The Handoff Protocol used for Cognitive Radio Networks

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Abstract— The mobile communication users have two types, primary user and secondary user. That communication, to register the users based on bandwidth and priority. The primary user registered in high bandwidth and high priority and also the secondary user registered in low bandwidth and low priority. Those users also called licensed users. The mobile communication used for Cognitive Radio Networks (CRNs). In that mobile communication have some scheduling problem and traffic analysis. Those problems are mainly effected the secondary users. The Spectrum Switching Delay Aware Scheduling Algorithm (SSDASA) and Handoff protocol used to avoid those problems. To formulate a scheduling problem that takes into account different hardware delays experienced by the secondary users (SUs) in a centralized cognitive radio networks (CRNs) while switching to different frequency bands. The simulation results indicate the proposed algorithm is robust to changes in the hardware spectrum switching delay and its performance is very close to its upper bound. To compare the proposed method with the corresponding constant switching delay based algorithm and demonstrate that suggestion of taking into account the different hardware delays while switching to different frequency bands is essential for scheduling in Cognitive Radio Networks.

Key words: SSDASA algorithm, CRNs, PUs, SUs, Handoff protocol, spectrum switching delay, traffic analysis, licensed user, unlicensed user

I. INTRODUCTION

A cognitive radio (CR) device changes its operation frequency; it experiences a hardware switching delay to tune to its new frequency before it can fully utilize it. This delay in general depends on the wideness between the two frequency bands; i.e., switching from central frequency of 800 MHz to 10 GHz conduces larger delay than switching from 800 MHz to 850 MHz due to the hardware capabilities of the frequency synthesizer. For instance, the delay incurred while switching from the central frequency belonging to one GSM operator to the frequency of another GSM operator might be small. However switching from a GSM band to X-band takes longer time.

The range of frequencies that the cognitive radio network (CRN) operates in is narrow, this delay difference might be negligible. However, the CRNs of the future are envisioned to operate in a wide range of frequency bands. Therefore, spectrum allocation and scheduling algorithms designed for CRNs have to take into account different delays that occur while switching to different frequency bands. That the dependence of the switching delay on the wideness between the old and new central frequencies is unique to the dynamic spectrum access paradigm since other wireless technologies typically operate in a narrower bandwidth.

Some works in the literature use the term channel switching latency to refer to the delay encountered while searching for an idle channel, whereas some other works use the term to refer to the hardware switching delay of the frequency synthesizer given that the CR device has already determined the idle channel to switch over. To focus in this paper is on the latter definition of the term.

Channel switching delay in CRNs is mostly considered in the realm of routing. The primary goal in most of these works is to minimize the number of channel switching along the route; hence, they do not differentiate between switching to different frequencies and assume that all of the channel switching cause a certain delay irrespective of the frequency separation distance. Only a few of these works about routing consider the possibly different delays depending on the wideness between the frequency bands. Besides, the current works about scheduling and channel assignment in CRNs do not take the spectrum switching delay into account.

II. OBJECTIVE

- A proactive spectrum handoff protocol is proposed to let unlicensed users vacate a channel before a licensed user utilizes it to avoid unwanted interference.
- Sensor based computational structure that can gather information disseminated even in remote and inaccessible areas are very much in need now. Wireless Sensor Network (WSN) can be readily deployed and are well adapted to monitor the activities such as in military applications; researcher can sit miles away and watch the activities of an active volcano, habitat monitoring, health monitoring, etc.
- Due to the resource constraint nature of sensor networks, these lack security which is critical in many applications such as military sensing and tracking. The resource constraint nature that makes a variety of DDoS attacks easy in sensor network. Traditional security mechanisms such as public key cryptography, authentication, etc involves lot of computation time and delays; thus result in decreased network performance and consumption of nodes energy because of which they are not very well suitable for application in sensor networks. Hence the proposed framework is that it can be deployed in already existing networks and can prevent the faked messages from being spread across the entire network. Pre-authentication filters are applied before actual verification of bogus messages.
- Main goal of the project is bandwidth allocation. The idle bandwidth allocated for all users. To avoid the traffic analysis. The idle spectrum or channel allocated for new entered users.

