

CONTENTS

<i>List of Illustrations</i>	xiii
<i>List of Exhibits</i>	xxi
<i>List of Tables</i>	xxiii
<i>Preface</i>	xxv

PART I Fundamentals of Metadata

ONE Introduction	3
1.1 Background	3
1.2 Definitions	11
1.3 A Brief History	14
1.4 Types and Functions	18
1.5 Standards	23
1.6 Principles	26
1.7 Examples of Metadata Descriptions	28
▶ Suggested Readings	36
▶ Exercises	36
TWO Understanding Metadata Vocabularies	37
2.1 Metadata Element Sets	38
2.1.1 Components and Structures—An Overview	38
2.1.2 Flat Structure	42
2.1.3 Nested Structure	51
2.2 Application Profiles	54
2.2.1 The Concept of Application Profile	54
2.2.2 Examples of APs Consisting of Elements Drawn from Other Schemas	55
2.2.3 Sources of Reusable Elements	58

2.3	Ontologies as Metadata Vocabularies	59
2.3.1	Background	59
2.3.2	Modular Structure	62
2.3.3	Friend of a Friend (FOAF)	62
2.3.4	Schema.org	64
2.4	RDF Vocabularies for Metadata Terms	67
2.4.1	An Introduction to RDF (Resource Description Framework)	67
2.4.2	DCMI Metadata Terms	72
2.4.3	Metadata Descriptions: From "Records" to "Statements"	78
▶	Suggested Readings	80
▶	Exercises	80
THREE	Creating Metadata Descriptions	81
3.1	Requirements for Metadata	82
3.2	Basic Unit of Metadata	85
3.2.1	Metadata Statement, Description, and Description Set	85
3.2.2	Relationships between Resources	88
3.3	Knowing the Difference	89
3.4	Levels of Granularity	93
3.4.1	Describing Individual Items That Constitute a Collection: Item-level Description	93
3.4.2	Describing the Entirety of a Collection: Collection-Level Description	93
3.4.3	Dataset-Level Metadata	95
3.4.4	Resource Decomposition	97
3.5	Metadata Sources	99
3.5.1	Manual Generation of Metadata	100
3.5.2	Automatic Generation of Metadata	102
3.5.3	Combination of Manual and Automatic Methods	104
3.5.4	Harvested Metadata	107
3.5.5	Converted Metadata	109
3.5.6	User-Contributed Metadata through Social Media	112
3.6	Metadata Storage	114
3.6.1	Internal Storage	114
3.6.2	External Storage	121
3.7	Expressing Metadata	124
3.7.1	HTML	125
3.7.2	XML	130
3.7.3	RDF/XML and Other RDF Serialization Formats	133

3.8	Linkage, Wrapper, Display, and Parallel Metadata	136
3.8.1	Linking between Descriptions for Different Resources	136
3.8.2	Wrapping	137
3.8.3	Encoding for Display	139
3.8.4	Encoding for Bilingual Metadata <i>Statements</i>	140
3.9	Combining Metadata Descriptions and Linking Resources	143
3.9.1	METS	144
3.9.2	RDF/XML	148
3.9.3	Aggregation	149
►	Suggested Readings	152
►	Advanced Readings	153
►	Exercises	153

PART II

Metadata Vocabulary Building Blocks

FOUR 	Metadata Structures and Semantics	157
4.1	Modeling for Metadata	160
4.1.1	Entity-Relationship Modeling	161
4.1.2	Ontological Modeling	165
4.1.3	Encapsulated and Modularized Approaches	171
4.2	Enumerating Metadata Terms	173
4.2.1	Communicating about the Functional Requirements	173
4.2.2	Identifying Desired Elements	175
4.3	Element Set Specification	176
4.3.1	Basic Components	177
4.3.2	Presentation	178
4.3.3	Principles for an Element Set to Follow	180
4.3.4	Methodologies for Working from an Existing Element Set	182
4.3.5	Testing the Element Set	186
4.4	Value Spaces and Value Vocabularies	187
4.4.1	Value Spaces That Should Follow Standardized Syntax Encoding Rules	188
4.4.2	Value Spaces That Require Standardized Vocabulary Encoding Schemes	190
4.4.3	Value Spaces That Require Predefined Lists of Terms	197

