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Cross-Layer Source Distribution for Video Streaming over OFDMA Cognitive Radio Networks

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Abstract: In this paper, a cross-layer source Distribution algorithm is proposed in the context of orthogonal frequency division multiple access (OFDMA)-based cognitive radio (CR) video application systems. User video quality and channel awareness are incorporated in the design, towards an optimal subcarrier and power allocation scheme, subject to minimum secondary receiver (SRx) video quality and primary receiver (PRx) interference threshold constraints. First, the relationship between PRx interference margin and power limits at the secondary transmitter (STx) is analytically derived. Then, to provide PRx with satisfactory quality of service (QoS), we propose a new probabilistic approach to mitigate the total imposed interference of the STx on PRx, considering imperfect STx to PRx channel state information (CSI). The effect of PRx interference limit violation probability, interference threshold, and error variance of imperfect CSI are evaluated through mathematical analysis and computer simulations.

Index Terms: Orthogonal Frequency Division Multiple Access (OFDMA), Cognitive Radio (CR), Primary Receiver (PRx), Secondary Receiver (SRx), Quality of Service (QoS), Channel State Information (CSI), Secondary Transmitter (STx).

I. INTRODUCTION

Cognitive radio (CR) techniques have been proposed to efficiently use the spectrum through an adaptive, dynamic, and intelligent process Spectrum utilization can be improved by permitting a secondary user (who is not being serviced) to access a spectrum hole unoccupied by the primary user, or to share the spectrum with the primary user under certain interference constraints. CR refers to different approaches to this problem that seek to overlay, underlay, or interweave the secondary user's signals with those of the primary users. In the underlay settings, cognitive users can communicate as long as the interference caused to non-cognitive users is below a certain threshold. Overlay systems, on the contrary, adopts a less conservative policy by permitting cognitive and non-cognitive users to communicate simultaneously exploiting side information and using sophisticated coding techniques. Perhaps the most conservative of the three, is the interweave system that permits to cognitive users to communicate provided that the actual spectrum is unoccupied by non-cognitive users. More details on these three systems can be found, for instance, in From an information-theoretical point-of view, establishing performance limits of these systems relies strongly on the available side information that a cognitive user has about the network nodes: channel state information (CSI), coding techniques, codebooks.

In existing system used heuristic algorithms for finding the joint routing and channel assignment that maximizes the throughput for the flows. It is fixed channel approach, that is, they treat each primary user's frequency band as a channel, and each cognitive radio can be assigned only one channel in the channel assignment. The optimal spectrum assignment for multihop flows in cognitive radio networks is more complex than the case of single-hop flows.

In this paper, we studied the multisource video on-demand streaming in cognitive wireless mesh networks. We propose a heuristic distributed protocol to find a joint routing and spectrum allocation for a single VoD session request that minimizes the total bandwidth cost in the network while satisfying the constraints. We propose a centralized algorithm, which has the promise of finding better solutions. The centralized algorithm runs on the receiver.

II .METHODOLOGY

1. Existing Algorithm:

Estimation Algorithms:

This algorithm focuses on the issue of estimating the used bandwidth by counting ACK packets and by filtering the information they convey. The ability of this method to perform well when the data is not perfect is crucial for the extension of the method from spheres (for which it was initially developed) to arbitrary shapes. When the observed shape is not spherical its normal will be mapped to a sphere, although a lot of normal will be missing. However this method works well even for incomplete spheres, as long as there are enough points inside each light patch for the least-squares method to work correctly. It detects multiple illuminant directions through the following six steps:

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- Detect critical points.
- Find initial critical boundaries by Hough transform.
- Adjust critical boundaries. Adjust every critical boundary by moving it by a small step, and a reduction in the least-squares error indicates a better solution. Update boundaries using a "greedy" algorithm to minimize the total error.
- Merge spurious critical boundaries. If two critical boundaries are closer than a threshold angle (e.g.5 degrees), they can be replaced by their average.
- Remove spurious critical boundaries. Test every critical boundary, and remove it if the least-squares error does not increase. Test boundaries in increasing order of Hough transform votes (first test boundaries that are not as trustworthy).

