K channels). The implementation of the underlay control channel for cognitive radio networks has been validated by [3]. With the underlay control channel, secondary nodes can report their sensing results to the FC. The sensing results (C_i) and the direction of the sensed PU. Additionally, the FC can disseminate a command, including optimized sensing parameters, through the underlay channel. However, to remain invisible to the PUs, the transmit power of the underlay channel should be at a level comparable to the noise.

Cluster-based Sensing

In the proposed scheme, FC forms multiple clusters, where each cluster corresponds to an FC beam direction. The rationale behind the cluster being formed by the FC's beam direction is that some secondary nodes are not located in the FC transmission range, such as SN_2 , SN_3 , SN_5 , SN_7 , and SN_9 in Fig. 1, and can have connections from the FC through multi-hop links. Sensing tasks can

be assigned to each cluster to achieve diversity. The spectrum sensing function

EXISTING SYSTEM

Existing solutions for coping with traffic demand focus on investing in additional fixed infrastructure, which is costly from an environment and network perspective. Besides, these solutions rely on conventional cellular infrastructure design built to satisfy peak rates and ignore the dynamic traffic fluctuations that render a significant part of this infrastructure unutilized in space and time. Despite densification efforts to increase spectrum reusability, the licensed spectrum continues to be scarce and its efficient usage will soon approach the theoretical limits

Cooperative spectrum sensing techniques have used omni-directional antennas. The SUs that use an omni-directional antenna cannot determine the sensed PUs exact location. If SUs sense the locations of PUs, they can efficiently utilize the geographic information of the spectrum. Some localization schemes such as the direction of arrival, triangulation or other similar methods used in omnidirectional antennas exchange to message of PU detection among SUs. As a result, it causes harmful interference to the PU.

To detect the PUs location more accurately and without harmful interference, a directional antenna can be used for spectrum sensing. Compared with the omni-directional counterpart, the directional technique which needs more radio units has several benefits such as a longer sensing range over the same amount of energy, lower energy consumption with the same sensing range, and fine-grained sensing. In this paper, we propose a directional sensing technique for cognitive radio networks. If we use a directional antenna for spectrum sensing, sensing overhead (sensing time, sensing energy, etc.) can be reduced, and more precise sensing is possible since directional antennas can identify the orientation of the PU.

NEED FOR NEW SYSTEM

A distributed sensing algorithm based on evolutionary/coalition games. In their scheme, each secondary node decides whether to participate in spectrum sensing or do nothing to save its own

energy. Each secondary node selects its action based on its utility history and chooses the strategy that yield the highest utility. Further, secondary nodes sense the channel that carries the most amount of information in order to reduce the uncertainty of the channel status. In the authors proposed an adaptive sensing period optimization scheme for cognitive radio networks based on a genetic algorithm. They aimed to maximize spectrum opportunities as well as minimize the sensing overhead for secondary nodes. In their scheme, the genetic algorithm was used to update the sensing period during each sensing operation. In the authors proposed a cooperative sensing technique based on a greedy heuristic algorithm. In order to reduce the energy consumption for sensing, they attempted to optimize the sensing schedule. In their scheme, each secondary node broadcasts its sensing schedule. If another secondary node receives this information, it determines an optimal sensing schedule by using a greedy heuristic algorithm to reduce the time complexity.

Proposed approach

We explore business opportunities in data and spectrum harvesting created by a cognitive dynamic network architecture (CDNA) where primary users (PUs) share their connectivities with secondary users (SUs) for some reward. In CDNA, each SU connects through its preferred PU using the harvested spectrum. The selected PU shares its unused data and acts as an access point for SU transmissions in return for a reward. CDNA creates a new collaborative market for data and spectrum trading and opportunities for revenue sharing among the parties involved (primary operator [PO], secondary operator [SO] and their respective end users).

A framework for data and spectrum trading optimization is developed to maximize the utility of each party and satisfy the QoS for SUs. Three approaches are considered: centralized, hybrid and distributed. Each incurs different levels of coordination and revenue sharing. In the centralized approach, the SO performs data and spectrum trading with the PO to satisfy the demands of SUs. The PO then rewards PUs willing to serve as access points for SU traffic. In the hybrid scheme, the SO and PO trade the spectrum

but delegate data trading to PUs and SUs. PUs benefit directly from this trading as an incentive to share their resources. Finally, in the distributed scheme, the SO and PO negotiate a revenue share for their cooperation and let PUs and SUs trade the data and spectrum.

METHODOLOGY

Objective

To exploit radio irregularity to build a novel LVS. Our system detects attack based on the estimated difference of radio irregularity coefficients, and the claimed locations of the malicious node and an assistant node.

