OFDM BASED SPECTRUM SHARING IN COGNITIVE RADIO NETWORK FOR INTERFERENCE CANCELLATION

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ABSTRACT

In this project analyses spectrum sharing in cognitive radio networks, and perform the selection of relays models to reduce the interference of primary nodes and achieve the maximize the rate in secondary nodes. The trade-off between the secondary rate and the interference on the primary is also characterized. To consider a spectrum-sharing analysis they taken an Alternating Relay Protocol to investigate the performance and clustering (frame work) for to achieve an above mentioned aspects. "In the paper Rayleigh fading is used to select the relay thus rate of transfer decrease per second. To increase the Rates of frequency by proposing with an algorithm of frequency selective fading with the help of this method data loss is comparatively reduced". Finally to address the rate loss due to half-duplex relaying in the secondary and propose an alternating relay protocol and investigate its performance.

***Keyterms**: ofdm,cognitive radio network,adaptive relaying protocol,amplify and forward relaying, montecarlo simulation, multi path fading channels.*

1. INTRODUCTION

A cognitive radio is an intelligent radio that can be programmed and configured dynamically. Its transceiver is designed to use the best wireless channels in its vicinity. Accordingly changes its transmission or reception parameters to allow more concurrent wireless communications in a given spectrum band at one location.

An intelligent antenna (or smart antenna) is an antenna technology that uses spatial beam-formation and spatial coding to cancel interference; however, it is emerging to be extended for an intelligent multiple- or cooperative-antenna array so as to be applied to the recent complex communication environments.With the development of cognitive radio technologies, dynamic spectrum access.

We consider a cognitive radio network in which a multiple-access secondary system coexists with an automatic repeat request (ARQ)-based primary system under heavy primary traffic.
To achieve spectrum sharing without degrading the performance of the primary system, the secondary transmitters alternate between cooperation and access modes based on a credit system. In the cooperation mode, the secondary transmitters serve as potential relays among which the best one is selected to help forward the primary packet, thus accumulating credits.
These credits will then allow the secondary transmitters to gain spectrum access by exploiting the ARQ mechanism of the primary system. Our results show that with a cluster of closely located secondary transmitters, the proposed spectrum sharing protocol achieves an equal average throughput for the primary system compared to the case without spectrum sharing, while providing access opportunities for the secondary system.

Furthermore, by increasing the number of secondary transmitters or decreasing the distance between secondary transmitters and secondary receiver, an overall higher throughput can be achieved for the secondary system, without affecting the analytical results for the upper bounds of primary throughput under cooperation mode and secondary throughput under access mode are also derived.

2.OVERVIEW

SPECTRUM-SHARING allows unlicensed (secondary) users to share the spectrum of licensed (primary) users as long as the interference caused on the primary is tolerable. This problem is often formulated as maximizing the secondary rate subject to interference constraints on the primary, or as the dual problem of minimizing the interference on the primary subject to a fixed rate for the secondary. There are already a number of spectrum sharing solutions in the market that can work under defined circumstances.

A spectrum-sharing approaches range from simple to extremely complex, from readily achievable and in use today to extremely difficult with technologies yet to be developed by the secondary and the primary user of the transmission channel, in the fading channel of the system.

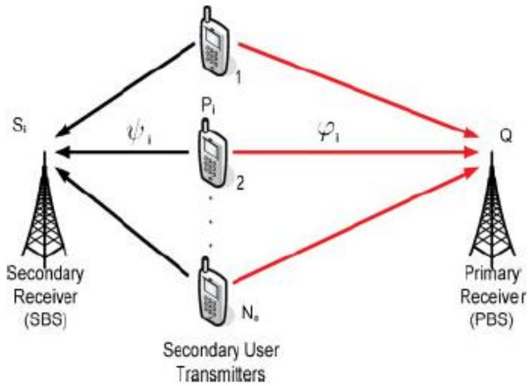


Fig 1.System model for spectrum-sharing systems.

3. EXISTING SYSTEM

In the Existing, we have investigated the cognitive radio paradigm when multiple SUs and PUs share the same channel. For selecting the SU with the best channel conditions, the MUX technique has been considered in which average power constraints are imposed on the transmit power of the SU for providing optimal power allocation on the secondary links and PU protection on the primary links over fading channels.

Rayleigh and Nakagami –m fading were considered deriving the corresponding PDFs and CDFs that were required for calculating the achievable average capacities and the outage probabilities.

Existing Simulation results were provided in order to examine the effects of multiple SUs and PUs when MUX and optimal power allocation are employed in systems.

3.1. Problem definition

Due to fading high loss in data at Receiver.

Spectrum allocation for multiuser is not up to the level of distribution.

Furthermore, it has been observed that the fading environment in high power regions will give a slight increase in capacity and thus it does not have a significant impact on the achievable capacity and consequently on probability of outage.