2. Proposed Algorithm:

Bucket Leaky Algorithm:

- Bucket Leaky Algorithm is an algorithm used to check that data transmissions, in the form of packets, conform to defined limits on bandwidth.
- A description of the concept of operation of the Bucket Leaky Algorithm as a meter that can be used in either traffic policing or traffic shaping, may be stated as follows:
- A fixed capacity bucket, associated with each virtual connection or user, leaks at a fixed rate.
- If the bucket is empty, it stops leaking.
  For a packet to conform, it has to be possible to add a specific amount of water to the bucket: The specific amount added by a conforming packet can be the same for all packets, or can be proportional to the length of the packet.
- If this amount of water would cause the bucket to exceed its capacity then the packet does not conform and the water in the bucket is left unchanged.

Rate Allocation Algorithm:

We consider rate allocation algorithm for resolving fundamental problem of bandwidth allocation among flows in a packet-switched network. The classical max-min rate allocation has been widely regarded as a fair rate allocation policy. But, for a flow with a minimum rate requirement and a peak rate constraint, the classical max-min policy no longer suffices to determine rate allocation since it is not capable of supporting either the minimum rate or the peak rate constraint from a flow. We generalize the theory of the classical max-min rate allocation with the support of both the minimum rate and peak rate constraints for each flow. Additionally, to achieve generalized max-min rate allocation in a fully distributed packet network.
The challenge of bandwidth sharing and rate allocation in a lambda network is how to efficiently and fairly share the capacity of each source and sink among active sessions. Of course, the allocation algorithm should also be stable. We describe the main bandwidth sharing objectives as follows. First, the rate allocation (bandwidth sharing) algorithm should efficiently utilize of the capacity of each source and sink while maintaining feasibility.

III .REVIEW OF RELATED WORKS

Fair subcarrier and power allocation for multiuser orthogonal frequency-division multiple access cognitive radio networks using a Colonel Blotto game

The problem of subcarrier allocation (SA) and power allocation (PA) for both the downlink and uplink of cognitive radio networks (CRNs) is studied. Two joint SA and PA schemes based on Blotto games are presented for orthogonal frequency-division multiple access (OFDMA)-based CRNs. In this work, the authors consider a more practical scenario by taking into account the correlation between adjacent subcarriers. In the proposed games, secondary users (SUs) simultaneously compete for subcarriers using a limited budget. In order to win as many good subcarriers as possible, the SUs are required to wisely allocate their budget subject to the transmit power, budget and interference temperature constraints .Two PA and budget allocation strategies are derived to enable fair sharing of spectrum among the SUs. It is shown that by manipulating the total budget available for each SU, competitive fairness can be enforced. In addition, the conditions to ensure the existence and uniqueness of Nash equilibrium (NE) in the proposed methods are established and algorithms which ensure convergence to NE are proposed. Simulation results show that the proposed methods can converge rapidly and allocate resources fairly and efficiently in correlated fading OFDMA channels.

How much Spectrum Sharing is Optimal in Cognitive Radio Networks?

We explore the performance tradeoff between opportunistic and regulated access inherent in the design of multiuser cognitive radio networks. We consider a multichannel cognitive radio system with sensing limits at the secondary users and interference tolerance limits at the primary and secondary users. Our objective is to determine the optimal amount of spectrum sharing, i.e., the number of secondary users that maximizes the total deliverable throughput. We begin with perfect primary user detection and zero interference tolerance at the primary and secondary nodes. With identical primary and secondary traffic statistics, we find that the optimal fraction of licensed users lies between the two extremes of fully opportunistic and fully licensed operation and is equal to the traffic duty cycle. When the secondary users can vary their transmission probabilities based on the number of active primary users, we find that the optimal number of opportunistic users is equal to the average number of unoccupied channels. For the more involved case of imperfect sensing and non-zero interference tolerance constraints, we provide numerical simulation results to study the tradeoff between licensing and autonomy and the impact of sensing and interference tolerance on the throughput for different sub channel selection strategies at the secondary users