III. EXISTING SYSTEM

Channel switching delay in CRNs is mostly considered in the realm of routing. The primary goal in most of these works is to minimize the number of channel switching along the route. Hence, they do not differentiate between switching to different frequencies and assume that all of the channel switching cause a certain delay irrespective of the frequency separation distance.

Only a few of these works about routing consider the possibly different delays depending on the wideness between the frequency bands. Besides, the current works about scheduling and channel assignment in CRNs do not take the spectrum switching delay into account. To the best of our knowledge, it is the first study on scheduling in CRNs that takes into account the hardware switching delay depending on the separation distance between the current and subsequent frequency bands.

A. Drawbacks

- It is not an efficient method to allocate the channel.
- Most of the time the channel might be in idle state.
- Most delay of Channel Switching

IV. Proposed System

The performance of proposed algorithm is robust to changes in the spectrum switching delay; it obviates the need to have small spectrum switching delay. Therefore, by using our proposed algorithm in the software, equipment manufacturers can use less number of filters in the hardware and still achieve high throughput performance. Therefore, our algorithm also helps decrease CR device weights by obviating the need to accomplish smaller spectrum switching delay and, hence, enabling the usage of less number of filters in the hardware.

A. Advantages

- Channel is utilized properly by both primary and secondary users
- To increase flexibility and spectrum efficiency
- To avoid the switching delay
- To avoid the traffic analysis

B. Modules

1) Dynamic Spectrum Management
2) Spectrum handoff
3) Channel Selection
4) Channel Switching

C. Module Description

1) Dynamic Spectrum Management:

This module is developed to overcome the imbalance between the increase in the spectrum access demand and the inefficiency in the spectrum usage, by dynamically accessing the assigned spectrum where the spectrum is not used for improve the spectrum utilization in Cognitive Radio networks. Cognitive Radio is a key technology to understand Dynamic Spectrum Access that enables an unlicensed consecondary usermer to adaptively adjust its working parameters and utilize the spectrum which is idle by licensed consecondary usermers in an opportunistic approach. The CR technology allows Secondary Users to seek and utilize “spectrum holes” in a time and location-varying radio background without causing destructive intrusion to Primary Users.

2) Spectrum handoff:

Spectrum handoff is an indispensable component in cognitive radio networks to provide resilient service for the secondary users. It gives rise to a new type of handoff called spectrum handoff, which refers to the process that when the current channel used by the secondary user is no longer available, the secondary user needs to pause its on-going transmission, vacate that channel, and determine a new available channel to continue the transmission. The techniques as well as the results secondary users are important for evaluating the primary and second users co-existence, and hence helpful for design and optimization of cognitive radio networks.

Instead of using a CCC to realize channel rendezvous, we incorporate two types of channel rendezvous and coordination schemes into the spectrum handoff protocol design and investigate the impact of different network coordination schemes on the network performance. We also compare the performance of our proposed proactive spectrum handoff protocol and the reactive spectrum handoff approach under different network coordination schemes. To the best of our knowledge, this is the first paper that incorporates channel rendezvous and coordination schemes into the spectrum handoff protocol design.

3) Channel Selection:

Since for channel selection schemes, reducing the number of collisions among SUs is the primary goal. The channel is selected for secondary user’s data transmission based on the secondary users throughput, average secondary user service time (i.e., the duration from the moment an SU starts a data transmission to the moment it finishes the data transmission), number of collisions among SUs, and average spectrum handoff delay to avoid the collision between the secondary users in cognitive radio networks.

