UML Class Diagram Practitioner's Subset for Data Modeling

DDI Alliance Working Group on Modeling, Representation, and Testing Lifecycle (MRT)

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Introduction

Unified Modeling Language (UML) is suitable for sharing information with both „business people" and „technical people".

"The Unified Modeling Language (UML) is a general-purpose, developmental, modeling language in the field of software engineering that is intended to provide a standard way to visualize the design of a system."[1]

"UML 2 class diagrams are the mainstay of object-oriented analysis and design. UML 2 class diagrams show the classes of the system, their interrelationships (including inheritance, aggregation, and association), and the operations and attributes of the classes."[2]

UML class diagrams have two levels, the formal definition of classes and their relationships, and the definition of related diagrams. This text focuses only on the formal definitions.

This subset uses version 2 of UML. The latest and also best official description is UML® Version 2.5.1[3] from the Object Management Group (OMG), a computer industry standards consortium.

Purpose

This subset of UML class diagram elements is intended for data modeling. It focuses on core elements which are well known in object-oriented programming. The subset focuses on elements which describe classes, their interrelationships, and their attributes.

The subset has multiple advantages:

- Powerful enough to describe data models
- Simple to use
- Provides robust models
- Implemented in all UML tools
- Elements have counterparts in object-oriented programming
- Elements have well-defined counterparts in visual UML class diagrams

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[1] Preface of "The unified modeling language user guide". Booch, Grady; Rumbaugh, James; Jacobson, Ivar, Upper Saddle River, NJ, 2005, http://www.informit.com/store/unified-modeling-language-user-guide-9780321267979
[2] UML 2 Class Diagrams: An Agile Introduction, Scott W. Ambler, http://www.agilemodeling.com/artifacts/classDiagram.htm
[3] OMG® Unified Modeling Language®, https://www.omg.org/spec/UML/2.5.1/PDF

Description of Elements

List

- Structural Items
  - Model
  - Package
  - Class
  - Property
- Relationships
  - Association
  - Generalization
- Data Type Definition
  - DataType
  - Enumeration
  - EnumerationLiteral
  - LiteralInteger
  - LiteralString
  - LiteralUnlimitedNatural
  - PrimitiveType
- Other
  - Comment

Description

Citations are from the website "UML Diagrams"[4] and the OMG UML specification.

Structural Items

Model

UML Diagrams

Model is a specialized UML package which describes a system from a certain point of view, viewpoint. …

OMG UML

A model captures a view of a physical system. It is an abstraction of the physical system, with a certain purpose. This purpose determines what is to be included in the model and what is irrelevant. Thus the model completely describes those aspects of the physical system that are relevant to the purpose of the model, at the appropriate level of detail.

Package

UML Diagrams

Package is a namespace used to group together elements that are semantically related and might change together. It is a general purpose mechanism to organize elements into groups to provide better structure for system model.

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[4] https://www.uml-diagrams.org by Kirill Fakhroutdinov

… A package is used to group elements, and provides a namespace for the grouped elements.

Class

UML Diagrams

A class is a classifier which describes a set of objects that share the same features, constraints, semantics (meaning).

OMG UML

A Class classifies a set of objects and specifies the features that characterize the structure and behavior of those objects. …

Property

UML Diagrams

A property is a structural feature which could represent an attribute of a classifier, or a member end of association, or a part of a structured classifier.

OMG UML

A Property is a StructuralFeature. A Property related by ownedAttribute to a Classifier (other than an association) represents an attribute and might also represent an association end. …

Relationships

Association

UML Diagrams

Association is a relationship between classifiers which is used to show that instances of classifiers could be either linked to each other or combined logically or physically into some aggregation.

OMG UML

A link is a tuple of values that refer to typed objects. An Association classifies a set of links, each of which is an instance of the Association. Each value in the link refers to an instance of the type of the corresponding end of the Association.

Generalization

UML Diagrams

A generalization is a binary taxonomic (i.e. related to classification) directed relationship between a more general classifier (superclass) and a more specific classifier (subclass).

OMG UML

A Generalization is a taxonomic relationship between a more general Classifier and a more specific Classifier. Each instance of the specific Classifier is also an instance of the general Classifier. The specific Classifier inherits the features of the more general Classifier. A Generalization is owned by the specific Classifier.

Data Type Definition

DataType

UML Diagrams
A data type is a classifier - similar to a class - whose instances are "identified only by their value".

A typical use of data types would be to represent value types from business domain, primitive types or structured types of a programming language. For example, date/time, gender, currency, address could be defined as data types. All copies of an instance of a data type and any instances of that data type with the same value are considered to be equal instances.

OMG UML
A DataType is a type whose instances are identified only by their value.

Enumeration

UML Diagrams
An enumeration is a data type whose values are enumerated in the model as user-defined enumeration literals.

OMG UML
An Enumeration is a DataType whose values are enumerated in the model as EnumerationLiterals.

EnumerationLiteral

OMG UML
An EnumerationLiteral is a user-defined data value for an Enumeration.

LiteralInteger

OMG UML
A LiteralInteger is a specification of an Integer value.

LiteralString

OMG UML
A LiteralString is a specification of a String value.

LiteralUnlimitedNatural

OMG UML
A LiteralUnlimitedNatural is a specification of an UnlimitedNatural number.

PrimitiveType

UML Diagrams
A primitive type is a data type which represents atomic data values, i.e. values having no parts or structure. A primitive data type may have precise semantics and operations defined outside of UML, for example, mathematically.

Standard UML primitive types include:

- Boolean,
- Integer,
- UnlimitedNatural,
- String,
- Real.

OMG UML

A PrimitiveType defines a predefined DataType, without any substructure. A PrimitiveType may have an algebra and operations defined outside of UML, for example, mathematically.

Other

Comment

UML Diagrams

A comment (aka note) is an element which represents a textual annotation (remark, comment) that can be attached to another element or a set of elements. A comment adds no semantics to the elements, but it may contain some information that is useful to a modeler or to a reader of UML diagram and which usually can't be expressed with other UML elements.

OMG UML

A Comment is a textual annotation that can be attached to a set of Elements.

Detailed List of Items

A detailed list of items on the basis of the UML 2.5.1/XMI 2.5.1 specifications is available in a separate spreadsheet[5]. This is intended for the processing of the related XMI.

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[5] UML Class Diagram - Practitioner's Subset for Data Modeling - Detailed List of Items 0_9.xlsx