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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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Contents

- 1 Introduction 1**
 - 1.1 When 5G Meets Edge Computing 1
 - 1.2 The Energy Dilemma 2
 - 1.3 Key Problems and Contributions 3
 - 1.4 Content Organization 4

- 2 Investigating Low-Battery Anxiety of Mobile Users 7**
 - 2.1 Introduction 7
 - 2.2 Related Work 9
 - 2.3 A Survey Over 2000+ Mobile Users 10
 - 2.4 Quantification of Low-Battery Anxiety 11
 - 2.4.1 Extraction of LBA Curve 11
 - 2.4.2 Observations and Analysis 12
 - 2.4.3 Lessons Learnt from LBA Quantification 15
 - 2.5 Impacts of LBA on Video Watching 15
 - 2.5.1 Extraction of Video Abandoning Likelihood Curve 15
 - 2.5.2 Observations and Analysis 16
 - 2.5.3 Advice for Video Streaming Services 19
 - 2.6 Ethics 19
 - 2.7 Conclusion 19

- 3 User Energy and LBA Aware Mobile Video Streaming 21**
 - 3.1 Introduction 21
 - 3.2 Background and Related Work 24
 - 3.2.1 Background of Low-Battery Anxiety 24
 - 3.2.2 Background of Display Power Saving 24
 - 3.2.3 Work Related to This Work 25
 - 3.3 LBA Survey and Modelling 26
 - 3.3.1 Data Collection 26
 - 3.3.2 LBA Curve Extraction 27
 - 3.3.3 Insights on LBA Alleviation 28

3.4	LPVS: Low-Power Video Streaming	28
3.4.1	Scenario Overview	28
3.4.2	Models for Power Consumption in Video Streaming	30
3.4.3	Models for Energy Status and Low-Battery Anxiety	31
3.4.4	Video Streaming Capacity at the Edge	32
3.4.5	Joint Optimization for Energy Saving and Anxiety Reduction	32
3.5	Solution Methodology	33
3.5.1	The Difficulties	33
3.5.2	Information Compacting	33
3.5.3	A Two-Phase Heuristic for Joint Optimization	35
3.5.4	Determine γ_n with Bayesian Inference	36
3.6	LBA Model Updating	38
3.6.1	Analysis of LBA Heterogeneity	38
3.6.2	Local LBA Model Updating	38
3.7	Implementations	40
3.7.1	Real-World Video Streaming Traces	40
3.7.2	LPVS Emulation and Setups	41
3.8	Performance Evaluations	43
3.8.1	LPVS with Sufficient Edge Resource	43
3.8.2	LPVS with Limited Edge Resource	44
3.8.3	Impact of LPVS on Low-Battery Users	45
3.8.4	LPVS with Updated LBA Models	46
3.8.5	Overhead of LPVS and Impact on Other QoE Metrics	47
3.9	Conclusion	48
4	Optimal Backup Power Allocation for 5G Base Stations	51
4.1	Introduction	51
4.1.1	Spatial Dimension	52
4.1.2	Temporal Dimension	53
4.2	Related Work	53
4.3	BS Power Measurements and Observations	54
4.3.1	Power Consumption of 4G and 5G BSs	54
4.3.2	Power Consumption of 5G BS Major Components	55
4.3.3	Multiplexing Gain with Backup Power Sharing	55
4.4	System Model	57
4.4.1	Scenario Overview	58
4.4.2	Traffic Load and Power Demand	59
4.5	Optimal Backup Power Allocation	59
4.5.1	Analysis of Power Outages and Network Failure	59
4.5.2	Condition of Network Reliability	61
4.5.3	Backup Power Deployment Constraints	62
4.5.4	Backup Power Allocation Optimization	62

4.6	Experimental Evaluations	63
4.6.1	Experiment Setup	63
4.6.2	Results and Analysis.....	63
4.7	Conclusion	65
5	Reusing Backup Batteries for Power Demand Reshaping in 5G	67
5.1	Introduction	67
5.2	System Models	69
5.2.1	Scenario Overview.....	69
5.2.2	BS Power Supply and Demand	70
5.2.3	Battery Specification.....	71
5.3	Power Demand Reshaping via BESS Scheduling	71
5.3.1	Energy Cost with BESS	72
5.3.2	Battery Degradation Cost.....	73
5.3.3	Optimal BESS Operation Scheduling	74
5.3.4	Problem Analysis	75
5.4	A DRL-Based Approach to Distributed BESS Scheduling	77
5.4.1	DRL Based BESS Scheduling: Components and Concepts	77
5.4.2	Reward Function Design	78
5.4.3	Learning Process Design	78
5.5	Experimental Evaluations	81
5.5.1	Experiment Setup	81
5.5.2	General Performance at Cost Reduction with BESS.....	83
5.5.3	Case Studies of DRL-Based BESS Scheduling	85
5.5.4	ROIs of Different BESS Deployments.....	86
5.6	Related Work	87
5.6.1	General System Peak Power Shaving with BESS	87
5.6.2	DC Peak Power Shaving with Centralized BESS	88
5.6.3	DC Peak Power Shaving with Distributed BESS	88
5.7	Conclusion	89
6	Software-Defined Power Supply to Geo-Distributed Edge DCs	91
6.1	Introduction	91
6.2	Architecture of Software-Defined Power Supply (SDPS).....	92
6.2.1	Motivation and Design Rationales	93
6.2.2	Architecture Design	93
6.3	Two-Phase Optimization in Software-Defined Power Supply	95
6.3.1	System Model.....	95
6.3.2	Phase-I: Constructing Green Cells	96
6.3.3	Phase-II: BESS Discharging/Charging Operations	97
6.4	Experimental Evaluations	99
6.4.1	Experiments Setup	99
6.4.2	Performance Comparison	99
6.5	Conclusion	101

7	Conclusions and Future Work	103
7.1	Conclusions	103
7.2	Future Work	103
A	Questionnaire of LBA Survey and Collected Answers	105
	Bibliography	109