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Throughput Maximization Scheduling For Energy Efficiency in Cognitive Radio Networks

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Abstract – **Spectrum is generally allocated by the Government for wireless networks. Licensed user has rights to access the channel. Federal communication centre announced that most of the time the spectrum is not utilized by licensed user, so the overall spectrum efficiency will be degraded. So cognitive radio is the emerging technology in order to access the underutilized spectrum by licensed user. Energy Efficiency Heuristic Scheduler (EEHS) and Energy Minimum Throughput Guarantees (EMTG) are used for this work. The parameters considered for simulation are number of nodes and frequency band. The simulation result shows that EEHS technique is better than EMTG technique in order to get higher Throughput, Energy efficiency and low Delay.**

Keywords – **cognitive radio (CR), Energy Efficiency, EEHS,EMTG technique**.

I INTRODUCTION

In communication networks, cognitive network is a new type of data network that makes use of cutting edge technology from several research areas to solve some problems current networks. Cognitive network is different from cognitive radio as it covers all the layers of the OSI model.The first definition of the cognitive network was provided by Theo Kantor in his doctoral research at KTH Technology, Stockholm, including a presentation in June 1998 of the cognitive network as the network with memory. Theo was a student of Chip Maguire who also was advising Joe Mitola, original of cognitive radio. Mitola focused on cognition in the nodes, while Kantor focused on cognition in the network. Mitola's Licentiate thesis, publish includes the following quote "Over time, empowered network can learn to distinguish a feature of the natural environment that does not match the models. It could declare the errors to a cognitive network." These is earliest publication of the concept cognitive network, since Kantor published.

IBM's autonomic networks challenge of 2001 instigated the introduction of a cognition cycle into networks. Cognitive radio, Kantor's cognitive networks are IBM's autonomic networks provid the foundation for the parallel evolution of cognitive wireless networks and other cognitive networks. In 2004, Petri Mahonen, currently at RWTH, Aachen, and a member of Mitola's doktoral committee organized the first international workshop on cognitive wireless networks at Dagstuhl, Germany. In addition, the EU's E2R and E3 programs developed cognitive network theory under the rubric of self - self organizing networks, self-aware networks, and so forth. One of the attempts to define the concept of cognitive network was made in 2005 by Thomas et al. (Thomas 2005) and is based on an older idea of the Knowledge Plane described by Clark et al. in 2003 (Clark 2003). Since then, several research activities in the area has been emerged.Cognitive radio is consider as a goal towards which a software-defined radio platform should evolve: a fully reconfigurable wireless transceiver which automatically adapts its communication parameters to network and user demands.

Traditional regulatory structures have been built for an analog model and are not optimized for cognitive radio. Regulatory bodies in the world (including the Federal Communications Commission in the United States and of com in the United Kingdom) as well as different independent measurement campaigns found that most radio spectrum has been inefficiently utilized. Cellular network band are overload in most parts of the world, but other frequency bands (such as military, amateur and paging frequencies) are insufficiently utilized. Independent studies performed in some countries confirm that observation, and conclude that a spectrum utilization depend on time and place. Moreover, fixed than a spectrum allocated prevents rarely used frequencies (those assigned to specific services) from used, even a any unlicensed users would not cause noticeable interference to the assigned service. Regulatory bodies in the world have been considering whether to allow unlicensed users in licensed band if they would not cause any interference to licensed user. These initiatives have been a focused cognitive-radio research on dynamic spectrum access.

Cognitive radio is a communication paradigm in which wireless users are classified into two categories based on whether they are licensed to use a particular spectrum band has been (primary users (PUs)) or are unlicensed (secondary users (SUs)) SUs are allowed to opportunistically use the spectrum as long as they do not cause harmful interference to active PUs. This is achievable if PU receivers are far enough from the SU transmitter (spatial channel availability), or no PU receivers are receiving while the SU transmitter is transmitting (temporal channel availability).

