CHANNEL SELECTION AND ASSIGNMENT SCHEMES FOR EFFICIENT SPECTRUM SHARING AND ENERGY EFFICIENCY IN COGNITIVE RADIO NETWORKS

PhD Thesis Defense

by

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ABSTRACT

In this thesis, we focus on distributed channel selection and centralized channel assignment in cognitive radio networks (CRN). For the former topic, we are concerned with the efficiency of spectrum sharing whereas in the latter, we also aim to improve energy efficiency of the CRN. First, we propose a non-selfish distributed channel selection scheme which improves the efficiency of spectrum sharing by mitigating the spectrum fragmentation. We also present an analytical model for our proposal using Continuous Time Markov Chains.

In this thesis, we also devise various centralized channel assignment algorithms that outperform pure opportunistic schedulers in terms of energy efficiency and fairness notion without significantly trading off throughput efficiency. Initially, we consider a CRN which acquires channel occupancy information from a white space database. We develop heuristic algorithms considering transmission, idling and channel switching periods in both contiguous and fragmented spectrum. Finally, we consider a CRN in which CRs apply a listen-before-talk access approach. Different from our previous proposal, this scheduler ensures that interference caused by CRs does not exceed the tolerable limits in any of the primary user (PU) channels. In addition, it considers the differences among the PU channels in terms of probability of being idle as well as the control messaging overhead in downlink and uplink. Considering the tradeoff between the scheduling overhead and PU interference probability, we identify the frame length achieving high throughput. Simulation results show that our proposal achieves high throughput performance comparable to a throughput maximizing scheduler but it consumes lower energy than the latter.