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To study method of Opportunistic Multiple Access technique in Cognitive Radio Networks

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ABSTRACT— In this paper advance investigation of remote correspondence innovation, frequency reuse or frequency utilization involves concern, constrained band of frequency ought to be utilized with full productivity so that alongside licensed user i.e essential users, unlicensed user which are optional users SU so they can likewise join in transmission of information in frequency range. This worldview is permitted in psychological radio system. Psychological radio is propelled arrangement of planning remote correspondences frameworks which chooses to build up the utilization of the radio frequency (RF) range. Artful multiple access permits to utilize accessible range for using the subjective user for impart SU, in which opening of frequency band is looking for chance to apportion band. The inspiration driving this is lack of the accessible radio frequency range, developing need, created by the rising remote applications for versatile user.

KEYWORDS: Cognitive radio networks; frequency utilization; formatting; licensed user; unlicensed user; Opportunistic multiple access.

I. INTRODUCTION

Cognitive Radio (CR) is an accommodative, smart radio and wireless network technology that has ability to automatically discover acquirable channels in band of wireless area and change sending parameters resulting in more communications to run at same time and also improve operating behavior of radio. Cognitive radio network allows to use full band of radio frequency in its zone. This CRN have attributes explained as follows

A. Rate of High transmission

First, for applications in wireless network one has to send text, audio, video files so for this purpose high data rate is required and which has ability to maintain the data rate and time duration so as the Integrity of the Specifications.

B. QoS Support

The traffic of for example Video files, audio files, data, is supported by the CRN. Its resource management can manage the various types of traffic occurring in the wireless area applications. And main task of cognitive radio network is that it provides the unlicensed user to get communicate through the available band of frequency such dynamical routing can be achieved using the cognitive radio network. Which lead to have good QoS.

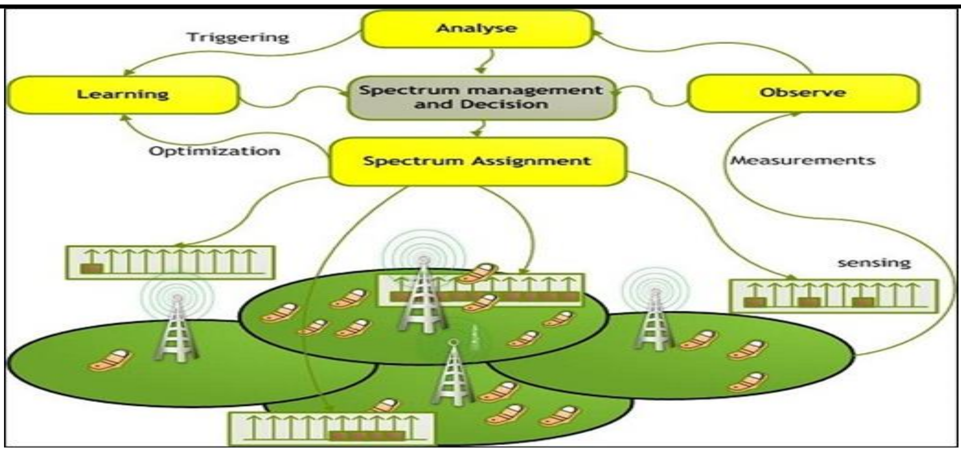

Fig. 1 Cognitive Radio Cycle

Here in this paper authors studies the method of spectrum sensing technique, and its method of opportunistically multiple access the it also shows out that most of the unlicensed spectrum are mostly utilized by users and have achieved full spectrum utilization, resulting in the way of modified the scarcity of limited spectra of radio frequency. These observations show us to an important idea the spectrum utilization have been amazingly grown by permitting secondary users to access to the spectrum holes that are unused by the primary user at instance of time and vacant space of frequency spectrum**.**

C. Spectrum sensing techniques

When a channel is continuously sensed, the sensing time period can be optimized to maximize the search of spectrum opportunities. For example, if the sensing period is more (i.e. a channel is not sensed frequently), spectrum opportunities may not be fully found . But, if the sensing period is less, the sensing overhead becomes more. Therefore, the ratio T s,i /T p,i , where T s,i is the sensing time interval and T p,i is the length of duration between two nearby channel sensing (i.e. sensing period) of channel i, can be minimized sensing period is too less, and, therefore, channel access by an unlicensed user is not maximized due to the large overhead.