Dedicated Path Protection

The work in proposes a design strategy that enhances the conventional Dedicated Path Protection (DPP) with attack-awareness. The above-mentioned studies show that physical-layer security can be enhanced while using the same amount of optical resources as conventional, resource-saving approaches. However, these works consider a WDM optical network where the damaging effects of jamming signals stay confined in a single fiber core. In SDM networks, signal interference among adjacent cores cannot be neglected, particularly in the presence of high-power jamming signals.

The models can be simplified assuming the worst-case ICo-XT scenario (i.e., the core with the highest number of adjacent cores), as well as applied to find transmission reaches of different modulation formats in the presence of ICo-XT.

SYSTEM DESIGN

Consider three nodes, A , B , and M , in a sparse MANET. B is assumed to be a normal node whose location is convinced due to certain regulation or verification result. M is a malicious node. A is a neighbor of B and M . The latter two can obtain the RSSI (Received Signal Strength Indicator) from node A [2]. We assume that all the nodes cannot hide their own locations, neither can they obtain the locations of other nodes from a different network. Besides, traditional AOA and fingerprint information are assumed not available in our system

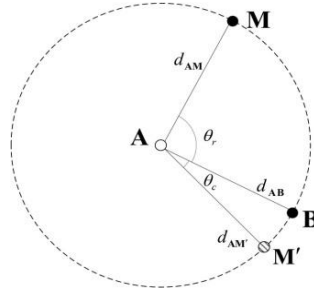


Figure 4.1: Illustration of our system model and the SDM attack

CDNA

In CDNA, each SU connects through its preferred PU using the harvested spectrum. The selected PU shares its unused data and acts as an access point for SU transmissions in return for a reward. CDNA creates a new collaborative market for data and spectrum trading and opportunities for revenue sharing among the parties involved (primary operator [PO], secondary operator [SO] and their respective end users).

Trust mechanism

Trust mechanism which encompasses partially distributed (via local physical interactions) and partially centralized (via operators' involvement) trust management. Since perception of trust varies among users, we model behavioral aspects and their impact on trust, and define a behavioral-based access control scheme that encourages consistent behavior through punishment (of misbehaved users) and reward (of well behaved users).

Centralized Scheme

Based on the SUs' demand for data volume and QoS requirements, the SO identifies the necessary channels and available PUs to satisfy the demand. It then negotiates the price for these resources with the PO. Once both parties agree, the SO assigns to each SU the channel and PU that satisfies its QoS requirements. Finally, the PO rewards the PU for sharing its connectivity.

Spectrum Trading

We consider the Cognitive Dynamic Network Architecture (CDNA). In contrast to multi hop cognitive networks, where routes are formed by SUs relaying traffic through primary channels, in our system data is forwarded by PUs through the primary network, which reduces reliability

concerns related to multi-hop cognitive transmissions to the first hop (SU-PU link).

CONCLUSION

This paper investigates the extent of disruption caused by high-power jamming attacks to legitimate traffic in a SDM network. We quantify the attack-induced reduction of maximum transmission reach for different bit rates and modulation formats, as well as the resulting traffic losses at the network level. The study provides an insight into the safety margins that could be considered to mitigate traffic losses and increase SDM network security. The results show that the correct modulation format is crucial not only for the spectrum efficiency, as shown in the related works, but is also of utmost importance for the resiliency of demands against high-power jamming signal attacks.

Further studies are needed to understand how different optical network technologies affect the vulnerability to physical layer attacks. In particular, the migration from WDM to SDM optical networks may require new approaches to guarantee the security of the optical layer. Moreover, the different extent of disruptions can be observed depending on the considered traffic matrices and network topology, as well as the applied SSA algorithm. Finally, in addition to jamming signal attacks, other kinds of physical layer attacks need to be studied in order to offer high security and minimize the network vulnerability.

FUTURE WORK

In wireless sensor networks position awareness is necessary to exploit the communication benefits of directional antennas and for sensors to provide

meaningful information about their surroundings. In this paper we evaluate the feasibility and quality of self-localization that can be obtained using received signal strength (RSS) measurements from arrays of directional antennas on each sensor node. We compare the performance of an optimal estimator utilizing all RSS data with a suboptimal one using angles of arrival as an intermediate statistic. Further, we compare the performance

bounds of our approach with others based on distance measurements potentially obtained through time of arrival or RSS observations. We demonstrate that sub-meter location accuracy is possible using 802.11 radio frequency communication signals and no assumed model for propagation loss. Results from an outdoor field experiment and our proposed printed circuit board quasi-Yagi directional antenna are also presented.

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