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Performance measurements of communication access technologies and improved cognitive radio model for smart grid communication

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Abstract

Traditional power grids have unidirectional power flow and often information transfer, this limits their capacity for scalability, efficiency, and renewable energy integration. Smart grids (SGs) are being developed as more intelligent power grids with bidirectional power flow and information interchange. A reliable communication network is required in order to realize some important SG features, such as renewable energy integration, distributed energy resources, scalability, self-healing and efficient holistic monitoring, and control capability. However, this communication network needs to comply with critical requirements. Cognitive radio (CR) has been projected as a possible solution to common problems in conventional wireless systems such as spectrum scarcity and interference. The CR accesses a greater range of spectra via dynamic spectrum access capability. This paper focuses on the evaluation of communication access technologies performance measurements and improved CR model for SG communications. This paper employs the National Institute of Standard framework for SG interoperability, the low power wide area network (LPWAN), multihoming, and a CR device such as TV white space band devices (TVBDs). The results from simulation analysis show that the performance of TVBDs outperforms the legacy Wi-Fi in terms of latency; also, LPWA devices, such as LTE Cat1/LTE-M devices, outperform the legacy cellular, such as CDMA 1x-EVDO, in terms of latency and throughput. In addition, the improved CR model, which involves a proposed channel fragmentation strategy–based Alamouti scheme, outperforms legacy CR in terms of blocking probability and throughput in the harsh SG environment.