Adaptive Resource Allocation in OFDM Systems Using GA and Fuzzy Rule Base System

Adaptive resource allocation is one of the hottest topic in almost every field of study and research now a day. It

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promises optimal utilization of resources while satisfying certain number of constraints. A similar constrained optimization problem has been solved for OFDM environment where channel hostilities are mitigated and throughput is maximized by adaptively selecting code rate, modulation symbol and transmits power. Many adaptive bit and power loading techniques have been investigated in the literature for enhancement of transmission rate in combination with Orthogonal Frequency Division Multiplexing (OFDM).

In these systems mainly adaptive coding modulation or adaptive power was the focus but not both. In this paper, two new schemes are proposed to adapt code rate, modulation size as well as transmit power based upon channel conditions and quality of service demand by any subcarrier. Adaptive coding and modulation is done by using a Fuzzy Rule Base System (FRBS) to enhance the achievable data rate in an OFDM system with a fixed target bit error rate and fixed transmit power for each subcarrier. Moreover, for power adaptation two approaches are proposed, first the conventional water-filling algorithm and in second technique Genetic Algorithm is used to choose the optimum power vector. Both of these schemes are tuned in conjunction with FRBS. Moreover, the value of constant K for water-filling algorithm is calculated analytically. Simulation results show that water-filling performs algorithm better than flat power distribution while Genetic Algorithm assisted adaptive power outperforms both fixed and water-filling assisted adaptive power.

Downlink Scheduling and Resource Allocation for OFDM Systems

We consider scheduling and resource allocation for the downlink of a cellular OFDM system, with various practical considerations including integer tone allocations, different sub channelization schemes, and maximum SNR constraint per tone and "self-noise" due to channel estimation errors and phase noise. During each time-slot a subset of users must be scheduled, and the available tones and transmission power must be allocated among them. Employing a gradient-based scheduling scheme presented in earlier papers reduces this to an optimization problem to be solved in each time-slot. Using a dual formulation, we give an optimal algorithm for this problem when multiple users can time-share each tone. We then give several low complexity heuristics that enforce integer tone allocations. Simulations are used to compare the performance of different algorithms.

Ergodic Capacity of Cognitive Radio under Imperfect Channel State Information

A spectrum-sharing communication system where the secondary user is aware of the instantaneous channel state information (CSI) of the secondary link, but knows only the statistics and an estimated version of the secondary transmitter primary receiver (ST-PR) link, is investigated. The optimum power profile and the erotic capacity of the secondary link are Derived for general fading channels (with continuous probability density function) under average and peak transmit-power constraints and with respect to two different interference constraints: an interference outage constraint and a signal-to-interference outage constraint. When applied to Rayleigh fading channels, our results show, for instance, that the interference constraint is harmful at high-power regime in the sense that the capacity does not increase with the power, whereas at low-power regime, it has a marginal impact and no-interference performance corresponding to the ergodic capacity under average or peak transmit power constraint in absence of the primary user, may be achieved.

