CWMI RFP
Final Submission Presentations
(ADTF Denver meeting, 3/8/00)

- CWM Overview (10 mins, Dan Chang)
- CWM Metamodel, Part 1 (20 mins, Doug Tolbert)
- CWM Metamodel, Part 2 (20 mins, John Poole)
- CWM Generation, Validation, and Extensions (20 mins, David Mellor)
- CWM Summary and Actions (10 mins, Dan Chang)

- **Vote to recommend CWM Adoption & CWM FTF Formation** (10 mins, Jim Odell)

CWM
(Common Warehouse Metamodel)
Overview

Dan Chang (dtchang@us.ibm.com)

CWM

- A complete specification of the **syntax and semantics** needed to **export/import** shared warehouse metadata and the common warehouse metamodel, including:
  - **The CWM Metamodel** (Volume 1)
  - Interchange format for shared warehouse metadata (**CWM DTD**, Volume 2)
  - Interchange format for the CWM Metamodel (**CWM XML**, Volume 2)
  - Access API for shared warehouse metadata (**CWM IDL**, Volume 2)

CWM Co-submitting Companies

- **IBM** (*Dan Chang*, J. J. Daudenarde, Debra LaVergne, Christoph Lingenfelder)
- **Unisys** (*Sridhar Iyengar*, Don Baisley, Doug Tolbert)
- **NCR** (*Vilhelm Rosenqvist*, Bruce McLean)
- **Hyperion** (*John Poole*, David Zhang)
- **Oracle** (*Gordon Callan*, David Last, David Mellor, Mark Hornick)
- **UBS** (*Hans-Peter Hoidn*, Jeffrey Peckham)
- **Genesis** (*David Frankel*, Phil Longden)
- **Dimension EDI** (*Chris Nelson*, Anders Tornqvist)

Expertise in UML, XML, metadata repository, databases, data warehousing, and business intelligence (OLAP, data mining)

CWM Supporting Companies

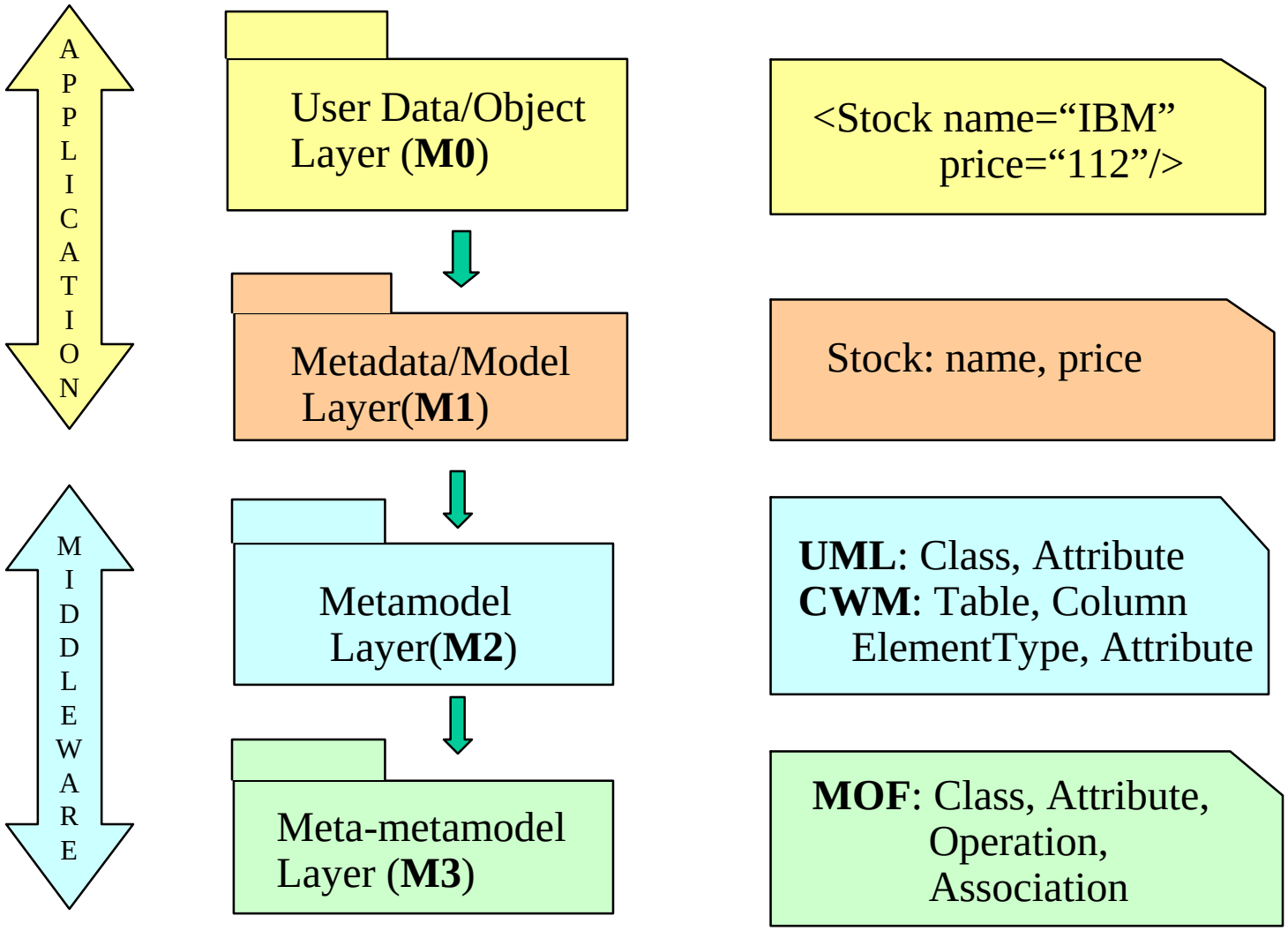
- **Deere** (*Dave Smith*)
- **Sun** (*Chuck Mosher*, Karsten Riemer, Nidhi Rao)
- **HP** (*Jishnu Mukerji*)
- **Data Access** (*Cory Casanave*)
- **InLine Software** (*Jack Greenfield*)
- **Aonix** (*Charles Simon*)
- **Hitachi** (*Yuichi Yugawa*)

Primary expertise in using databases, data warehouses, and business intelligence tools

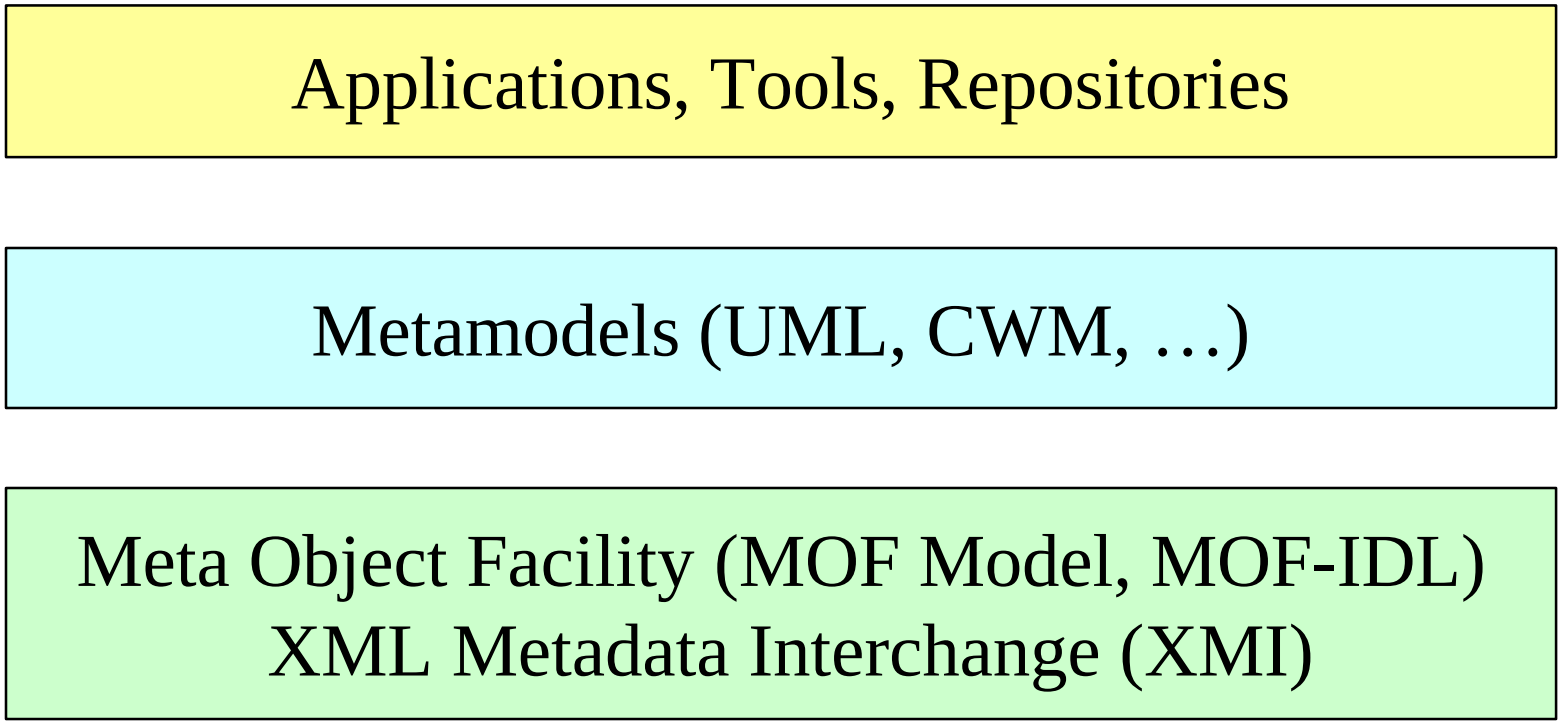
CWM Design Basis

- **OMG Metamodeling Architecture**
  - **UML** as the standard language for defining metamodels
  - **XMI** as the standard mechanism for interchanging metadata and metamodels in **XML**
  - **MOF to IDL Mapping** as the standard mechanism for accessing metadata through APIs (independent of programming languages and object models)

OMG Metamodeling Architecture



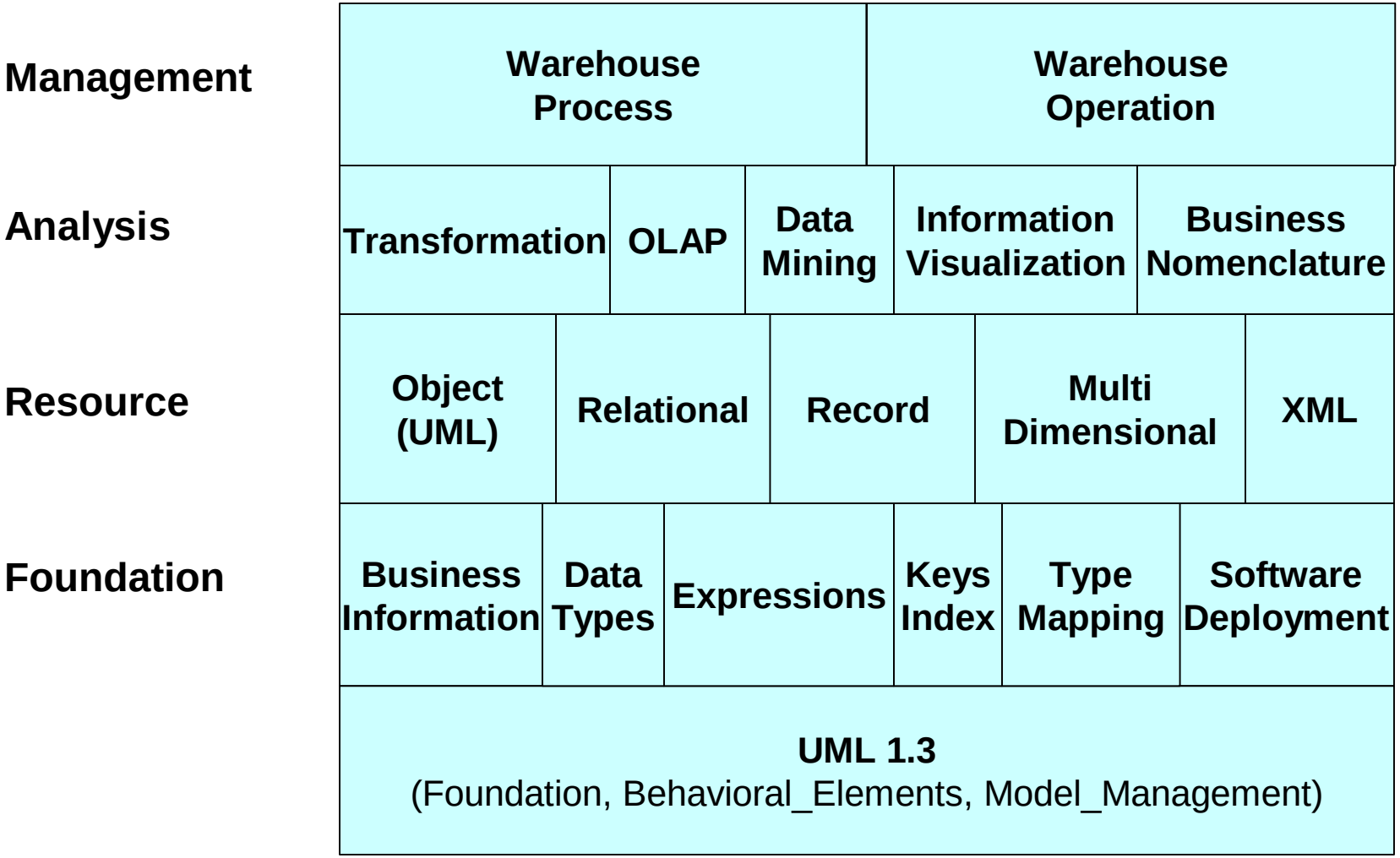
OMG Modeling Architecture



Roles of UML in CWM

- The *metamodeling language* (as in the MOF Model)
  - UML Semantics, UML Notation, OCL
- The *foundation metamodel*
  - UML Foundation, Common_Behavior, and Model_Management packages
- The *object (resource) metamodel*
  - Same as above

