

EMF: Eclipse Modeling Framework (2nd Edition)

By Dave Steinberg, Frank Budinsky, Marcelo Paternostro, Ed Merks

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Series Editors: Erich Gamma • Lee Nackman • John Wiegand

The Authoritative Guide to EMF Modeling and Code Generation
The Eclipse Modeling Framework enables developers to rapidly construct robust applications based on surprisingly simple models. Now, in this thoroughly revised Second Edition, the project's developers offer expert guidance, insight, and examples for solving real-world problems with EMF, accelerating development processes, and improving software quality.

This edition contains more than 40% new material, plus updates throughout to make it even more useful and practical. The authors illuminate the key concepts and techniques of EMF modeling, analyze EMF's most important framework classes and generator patterns, guide you through choosing optimal designs, and introduce powerful framework customizations and programming techniques. Coverage includes

- Defining models with Java, UML, XML Schema, and Ecore
- NEW: Using extended Ecore modeling to fully unify XML with UML and Java
- Generating high-quality code to implement models and editors
- Understanding and customizing generated code
- Complete documentation of @model Javadoc tags, generator model properties, and resource save and load options
- NEW: Leveraging the latest EMF features, including extended metadata, feature maps, EStore, cross-reference adapters, copiers, and content

types

- NEW: Chapters on change recording, validation, and utilizing EMF in stand-alone and Eclipse RCP applications
- NEW: Modeling generics with Ecore and generating Java 5 code

About the Authors

Dave Steinberg is a software developer in IBM Software Group. He has worked with Eclipse and modeling technologies since joining the company, and has been a committer on the EMF project since its debut in 2002.

Frank Budinsky, a senior architect in IBM Software Group, is an original coinventor of EMF and a founding member of the EMF project at Eclipse. He is currently cochair of the Service Data Objects (SDO) specification technical committee at OASIS and lead SDO architect for IBM.

Marcelo Paternostro is a software architect and engineer in IBM Software Group. He is an EMF committer and has been an active contributor to several other Eclipse projects. Before joining IBM, Marcelo managed, designed, and implemented numerous projects using Rational's tools and processes.

Ed Merks is the project lead of EMF and a colead of the top-level Modeling project at Eclipse. He holds a Ph.D. in Computing Science and has many years of in-depth experience in the design and implementation of languages, frameworks, and application development environments. Ed works as a software consultant in partnership with itemis AG.

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Preface

This book is a comprehensive introduction and developer's guide to the Eclipse Modeling Framework (EMF). EMF is a powerful framework and code generation facility for building Java applications based on simple model definitions. Designed to make modeling practical and useful to the mainstream Java programmer, EMF unifies three important technologies: Java, XML, and UML. Models can be defined using a UML modeling tool or an XML Schema, or even by specifying simple annotations on Java interfaces. In this last case, the developer writes just a subset of abstract interfaces that describe the model, and the rest of the code is generated automatically and merged back in.

By relating modeling concepts to the simple Java representations of those concepts, EMF has successfully bridged the gap between modelers and Java programmers. It serves as a gentle introduction to modeling for Java programmers and at the same time as a reinforcement of the modeler's theory that a great deal of coding can be automated, given an appropriate tool. This book shows how EMF is such a tool. It also shows how using EMF lets you do more with your models that you might have thought possible.

EMF provides a runtime framework that allows any modeled data to be easily validated, persisted, and edited in a UI. Change notification and recording are supported automatically. Metadata is available to enable generic processing of any data using a uniform, reflective API. With all of these features and more, EMF is the foundation for data sharing and fine-grained interoperability among tools and applications in Eclipse, in much the same way that Eclipse is itself a platform for integration at the component and UI level. Numerous organizations are currently using Eclipse, EMF, and the growing number of EMF-based technologies in the Eclipse Modeling Project as the foundation for their own commercial and open source offerings.

This book assumes the reader is familiar with object-oriented programming concepts and specifically with the Java programming language. Previous exposure to modeling technologies such as UML, although helpful, is not required. Part I (Chapters 1 to 4) provides a basic overview of the most important concepts in EMF and modeling. This part teaches someone with basic Java programming skills everything needed to start using EMF to model and build an application. Part II (Chapters 5 to 9) presents a thorough overview of EMF's metamodel, Ecore, followed by details of the mappings between Ecore and the other supported model-definition forms: UML, annotated Java, and XML Schema. Part III (Chapters 10 to 13) includes detailed analyses of EMF's code generator patterns and tools, followed by an end-to-end example of a non-trivial EMF application. Finally, Part IV (Chapters 14 to 21) takes a close look at EMF's runtime framework and discusses important EMF programming techniques.

The bulk of this book is based on EMF 2.2, the last version to support the venerable Java 1.4 language. In version 2.3, EMF adopted key language features of Java 5.0, making it incompatible with previous Java runtimes. EMF 2.2, which was current while much of this book was written, is therefore still popular and an excellent base for learning about the framework. The code in Chapters 1 to 20 is based on that version, but due to EMF's backward compatibility, all examples run without change on version 2.4, the latest at the time of this book's release. Chapter 21 focuses specifically on changes in EMF 2.3 and 2.4 and, as such, uses 2.4 as the basis for its examples.

Conventions Used in This Book

The following formatting conventions are used throughout this book:

- **Bold**—Used for the names of model elements, such as packages, classes, attributes, and references; and of user-interface elements, including menus, buttons, tabs, and text boxes.
- *Italic*—Used for filenames and URIs, as well as for placeholder text that is meant to be replaced by a

particular name. New terms are often italicized for emphasis. Also, in Chapter 9's example mappings, items shown purely to provide context appear in italics.

- `Courier`—Used for all code samples and for in-text references to code elements, including the names of Java packages, classes, interfaces, methods, fields, variables, and keywords. Plug-in names, command lines, and elements of non-Java files, including XML, also appear in this font.
- **`Courier Bold`**—Used to emphasize portions of code samples, usually new insertions or changes.
- ~~`Courier Strikethrough`~~—Used in code samples to indicate that text should be deleted.

Online Examples

The Web site for this book is located at http://www.informit.com/title/9780321331885. All of the example models and code used throughout this book can be downloaded from there. The site will also provide an errata list, and other news related to the book.

Eclipse and EMF are required to use the examples. You can download one of several Eclipse packages (we recommend Eclipse Classic) at http://www.eclipse.org/downloads/ and the all-in-one EMF SDK at http://www.eclipse.org/modeling/emf/downloads/.

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