3.2. A case for amplify- forward relaying in the block-fading

The proposed protocol, namely the multi-access relay amplify-forward, allows for a low-complexity relay and achieves the optimal diversity multiplexing trade-off at high multiplexing gains. Analysis of the protocol reveals that it uniformly dominates the compress-forward strategy and further outperforms the dynamic decode-forward protocol at high multiplexing gains. An interesting feature of the proposed protocol is that, at high multiplexing gains, it resembles a multiple-input single-output system, and at low multiplexing gains, it provides each user with the same diversity-multiplexing trade-off as if there is no contention for the relay from the other users. Because several previous works on the multi-access relay channel (MARC) have focused on protocols that requires complicated signal processing at the themain contribution is to proposes a linear relaying protocol.

3.3. COGNITIVE RADIO NETWORK PARADIGMS

Primary concern of cognitive radio is to ensure that cognitive user will not interfere with the licensed user while communicating in licensed spectrum. Based on available network information and other regulations there are different approaches by whichsecondary user access spectrum without interfering with primary user. These approaches include under lay, overlay and interweave paradigm.

3.3.1. Underlay Paradigm:

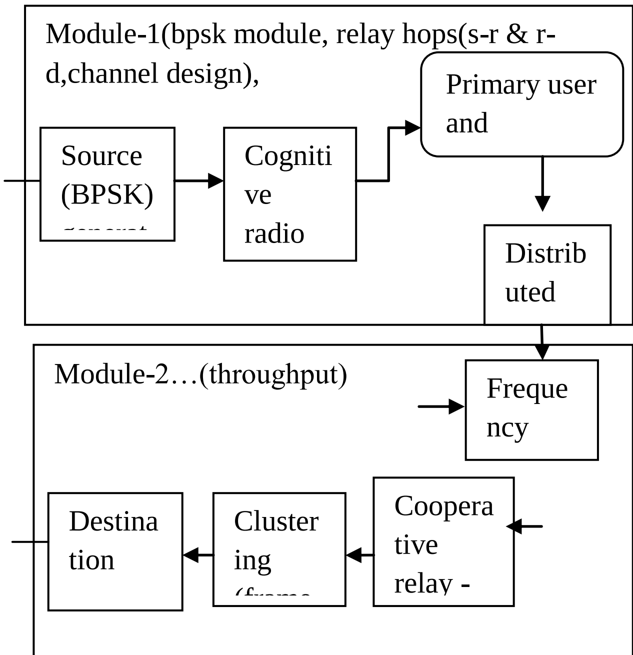
In this approach, secondary users simultaneously transmit with the primary users by maintaining endurable interference. This could be achieved by maintaining interference at primary receiver by secondary userscertain threshold.

Underlay approach uses interference temperature model for measuring interference level at primary receiver caused by secondary users and uses measured data to minimize the interference caused by secondary user. The interference problem caused by secondary users could also be solved by the use of multiple antennas by which secondary user transmission could be guided away from primary receiver. Another approach for reducing interference is the use of wide bandwidth on which secondary transmission could spread while dispreading signals at secondary receiver; this technique is also basis for spread spectrum and Ultra-wide-band (UWB) communication.

3.3.2. Overlay Paradigm:

In overlay technique interference is mitigated and in some cases completely cancelled as secondary user uses codebook information and messages that primary user sends. In this way primary users assist secondary users for simultaneous transmission by using portion of their transmitting power. As the secondary user knows both message and codebook to decode the message it can apply various coding schemes so that data rate of both secondary and primary users could be improved using this information.

4. PROPOSED SYSTEM



This paper studies a spectrum sharing network consisting of multiple primary nodes and a secondary system with M antenna source and destination, and n half-duplex relays. Unlike conventional relay networks the secondary relays must not only maximize the secondary rate.

- Spectrum sharing networks with distributed AF relaying to improve the secondary rate and reduce the interference on the primary. In the asymptote of large (number of relays) the optimal power strategy for the secondary source and relays was found, achieving a secondary rate proportionally to log n.
- The half-duplex rate loss was reduced and the scaling of secondary rate was enhanced by the introduction of the Alternating Relay Protocol.

- The trade-off between the secondary rate and the interference on the primary was characterized. Finally, our results show that even without cross channel information at the secondary, the secondary rate can achieve the growth rate log n.

4.1.Frequency channel

By transmitting a wide bandwidth signal or spread spectrum as CDMA, any dips in the spectrum only result in a small loss of signal power, rather than a complete loss. Another method is to split the transmission up into many small bandwidth carriers, as is done in a COFDM/OFDM transmission. The original signal is spread over a wide bandwidth thus; any nulls in the spectrum are unlikely to occur at all of the carrier frequencies.