The CWM Metamodel



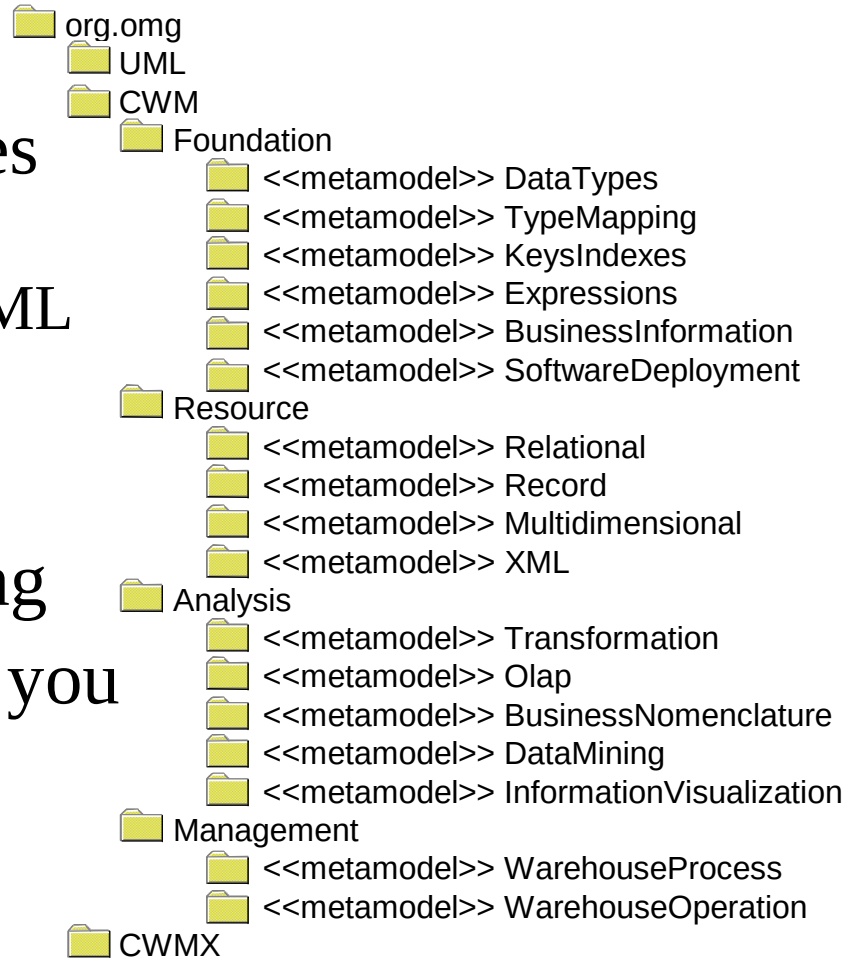
CWM Metamodel, Part 1

Doug Tolbert
(doug.tolbert@unisys.com)

Package Architecture

Modular Design

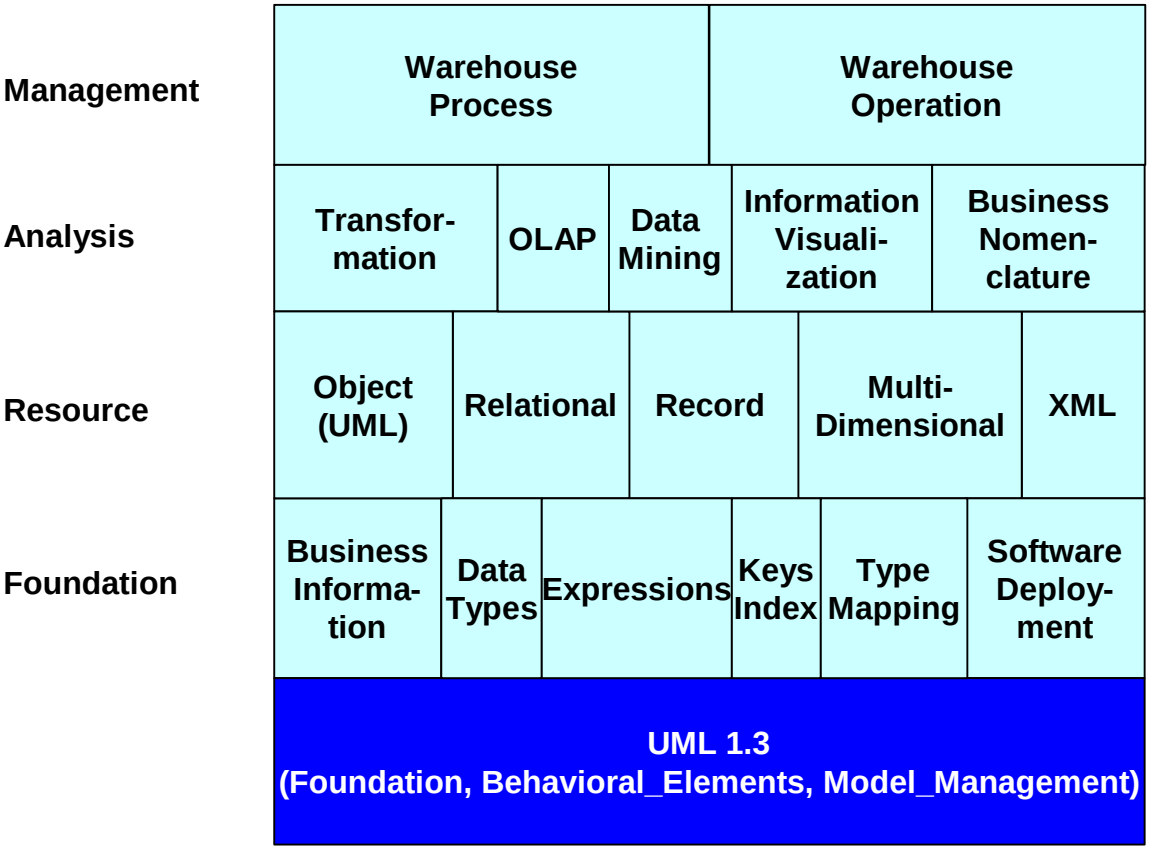
- Minimum dependencies
  - Cross package services provided by links to UML
- Avoid subpackages
- Reduced complexity, improved understanding
- Use only the packages you need



Base

The modeling environment

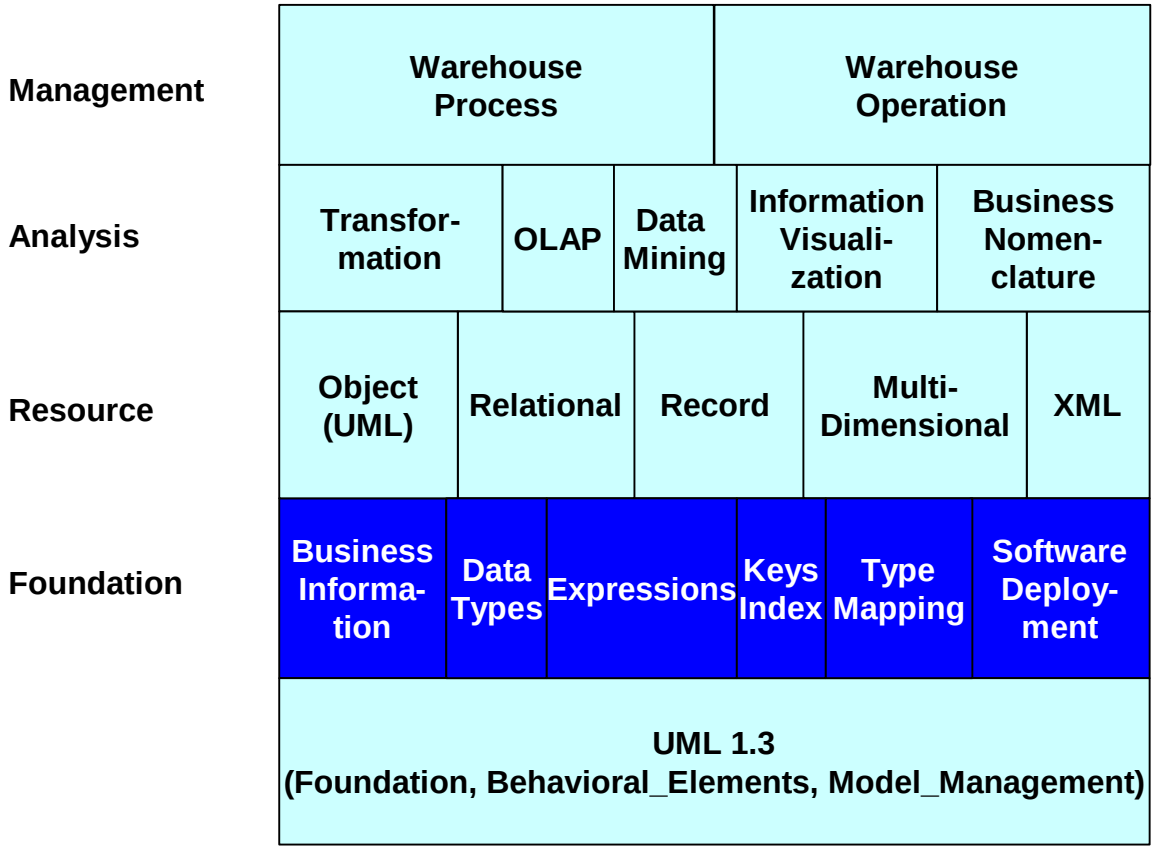
- UML notation used as diagramming technique
- UML metamodel extended to support warehouse concepts



Foundation

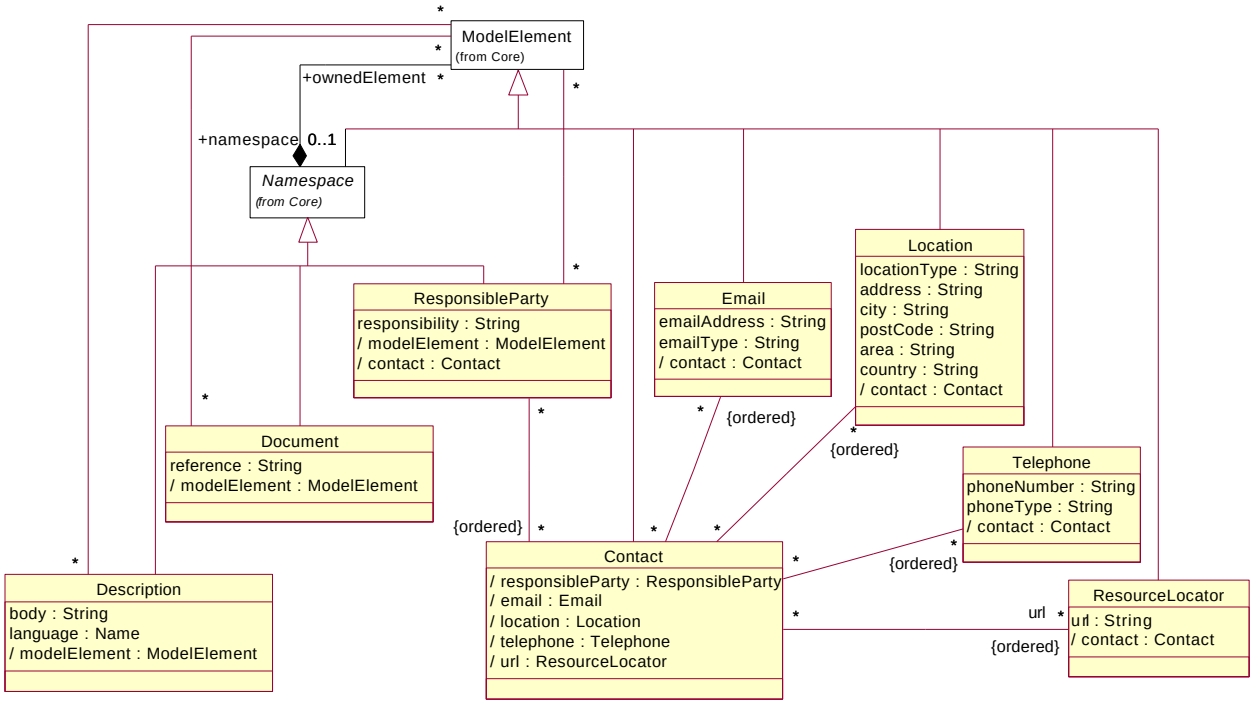
Metamodels shared by other packages

- Foundation
  - Business Information
  - Data Types
  - Expressions
  - Keys & Indexes
  - Software Deployment
  - Type Mapping



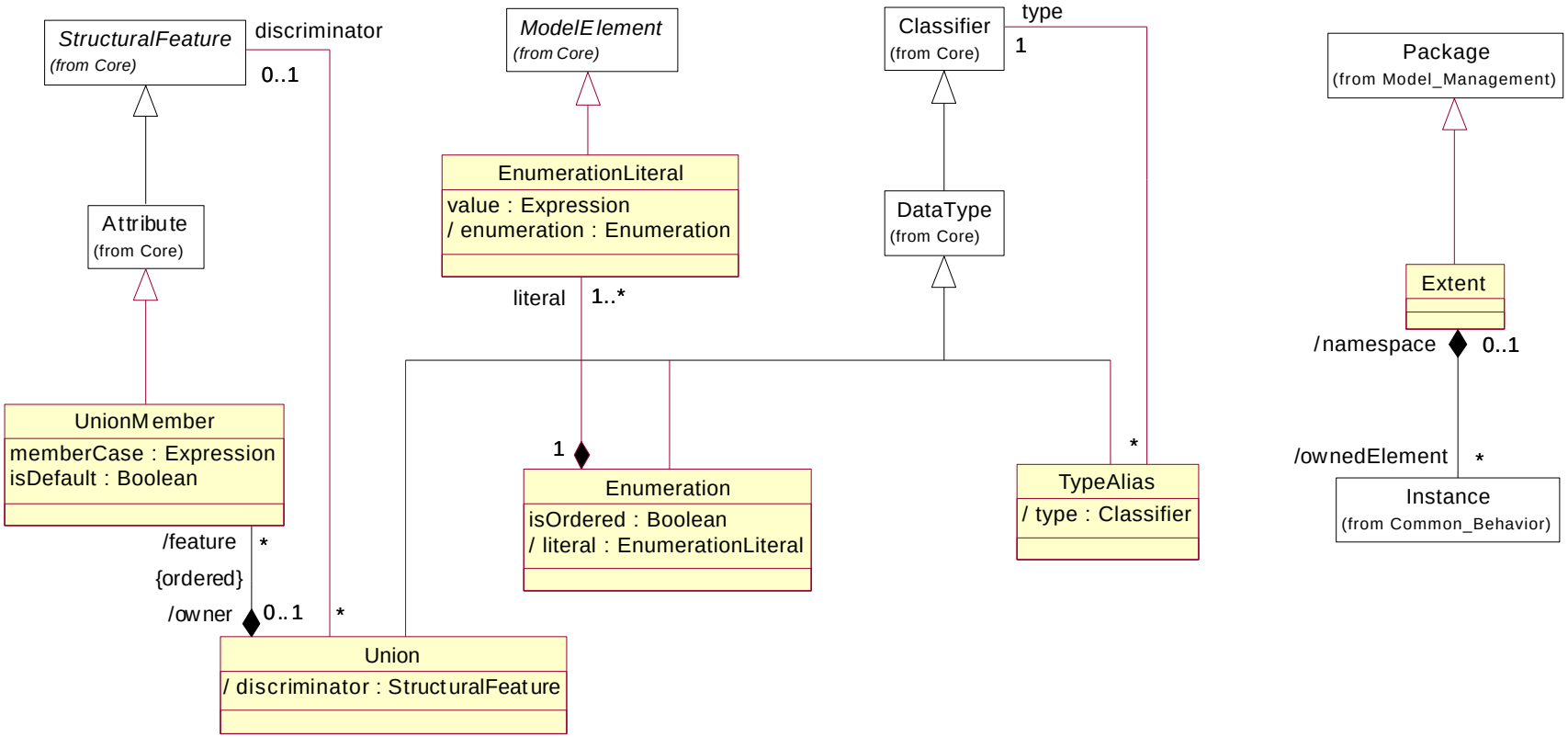
Foundation

- Business Information
  - Responsible parties & their contact information
  - Documentation and general commentary
  - Hierarchies of business types can be constructed



