

# Contents

## Part I Get Started

<b>1</b>	<b>Background and Overview</b> . . . . .	3
1.1	Internet Content Distribution . . . . .	3
1.2	Cloud Computing and Mobile Internet . . . . .	6
1.3	Frontier Techniques . . . . .	7
1.4	Overview of the Book Structure . . . . .	9
	References . . . . .	13

## Part II Cloud-Based Cellular Traffic Optimization

<b>2</b>	<b>Cross-Application Cellular Traffic Optimization</b> . . . . .	19
2.1	Introduction . . . . .	19
2.2	State-of-the-Art Systems . . . . .	22
2.3	Measuring Cellular Traffic . . . . .	24
2.3.1	Dataset Collection . . . . .	24
2.3.2	Content Analysis . . . . .	25
2.4	System Overview . . . . .	29
2.5	Mechanisms . . . . .	31
2.5.1	Image Compression . . . . .	32
2.5.2	Content Validation . . . . .	34
2.5.3	Traffic Filtering . . . . .	34
2.5.4	Value-Based Web Caching (VBWC) . . . . .	36
2.6	Evaluation . . . . .	37
2.6.1	Data Collection and Methodology . . . . .	37
2.6.2	Traffic Reduction . . . . .	37
2.6.3	System Overhead . . . . .	40
2.6.4	Latency Penalty . . . . .	43
2.7	Conclusion . . . . .	45
	References . . . . .	46

### Part III Cloud-Based Mobile Video Distribution

<b>3</b>	<b>Cloud Downloading for Unpopular Videos</b>	51
3.1	Introduction	51
3.2	Related Work	55
3.3	System Design	56
3.3.1	System Overview	56
3.3.2	Data Transfer Acceleration	58
3.3.3	Download Success Rate Improvement	60
3.3.4	Cache Capacity Planning	62
3.3.5	Cache Replacement Strategy	63
3.4	Performance Evaluation	64
3.4.1	Dataset	64
3.4.2	Metrics	65
3.4.3	Data Transfer Rate	66
3.4.4	View Startup Delay	68
3.4.5	Energy Efficiency	69
3.5	Conclusion and Future Work	71
	References	72
<b>4</b>	<b>Cloud Transcoding for Mobile Devices</b>	75
4.1	Introduction	75
4.2	System Design	79
4.2.1	System Overview	79
4.2.2	Transcoding Prediction	81
4.2.3	Cloud Cache Organization	82
4.2.4	Accelerating the Data Transfer of Transcoded Videos	84
4.3	Performance Evaluation	84
4.4	Future Work	87
	References	88
<b>5</b>	<b>Offline Downloading: A Comparative Study</b>	89
5.1	Introduction	89
5.2	Related Work	93
5.3	System Overview	95
5.3.1	Overview of Xuanfeng	95
5.3.2	Overview of the Smart AP Systems	97
5.4	Workload Characteristics	98
5.5	Performance of the Cloud-Based System	101
5.5.1	Pre-downloading Performance	101
5.5.2	Fetching Performance	103
5.5.3	End-to-End Performance	106
5.6	Performance of the Smart APs	106
5.6.1	Methodology	106
5.6.2	Benchmark Results	108

- 5.7 The ODR Middleware . . . . . 111
  - 5.7.1 Design and Implementation . . . . . 111
  - 5.7.2 Performance Evaluation . . . . . 114
- 5.8 Conclusion . . . . . 115
- References . . . . . 116

