Throughput of Distributed Queueing Based LoRa for Long-Distance Communication

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Research

Keywords: LoRa, distributed queueing, in-band-full-duplex, medium access control, throughput improvement

Posted Date: April 20th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-428983/v1>

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Abstract

LoRa, due to its advantage of long-range communication capability, is promising for Internet of Things (IoT) and space-air-ground communications. However, the conventional MAC protocol used with LoRa is classified as an Aloha-based algorithm, which leads to drastic decrease in throughput when a huge amount of end-devices try to access the network. To achieve stable and high throughput of LoRa, we propose a design to combine the distributed queueing (DQ) and in-band-full-duplex (IBFD) technologies. The usage of DQ mechanism is benefit for fast collision resolution, while the IBFD-enabled gateway helps to reduce the heavy-control-overhead of DQ. The designs of access procedure and frame structure are discussed in detail. The outage probability and average throughput are evaluated under imperfect self-interference cancellation. Also, a mathematical programming method is developed to optimize the spreading-factor and code-rate. Numerical results show that our proposal gains an extra enhancement of 1.83-fold in throughput.

Full Text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed. However, the manuscript can be downloaded and accessed as a PDF.

Figures

Figure 1

An example to illustrate the access procedure of FDQ-LoRa.

Figure 2

FBP structure.

Figure 3

Outage probability of FDQ-LoRa, in the sub-urban environment ($\alpha = 2:7$).

Figure 4

Outage probability of FDQ-LoRa, in the urban environment ($\alpha = 4$).

Figure 5

Average throughput comparison.