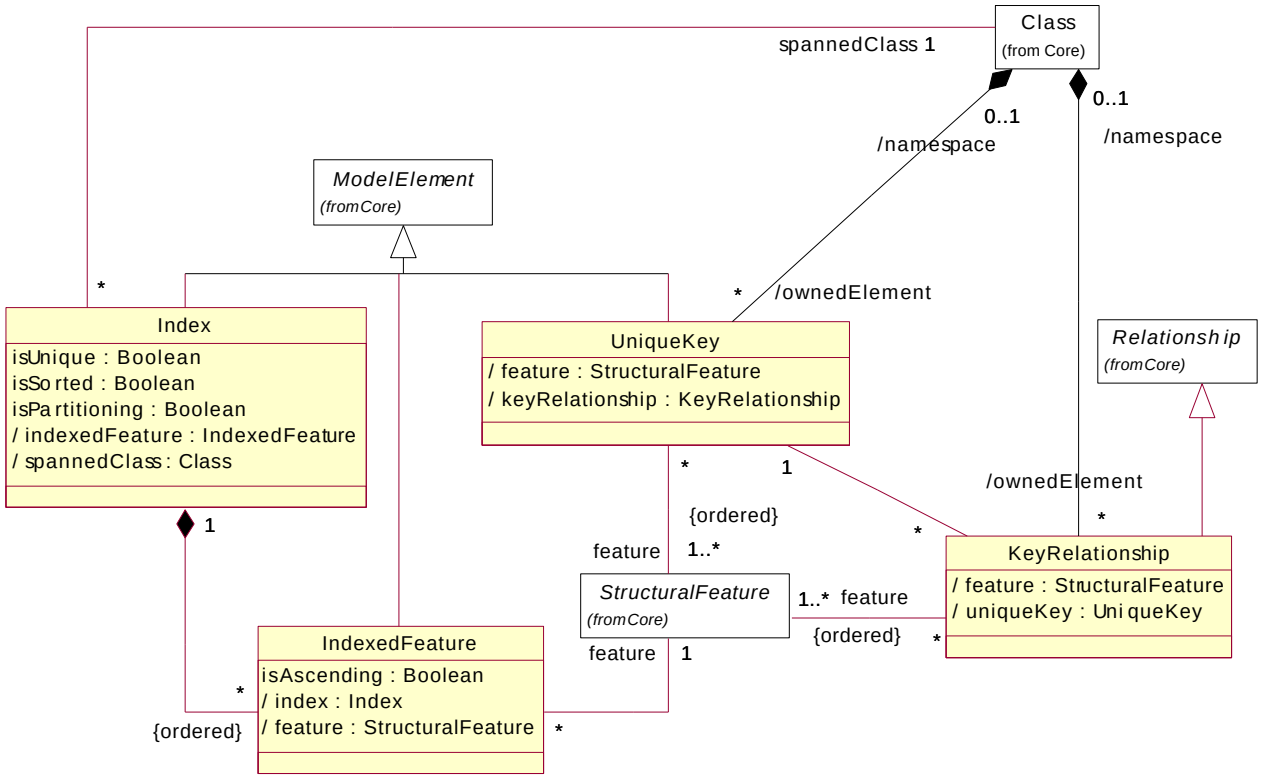
Foundation

- Data Types
  - Supporting classes for modeling of data type systems
  - Extent class represents collections of instances



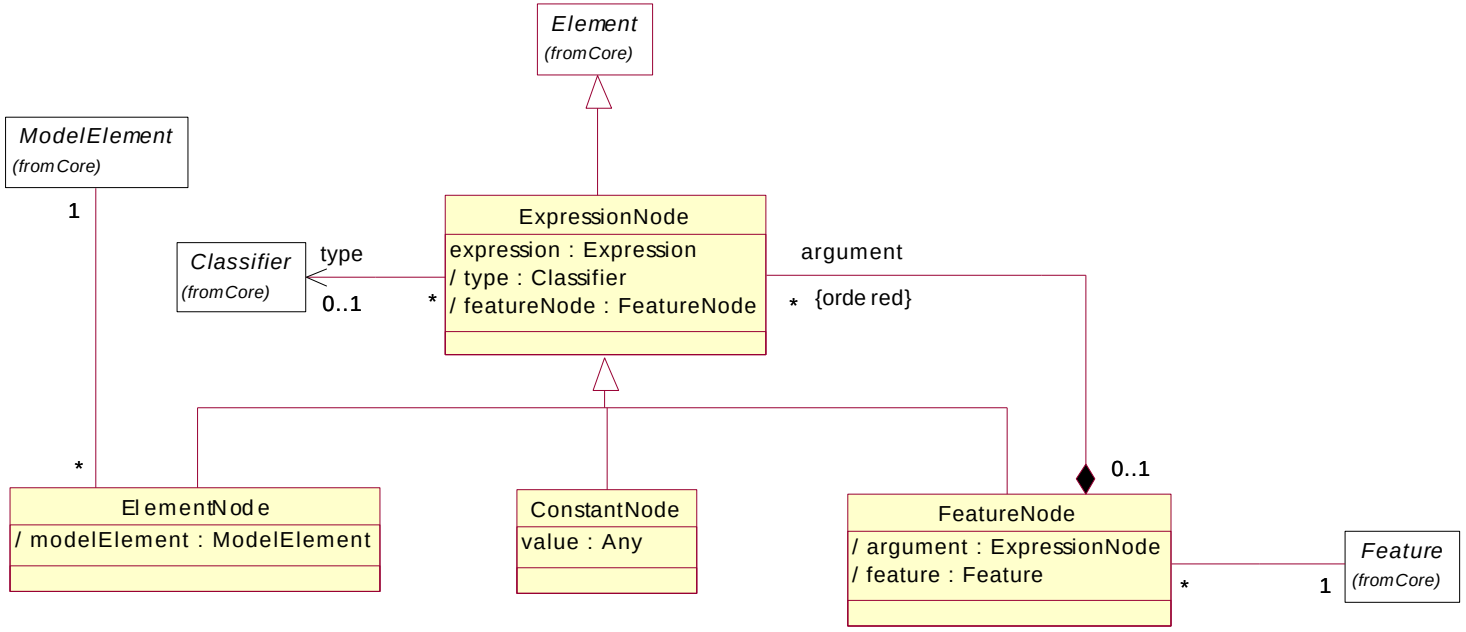
Foundation

- Keys & Indexes
  - Shared by several data resource models
  - Promotes similar representation across models



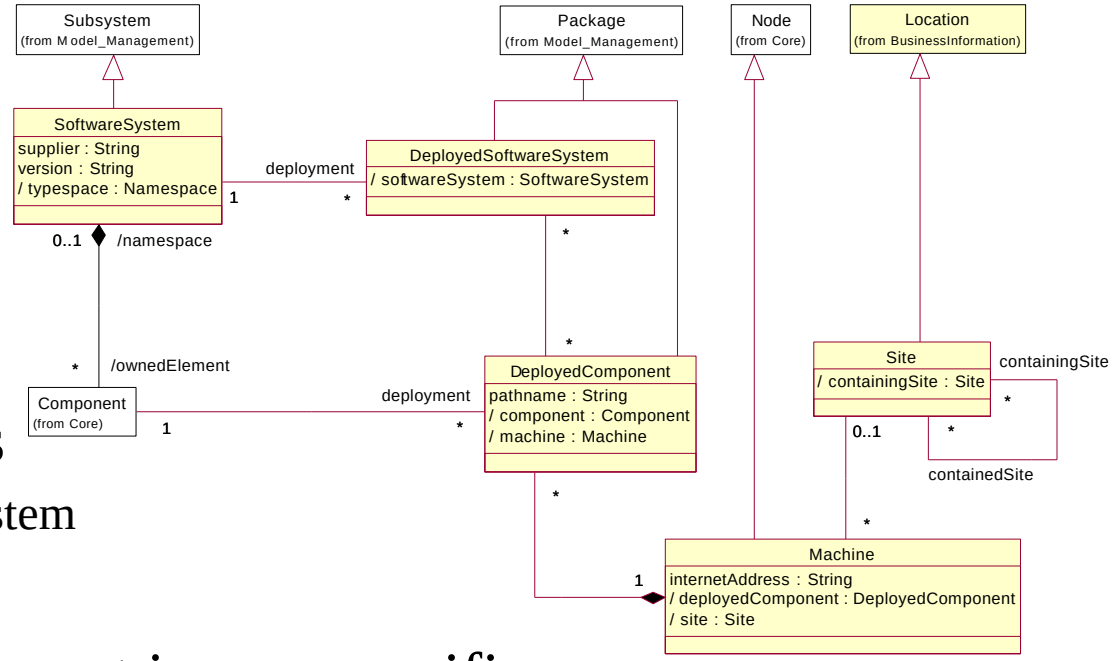
Foundation

- Expressions
  - Tree-structured, functional model of expressions
  - Full access to all CWM objects
  - Supports both “black box” and “ white box” expressions
  - Use “white box” expressions for interchange and lineage



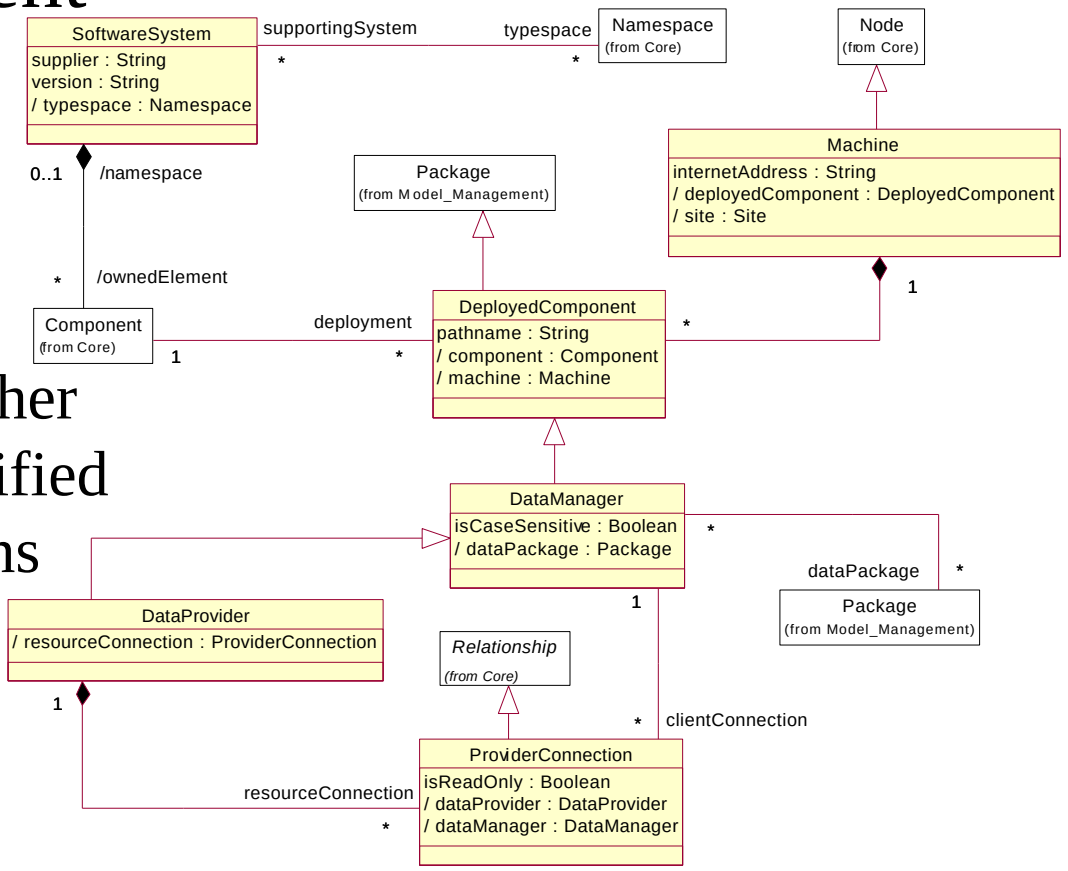
Foundation

- Software Deployment
  - SoftwareSystem
    - A software package on a CD
  - A Deployed Software System is a set of DeployedComponents
    - An installed SoftwareSystem
  - Each Deployed Component is on a specific Machine
    - An installed program



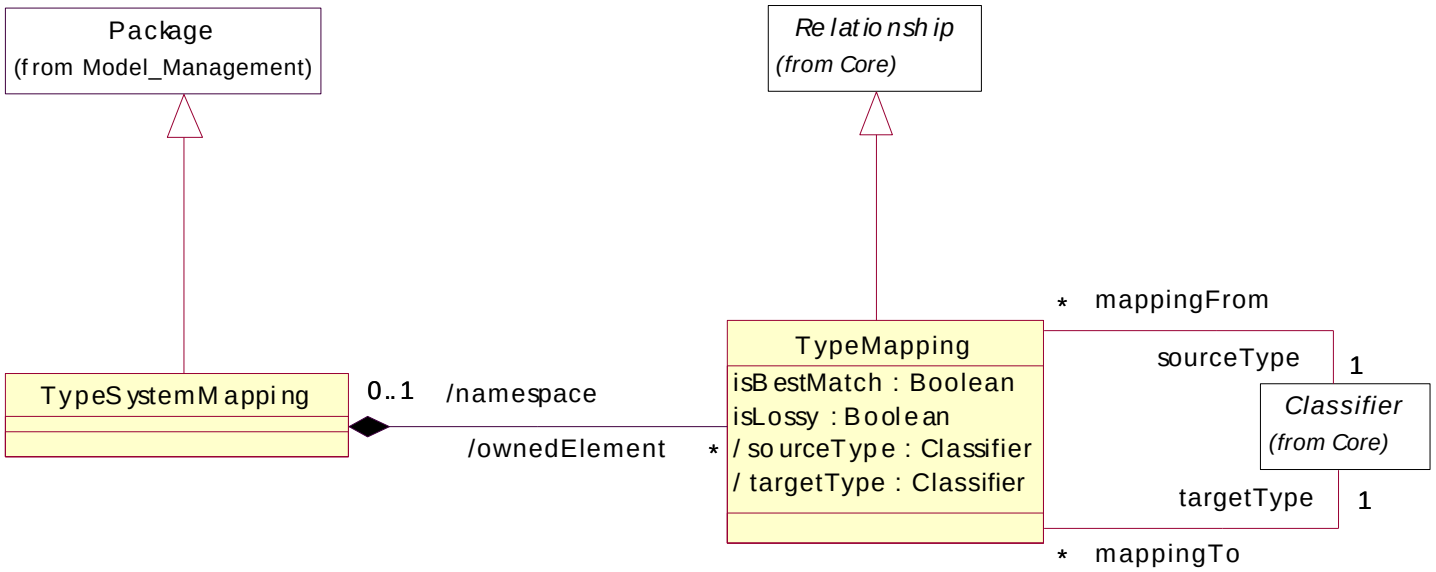
Foundation

- Software Deployment
  - DataManagers provide access to data
    - A deployed DBMS
  - DataProviders wrap other DataManagers as specified by ProviderConnections
    - ODBC and JDBC drivers