The channel selection issue should be handled with caution to avoid collisions among SUs. On one hand, preventing SU collisions is more important in the spectrum handoff scenario than in general channel allocation scenarios [35] due to the fact that collisions among SUs lead to data transmission failures, thus they may result in long spectrum handoff delay, which has deteriorating effect on delay-sensitive network applications. Additionally, the channel selection algorithm also should be executed fast in order to achieve short handoff delay. Furthermore, since no centralized network entity exists in CR ad hoc networks to manage the spectrum allocation, the channel selection algorithm should be applied in a distributed manner to prevent SU collisions. Our goal is to design a channel selection scheme for the spectrum handoff scenario in CR ad hoc networks that can eliminate collisions among SUs in a distributed fashion.

4) Channel Switching:

By utilizing the sensed channel usage statistics, a secondary user can make predictions of the channel availability before the current transmission frame ends. Based on the prediction, the secondary user decides whether to stay in the present channel, or switch to a new channel, or stop the on-going transmission. We propose two criteria for determining whether a spectrum handoff should occur: 1) the predicted probability that the current and a candidate channel (i.e., a channel that can be selected for continuing the current data transmission) is busy or idle and 2) the expected length of the channel idle period.

For both the single rendezvous coordination scheme and the multiple rendezvous coordination scheme, all SUs follow the same sequence to hop through the channels during a spectrum handoff. When an SU needs to perform a spectrum handoff at the beginning of a time slot, it broadcasts the sensed channel availability information to neighbouring SU nodes on the current hopping channel only in the corresponding mini slot based on the selecting sequence generated in Step 1. In addition, for the SU transmitter who needs to initiate a new transmission, it sends an Request-To-Send RTS in the corresponding mini slot. Thus, the channel information messages and RTS packets do not collide with each other. Since every SU may have different neighbours and may not receive the channel information from all SUs involved in the spectrum handoffs, each SU is required to broadcast its own channel information with its previously received channel information from other SUs. Therefore, an SU can obtain the channel availability information predicted by the SUs who need to perform spectrum handoffs and whose orders of broadcast are earlier than this SU. It is noted that since only those SUs who perform spectrum handoffs broadcast their channel availability information, this proposed channel selection scheme will not cause excessive overhead.

D. *Input Design*

Input design is the process of converting user-originated inputs to a computer-based format. Input design is one of the most expensive phases of the operation of computerized system and is often the major problem of a system.

E. *Output design*

- Output design generally refers to the results and information that are generated by the system for many end-users; output is the main reason for developing the system and the basis on which they evaluate the usefulness of the application. In any system, the output design determines the input to be given to the application.
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- The output is designed in such a way that it is attractive, convenient and informative. Forms are designed in Java with various features, which make the console output more pleasing.

As the outputs are the most important sources of information to the users, better design should improve the system's relationships with us and also will help in decision-making. Form design elaborates the way output is presented and the layout available for capturing information.

F. *Security*

- The Administrator checks the path information and status information before the data transfer
- Messages that are sent will receive the acknowledgements automatically if there is no link failure after the message received by the Receiver Node
- Attackers of node's will automatically make updating in the VEBEK table to other nodes in the Network

V. CONCLUSION

To formulate in this paper a scheduling problem that considers different hardware delays that occur during switching to different frequency bands. We propose a polynomial time heuristic algorithm called S2DASA to solve our formulated problem. The simulation results show that the throughput that S2DASA yields is very close to its upper bound. Moreover, S2DASA is robust to changes in the hardware spectrum switching delay. Furthermore, throughput savings it achieves increase as the number of frequencies in the CRN cell (F) and the hardware switching delay for a unit frequency difference increases. Furthermore, the throughput savings of our algorithm are significant even when there are a small number of SUs, and the savings remain significant as the number of SUs increases. Simulation results demonstrate that our idea of taking into account different hardware delays that occur during switching to different frequency bands is essential for CRNs since the assumption of constant switching delay can lead to low throughput performance.

VI. FUTURE ENCHANTEMENTS

The superior throughput performance of S2DASA calls for techniques that quantify its worst case performance analytically. As a future work, plan to derive an analytical lower bound for the throughput performance of our proposed algorithm S2DASA. To this end, plan to utilize algorithmic graph theory and approximation algorithms.

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