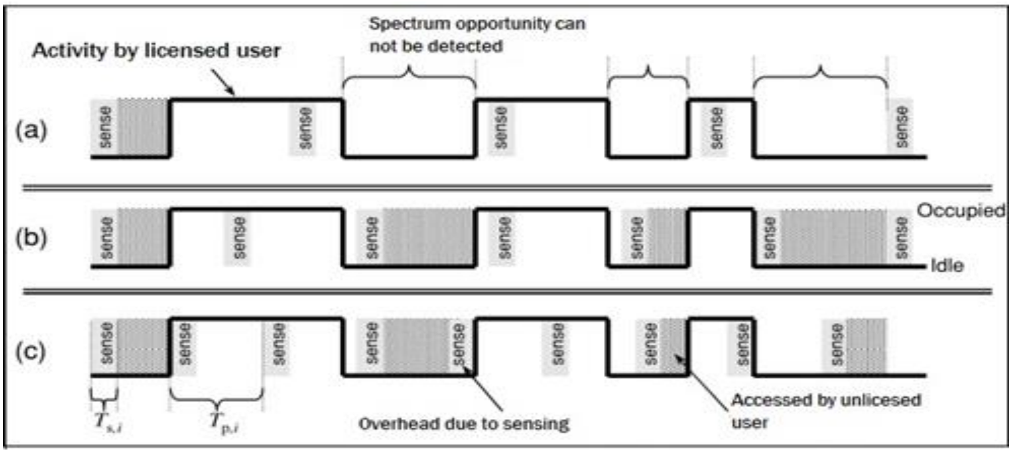

Fig. 2 Sensing time and sensing period

The sensing period is too large, and only a small number of spectrum opportunities are found. The sensing period is optimally chosen so that the maximum number of spectrum opportunities are found.

II. OPPORTUNISTIC MULTIPLE ACCESS FOR CRN

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In the previous section, the spectrum sensing techniques are studied which are for channel resource detection nodes forward their packets was considered. Opportunistic multiple access allows the network to have communication when vacancy of time slot is available in the TDMA cycle of data transmission, such opportunity is searched continuously by using relay cooperation. Instead from being utilized by relays, these available channel resources could be used by a secondary (unlicensed) nodes to communicate their own data packets. Hence, the utilization of these standard channel resources (vacant time period, in our network) offers either diversity to the PU nodes through the relays, or multiplexing through the SU nodes that transmit\new information over the channel.

A. Sharing the idle time slots

In this section, the impact of sharing the idle time slots between relays and secondary nodes on the performance of both PU and SU networks. Broadly, by which mean the secondary network's delivers its impact when part of the idle channel resources are composed by the relays. And, how the PU is affected when SU sends data and it interfere with relay transmissions. Furthermore, we study the possibility that cognitive nodes work as relays for the PU network. By functioning as relays, the unlicensed nodes aim at forming more transmission opportunities for Time slot architecture, showing the sensing period used by the relays to detect primary presence. Themselves by helping primary nodes empty their queues at a faster rate. The secondary network consists of Ms Nodes forming an\ad-hoc network, in which nodes are grouped into source destination\pairs where each source node communicates with\its associated destination node. To access the channel, secondary\nodes will use the beacon sent by primary nodes at the beginning of each time slot, as shown in Fig. 2, to detect primary activity. As with the relays, we assume that the primary detection process is error free. to share the idle time slots among the secondary network, secondary nodes employ slotted ALOHA as a MAC protocol. Therefore, whenever an idle slot is detected, secondary nodes with nonempty queues will attempt to transmit their packets with channel access probability αs.

