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GreenEdge: New Perspectives to Energy Management and Supply in Mobile Edge Computing

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GreenEdge: New Perspectives to Energy Management and Supply in Mobile Edge Computing

The First Book on Green Edge Computing

Springer

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Preface

The 5G technology has been commercialized worldwide and is expected to provide superior performance with enhanced mobile broadband, ultra-low latency transmission, and massive IoT connections. Meanwhile, the edge computing paradigm gets popular to provide distributed computing and storage resources in proximity to the users (at the network edge). Compared with cloud computing, edge computing has the advantage of conducting latency-critical tasks by having them executed closer to end users. As edge services and applications prosper, 5G and edge computing will be tightly coupled and continuously promote each other forward. Embracing this trend, however, mobile users, infrastructure providers, and service providers are all faced with the energy dilemma. From the user side, battery-powered mobile devices are much constrained by battery life, whereas mobile platforms and apps nowadays are usually power-hungry. From the infrastructure and service provider side, the energy cost of edge facilities, particularly 5G base stations and edge datacenters, accounts for a large proportion of operating expenses and has become a huge burden.

In this book, we introduce our recent work tackling the energy issues in mobile edge computing. We name the constellation of work GreenEdge. Unlike traditional approaches, solutions, and frameworks, we deal with energy management and supply problems from totally new perspectives. For mobile users, (i) we investigate their low-battery anxiety through a large-scale user survey and quantify their anxiety degree and video watching behavior concerning the battery status; and (ii) by leveraging the quantified low-battery anxiety model, we further develop a low-power video streaming solution at the network edge to save mobile devices' energy and alleviate users' low-battery anxiety. For edge infrastructure and service operators, (i) we devise an optimal backup power deployment framework to cut down the backup battery cost in 5G networks; (ii) we investigate the cost-saving potential of transforming the backup batteries to a distributed battery energy storage system; and (iii) we design an integrated renewable energy supply architecture and a software-defined power supply mechanism to pursue net-zero edge datacenters in the future edge computing environment.

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