Entity Framework 4 in Action

STEFANO MOSTARDA
MARCO DE SANCTIS
DANIELE BOCHICCHIO
brief contents

PART 1 REDEFINING YOUR DATA-ACCESS STRATEGY...................1
  1 • Data access reloaded: Entity Framework  3
  2 • Getting started with Entity Framework  33

PART 2 GETTING STARTED WITH ENTITY FRAMEWORK..............61
  3 • Querying the object model: the basics  63
  4 • Querying with LINQ to Entities  80
  5 • Domain model mapping  119
  6 • Understanding the entity lifecycle  151
  7 • Persisting objects into the database  176
  8 • Handling concurrency and transactions  203

PART 3 MASTERING ENTITY FRAMEWORK..............................225
  9 • An alternative way of querying: Entity SQL  227
 10 • Working with stored procedures  253
 11 • Working with functions and views  284
 12 • Exploring EDM metadata  296
 13 • Customizing code and the designer  322
PART 4  APPLIED ENTITY FRAMEWORK  ........................................355

14  • Designing the application around Entity Framework  357
15  • EntityFrameworkandASP.NET  378
16  • Entity Framework and rc-tier development  396
17  • Entity Framework and Windows applications  423
18  • Testing Entity Framework  447
19  • Keeping an eye on performance  474
PART 1 REDEFINING YOUR DATA-ACCESS STRATEGY

Data access reloaded: Entity Framework  3

1.1 Getting started with data access  4

1.2 Developing applications using database-like structures  t

Using datasets and data readers as data containers  5
The strong coupling problem 8* The loose typing problem 9
The performance problem 10

1.3 Using classes to organize data  10

Using classes to represent data 11 * From a single class to the
object model 13

1.4 Delving deep into object/relational differences  15

The datatype mismatch  15* The association mismatch  16
The granularity mismatch  18* The inheritance mismatch  20
The identity mismatch  21 * Handling the mismatches  22
1.5 Letting Entity Framework ease your life 23
   What is O/RM? 23* The benefits of using Entity Framework 24
   When isn’t O/RM needed? 26

1.6 How Entity Framework performs data access 26
   The Entity Data Model 27* Object Services 29* Entity Client
   data provider 31 * LINQ to Entities 31* Entity SQL 32

1.7 Summary 32

2 Getting started with Entity Framework 33

2.1 Introducing the OrderIT example 34

2.2 Designing the OrderIT model and database 35
   Bottom-up vs. top-down design 36* Customers and suppliers 37
   Products 39 * Orders 41

2.3 Structuring the application 42
   Creating the assemblies 42* Designing entities using the database-
   first approach 43* Designing relationships 50* Organizing
   the generated code 52* The model-first approach in the
   designer 54

2.4 A sneak peek at the code 55
   Querying the database 55* Updating objects and reflecting
   changes into storage 56

2.5 Summary 60

PART 2 GETTING STARTED WITH ENTITY FRAMEWORK .... 61

3 Querying the object model: the basics 63

3.1 One engine, many querying methods 64

3.2 The query engine entry point: Object Services 64
   Setting up the connection string 66 * Writing queries against
   classes 70 * LINQ to Entities queries vs. standard LINQ
   queries 70 * Retrieving data from the database 71
   Understanding Identity Map in the context 72 * Understanding
   interaction between Object Services and Entity Client 74
   Capturing the generated SQL 75 * Understanding which entities
   are returned by a query 76 * When is a query executed”? 77
   Managing the database from the context 79

3.3 Summary 79
4 Querying with LINQ to Entities 80
   4.1 Filtering data 81
      Filtering data based on associations 82 * Paging results 86
      Retrieving one entity 87 * Creating queries dynamically 89
   4.2 Projecting results 90
      Projecting with associations 92 * Projections and object
      tracking 95
   4.3 Grouping data 96
      Filtering aggregated data 100
   4.4 Sorting 100
      Sorting with associations 101
   4.5 Joining data 102
   4.6 Querying with inheritance 105
   4.7 Using functions 107
      Canonical functions 108 * Database functions 109
   4.8 Executing handmade queries 110
      Working with parameters 111
   4.9 Fetching 113
      Eager loading 114 * Lazy loading 115 * Manual deferred
      loading 116 * Choosing a loading approach 118
   4.10 Summary 118

