

**Data and Spectrum Trading Policies in a Trusted Cognitive Dynamic Network Architecture**

**Abstract:**

Future wireless networks will progressively displace service provisioning towards the edge to accommodate increasing growth in traffic. This paradigm shift calls for smart policies to efficiently share network resources and ensure service delivery. In this paper, we consider a cognitive dynamic network architecture (CDNA) where primary users (PUs) are rewarded for sharing their connectivities and acting as access points for secondary users (SUs). CDNA creates opportunities for capacity increase by network-wide harvesting of unused data plans and spectrum from different operators. Different policies for data and spectrum trading are presented based on centralized, hybrid, and distributed schemes involving primary operator (PO), secondary operator (SO), and their respective end users. In these schemes, PO and SO progressively delegate trading to their end users and adopt more flexible cooperation agreements to reduce computational time and track available resources dynamically. A novel matching-with-pricing algorithm is presented to enable self-organized SU-PU associations, channel allocation and pricing for data and spectrum with low computational complexity. Since connectivity is provided by the actual users, the success of the underlying collaborative market relies on the trustworthiness of the connections. A behavioral-based access control mechanism is developed to incentivize/penalize honest/dishonest behavior and create a trusted collaborative network. Numerical results show that the computational time of the hybrid scheme is one order of magnitude faster than the benchmark centralized scheme and that the matching algorithm reconfigures the network up to three orders of magnitude faster than in the centralized scheme.

**Existing System:**

Existing solutions for coping with traffic demand focus on investing in additional fixed infrastructure, which is costly from an environment and network perspective. Besides, these solutions rely on conventional cellular

infrastructure design built to satisfy peak rates and ignore the dynamic traffic fluctuations that render a significant part of this infrastructure unutilized in space and time. Despite densification efforts to increase spectrum reusability, the licensed spectrum continues to be scarce and its efficient usage will soon approach the theoretical limits.

**Proposed System:**

We explore business opportunities in data and spectrum harvesting created by a cognitive dynamic network architecture (CDNA) where primary users (PUs) share their connectivities with secondary users (SUs) for some reward. In CDNA, each SU connects through its preferred PU using the harvested spectrum. The selected PU shares its unused data and acts as an access point for SU transmissions in return for a reward. CDNA creates a new collaborative market for data and spectrum trading and opportunities for revenue sharing among the parties involved (primary operator [PO], secondary operator [SO] and their respective end users).

A framework for data and spectrum trading optimization is developed to maximize the utility of each party and satisfy the QoS for SUs. Three approaches are considered: centralized, hybrid and distributed. Each incurs different levels of coordination and revenue sharing. In the centralized approach, the SO performs data and spectrum trading with the PO to satisfy the demands of SUs. The PO then rewards PUs willing to serve as access points for SU traffic. In the hybrid scheme, the SO and PO trade the spectrum but delegate data trading to PUs and SUs. PUs benefit directly from this trading as an incentive to share their resources. Finally, in the distributed scheme, the SO and PO negotiate a revenue share for their cooperation and let PUs and SUs trade the data and spectrum.