B. Case I: No Interference

Here we consider the case when secondary nodes are always able to successfully detect relays transmissions. Therefore, no interference is exhibited by relay nodes from secondary transmissions. This can be seen as a best case scenario and helps in characterizing an upper bound on the performance of both primary and secondary networks.

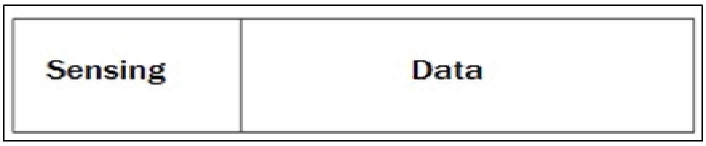

Fig. 3. Time slot structure, showing Sensing period

In other words, when a relay detects an empty time slot, it transmits the packet at the head of its queue with probability αr, and remains silent with probability 1 − αr. In this case, TDMA is still used to organize relays access to idle time slots, and we assume that all relays will use the same probability αr. Therefore, relays will collectively use a fraction αr of the idle time slots to offer help to primary nodes, and secondary nodes will have a guaranteed access to at least a fraction 1−αr of the idle time slots. The actual figure will be higher since relays will not have packets to transmit all the time.

C. Case II; Maximum Interference

Here we consider the worst case scenario where secondary nodes cannot sense relay transmissions at all. In this case, collisions between relays and secondary transmissions are inevitable. In case of a collision all packets involved are lost, and a retransmission is necessary. This scenario helps us characterize a lower bound on the performance of both primary and secondary networks. Because of the possible collisions between secondary and relay transmissions, relay and secondary nodes queues form a system of interacting queues

Next, we consider the service processes for the secondary queues. Beside the idle time slots unused by the primary nodes and other secondary nodes queues, the service process of a secondary node now depends on whether or not relays have permission to transmit. The primary node for which the current time slot is assigned has an empty queue, the relay has no permission to transmit, the kth secondary node has permission to transmit, all other secondary nodes do not have permission.

III. RESULTS

First we present results for the proposed selection schemes by considering the following scenario.

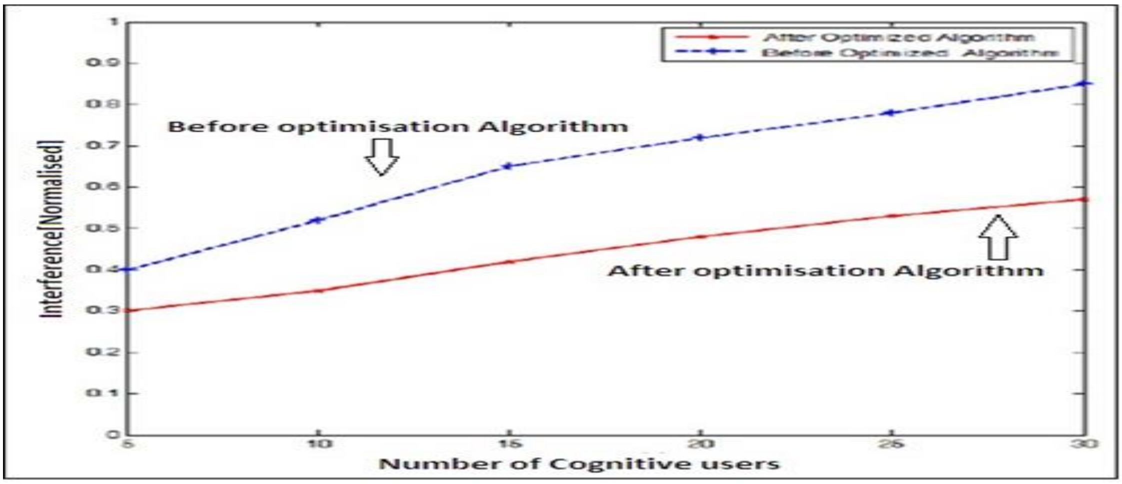

Fig. 4 Normalized interference vs. cognitive user

It is clear that the cooperative sensing protocol outperforms its no cooperative itself; even with a mono relay (which of course is not helping all the nodes) a 25% increase in output result is achieved. As the number of relays increases we notice a fast increase in output result; for example, with 5 relays the output result is increased by 128%. Increasing the number of relays to 10 leads to a 167% increase in output result. This is mainly because increasing the number of relays increases the number of source nodes that are getting help from these relays, hence leading to higher output result