4.5	Crosswalks	202
4.5.1	Methods Used in Crosswalking	202
4.5.2	Aligning Elements with Indicators of Matching Degrees	205
4.6	Best Practice Guides and Other Content Guidelines	206
4.6.1	Best Practice Guides	207
4.6.2	Standard-Specific Guidelines	210
4.6.3	Community-Oriented Best Practice Guides	212
4.6.4	Data Content Standards	212
4.7	Conclusion	214
▶	Suggested Readings	214
▶	Exercises	215
FIVE	Metadata Schemas	219
5.1	Background	219
5.2	Resource Identification	224
5.3	Namespaces	228
5.4	Schema Encoding	232
5.4.1	Relational Schema	232
5.4.2	XML Schema	233
5.4.3	Schema Encoding in Mixed Namespaces	237
5.5	Encoding Examples of Metadata Vocabularies	239
5.5.1	Dublin Core Schemas	240
5.5.2	EAD 2002 XML Schema	241
5.5.3	DLESE Metadata Framework XML Schemas	244
5.6	Summary	246
▶	Suggested Readings	246
▶	Exercises	247

PART III

Metadata Services

SIX	Metadata Services	251
6.1	Metadata Services as an Infrastructure	252
6.2	Metadata Registries	258
6.2.1	Functional Requirements	259
6.2.2	Types	261
6.2.3	Essential Components	264

6.3	Metadata Repositories	267
6.3.1	Metadata Harvesting Model	269
6.3.2	OAI-PMH Commands	272
6.3.3	Support for Multiple Description Formats in OAI-PMH	275
6.4	Metadata as Linked Data	277
6.4.1	Two Roles of LAMs	278
6.4.2	Using Knowledge Organization Systems (KOS) as the Connectors of Linked Datasets	279
6.4.3	Metadata in Information Silos	284
6.4.4	Factors Impacting Metadata Linkability	285
6.5	Ensuring Optimal Metadata Discovery and Increasing Findability	294
6.5.1	Metadata Retrieval	295
6.5.2	Metadata Exposure Methods	299
6.6	Summary	313
▶	Suggested Readings	314
▶	Exercises	315
SEVEN	Metadata Quality Measurement and Improvement	317
7.1	Quality of Metadata	317
7.2	Meeting the Functional Requirements	319
7.3	Quality Measurement with Different Granularities	322
7.4	Metadata Quality Measurement Indicators: CCCD	325
7.4.1	Completeness	325
7.4.2	Correctness	327
7.4.3	Consistency	329
7.4.4	Duplication Analysis	331
7.5	Metadata Evaluation	334
7.6	Enhancing Quality of Metadata	337
7.7	Entity-Level Quality for Reusable Metadata	340
▶	Suggested Readings	345
▶	Exercises	346
EIGHT	Achieving Interoperability	347
8.1	Definitions	348
8.2	Metadata Decisions at Different Stages of a Digital Library Project	349
8.3	Achieving Interoperability at the Schema Level	351
8.3.1	Derivation	351
8.3.2	Application Profiles (APs)	353