Foundation

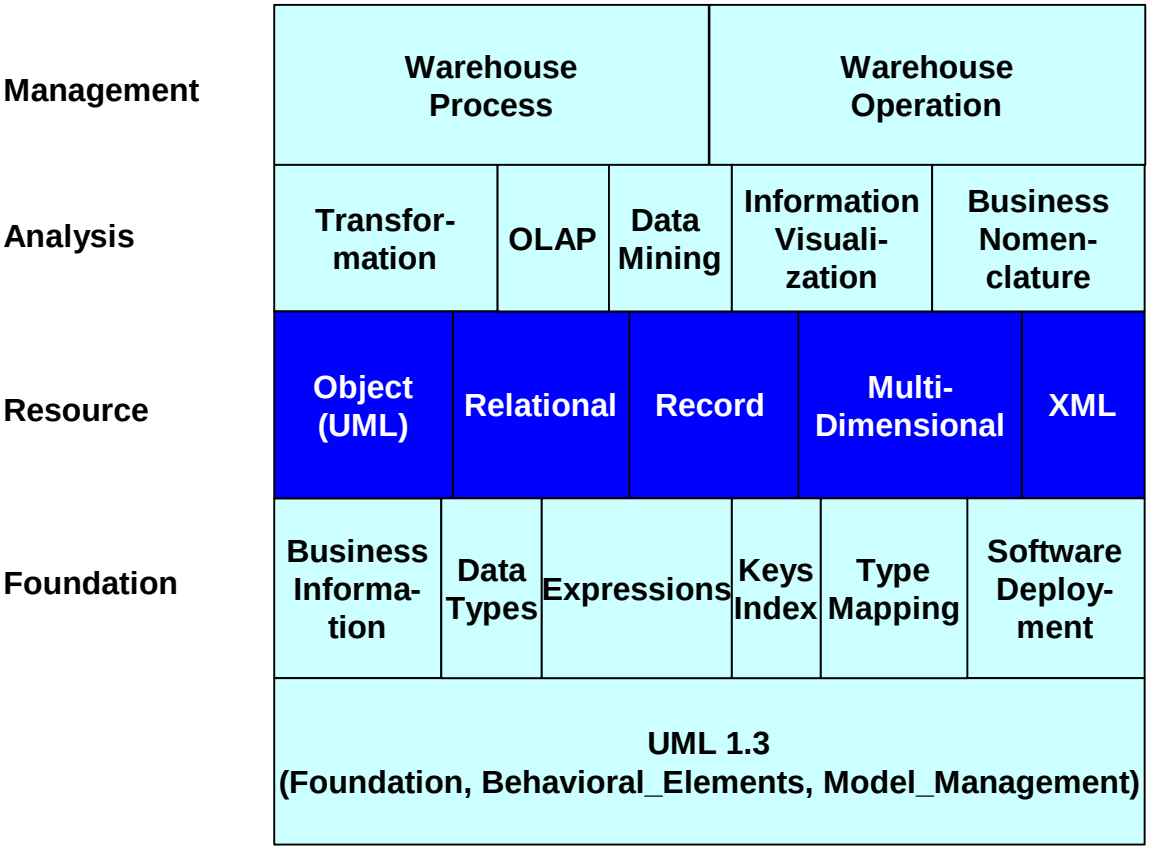
- Type Mapping
  - Map types to corresponding types in other systems
  - Designed for simple data type exchanges
  - Use Transformations for more complex mappings



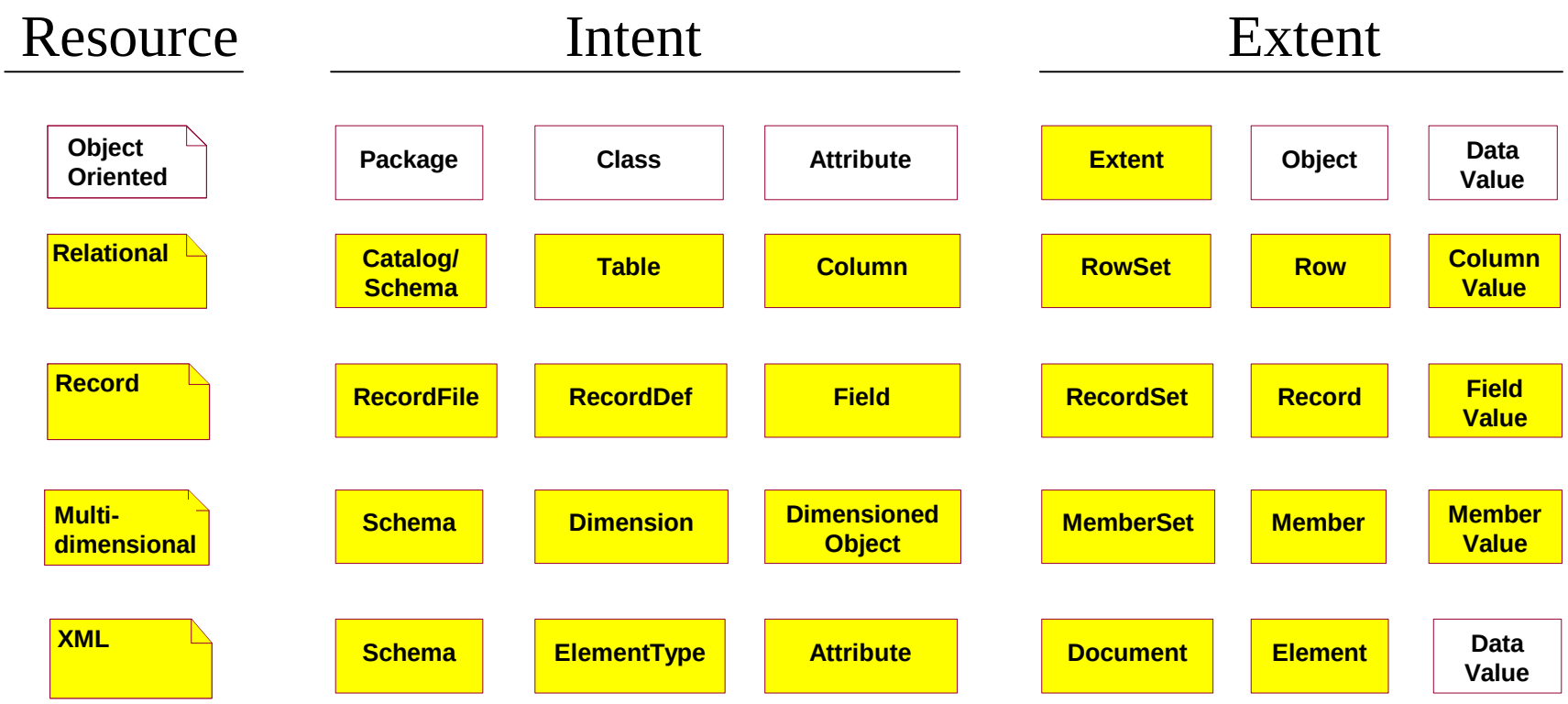
Data Resources

Describe logical and physical data containers

- Operational sources
- Warehouse targets
- Logical models

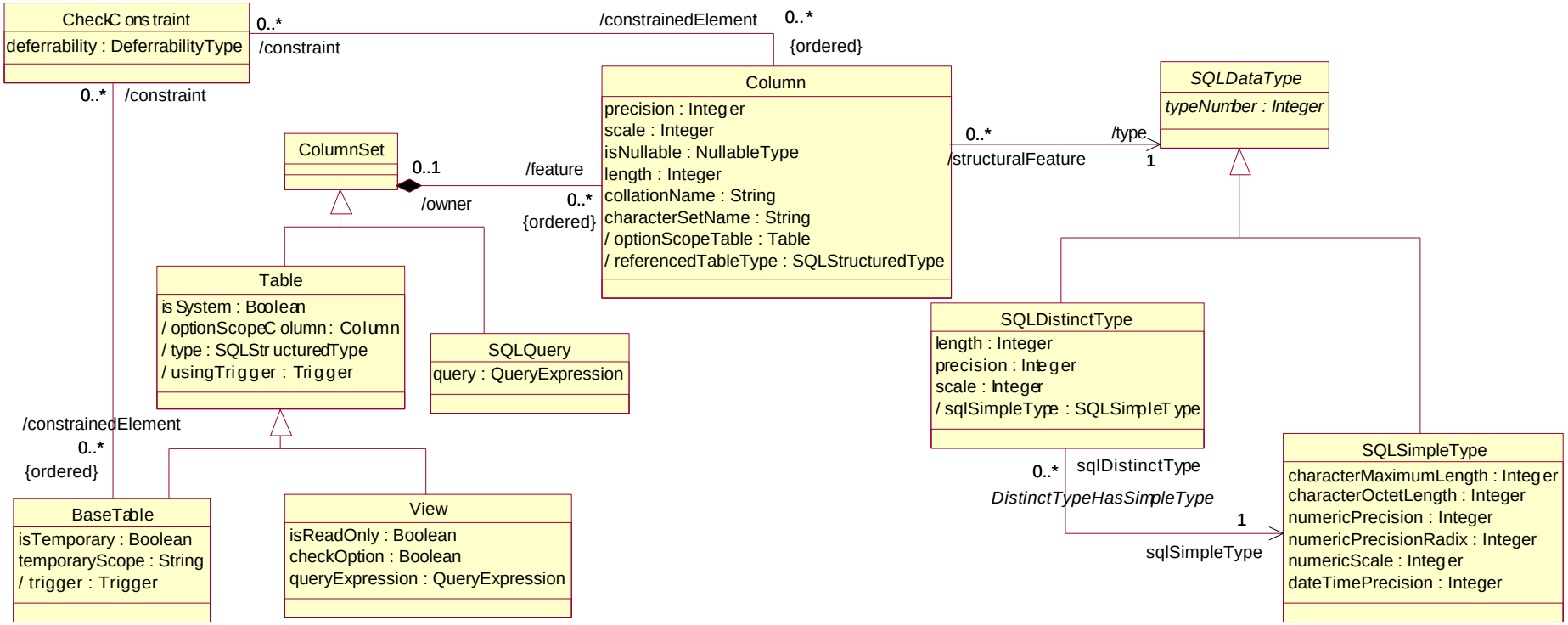


Data Resource Matrix



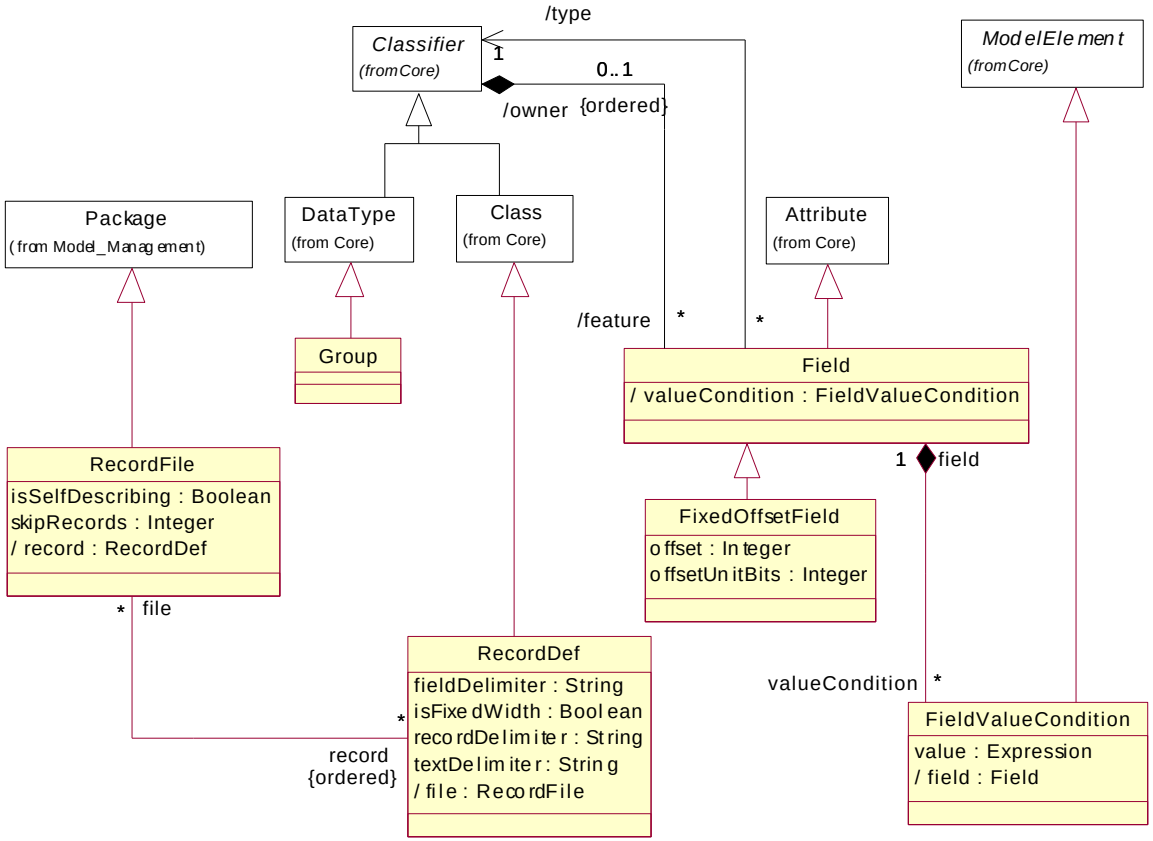
Data Resource Packages

- Relational
  - RDBMS catalogs & ODBC/JDBC client catalog views
  - SQL-99 compliant