This will result in only some of the carriers being lost, rather than the entire signal. The information in the lost carriers can be recovered provided enough forward error corrections are sent. The current scarcity of spectrum for many types of servicescan be alleviated by dynamically sharing spectrum across amultitude of services.

That possibility motivates the considerationof "wideband" systems in which each user can choose from among a large number of coherence bands.

A primary challenge when the users are non-cooperative is the mitigation and control of interference. In this work we assume that the available spectrum is shared by several independent devices, which communicate synchronously with a central transceiver. Although the devices do not avoids interference from other devices and exploits available frequency diversity.

The achievable rate for a doubly-selective fading channel depends on what channel state information (CSI) is available at the receiver and transmitter. Namely, CSI at the receiver can increase the rate by allowing coherent detection, and CSI at the transmitter allows adaptive allocation of rate and power across sub-channels in addition to opportunistic scheduling across the users. The scaling resources must be limited by some threshold with high privacy requirements.

This information is all the more important given a wideband fading channel, which offers many degrees of freedom for diversity. Obtaining CSI at the receiver and/or transmitter typically requires overhead in the form of a pilot signal and feedback. Hence there is a fundamental tradeoff in allocating available resources between learning CSI and data transmission.

From the proposed system, we take concept of source (S), relay (i), and destination (D). This is the general outline of our system; here one more nodes called primary users are taking as a part. As we know the licensed user called primary and unlicensed users called secondary.

The spectrum sharing network includes multiple primary nodes (Np) and secondary system with M antenna source and destination, and n single antenna half duplex relays. So the communication happens between source and destination via two hops. One is source to primary it done via relays and second hops between relay to destination. Multi hop relaying and cooperative communication is known to significantly mitigate interference and increase the throughput in many multiuser scenarios.

4.2. SPECTRUM SHARING WITH ALTERNATING RELAY PROTOCOL

In this section the issues raised by the relay half duplex constraint, i.e., limitations that arise because relays cannot listen to the source at the same time as they are transmitting.When a subset of relays are activated for relaying the previously received information, the inactive relays are able to listen and receive information from the source, thus in principle the source can transmit continually and the half duplex loss can be mitigated. This is the basic idea of spectrum sharing with Alternating Relay Protocol, which is the subject of this section.

The protocol consists of L transmission frames. It is assumed the channel coefficient remains constant during each frame, but varies independently from frame to frame. The source transmits during frames 1 through $L - 1$, and remains silent during frame.

Since the source transmits $L-1$ data segments during L time intervals, the rate loss induced by the half-duplex relaying is a factor of $(L-1)/ L$.The relays are partitioned into two groups $G1 = \{1 \le i \le n/2 \}$ and $G2 = \{n/2 + 1 \le i \le n\}$. During even-numbered transmission frames a subset of the relays in G1 transmit to the destination, while the relays in G2 listen to the source.

During odd-numbered transmission frames, a subset of the relays in G2 transmit, while the relays in G1 listen. As shown later, each of the two relay groups asymptotically achieves a rate that grows as $M/2\ (L-1)/\ L \log n$, thus the overall system has a rate that grows proportionally to $M\ (L-1/L) \log n$.

5. PERFORMANCE METRICS OF COGNITIVE RADIO

The performance evaluation of CR network is of keen importance as it used to check implementation feasibility of CR networks. Formalization of performance metrics will help in the research, comparison and advancement of the cognitive radio algorithms. Performance analysis could be done by applying various performance metrics on CR network. The performance metrics are examined at the node, network and application level. The performance evaluation is a big challenge in the designing of CR networks and devices.

The important step in CR design is the selection and establishment of effective performance metrics. The performance metrics will help the integration of the existing wireless networks with the CR based paradigm. It also helps in establishing base for regulating and certifying CR. The vendors also need performance nontrivial, subjective benchmark for the approval and testing during the production and development of the CR networks.

The performance bench mark is used by the service providers in the deployment and maintenance of CR network. The CR technologies cannot operate without performance metrics and bench marking methods. The performance metrics must be selected carefully and they must enable the CE to give the proper response to the changing environment and they must have the dynamic situation aware utility functions of the cognitive radio network.

The CR performance metrics are sub-divided in to two categories node level performance metrics (Node Score Card) and network level performance metrics (Network Score Card).The functionality of both CR node and network is evaluated on the basis of four domains given below.

For CR node domains are cognitive functions, overall node performance, node complexity and technical maturity. Similarly for CR network domains are cognitive functions, overall network performance, network complexity and technical maturity. On the basis of these domains various performance metrics are purposed to test the performance of CR node and network.