From Fig. 4, it can be seen that the "maximum success probability" relay selection criterion outperforms the "nearest neighbour" criterion by a margin of 3% to 4% on average. Furthermore, it is noted that the gap between the two criteria increases with increasing number of relays. This is due to the fact that with an increased relay density in the network, there will be a higher probability that a source node finds a relay at or near the optimal relay position corresponding to that source node. While the "maximum success probability" criterion will be able to select the relay at the optimal (or near optimal) location, the "nearest neighbour criterion" will always communicated.

Here the scenerion considered is Mp = 20 source nodes, and Mr = 1, ..., 20 relay nodes are deployed uniformly in a circular cell of radius R = 200m, with the BS located at the center of the cell. Despite the fact that relay and secondary nodes are competing for idle channel resources, significant improvements in the stability regions of both primary and secondary network are observed.

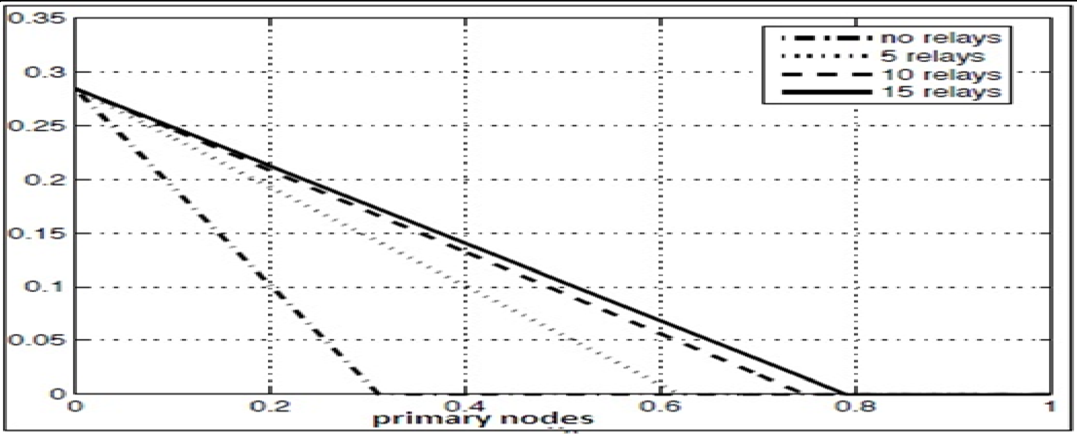

Fig. 5. Result of increasing no. of relay on nodes

It is noted that, as in the case without collisions, both networks benefit from assigning more resources for cooperation, or increasing the number of relays in the primary network, although this increase is apparently increasing the probability of collision.

IV. CONCLUSION

In this paper, the exploitation of idle channel resources in a TDMA network is investigated. First, the use of these idle channel resources cognitively by a group of relay nodes that help the source nodes is studied. Two different relay selection criteria, namely, the nearest neighbour and maximum success probability, were proposed and analyzed. Stability analysis reveals that the cognitive relays can lead to up to 167% increase in the maximum stable throughput of the network. Then the problem of sharing the idle channel resources between the group of relays and a group of secondary nodes trying to transmit new information over the network is considered. Two different scenarios are studied in details, the first is when the secondary nodes can sense relay transmissions and organize their access to the channel accordingly, the second scenario is when the secondary nodes interfere with relays transmissions in the idle time slots T.

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