

Cognitive Radio Network Spectrum Access

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Abstract - Network in which the unauthorised users are permitted to use vacant quotas of the authorized spectrum for their communication without interrupting the communications of the authorized Users is called Cognitive Radio Networks. But According to the spectrum heterogeneity phenomenon, for the unauthorized users Channel availability is variable, due to the licensed user's activity. Due to this, it is not easy to coordinate among the unauthorised users during data communication. So, to govern unauthorised users Dynamic Spectrum Access scheme is implement i.e. Secondary User (SU) transportation in an authorized spectrum without co-operating the communications of the authorized customers, wherein all the unauthorized users are usually treated equally, and this paper considered prioritized unauthorized user traffic. Unauthorized user transportation is distributed into two significance modules (high & low significance) in which the authorized user's communications can occur at any interval instantaneous. Consequently, the DSA schemes are used to accomplish spectrum handoff to defend the authorized user's communication. Centralized and Distributed Dynamic Spectrum Access schemes are considered under different CRN architecture with altered handoff mechanisms for both the significance classes of unauthorised users. In this paper investigation is done by developing different parameters such as call completion rate, blocking probability & probability of forced termination, & mean handoff delay for both high & low-priority unauthorized users.

Index Terms -- Dynamic Spectrum Access, Cognitive Radio, Spectrum Handoff.

I. INTRODUCTION

In past eons, there are large numbers of wireless technologies introduced in wireless markets. Which are developing rapidly, on the other hand in arrears to the inadequate amount of spectrum (nearby the 2.4 GHz), it becomes difficult to achieve good quality of service (QoS) for forthcoming wireless technologies. In consonance to Federal Communications

Commission (FCC), the traffic dissemination through radio spectrum is not uniform. FCC is the spectrum supervisory and governing consultant in the U.S. Because of the unlicensed quotas of the spectrum i.e. 2.4-and 5-GHz bands are used by most wireless networks. Similar to Internet, Wi-Fi, etc. Hence, unlicensed portion of the continuum is easily used by most of unlicensed users; however the licensed quotas of spectrum (for example ultrahigh-frequency band) are hardly used. These observations motivate the strategy of wireless networks called cognitive radio networks (CRNs). Wherein the unlicensed users are permitted to use vacant quotas of the permitted continuum for their communication without interrupting the communications of the authorized Users.

According to the spectrum heterogeneity phenomenon, for the unauthorized users Channel availability is variable, owed to the permitted user's activity. Because of this Spectrum heterogeneity it is not easy to coordinate amongst

the unauthorized customers for the duration of data communication. So, to evade this spectrum heterogeneity, the unauthorized customers in CR Network appliances two elementary purposes, that is spectrum sensing and DSA. Whereas spectrum sensing is defined as detecting inactive networks in the authorized spectrum, the Dynamic Spectrum Access scheme is used to simplify the unlicensed users' communications over the identified sluggish channels. A DSA scheme is actually implement to prioritize between licensed and unlicensed users. In the course of spectrum access it gives higher precedence to licensed user as compared to unlicensed users. For the reason that of the authorized users are called as primary user (PU) and the unauthorized users are called as secondary users (SU). This paper presents the brief idea of in what way Dynamic Spectrum Access is used for various Cognitive Radio Network structural designs that are centralized & distributed.

II. PAPER STATEMENT

The goal of this paper is prioritization of SU traffic. The SU traffic can be prioritized based on Quality of service requirements (e.g., real-time traffic has higher priority than non-real-time traffic). During spectrum handoff, in case of a two-priority class high-priority SU gets handoff before a low-priority SU. DSA schemes are mainly useful when there are number of ongoing SU transmission require handoff. Here distributed call-level DSA schemes are proposed for the centralized and distributed CRNs by considering priority based spectrum handoff. This paper present the numerical and simulation results by using performance measures including the blocking probability, probability of forced termination, successful call completion rate and mean handoff delay for both type of priority users.