A. LICENSED BAND OPERATION

The licensed band is primarily used to the primary network. Hence, CR networks are focused mainly on the detection of primary users in this case. The channel capacity depends upon the interference at nearby primary user. Furthermore, if primary user appear than the spectrum band occupied by CR users,should be vacate that spectrum band and move to available spectrum immediately.

B. UNLICENSED BAND OPERATION

In the absence of primary user often by CR users have the same right to access the spectrum.Hence a sophisticated spectrum is shared b a methods are required for CR users to compete for the unlicensed band.

C. SPECTRUM SENSING

A CR user can allocate only an unused portion of the spectrum. Therefore, a CR user should be monitor the available spectrum bands, capture their information, than detected spectrum holes.

D. SPECTRUM DECISION

Based on the spectrum availablity, CR users can allocatedby a channel. This allocation is not only depends on spectrum availablity, but its also determined based on internal (and possibly external) policies.

E. SPECTRUM SHARING

Because there are may be multiple CR users trying to access the spectrum, CR network access should be coordinated to prevent multiple users colliding in overlapping portions of the spectrum.

F. SPECTRUM MOBILITY

CR users are regarded as visitors to the spectrum. Hence, if its a specific portion of the spectrum is required by a primary user, the communication must be continued in another vacant portion of the spectrum.

II RELATED WORK

In this section the existing work for Cognitve Radio Networks (CRNs) is to enable secondary nodes to intelligently communicate using the radio spectrum assigned to licensed users, also known as Primary Users (PU), provides secondary nodes the ability to progressively sense the radio spectrum for white spaces and use them for their intended communication Channel assignment for unicast traffic is optimized when there is minimum interference on the assigned channel, there are minimum number of neighbors on that particular channel.

In Unified Channel Assignment (UCA) algorithm is proposed which assigns channels according to their respective interference and connectivity parameters depending on the proportions of unicast and broadcast traffic in the network. Unified channel assignment algorithm for CRNs. Through the literature review it was found out that channel assignment has different requirements for different types of traffics. Therefore, to cater for this heterogeneity of the network, parameters are chosen with respect to the traffic type and ratios. Optimal channel assignment is carried out by keeping in view the interference and connectivity parameter on each channel in order to utilize the spectrum efficiently[1].

Advances in research related to cognitive radios. The fundamentals of cognitive radio technology, as cognitive radio network. Interference Temperature traditional approach is to limit the transmitter power of interfering devices. Due to the increased mobility and variability of radio frequency. Spectrum Sensing Frequency band is detected as not being used by the primary licensed user of the band at a particular time in a particular position, secondary users can utilize the spectrum. Cooperative Sensing Secondary users cannot detect the primary transmitter receiver is within the secondary users transmission range is a hidden primary user problem[2].

Spectrum sharing has attracted a lot of attention in cognitive radio recently as an effective method of alleviating the spectrum scarcity problem by allowing unlicensed users to coexist with licensed users under the condition of protecting the latter from harmful interference. The throughput maximization of spectrum sharing cognitive radio networks and proposes a novel cognitive radio system that significantly improves their achievable throughput.

Average Transmit and Power Constraints the capacity cognitive radio system under two constraints, namely under an average transmit power constraint and an average interference power constraint, the same as in the previous section for the ergodic capacity.

Both Average and Peak Power Constraints spectrum sharing cognitive radio system under joint average and peak interference power constraints.

Average Transmit and Power Constraints high Target Detection Probability high target detection probability is employed on the proposed spectrum sharing cognitive radio system and that when the primary users are detected to be idle, the secondary transmitter accesses the frequency band in an opportunistic spectrum access manner, and namely it does not impose an interference power constraint.[3]

III PROPOSED SCHEME

In this section we propose a cognitive Radio networks formation of Spectrum nodes in the network and select the Energy Efficiency Heuristic Scheduler (EEHS) and Energy Minimum Throughput Guarantees (EMTG).It consists of modifying algorithm of the traditional work to overcome the shortcomings of number of nodes and frequency band. Because of these modifications in each technique, energy consumption can be reduced and throughput and energy efficiency increased.

