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A delay-aware spectrum handoff scheme for prioritized time-critical industrial applications with channel selection strategy

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Abstract:
Cognitive radio has emerged as an enabling technology in the realization of a spectrum-efficient and delaysensitive industrial wireless communication where nodes are capable of responding in real-time. However, particularly for time-critical industrial applications, because of the link-varying channel capacity, the random arrival of a primary user (PU), and the significant delay caused by spectrum handoff (SH), it is challenging to realize a seamless real-time response which results in a quality of service (QoS) degradation. Therefore, the objectives of this paper is to increase spectrum utilization efficiency by allocating channel based on the priority of a user QoS requirements, to reduce SH delay, to minimize latency by preventing avoidable SHs, and to provide real-time response. To achieve an effective spectrum utilization, we proposed an integrated preemptive/non-preemptive priority scheme to allocate channels according to the priority of user QoS requirements. On the other hand, to avoid significant SH delays and substantial latency resulting from random PU arrival, a unified spectrum sensing technique was developed by integrating proactive sensing and the likelihood estimation technique to differentiate between a hidden and a co-existence PU, and to estimate the mean value of the busy and the idle periods of a channel respectively. Similarly, to prevent poor quality channel selection, a channel selection technique that jointly combines a reward system that uses metrics, e.g. interference range, and availability of a common channel to ranks a set of potential target channels, and a cost function that optimizes the probability of selecting the channel with the best characteristics as candidate channels for opportunistic transmission and for handoffs was developed. The simulation results show a significant performance gain of the delay-PritSHS in terms of number of SHs, Latency, as well as throughput for time-critical industrial applications in comparison to other schemes.