5 Domain model mapping 119
   5.1 The Entity Data Model 120
      The Entity Data Model and Visual Studio designer 120
   5.2 Creating consumable entities 123
      Writing the entities 124 * Describing entities in the conceptual
      schema 127 * Describing the database in the storage schema 130
      Creating the mapping file 133
   5.3 Defining relationships in the model 136
      One-to-one relationships 136 * One-to-many relationships 140
      Many-to-many relationships 142 * Some tips about
      relationships 143
   5.4 Mapping inheritance 144
      Table per hierarchy inheritance 144 * Table per type
      inheritance 147
5.5 Extending the EDM with custom annotations 149
   Customizing the EDM 149

5.6 Summary 150

6 Understanding the entity lifecycle 151

6.1 The entity lifecycle 152
   Understanding entity state 152 * How entity state affects the database 153 * State changes in the entity lifecycle 153

6.2 Managing entity state 155
   The AddObject method 155* The Attach method 157
   The ApplyCurrentValues and ApplyOriginalValues methods 158
   The DeleteObject method 159 * The AcceptAUChanges method 160* The ChangeState and ChangeObjectState methods 161* The Detach method 161

6.3 Managing change tracking with ObjectStateManager 162
   The ObjectStateEntry class 163* Retrieving entries 164
   Modifying entity state from the entry 166* Understanding object tracking 167* Understanding relationship tracking 170
   Change tracking and MergeOption 174

6.4 Summary 175

Persisting objects into the database 116

* 7.1 Persisting entities with SaveChanges 177
   Detecting dirty entities 177 * Starting database transactions 178 * SQL code generation and execution 178
   Database transaction commit or rollback 179 * Committing entities 179 * Overriding SaveChanges 180

7.2 Persisting changed entities into the database 180
   Persisting an entity as a new row 180 * Persisting modifications made to an existing entity 182 * Persisting entity deletion 187

7.3 Persisting entities graphs 187
   Persisting a graph of added entities 188 * Persisting modifications made to a graph 192 * Persisting deletions made to a graph 196
   Persisting many-to-many relationships 199

7.4 A few tricks about persistence 199
   Handling persistence exceptions 199* Executing custom SQL commands 200

7.5 Summary 202
CONTENTS

10 Working with stored procedures 253

10.1 Mapping stored procedures 254
   Importing a stored procedure using the designer 254
   Importing stored procedures manually 256

10.2 Returning data with stored procedures 258
   Stored procedures whose results match an entity 258
   Stored procedures whose results don't match an entity 261
   Stored procedures that return scalar values 266
   Stored procedures that return an inheritance hierarchy 268
   Stored procedures with output parameters 271

10.3 Embedding functions in the storage model 274

10.4 Updating data with stored procedures 275
   Using stored procedures to persist an entity 276
   Using stored procedures to update an entity with concurrency 279
   Persisting an entity that's in an inheritance hierarchy 280
   Upgrading and downgrading an entity that's in an inheritance hierarchy 282
   Executing stored procedures not connected to an entity 282

10.5 Summary 283

Working with Junctions and views 284

11.1 Views in the storage model: defining queries 285
   Creating a defining query 285
   Mapping stored procedures to classes with complex properties 287

11.2 User-defined functions and scalar-valued functions 288
   Scalar-valued functions 288
   User-defined functions 290
   User-defined functions and collection results 294

11.3 Summary 295

12 Exploring EDM metadata 296

12.1 Metadata basics 297
   Accessing metadata 297
   How metadata is internally organized 300
   Understanding when metadata becomes available 301

12.2 Retrieving metadata 301
   Understanding the metadata object model 302
   Extracting metadata from the EDM 303

12.3 Building a metadata explorer 306
   Populating entities and complex types 306
   Populating functions 312
   Populating containers 313
   Populating storage nodes 315
12.4 Writing generic code with metadata 316

Adding or attaching an object based on custom annotations 317
Building a generic GetByld method 319