Scheduling in CRNs, in which a cognitive base station (CBS) makes frequency allocations to the CRs at the beginning of each frame Energy-efficient heuristic scheduler (EEHS), which allocates each idle frequency to the CR that, attain on the highest energy efficiency at frequency. Next a re formula has been original problem first as a throughput maximization problem subject to energy consumption restrictions and then as an energy consumption minimization throughput guarantee (EMTG).

Two schedulers also provide fairness in resource allocation. Analyze the energy efficiency and successful transmission probability of the proposed schedulers under both contiguous and fragmented spectrum scenarios. Performance studies, compared with a pure opportunistic scheduler with throughput maximization, schedulers can attain almost the same throughput performance with better energy efficiency

Energy-efficient heuristic scheduler(EEHS) Assigns each idle frequency to attain the maximum throughput.If there are more CRs than the idle frequency best CRs is selected.

Higher energy efficiency at the frequency for best CR.

Energy efficiency = Ci,f / Ei,f

Ci,f = Efficiency rate

Ei,f = Energy consumption value,If there are more idle frequency then the best f* is selected for each CR.After frequency assignment it is removed from set of idle frequency.

Energy minimum throughput guarantees (EMTG) Energy consumption minimization problem with minimum throughput guarantees,

Energy efficiency of the CRN

$$\eta = R/E \text{ bits/J}$$

formulate the energy efficiency maximization.

EMTG schedulers can be changed into schedulers ignoring fairness by setting $\omega i = 1$.

EMTG can be modeled using minimum weighted bipartite matching. Additional energy consumption and a minimum throughput constraint. There are various algorithms running in polynomial time for maximum/minimum weighted bipartite matching. Using the solutions in the literature and dealing with the additional constraints, EMTG optimization problems can be solved efficiently.Assigns idle frequency to attain the minimum energy consumption.Schedulers can be changed into maximum/minimum values.EMTG schedulers have the lowest energy consumption increases CRs having chance to transmit.

Schedulers directly depend on our estimate of expected energy consumption and expected throughput.Each idle frequency f to the CR with maximum effective rate Ci, f , as opposed to EEHS that assigns frequency f to the CR that will attain the maximum energy efficiency Ci, f/Ei, f at frequency f. First the CRN operates on a contiguous spectrum of all F bands with equal bandwidth. Frequency bands are fragmented. The second scenario is more realistic.

EMTG can be modeled using minimum weighted bipartite matching. Additional energy consumption and a minimum throughput constraint. There are various algorithms running in polynomial time for maximum/minimum weighted bipartite matching. Schedulers can be changed into maximum/minimum values. EMTG schedulers have the lowest energy consumption increases CRs having chance to transmit.

IV PERFORMANCE EVALUATION

The probability of success represents the fraction of the generated CR traffic that is delivered successfully. CRN’s use becomes a collection of various frequency bands with no identical bandwidth and spectrally separated from each other location of an opportunity is important since,channel switching is a function of spectral separation of two frequencies.

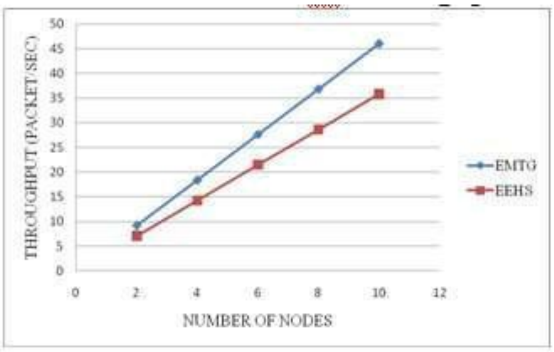

Figure 1. Throughput vs No of nodes for EEHS and EMTG .

