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Fairness-constrained Optimized Time-Window Controllers for Secondary-Users with Primary-User Reliability Guarantees

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Abstract

In this paper we design and test a primary-secondary user resource-management controller in cognitive radio vehicular networks, under hard and soft collision constraints. We cast the resource-management problem into a stochastic network utility maximization problem and derive the optimal steady-state controllers, which adaptively allocate the access time-windows to the secondary-users. We derive closed form expressions for the throughput-gain of the general controller with respect to the memoryless one, discussing conditions of applicability and advantages of each subclass. We prove that the hard controllers are able to make the outage-probability vanishing, without any throughput-loss with respect to the soft controllers. Finally, we generalize the obtained results to probabilistic fairness constrained problems and to controllers exploiting cognitive data-fusion techniques. We investigate about possible distributed implementations and show as controllers are able to adapt to unpredictable and abrupt changes of the network, without requiring any a priori knowledge of the vehicular traffic patterns.

Keywords: Optimization, Primary-Secondary resource-management, Real-Time constraint, Hard reliability, Fairness, Cognitive, Medium Access Control (MAC).

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