

In this paper, we propose a beamforming-based dynamic spectrum leasing (DSL) technique to improve the spectral utility of bi-directional communication of the legacy/primary spectrum users through the help of colocated secondary users. The secondary users help for a time interval to relay the data between two primary terminals using physical layer network coding and beamforming to attain bi-directional communication with high spectral utility. As a reimbursement, the secondary users, cognitive radios (CRs) in our case, get exclusive access to the primary spectrum for a certain duration. We use Nash bargaining to determine the optimal division of temporal resources between relaying and reimbursement. Moreover, we consider that a fraction of secondary nodes can act selfishly by not helping the primary, yet enjoy the reimbursement time. We measure the utility of the DSL scheme in terms of a metric called time-bandwidth product (TBP) ratio quantifying the number of bits transmitted in direct communication versus DSL. We show that if all secondary nodes act honestly, more than 17-fold increase in the TBP ratio is observed for a sparse CR network. However, in such a network, selfish behavior of CR nodes can reduce the gain by more than a factor of 2.