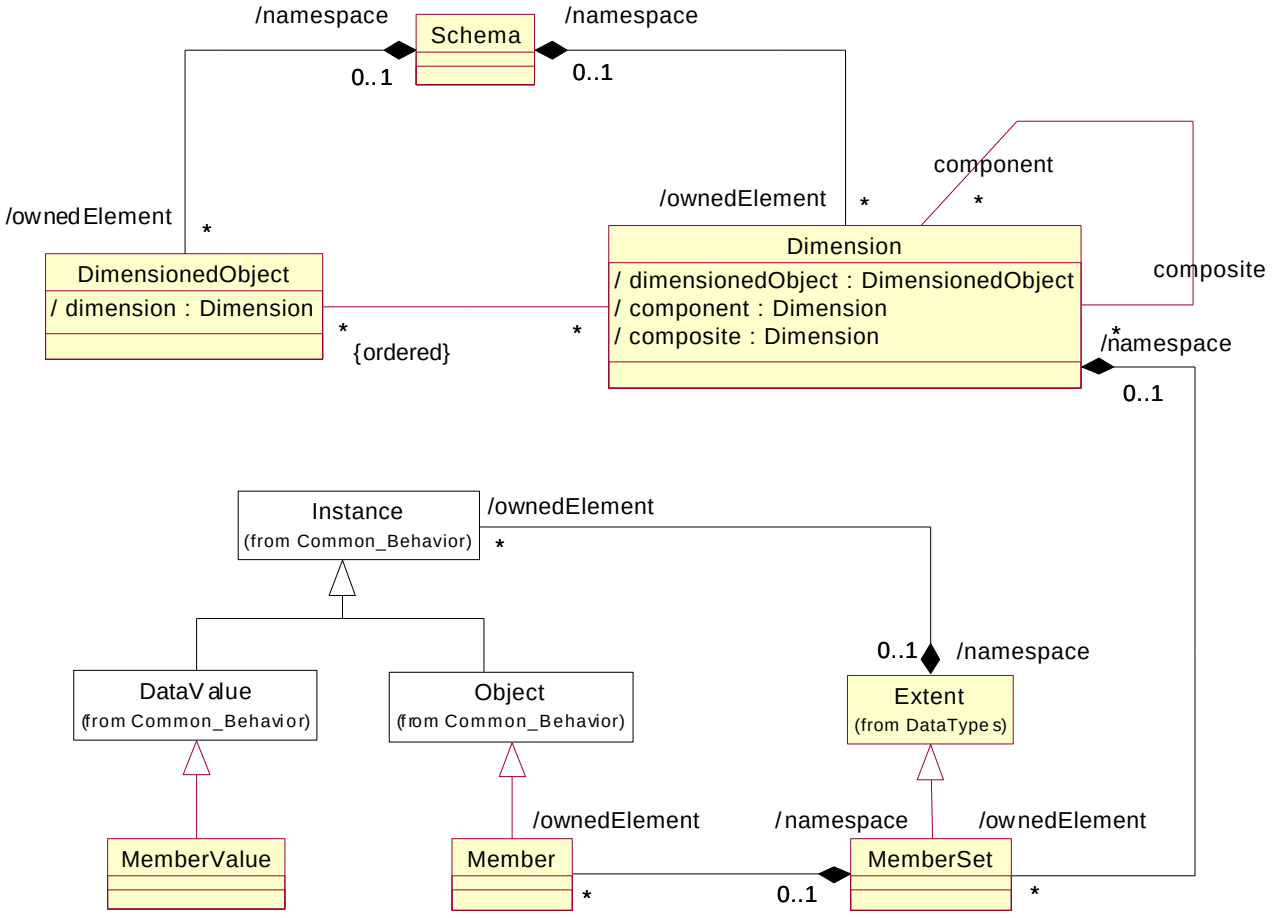
Data Resource Packages

- Record
  - Basis for traditional databases & files
  - Self-describing, delimited, & fixed-offset supported



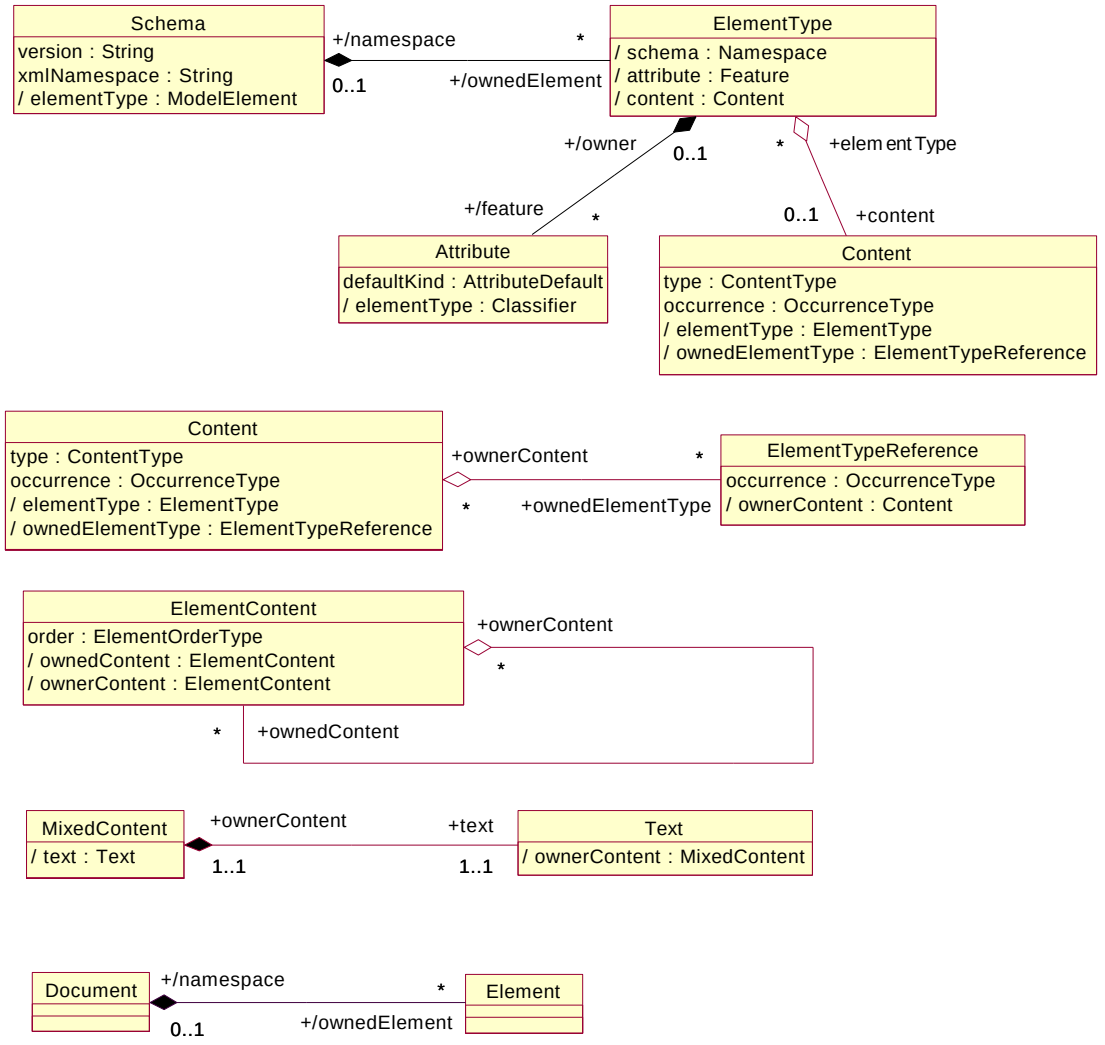
Data Resource Packages

- Multidimensional
  - Physical representation of multidimensional databases



Data Resource Packages

- XML
  - Supports XML 1.0
  - Basis for XML documents
  - Allows use as sources and as targets



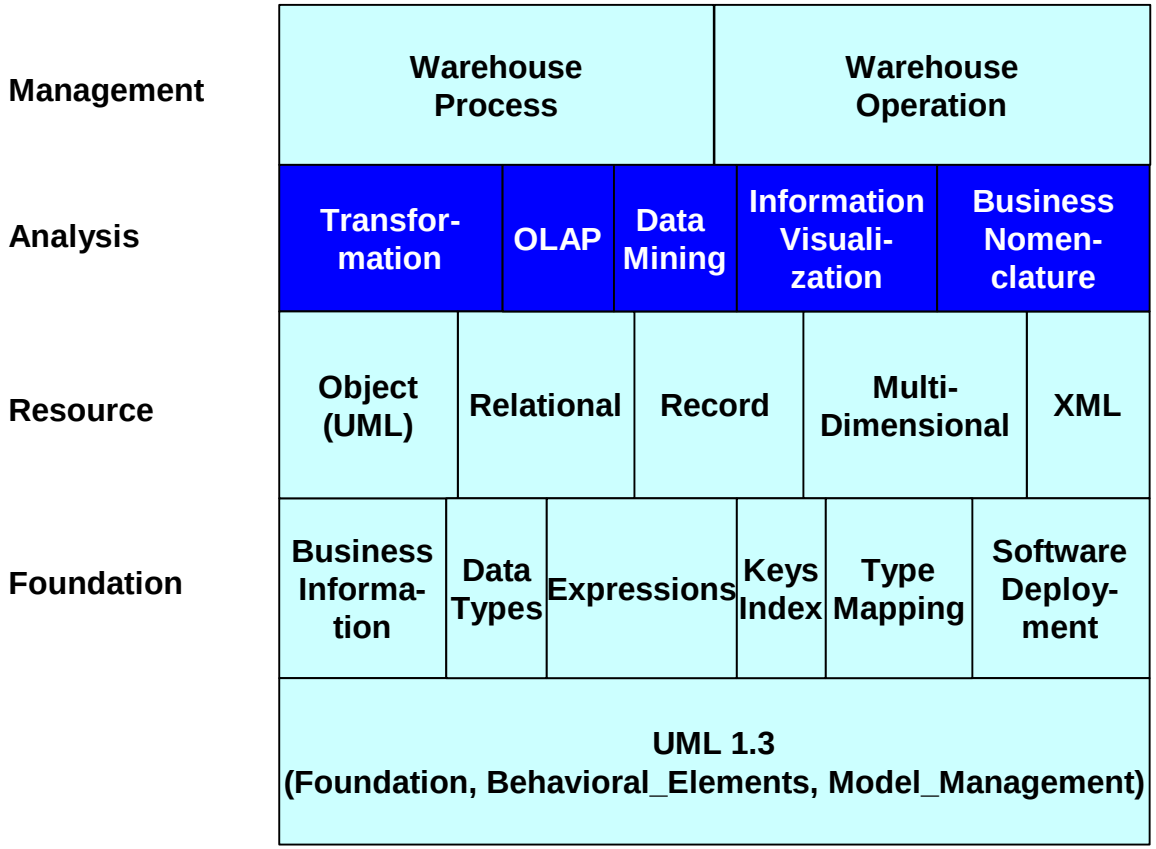
CWM Metamodel, Part 2

John Poole
(john_poole@hyperion.com)

Data Analysis

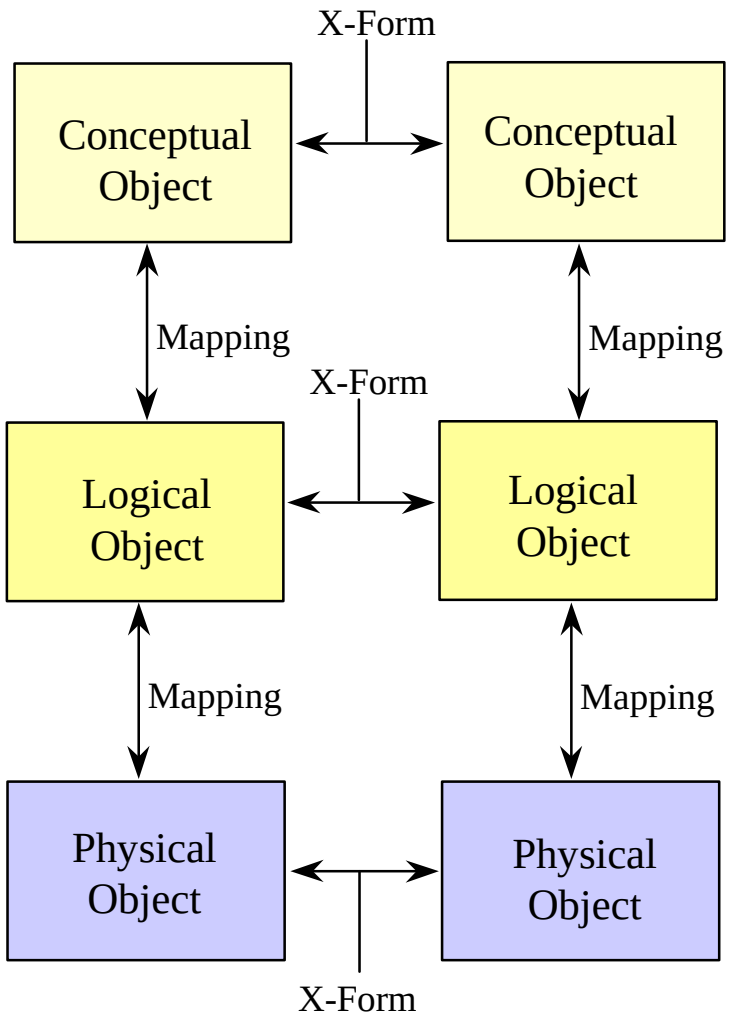
Describes production & analysis of warehouses

- Describe analytical & deployment structures
- Design data movement & transformations
- Deployable on a number of data resources



