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DEVELOPMENT OF MULTI-OBJECTIVE BASED SPECTRUM-AWARE ROUTING PROTOCOL FOR COGNITIVE RADIO AD HOC NETWORKS

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Abstract

A Cognitive Radio network has been proposed as a promising technology to satisfy the manifold requirements of a future generation (5G) wireless system by intelligently accessing the underutilized channel of a primary user. However, due to the heterogeneity in channel propagation characteristics, intermittent availability of licensed channels, recurrent hand-offs, and the need for protection to primary users, finding a successful route is more challenging. Also, the incorporation of opportunistic spectrum access in cognitive radio network requires potential spectrum management functions across the network protocol stack.

PU activity is modeled using the two-state ON-OFF model. Energy-detection based spectrum sensing algorithm is used at the physical layer to allow the secondary users to identify spectrum opportunities. A common control channel is used for the exchange of control packets. The proposed spectrum-aware routing protocols aim at maximizing the performance of cognitive radio ad hoc network with minimum possible interference to Pus and are treated as two different objectives of the spectrum-aware routing problem in our proposed research. Accordingly, the thesis proposes to develop a multi-objective based spectrum-aware routing protocol for the multi-hop cognitive radio ad hoc networks.

At first, the distinct issues of cognitive radio ad hoc networks due to the dynamic spectrum access are identified. These problems are then addressed by proposing a cross-layered spectrum-aware routing protocol. Second, an application-aware routing protocol is proposed to support multiple quality of service based objectives of different wireless applications. Third, the thesis models the cognitive radio as a multi-objective reinforcement learning agent in order to make it more adaptive to the spectrum environment by making cognitive radio explore, learn, and select a suitable channel for transmission.

Keywords- Cognitive radio network, Dynamic spectrum access, Multi-hop, Primary user, Quality of service, Cognitive radio, Cognitive radio ad hoc network, Opportunistic access, Spectrum-aware routing protocol, Multi-objective reinforcement learning