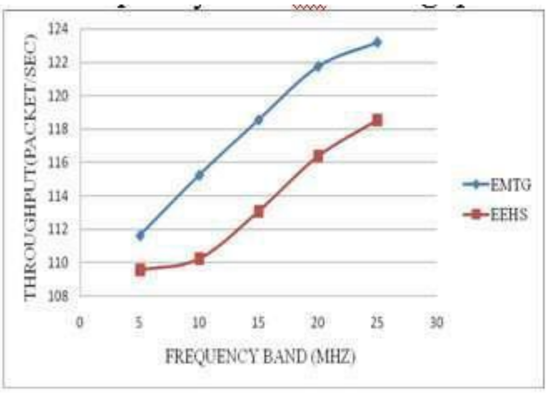

Figure 2. Throughput vs frequencyband for EEHS and EMGT

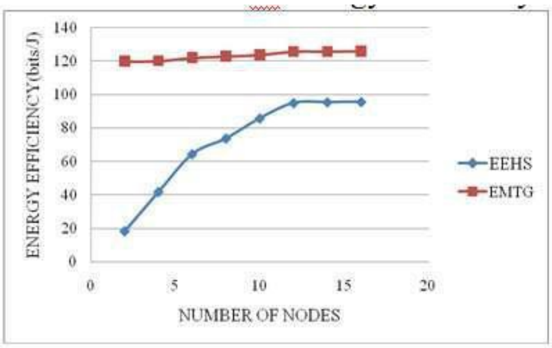

Figure 3. Energy Efficiency vs No of nodes for EEHS and EMTG

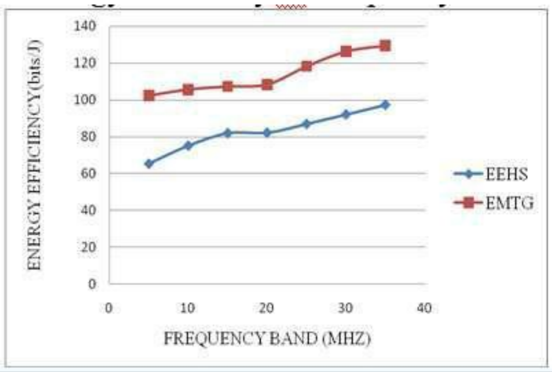

Figure 4. Energy Efficiency vs Frequency band for EEHS and EMTG

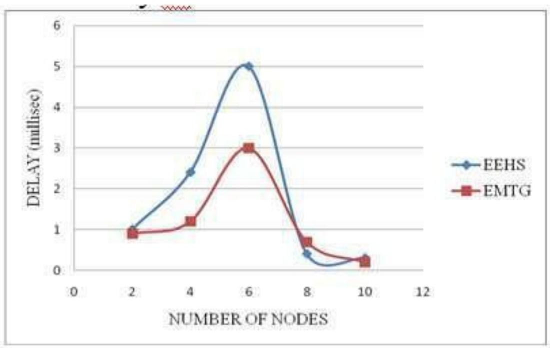

Figure 5. Delay vs No of nodes for EEHS and EMTG

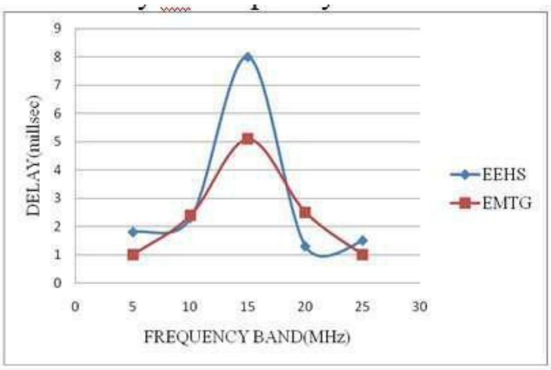

Figure 6. Delay vs Frequency band for EEHS and EMTG

V CONCLUSION AND FUTURE WORK

In this paper, we have formulated an energy efficiency maximizing scheduler for CRNs. First presented the EEHS, which is a heuristic algorithm running in polynomial time, for energy-efficient resource allocation. Reformulated resource allocation as EMTG schedulers also have the power to provide fairness among the CRs. Throughput, Energy efficiency and Delay is using for number of nodes and frequency band. EMTG schedulers provide a good balance in resource allocation among CRs. We further identify the research challenges and unresolved issues in cooperative sensing that may be used as the starting point for future research.

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