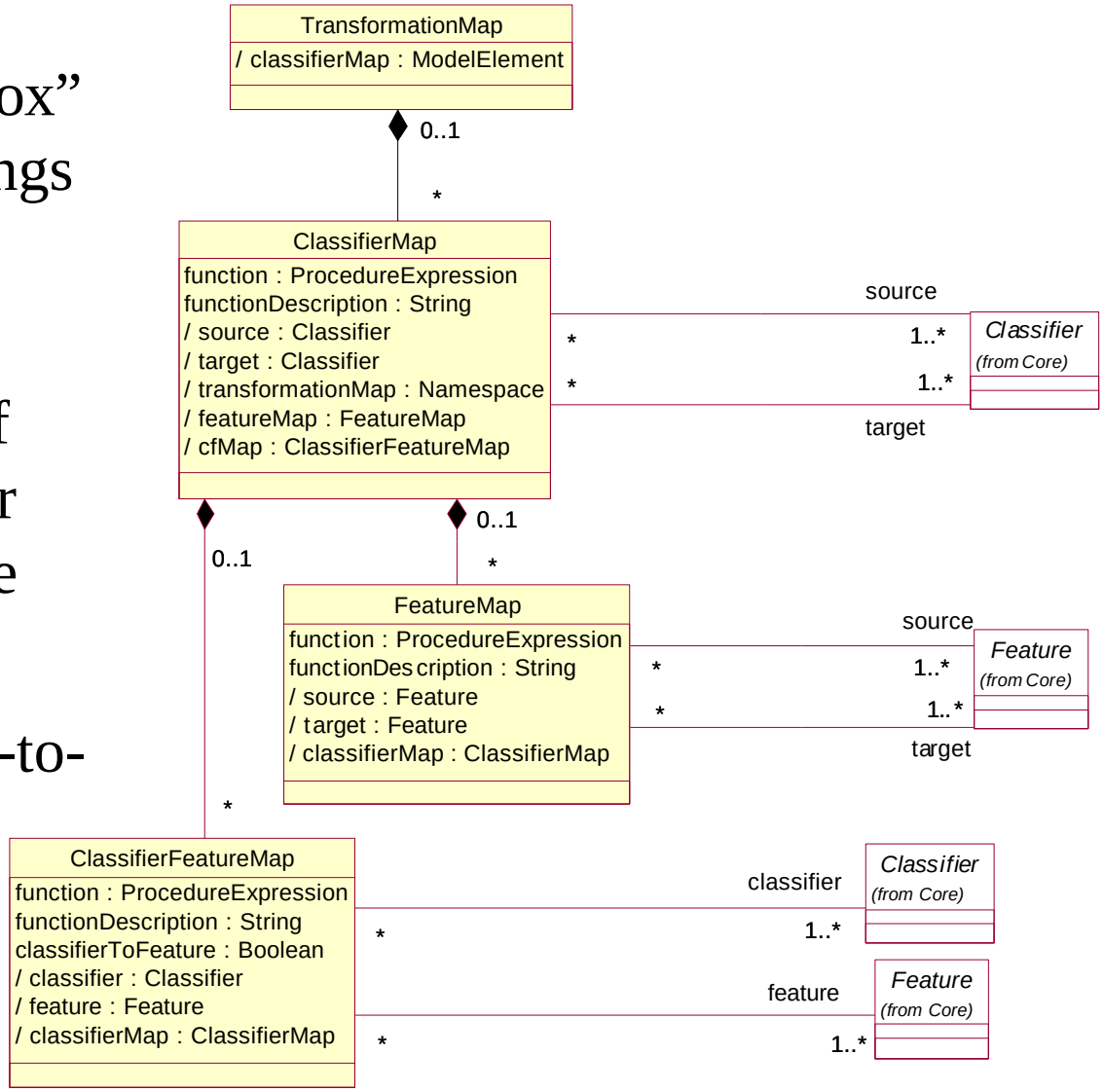
Transformation

- General mechanism describing data movement and lineage
- Generic transformations from any physical object to any other physical object
- Maps logical structures and concepts in the warehouse onto physical implementation
- Provides for multiple physical implementations of logical structures and concepts



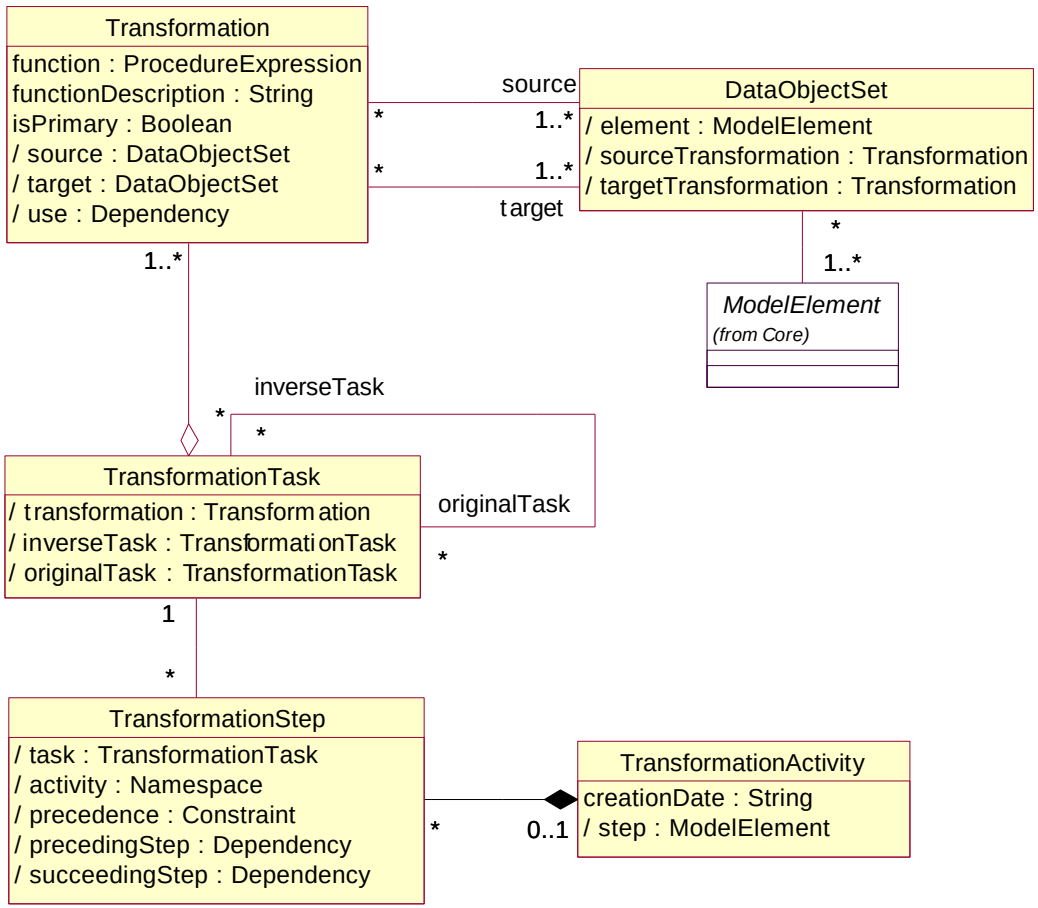
Transformation

- Support for “White-Box” transformation mappings
- Leverages the UML hierarchy: Mapping of Classifier-to-Classifier and Feature-to-Feature
- Mapping of Classifier-to-Feature



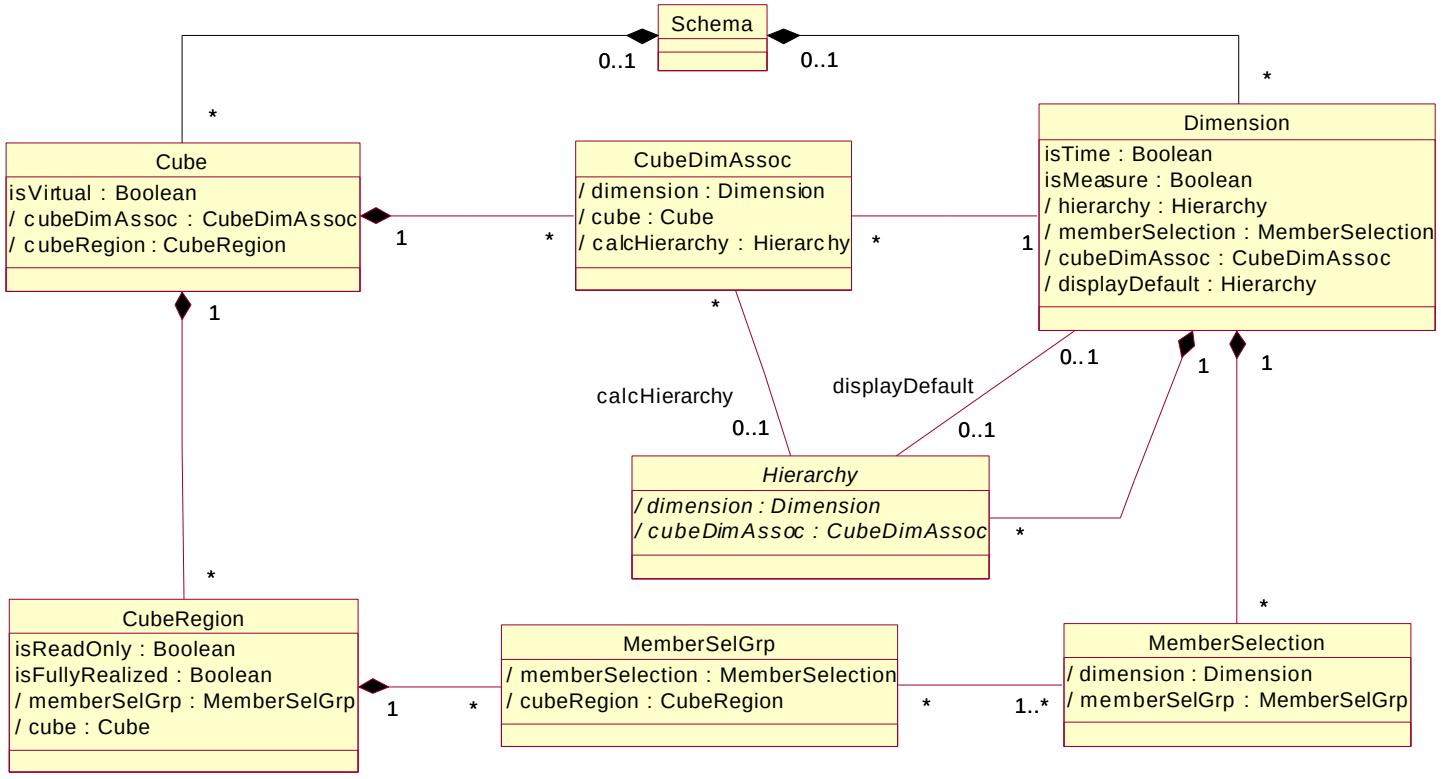
Transformation

- Transformations can be specified for arbitrary model elements
- Reification of the transformation “process”
- Relates to Warehouse Process and Warehouse Operation metamodels



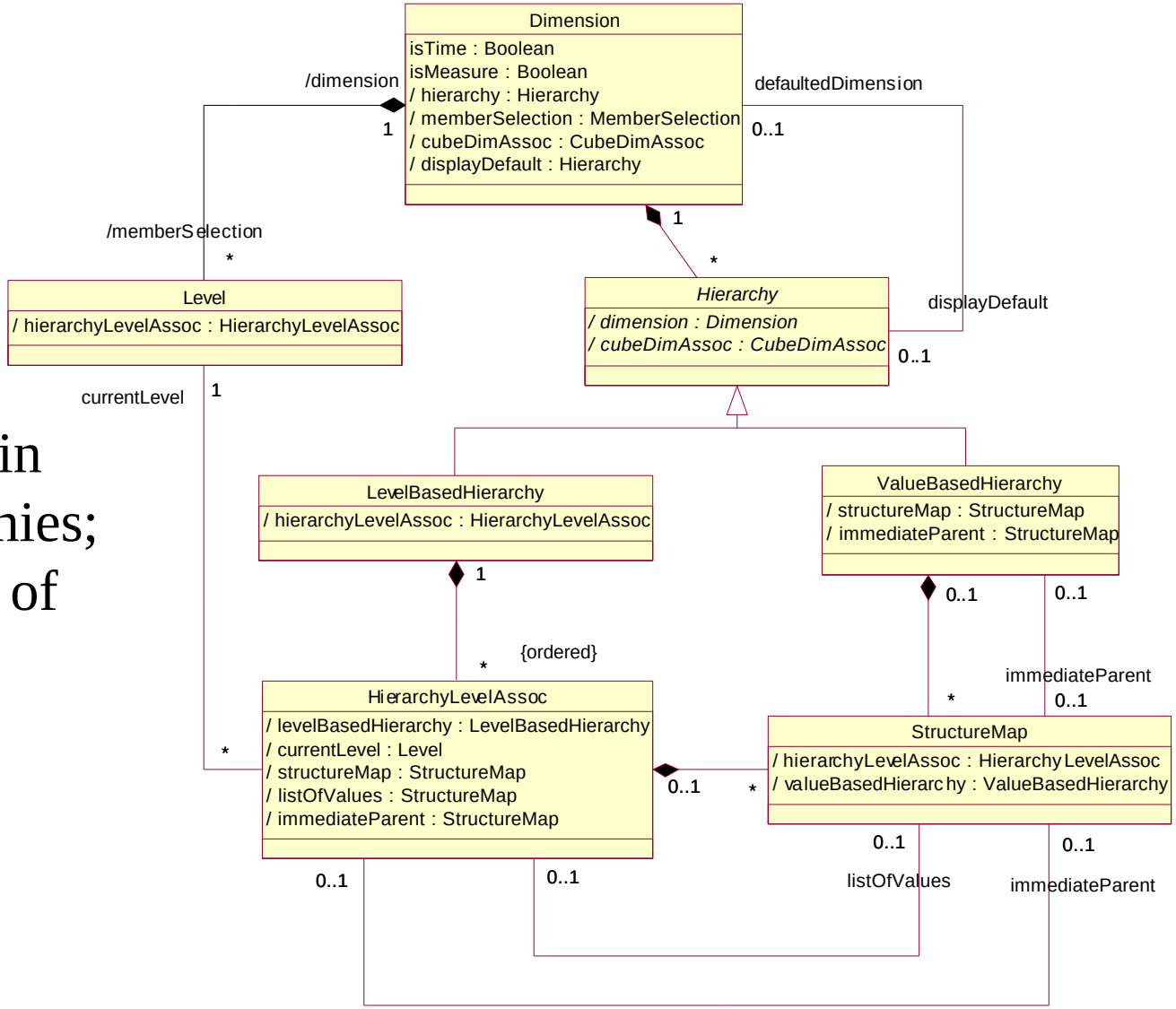
OLAP

- Analytical model: Cubes, measures, dimensions, attributes, levels, and hierarchies
- Cubes contain multiple measures and are implemented via cube regions



