

**Session-Based Cooperation in Cognitive Radio Networks: A Network-Level Approach**

**Abstract:**

Currently, the cooperation-based spectrum access in cognitive radio networks (CRNs) is implemented via cooperative communications based on link-level frame-based cooperative (LLC) approach, where individual secondary users (SUs) independently serve as relays for primary users (PUs) in order to gain spectrum access opportunities. Unfortunately, this LLC approach cannot fully exploit spectrum access opportunities to enhance the throughput of CRNs and fails to motivate PUs to join the spectrum sharing processes. To address these challenges, we propose a network-level session-based cooperative (NLC) approach, where SUs are grouped together to cooperate with PUs session by session, instead of frame by frame, for spectrum access opportunities of the corresponding group. To articulate our NLC approach, we further develop an NLC scheme under a cognitive capacity harvesting network architecture. We formulate the cooperative mechanism design as a cross-layer optimization problem with constraints on primary session selection, flow routing and link scheduling. Through extensive simulations, we demonstrate the effectiveness of the proposed NLC approach.

**Existing System:**

In the current literature, the cooperation-based spectrum access is implemented through a link-level frame-based cooperative (LLC) approach which is built on cooperative communications. In the LLC approach, PUs employ SUs as relays to expedite data transmissions for each MAC frame so that the saved frame transmission time can be offered to SUs for spectrum access. Although the LLC approach may maximize the achievable throughput of relaying SUs, it cannot efficiently exploit available spectrum access opportunities in cognitive radio networks (CRNs) to improve network-level throughput.

**Proposed System:**

This is the first work to consider network-level sessionbased cooperation for CRNs. Unlike existing schemes, the proposed NLC scheme is a network-wide cooperative scheme where BSs and CR routers deployed by the SSP, as a group, cooperate with PUs for spectrum access opportunities of the CCHN.

To characterize interfering relationships in the CCHN, we introduce a PU-related conflict graph which not only characterizes conflicting relationship between CR links,1 but also captures conflicts among CR links, PU-related links,2 and primary sessions.

We formulate the cooperative mechanism design as a cross-layer optimization problem to maximize the throughput of the CCHN by jointly considering primary session selection, flow routing, and link scheduling constraints.