6. SIMULATION RESULTS

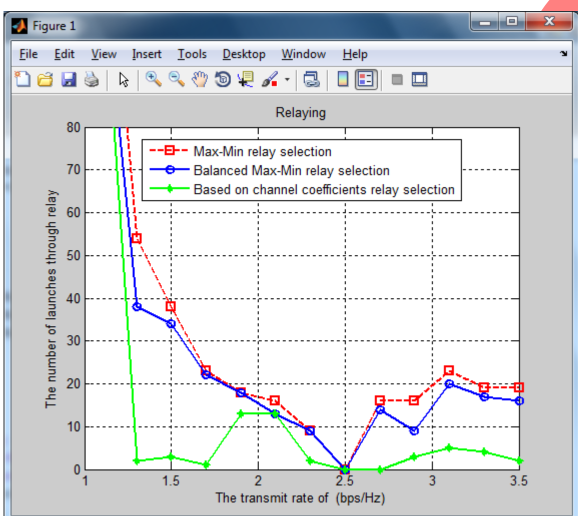


Figure 6.1.1 Relaying Section

In the figure 6.1.1, the graph is plotted between transmission rate of primary and secondary users versus number of relays used in the frequency fading channel. In this graphical representation three different variations are plotted. The three different variations are given as

a. Maximum minimum relay selection
b. Balanced maximum relay selection
c. Channel coefficient relay selection

In this graph it is represented that the data rate of the secondary users are increased as compared to other signal channels. The secondary source will manage its instantaneous interference to be smaller on all primary nodes by adjusting it are transmit power according to the largest cross-channel gain to the primaries.

7.Bit Error Rate VS Signal To Noise Ratio

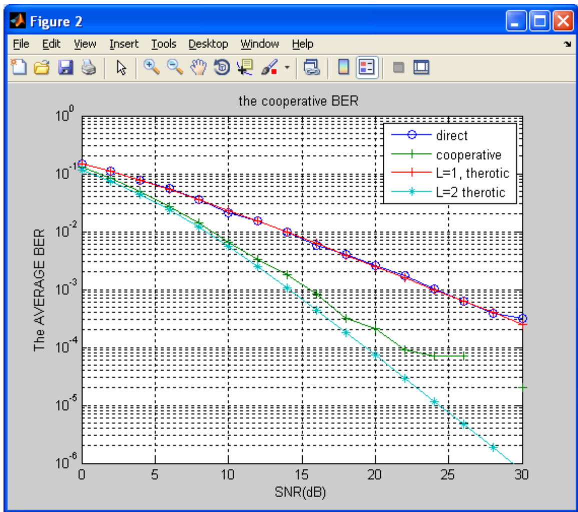


Figure 6.1.2 BERVs SNR

In the figure 6.1.2, the graph is plotted between the average bit error ratio and signal to noise ratio in the fading channel. In this graphical representation represents the variation of bit error rate and the signal to noise ratio of direct transmission in the Rayleigh fading channel and the cooperative system transmission in the frequency fading channel.

And also the graph represents the bit error rate versus signal to noise ratio of two different values of channel co-efficient. The signal to noise ratio will decreased as compared to the direct transmission channel. The channel coefficient is one, it is nearly equal to the direct transmission i.e. Rayleigh fading channel. If the channel coefficient is two, it is nearly equal to the co-operative transmission i.e. frequency fading.

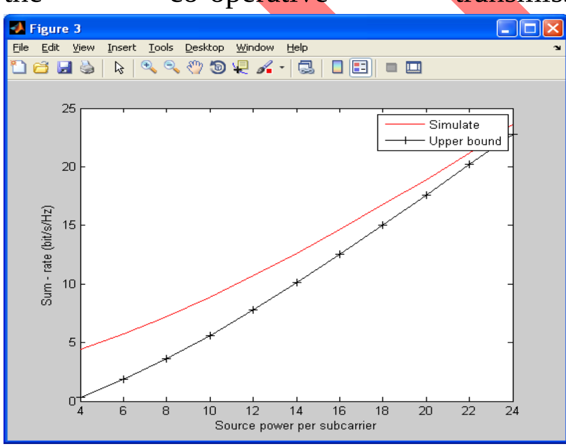


Figure 6.1.3 Sum Rate Vs Source Power

In the figure 6.1.3 the graph plotted between the sum-rate and the source power present in the frequency selective fading channel.

CONCLUSION

The existing one applied with cognitive radio network and selected relay selection to reduce the interference and improve thesecondary rate. With this parameter evaluation the power usage is high so cost of the system increased. Consider this criterion we change the network and apply to WSN, it achieves more effective work for PU and SU's strategies.

Spectrum sharing networks with distributedAF relaying to improve the secondary rate and reduce the interference on the primary. In the asymptote of large *n* (number of relays) the optimal power strategy for the secondary source and relays was found, achieving a secondary rate proportionally to log *n*.

The half-duplex rate loss was reduced and the scaling of secondary rate was enhanced by the introduction of the Alternating Relay Protocol. The trade-off between the secondary rate and the interference on the primary was characterized. Finally, our results show that even withoutcross channel information at the secondary, the secondary rate can achieve the growth rate log *n*.

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