- 8.3.3 Crosswalks 354
 - 8.3.4 Frameworks 356
 - 8.3.5 Metadata Registries 359
- 8.4. Achieving Interoperability at the Record Level 360
 - 8.4.1 Conversion of Metadata Records 360
 - 8.4.2 Data Reuse and Integration 361
- 8.5. Achieving Interoperability at the Metadata Repository Level 362
 - 8.5.1 Metadata Repositories Based on the
Open Archives Initiative (OAI) Protocol 363
 - 8.5.2 Metadata Repositories Supporting Multiple
Formats without Record Conversion 364
 - 8.5.3 Aggregation and Enriched Metadata Records in a Repository 365
 - 8.5.4 Element-Based and Value-Based Crosswalking Services 366
 - 8.5.5 Value-Based Mapping for Cross-Database Searching 367
 - 8.5.6 Value-Based Co-Occurrence Mapping 367
- 8.6. Alignment Approaches Used for Linked Data 370
 - 8.6.1 The Need for Alignment of Metadata Vocabularies 370
 - 8.6.2 Alignment at Class Level 371
 - 8.6.3 Alignment at Property Level 372
 - 8.6.4 Mapping Degrees 373
- 8.7. Conclusion 375
 - Suggested Readings 375
 - Exercise 376

PART IV

Metadata Outlook in Research

NINE | Metadata Research Landscape 379

- 9.1 Overview 379
- 9.2 Research in Metadata Architecture 384
- 9.3 Research in Metadata Modeling 386
- 9.4 Research in Metadata Semantics 390
- 9.5 Metadata and Data-Driven X 393
- 9.6 Metadata Research Landscape: Conclusions 396
 - Suggested Readings 397
 - Exercise 397

PART V

Metadata Standards

TEN Current Standards	401
10.1 Metadata for General Purposes	402
10.1.1 Dublin Core (DC)	402
10.1.2 MODS and the MARC Family	405
10.2 Metadata for Cultural Objects and Visual Resources	414
10.2.1 Introduction to CDWA	415
10.2.2 Important Concepts	417
10.2.3 Element Sets of CCO, CDWA Lite, LIDO, and VRA Core	420
10.2.4 Object ID Checklist	426
10.2.5 Value Vocabularies	428
10.3 Metadata for Research Data	429
10.3.1 Overview	429
10.3.2 Metadata Standards for Geospatial Data	432
10.3.3 Metadata Standards for Biodiversity and Ecology Data	438
10.3.4 Metadata for Social Sciences Research Data	441
10.3.5 Other Developments	444
10.4 Metadata for Archives	445
10.4.1 Background	445
10.4.2 Finding Aid Examples	446
10.4.3 EAD 2002 Record at a Glance	449
10.4.4 EAC-CPF	453
10.4.5 Related Standards	454
10.4.6 EAD3	455
10.5 Rights Management Metadata	456
10.5.1 Rights Metadata Elements for User-Oriented Rights Information	457
10.5.2 Metadata Activities of Rights-Holder Communities	459
10.5.3 Open Digital Rights Language (ODRL)	461
10.6 Metadata for Publishing and Press Communications	463
10.6.1 ONIX (ONline Information Exchange)	464
10.6.2 EPUB	465
10.6.3 IPTC Metadata Standards	466
10.7 Metadata for Multimedia Objects	467
10.7.1 The MPEG standards	468
10.7.2 MPEG-7	468
10.7.3 ID3v2	471
10.7.4 PBCore, the Public Broadcasting Metadata Dictionary	471

10.8 Preservation and Provenance Metadata	473
10.8.1 Digital Preservation Metadata Standards	473
10.8.2 OAIS Reference Framework	474
10.8.3 Preservation Metadata: Implementation Strategies (PREMIS)	476
10.8.4 PROV for Provenance Interchange on the Web	479
10.8.5 DCMi Metadata Terms for Provenance	481
10.9 Metadata Describing Agents	482
10.9.1 vCard	482
10.9.2 FOAF (Friend of a Friend)	483
Suggested Readings	484
Exercises	484

Appendixes: The following appendixes are available online only.

- A** Metadata Standards: Metadata Schemas, Application Profiles, and Registries
<http://www.metadataetc.org/book-website/readings/appendixaschemas.htm>
- B** Value Encoding Schemes and Content Standards
<http://www.metadataetc.org/book-website/readings/appendixbencodeschemes.htm>



<i>Glossary</i>	487
<i>References</i>	497
<i>About the Authors</i>	533
<i>Index</i>	535