An Evaluation of LoRa Low-Power Wide-Area Technology for Firmware Update Transmission

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Wireless communications are typically the most energy-intensive operation of a wireless sensor node. Newly emerging low-power wide-area (LPWA) technologies trade data rate for long range transmissions at low power. Wireless firmware updating has always posed problems in resource constrained wireless sensor networks. Considering the data rate constraints of LPWA technologies and with firmware update images typically in the order of tens or hundreds of kilobytes, this poses an even greater challenge to wireless firmware updating.

This work evaluates LoRa, a LPWA technology, and its ability to transmit firmware images to Class A devices. An incremental firmware update approach is adopted, with firmware update image deltas of 7000 bytes and less considered in this evaluation. Two firmware transmission protocols are purposefully designed for LoRa bi-directional communication and evaluated. The evaluation considers all six available spreading factors, which trade data rate for range and reliability. The results showed that at the lower spreading factors (higher data rates), LoRa can comfortably transmit a 7000 byte update in less than one hour. The corresponding time rises to 9 hours at the lowest data rate, however, a bug in the LoRa module is expected to contribute greatly to this time, and upon its resolution a time closer to 5 hours is expected. This work also found that in urban environments gateways should be located within 2 km of the node with good line of sight for adequate reliability at lower spreading factors. This distance can be increased to approximately 5 km for higher spreading factors.