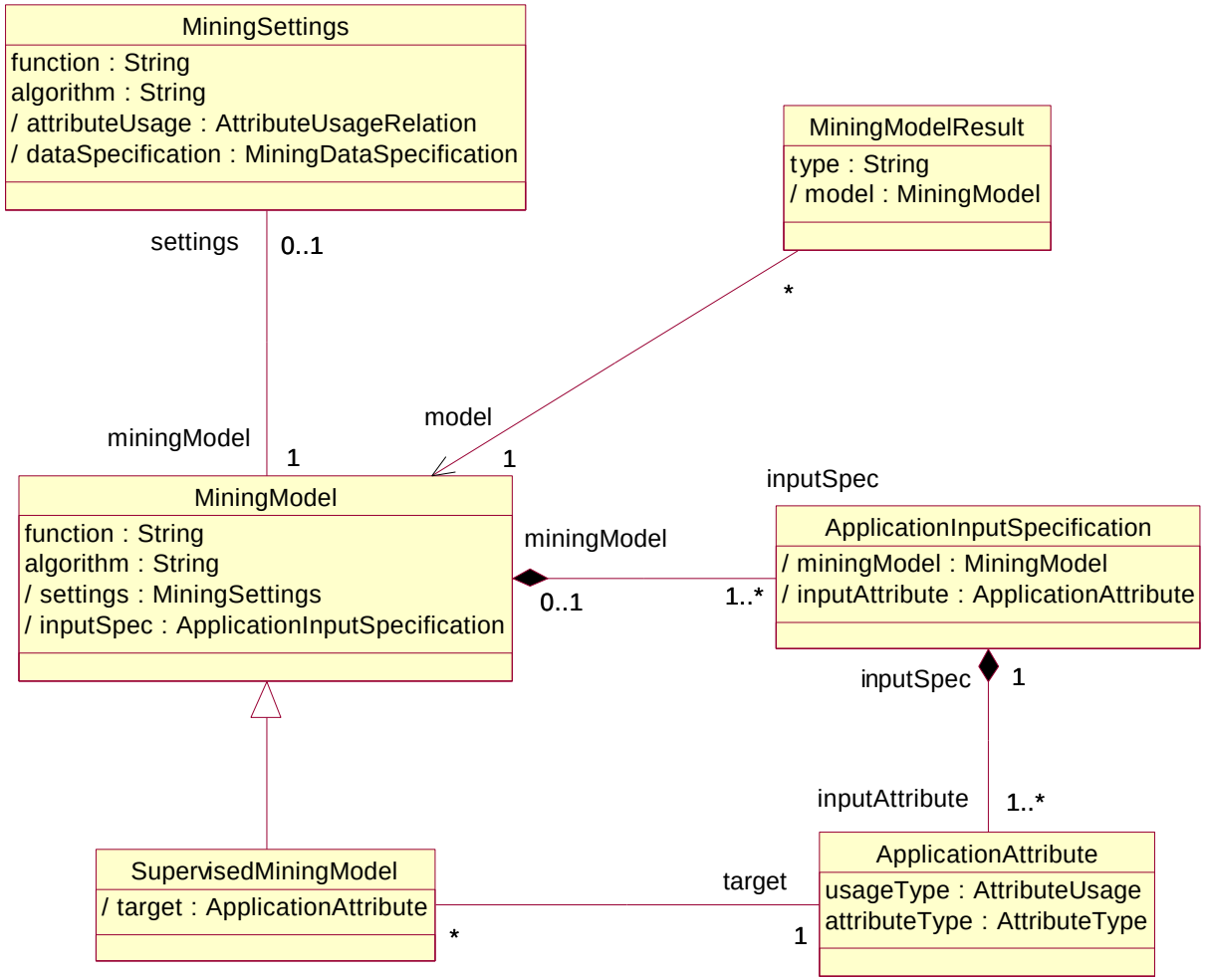
OLAP

- Dimensions: Multiple levels, attributes, and hierarchies
- Levels are used in multiple hierarchies; support a subset of the dimension attributes



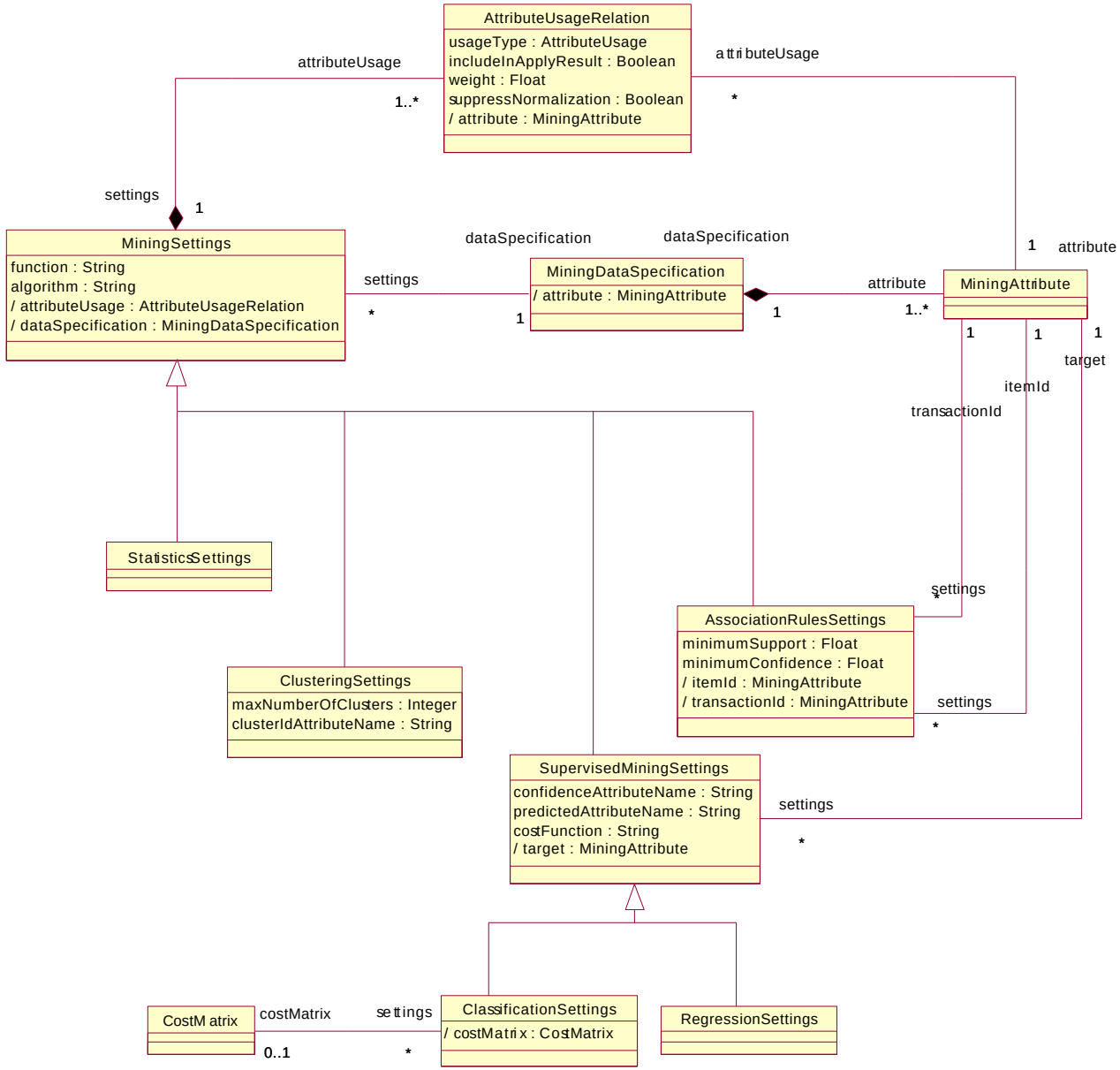
Data Mining

- Models the fundamental meta data necessary for constructing and managing Data Mining models
- Three conceptual areas: Model, Settings and Attributes



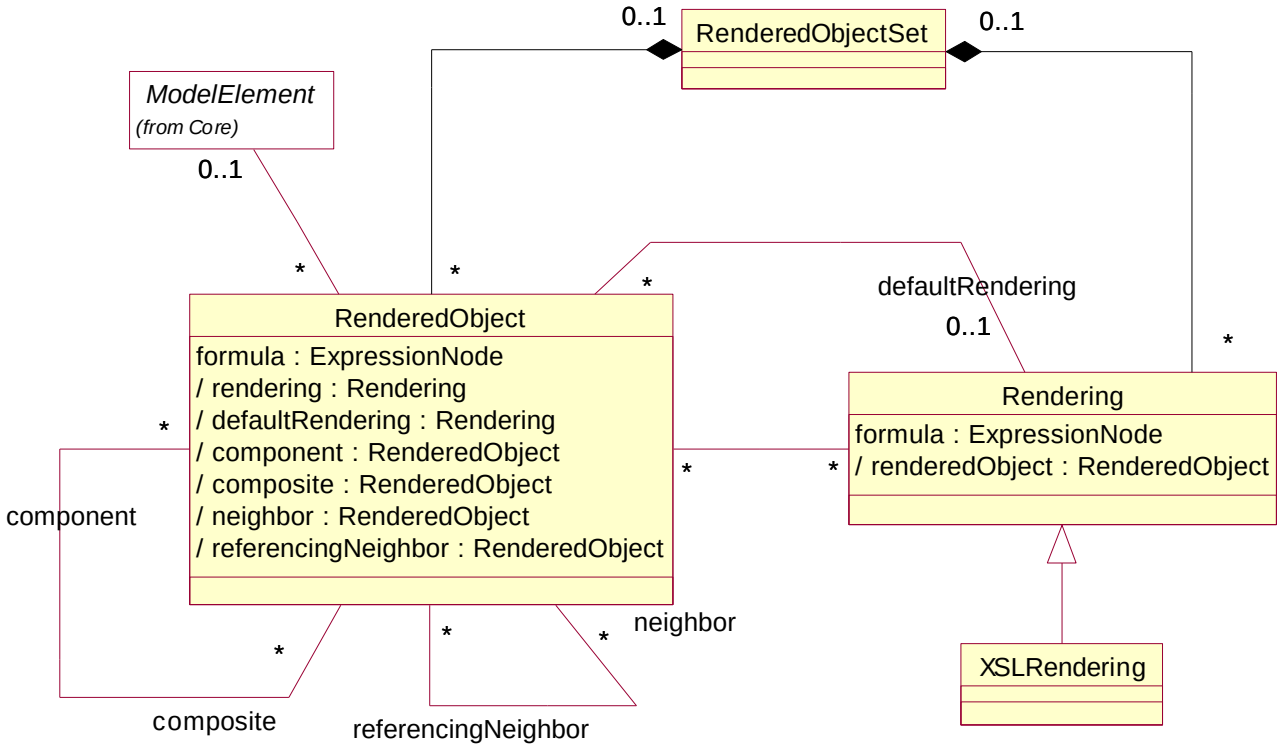
Data Mining

- Models major settings types: Statistical, Clustering, Association Rules, Supervised
- Relates settings to specification and attributes



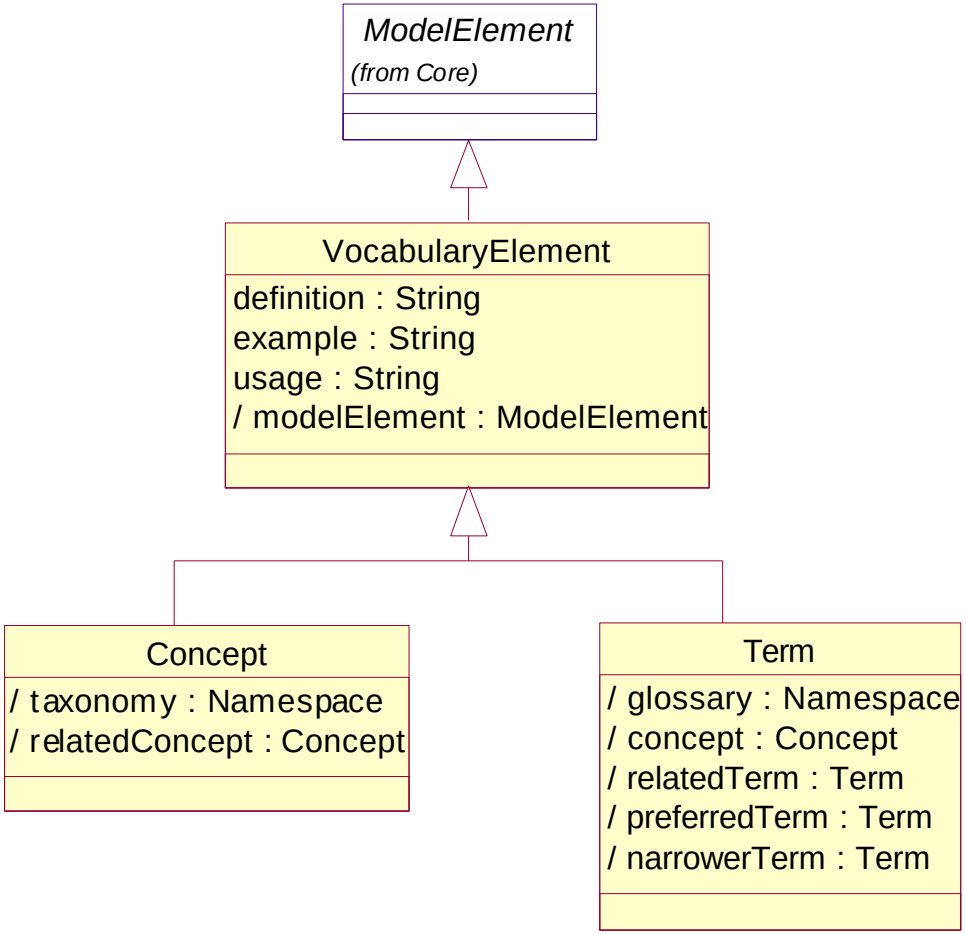
Information Visualization

- CWM core metamodel for information visualization and publishing
- Separation of “logical” rendered object from rendering “transformation”
- Recursive/composite structuring



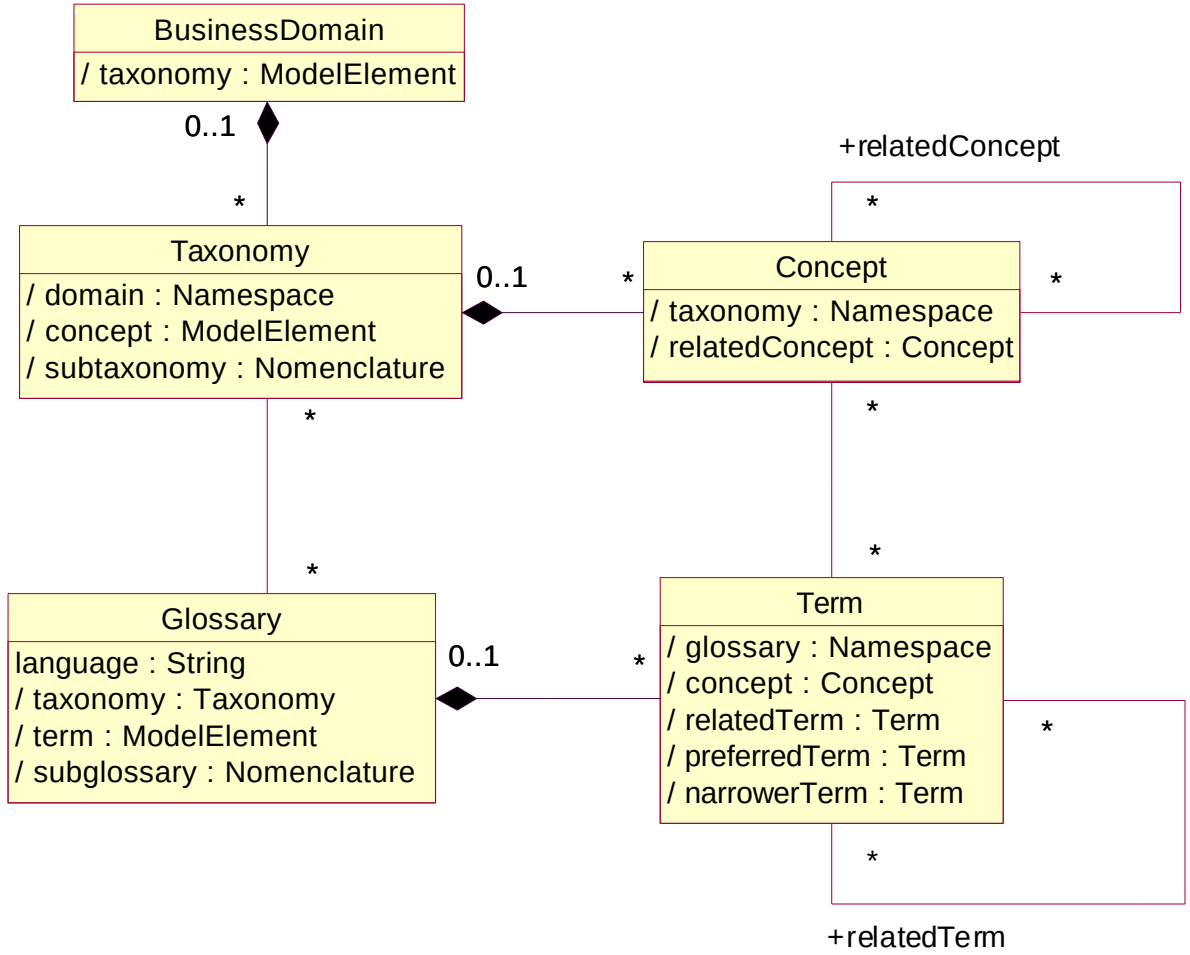
Business Nomenclature

- CWM metamodel for "Business Metadata"
- Intended for Data Warehousing and Business Intelligence domains
- Common business terms and concepts
- Used in conjunction with analysis and reporting tools