IV .EXISTING SYSTEM AND PROPOSED SYSTEM

Existing System:

- In existing system used heuristic algorithms for finding the joint routing and channel assignment that maximizes the throughput for the flows. It is fixed channel approach, that is, they treat each primary user's frequency band as a channel, and each cognitive radio can be assigned only one channel in the channel assignment.
- The optimal spectrum assignment for multihop flows in cognitive radio networks is more complex than the case of single-hop flows

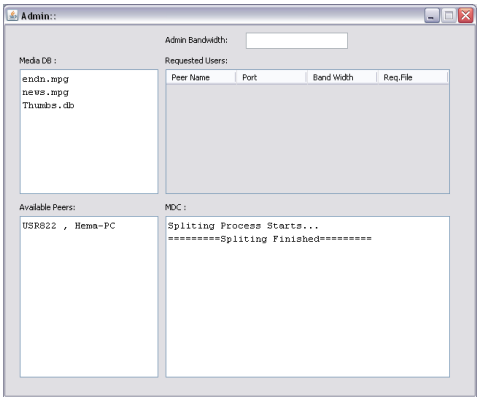
Proposed System:

- In this paper, we studied the multisource video on-demand streaming in cognitive wireless mesh networks.
- We propose a heuristic distributed protocol to find a joint routing and spectrum allocation for a single VoD session request that minimizes the total bandwidth cost in the network while satisfying the constraints.
- We propose a centralized algorithm, which has the promise of finding better solutions. The centralized algorithm runs on the receiver.

V. MODULES DESCRIPTION

- **Sender:**

In the sender side machine, initially user wants the ip address and port number of the target machine that is receiver side machine. The sender can capable of storing the movie file in the local machine into remote machine. Then in the sender side machine we are using two protocols, they are Video for Window (VFW) and Heuristic Distributed Protocol (HDP).



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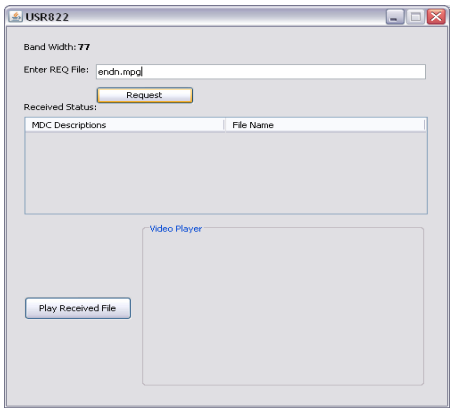
• **Receiver:**

In the receiver side machine also, initially the user wants the ip address and port number of the sender side machine. So now the communication is established between the sender side machine and receiver side machine.



• **Distributed Routing and Channel Allocation:**

We use two rounds to find two paths together with spectrum allocation. In each round, the receiver broadcasts the path discovery message to its neighbors. Each intermediate node updates its currently best path and spectrum allocation to the receiver, and further broadcasts the update information. Once the sender has received the update messages, it selects a best path and spectrum allocation and replies to the receiver.

• **Heuristic Distributed Protocol:**

HDP scans the data transferred from port. Whenever any media streams have been transferred across the receiver application and sender application. It just track the data transferred from the sender application. HDP is adapted in both sender side as well as the receiver side. In both side it will report the information passed across the channel.

• **Centralized Algorithm:**

The sender can capable of storing the movie file in the local machine in to remote machine. Then in the sender side machine we are using two protocols, they are Video for Window (VFW) and Heuristic Distributed Protocol (HDP).By using the VFW we sends entire movie files into HDP. So, now all the movie files are placed in the HDP. From the HDP we are going to transmit the movie files in to the receiver side machines.

VI. CONCLUSION AND FUTURE WORK

In this paper, we studied the multisource video on-demand streaming in cognitive wireless mesh networks. We propose a heuristic distributed protocol to find a joint routing and spectrum allocation for a single VoD session request that minimizes the total bandwidth cost in the network while satisfying the constraints. Improve each session's performance with regard to spectrum mobility. Provide better quality of services for high bit-rate applications. DOFDM -based cognitive radios are more powerful and flexible than traditional radios, which enable the access of larger amount of spectrum and more flexibility in channel assignment. In existing system used heuristic algorithms for finding the joint routing and channel assignment that maximizes the throughput for the flows. It is fixed channel approach, that is, they treat each primary user's frequency band as a channel, and each cognitive radio can be assigned only one channel in the channel assignment.

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