12.5 Summary 321

13 Customizing code and the designer 322

13.1 How Visual Studio generates classes 323

Understanding template tags 324 * Understanding directives 325 * Writing code 326

13.2 Customizing class generation 328

Understanding the available POCO template 328 * Generating user-defined and scalar-valued functions 329 * Generating data-annotation attributes 333 * Extending classes through partial classes 335

13.3 How Visual Studio generates database DDL 336

Choosing the workflow 337 * Generating SSDL, MSL, and DDL 338

13.4 Customizing DDL generation 339

Understanding the conceptual-to-storage template 340
Understanding the conceptual-to-mapping template 342
Understanding the storage-to-database script template 343

13.5 Creating designer extensions 344

How the property-extension mechanism works 344 * Setting up the project containing the extension 345 * Creating the property class 346 * Creating the factory class 348 * Creating the manifest extension file 351 * Installing, debugging, and uninstalling the extension 352

13.6 Summary 353

PART 4 APPLIED ENTITY FRAMEWORK .................. 355

14 Designing the application around Entity Framework 357

14.1 The application design process 358

14.2 A typical three-layer architecture 359

Filling the product list 359* Calculating order totals and saving them to the database 361 * Dealing with higher levels of complexity 363
14.3 Principles of domain-driven design 363
   Entities 364 * Value objects 365 * Handling associations correctly: domain roots and aggregates 367 * Refining the model 368
14.4 Retrieving references to a domain's entities 371
   Repositories at a glance 371 * Implementing a repository 372
   Getting a reference to a brand new entity 376
14.5 Summary 377

15 Entity Framework and ASP.NET 378
15.1 EntityDataSource, a new approach to data binding 379
   A practical guide to data source controls 379
   The EntityDataSource control in depth 380
15.2 Using Dynamic Data controls with Entity Framework 384
   Registering the model 384 * Working with data annotations 386
15.3 The ObjectContext lifecycle in ASP.NET 388
   The Context-per-Request pattern 389 * Wrapping the context 390 * A module to handle the lifecycle 392
   Using the repository in a page 393
15.4 Common scenarios involving ASP.NET and Entity Framework 393
15.5 Summary 395

16 Entity Framework and n-tier development 396
16.1 n-Tier problems and solutions 397
   Tracking changes made on the client 397 * Choosing data to be exchanged between server and client 398 * The serialization problem 399
16.2 Developing a service using entities as contracts 400
   Persisting a complex graph 403 * Optimizing data exchanges between client and server 404 * Dealing with serialization in WCF 405
16.3 Developing a service using DTOs 409
   Persisting a complex graph 411
16.4 Developing a service using STEs 413
   Enabling STEs 414 * Inside an STE 415 * Inside the context 417 * Using STEs 417 * STE pros and cons 421
16.5 Summary 422
17 Entity Framework and Windows applications 423

17.1 An example application 424
17.2 Designing model classes for binding 425
   Implementing INotifyPropertyChanged 425 * Implementing IEditableObject 426 * Implementing IDataErrorInfo 429
   Using a template to generate the binding code 431
17.3 Binding in Windows Forms applications 432
   Showing orders 433 * Showing data for the selected order 434 * Showing details of the selected order 436
   Showing selected detail information 437 * Adding code to persist modifications 438 * Taking advantage of binding interfaces 440
17.4 Binding in WPF applications 441
   Showing orders 441 * Showing data for the selected order 442 * Showing selected order details 443 * Showing selected detail information 443 * Adding code to persist modifications 445
17.5 Summary 446

18 Testing Entity Framework 447

18.1 Unit tests at a glance 448
18.2 Writing a test suite in Visual Studio 2010 451
   Testing a simple method 451 * Advanced features of Microsoft's Unit Testing Framework 453
18.3 Isolating dependencies 455
   Refactoring for testability 456 * Using a mocking framework to fake dependencies 458
18.4 Unit-testing the data access layer 461
   A test infrastructure for a repository 462 * Testing LINQ to Entities queries 466
18.5 Testing the persistence and retrieval of an entity 470
18.6 Summary 473

Keeping an eye on performance 474

19.1 Testing configuration and environment 475
   The performance test visualizer 476 * Building the timer 476
19.2 Database-writing comparison 479