Empirical analysis of LoRaWAN-based adaptive data rate algorithms

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Abstract:
Long Range Wide Area Networking (LoRaWAN) has established itself as one of the leading Media Access Control (MAC) layer protocols in the realm of Low Power Wide Area Networks (LPWAN). Although the technology itself is quite mature, the resource allocation mechanism, the Adaptive Data Rate (ADR) algorithm it uses is still quite new, unspecified and its functionalities still limited. Various studies have shown that the performance of the ADR algorithm gradually suffers in dense networks. As such, studies and proposals have been made as attempts to improve the algorithm. In this paper, the authors chose four proposed algorithms that focused on improving the ADR in terms of data extraction rate (DER) and evaluated them to study and critically analyze their performances. LoRaSim was used and the algorithms were employed in a simple sensing application that involved end devices transmitting data to the gateway every hour. The performances were measured based on how they affected DER as the network size increases. The results obtained show that the implemented algorithms outperformed the ADR algorithm. However, as network size increases, these superior performances are not adequate for a reliable and energy-efficient LoRaWAN network. Though attempts have been made to improve the ADR algorithm, arriving at its ideal implementation is still an open research area and therefore, we recommend more improvement should be proposed.