**Part IV Cloud-Assisted P2P Content Distribution**

- 6 Cloud Tracking or Open-P2SP** . . . . . 121
  - 6.1 Introduction . . . . . 121
  - 6.2 Related Work . . . . . 125
  - 6.3 QQXuanfeng System Overview . . . . . 126
    - 6.3.1 System Architecture and Index Structure . . . . . 126
    - 6.3.2 A Typical User’s Request Processing . . . . . 128
  - 6.4 Challenging Problems and Solutions . . . . . 129
    - 6.4.1 Handling Server and Content Dynamics . . . . . 129
    - 6.4.2 Limited Utilization of Server Bandwidth . . . . . 131
    - 6.4.3 Differentiated Acceleration of Peer Swarms . . . . . 132
    - 6.4.4 Bringing Extra Benefit to Server Providers . . . . . 134
  - 6.5 Performance Evaluation . . . . . 135
    - 6.5.1 Acceleration Effect on Peer Swarms . . . . . 135
    - 6.5.2 Bandwidth Contribution of Servers . . . . . 137
    - 6.5.3 Extra Bandwidth Utilization of Servers . . . . . 139
  - 6.6 Conclusion and Future Work . . . . . 140
  - References . . . . . 141
- 7 Cloud Bandwidth Scheduling** . . . . . 143
  - 7.1 Introduction . . . . . 143
  - 7.2 Related Work . . . . . 146
  - 7.3 Fine-Grained Performance Model . . . . . 148
    - 7.3.1 Key Impact Factors . . . . . 148
    - 7.3.2 OBAP and Its Optimal Solution . . . . . 151
  - 7.4 Fast-Convergent Iterative Algorithm . . . . . 153
  - 7.5 Trace-Driven Simulations . . . . . 157
    - 7.5.1 Trace Dataset . . . . . 157
    - 7.5.2 Metrics . . . . . 159
    - 7.5.3 Simulation Results . . . . . 159
  - 7.6 Prototype Implementation . . . . . 162
  - 7.7 Conclusion and Future Work . . . . . 163
  - References . . . . . 164

**Part V Cloud Storage-Oriented Content Distribution**

- 8 Toward Network-Level Efficiency for Cloud Storage Services** . . . . 167
  - 8.1 Introduction . . . . . 167
  - 8.2 Related Work . . . . . 171

- 8.3 Common Design Framework. . . . . 172
- 8.4 Methodology. . . . . 174
  - 8.4.1 Real-World Cloud Storage Trace. . . . . 174
  - 8.4.2 Benchmark Experiments. . . . . 175
- 8.5 Simple File Operations. . . . . 176
  - 8.5.1 File Creation. . . . . 178
  - 8.5.2 File Deletion. . . . . 180
  - 8.5.3 File Modification and Sync Granularity . . . . . 181
- 8.6 Compression and Deduplication. . . . . 183
  - 8.6.1 Data Compression Level . . . . . 183
  - 8.6.2 Data Deduplication Granularity . . . . . 185
- 8.7 Frequent File Modifications. . . . . 188
  - 8.7.1 Sync Deferment . . . . . 188
  - 8.7.2 Impact of Network and Hardware . . . . . 191
- 8.8 Conclusion . . . . . 194
- References . . . . . 194
- 9 Efficient Batched Synchronization for Cloud Storage Services . . . . . 197**
  - 9.1 Introduction . . . . . 197
  - 9.2 Related Work . . . . . 200
  - 9.3 Understanding Cloud Storage Services . . . . . 201
    - 9.3.1 Data Synchronization Mechanism . . . . . 201
    - 9.3.2 Controlled Measurements . . . . . 203
    - 9.3.3 Other Cloud Storage Services and Operating Systems . . . . . 208
  - 9.4 The Traffic Overuse Problem in Practice. . . . . 210
    - 9.4.1 Analysis of Real-World Dropbox Network Traces . . . . . 210
    - 9.4.2 Examining Practical Dropbox Usage Scenarios . . . . . 212
  - 9.5 The UDS Middleware . . . . . 214
    - 9.5.1 UDS Implementation . . . . . 214
    - 9.5.2 Configuring and Benchmarking UDS . . . . . 216
  - 9.6 UDS+: Reducing CPU Utilization . . . . . 218
    - 9.6.1 CPU Usage of Dropbox and UDS . . . . . 219
    - 9.6.2 Reducing the CPU Utilization of UDS . . . . . 220
  - 9.7 Conclusion . . . . . 221
  - References . . . . . 222
- Part VI Last Thoughts**
- 10 Research Summary and Future Work . . . . . 227**
  - 10.1 Research Summary . . . . . 227
  - 10.2 Future Work . . . . . 229
  - References . . . . . 230



<http://www.springer.com/978-981-10-1462-8>

Content Distribution for Mobile Internet: A Cloud-based Approach

Li, Z.; Dai, Y.; Chen, G.; Liu, Y.

2016, XIII, 231 p. 146 illus., 90 illus. in color., Hardcover

ISBN: 978-981-10-1462-8