UNIVERSITY OF CALIFORNIA MERCED | SCHOOL OF ENGINEERING

Electrical Engineering and Computer Science Technical Seminar Series

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Towards Energy-Fairness in LoRa Networks

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Faculty Host: Wan Du

Abstract

LoRa networks, as a promising low power wide area networking technology, have recently been deployed in many Internet-of-Things applications. A LoRa gateway can cover a large area of several squaire miles with thousands of end devices. With this large coverage, some distant end devices have to use a low data rate to reach the gateway, which causes long in-the-air transmission time and high energy consumption. Compared with the end devices using high data rate, they will drain the batteries much earlier and the network may be broken. Such an energy unfairness can be mitigated by deploying more gateways, since it allows end devices to reach closer gateways with higher data rates. However, more gateways may not solve the energy unfairness problem efficiently, due to the collision problem caused by a unique feature of LoRa networks, chirp spread spectrum modulation. Spreading factors of LoRa transmissions can determine both data rate and multiplexing of different transmissions. With more gateways, end devices may choose low spreading factors to reach closer gateways, which increase the collision probability. In this talk, we design a resource allocation scheme that carefully allocates different network resources, such as spreading factors and transmission power, to achieve fair energy consumption among end devices and prolong the network lifetime. We develop a LoRa network model to study the energy consumption of end devices in a network by considering the unique features of LoRa networks, such as LoRaWANs MAC protocol, spreading factors, interference, and the capacity limitation of a LoRa gateway. In order to adapt to the dynamic wireless environment, A bit-level network model is developed to capture the link quality variation and network interference. We formulate the energy fairness problem as an optimization problem and finally propose a greedy algorithm to allocate resources to each end device in a LoRa network.

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Biography
Weifeng Gao is a third-year Ph.D. student of School of Computer Science and Technology at the University of Electronic Science and Technology of China. He is visiting UC Merced in the group of Professor Wan Du. His research interests include wireless and mobile computing, low power and networked systems, LoRa networks, etc.