III. LITERATURE SURVEY

In Cognitive Radio Networks Dynamic spectrum access (DSA) is an important design aspect. Most of existing DSA schemes is to govern unlicensed user (i.e., secondary user, SU) traffic in a licensed spectrum without compromising the transmissions of the licensed users, in which all the unlicensed users are typically treated equally. We have considered prioritized unlicensed user traffic in this paper. Unlicensed user traffic is categorized into two priority classes (i.e., high and low priority). Most of the research on cognitive radio networks mainly focused on efficient bandwidth utilization of RF spectrum. It contained cognitive radio technology, cognitive radio network architecture, spectrum management framework, spectrum sensing, spectrum decision, and spectrum sharing & spectrum mobility. Remaining paper describes the overview, basic functions of cognitive radio network, and spectrum sharing & spectrum decision implementation in detail.

IV. RELEVANCE

The goal for this paper is to discuss the system in which it can able to prioritized SU traffic based on QOS requirements. If, we saw history of the CRN, very few works considered SU traffic prioritization in which it includes packet transmission during a frame using SU's priorities. However, the SU priority does not affect spectrum handoff. Whereas, during spectrum handoff SU's priorities plays a vital role is explained in this paper. Proposed DSA schemes are mainly used when multiple SU transmissions simultaneously require handoff. In this paper call level DSA schemes are used which are similar to call level DSA schemes. However, there are some little-bit differences; such as this paper consider priority-based spectrum handoff and also analyses the effect of handoff buffer under both the centralized and distributed CRNs.

A. Important factors in analysis of cognitive radio spectrum access: This paper present an idea of SU traffic prioritization and this prioritization depends on the following:

- **QOS requirements:** Which SU provides the high QOS having the higher priority
- **Priority based on spectrum handoff:** High priority SU gets spectrum handoff before low priority SU.

DSA schemes: Call level DSA (Dynamic spectrum access) schemes are used when there are multiple on going SU calls require spectrum handoff at the same time.

B. Paper directions

This paper mainly concern with the effective utilization of spectrum for different wireless networks.so as to solve the problem of limited spectrum for rapidly increasing wireless technology. So, this paper presents the concept of prioritization of unlicensed users (SUs) traffic. In which two levels of prioritization are used. This prioritization is based on QOS requirements. And to achieve this purpose various novel DSA call level schemes under different CRN architectures with and without buffer are used. Under these all proposed DSA schemes for CRN the analytical models are presented in this paper.

The analysis of cognitive radio spectrum access is done by deriving the following parameters for the two priority classes in the SU traffic:

- **Blocking probability:** It is the probability which represents with SU which does not permitted to enter into the system due to the no availability of subchannel. Blocking probability represents probability with which an incoming SU call is not permitted to enter in the system due to the lack of availability of subchannel or number of SU calls already on hold.
- **Probability of forced termination:** Probability of force termination represents the probability with which an ongoing SU call is terminated by incoming PU calls.

- **Call completion rate:** Call completion is defined for a given priority class of SU that represents the minimum number of calls that successfully completed their services.
- **Mean handoff delay:** It is the delay for SU calls which defines the mean time taken by the SU call to perform successful handoff.

According to these parameters analytical results are verified through simulations.

V. SYSTEM DESIGN

The system spectrum for analysis of cognitive radio spectrum access is shown in below fig. (A). System spectrum and the different call-level DSA schemes for the centralized and distributed CRNs.

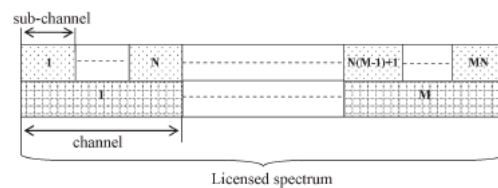


Figure. A. System Spectrum

The system spectrum (Fig. A) is consists of M licensed channels, in which every M licensed channel is again split into N sub channels. And each channel and sub channel is allocating to the both priority users. In which, primary user (PU) uses one channel for their transmission whereas, secondary user (SU) uses one sub channel and their transmissions are treated as a calls. The number of ongoing PU call is denoted by (K) on which PU call attempt is done. Means if, $K < M$ then only PU call is accepted. And obviously a PU call attempt gets first priority than the ongoing SU calls. Hence, an ongoing SU call interrupting the new PU call must be handed off to another empty sub channel. SU1 represent high-priority SUs whereas the low-priority SUs are denoted as SU2. Now consider, a fully connected COgnitive radio network then, all SUs see for the status of same Channel s (i.e., activity of PU/SU). Perfect sensing is expected to identify activity of PU. A common control channel is supposed to coordinate among the SU's. In this paper, we use different DSA schemes for the both CRN architectures:

1. Centralized CRN.
2. Distributed CRN.

A. Centralized CRN: For the centralized CRN, four novel DSA schemes are used,

- i. DSA-C1.
- ii. DSA-C2.
- iii. DSA-C3.
- iv. DSA-C4

B. Distributed CRN: For the centralized CRN, two novel DSA schemes are used,

- i. DSA-D1
- ii. DSA-D1.

In these, DSA-C1, DSA-C2, and DSA-D1 schemes are without buffer, whereas DSA-C3, DSA-C4, DSA-D2 are with buffer. Base on the SU's each DSA schemes implements handoff by using different methods.

1) *Handoff method for DSA-C1:*

- i. A moved SU1 call is allocated to an available vacant channel arbitrarily.
- ii. For the residual moved SU1 calls, necessary number of ongoing SU2 calls should be get dismissed and allocate each to the resulting vacant subchannel to a moved SU1 call.
- iii. Dismiss the residual moved SU1 calls, If there are no ongoing SU2 calls
- iv. Arbitrarily allocate a moved SU2 calls, when there are vacant subchannels are available after handoff of displaced SU1.
- v. If there is no any available vacant subchannel, then dismiss the residual moved SU2 calls.

2) *Handoff method for DSA-C2:*

The handoff method for DSA-C2 is similar to the DSA-C1 method, only (2) and (3) points are different, because, ongoing SU2 calls are not going to dismiss for the SU1 handoff. When there is no any vacant sub channel, the moved SU1 calls are dismissed.

3) *Handoff method for DSA-C3:*

- i. A moved SU1 call is allocated to an available vacant channel arbitrarily.
- ii. For the residual moved SU1 calls, necessary number of ongoing SU2 calls put on hold and allocate each to the resulting vacant sub channel to a moved SU1 call.
- iii. The residual moved SU1 calls put on hold if there are no any ongoing SU2 calls
- iv. Arbitrarily allocate a moved SU2 calls, when there are vacant sub channels are available after handoff of displaced SU1 call.
- v. If there is no any available vacant sub channel, then put the residual moved SU2 calls on hold.

4) *Handoff method for DSA-C4:*

The handoff method for DSAC-4 is similar to the DSA-C3 method, only (2) and (3) points are different, because ongoing SU2 calls are not going to put on hold for the SU1 handoff. When there is no any vacant sub channel, the moved SU1 calls are put on hold.

5) *Handoff method for DSA-D1:*

After identifying the PU call, at the beginning of the subsequent slot, a moved SU determines the vacant sub channels after complete sensing of spectrum. If vacant sub channels are detected then, the displaced SU arbitrarily chooses single vacant sub channel and rights it using a contention process because moved SU calls can have dissimilar priorities.

6) *Handoff method for DSA-D2:*

In DSA-D2 scheme, moved SU calls facing unsuccessful handoff are not dismissed and permitted to reattempt in the next slots till they succeed to get handoff. Therefore, in the next slot, such moved SU calls perform spectrum sensing and again uses the contention process. The moved SU calls can be observed as existence in a virtual buffer and contending for the vacant sub channels to get successful handoff.

IV. CONCLUSION

Analysis of cognitive radio network spectrum access is used for prioritization of SU traffic. The SU traffic can be prioritized based on Quality of service requirements (e.g., real-time traffic has higher priority than non-real-time traffic). During spectrum handoff, in case of a two-priority class high-priority SU gets handoff before a low-priority SU. DSA schemes are mainly useful when there are number of ongoing SU transmission require handoff. Here distributed call-level DSA schemes are proposed for the centralized and distributed CRNs by considering priority based spectrum handoff. This paper present the numerical and simulation results by using performance measures including the blocking probability, probability of forced termination, successful call completion rate and mean handoff delay for both type of priority users.

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