Business Nomenclature

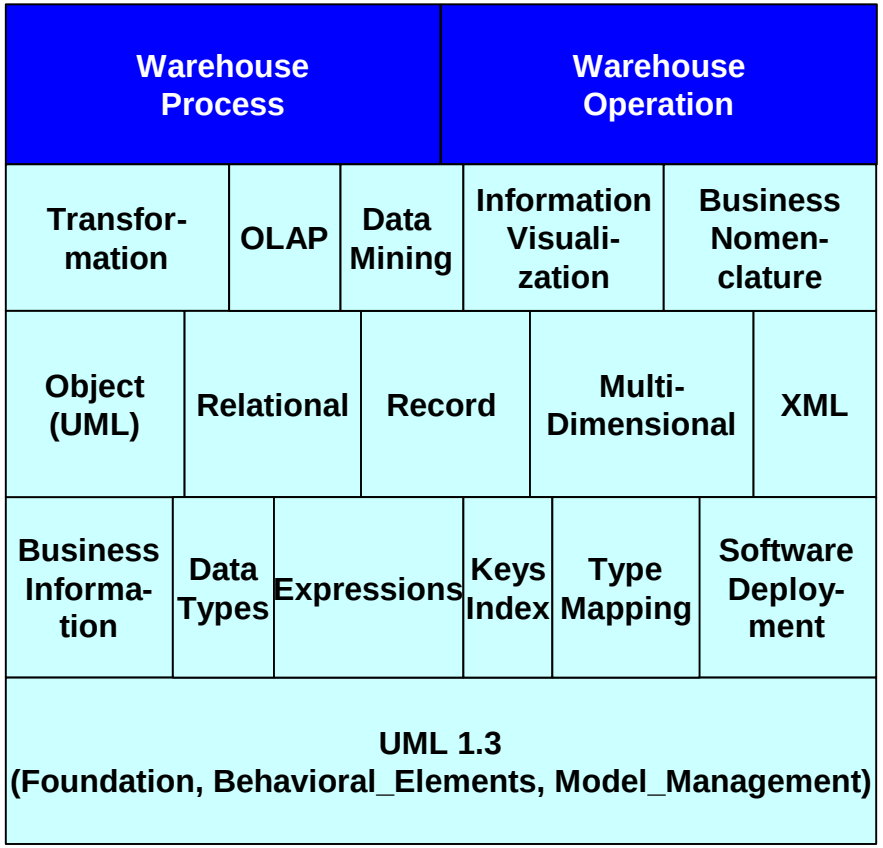
- Taxonomies consists of concepts
- Glossaries consist of terms
- Taxonomies and Glossaries can be associated
- All are relevant to some “business domain”



Warehouse Management

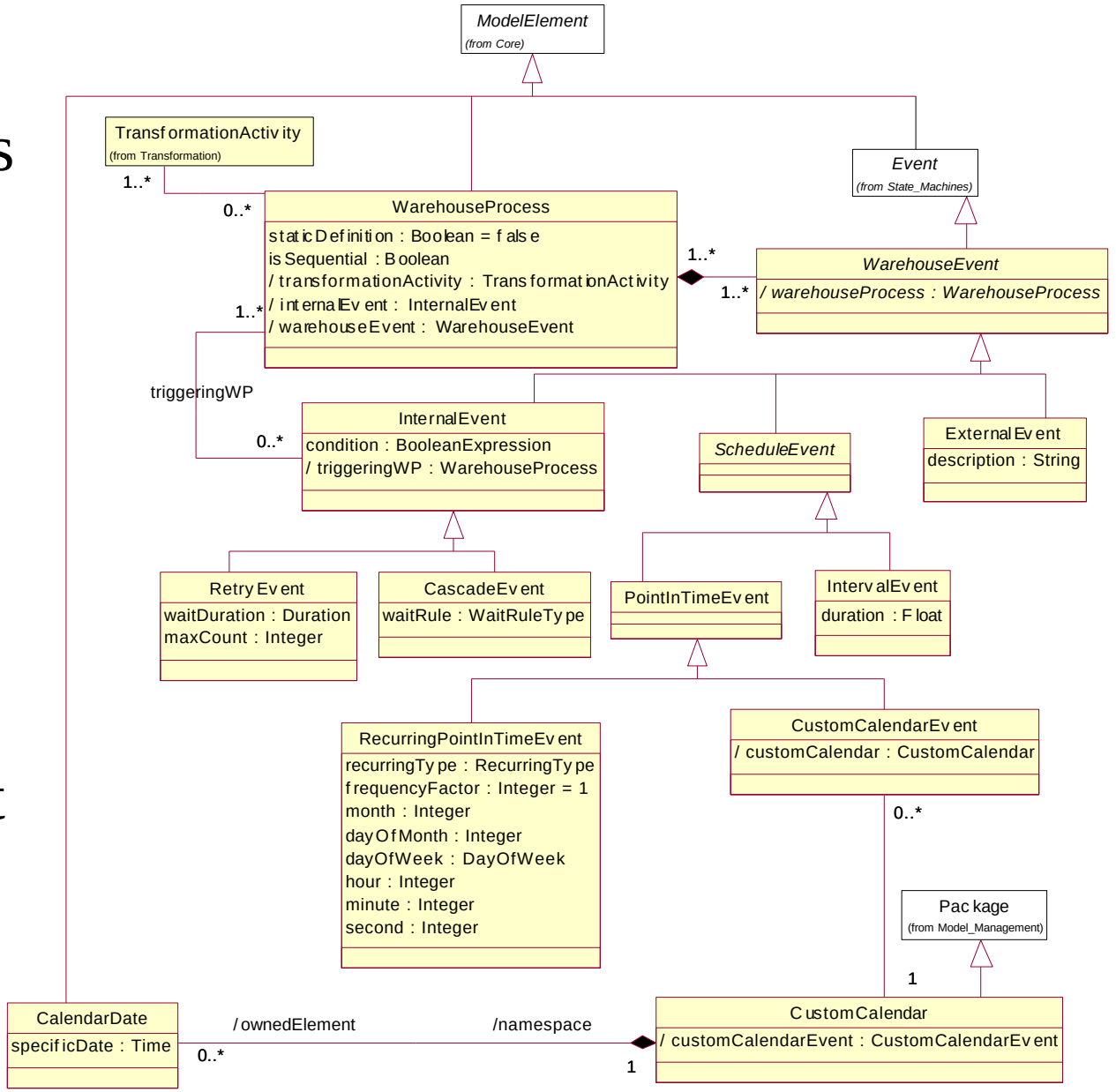
Orchestrates warehouse activities

- Warehouse Process relates
  - Transformations
  - Triggering events
- Warehouse Operation logs
  - Transformation activity
  - Metrics



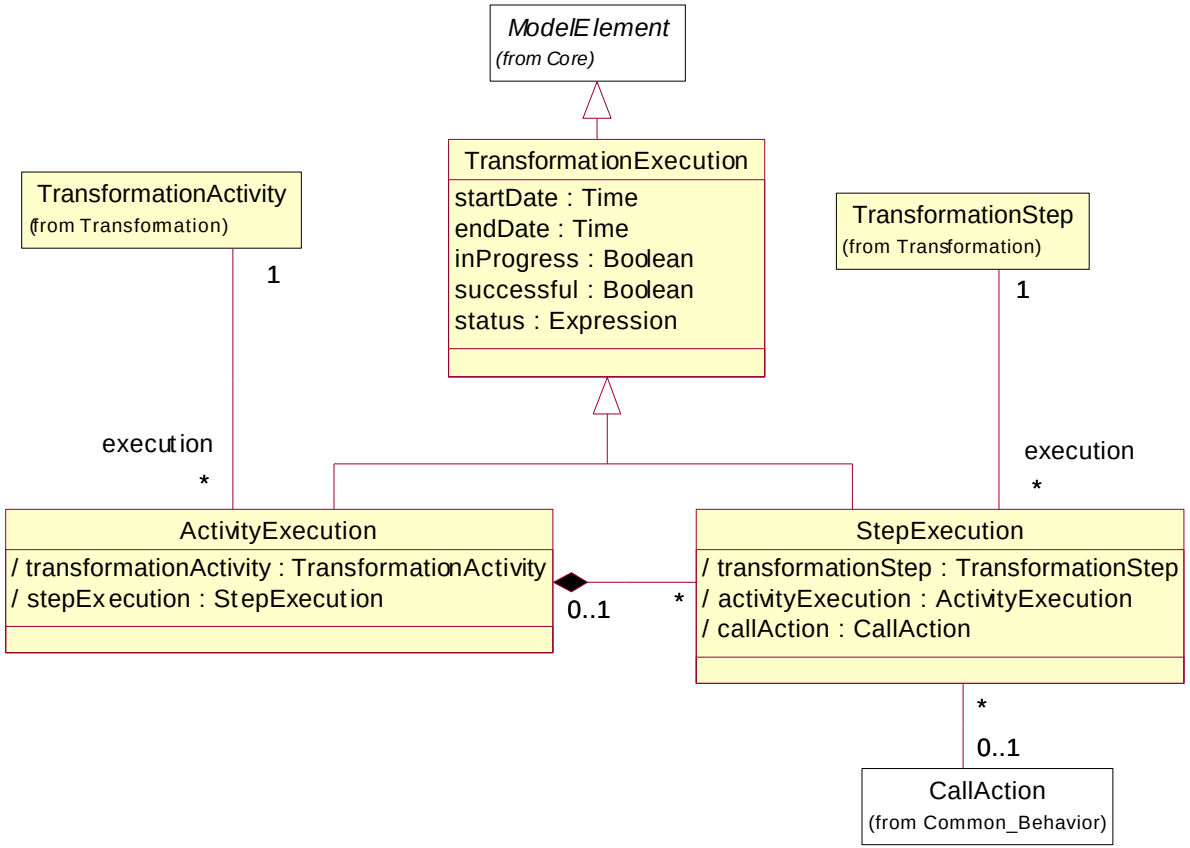
Warehouse Process

- A Warehouse Process identifies warehouse tasks and the events that trigger them (“what gets done”)
- Relates Transformation Activity to Event types



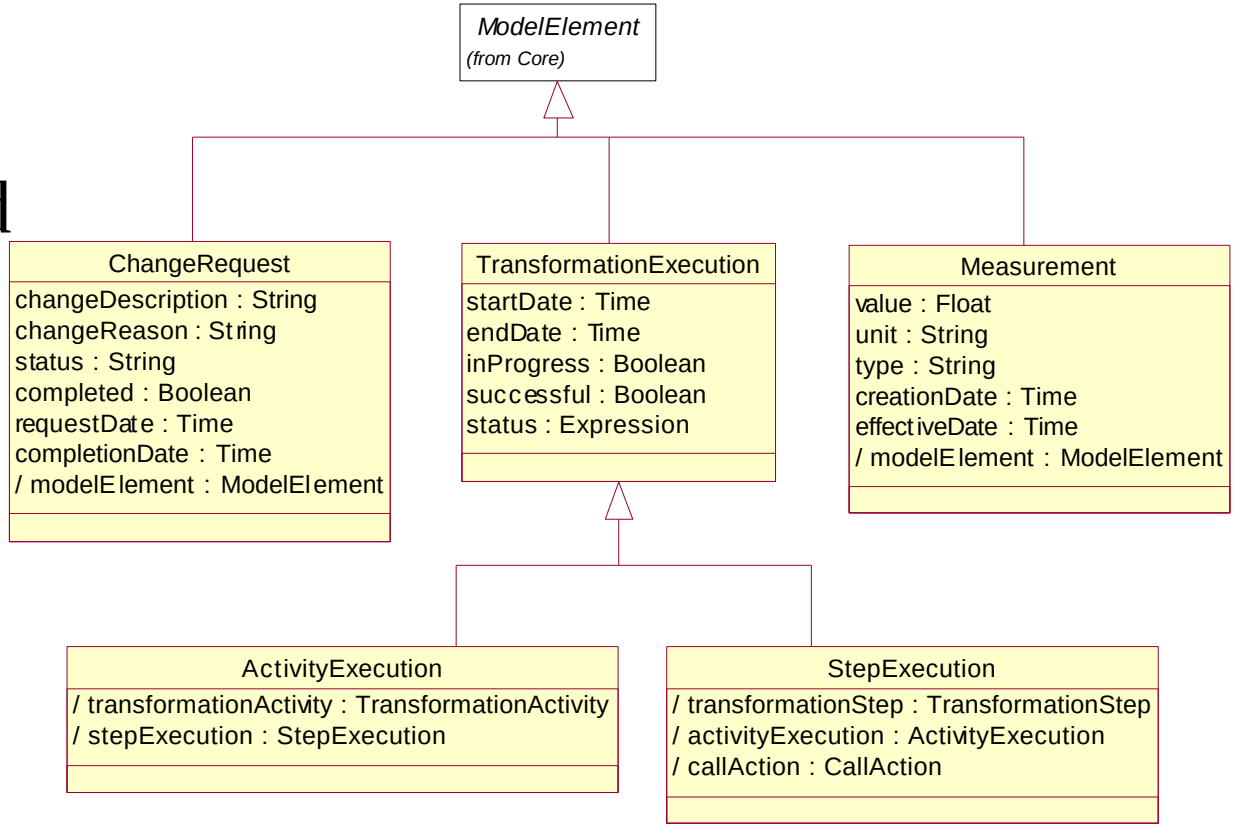
Warehouse Operation

- Activity and Step Execution track details of executions of Transformations (tracks “what got done when”)
- Step Execution may be related to a UML CallAction model element



Warehouse Operation

- ChangeRequest objects represent a proposed change or one that has been implemented or rejected.
- Measurement objects can hold values for any object (such as volumetric details)

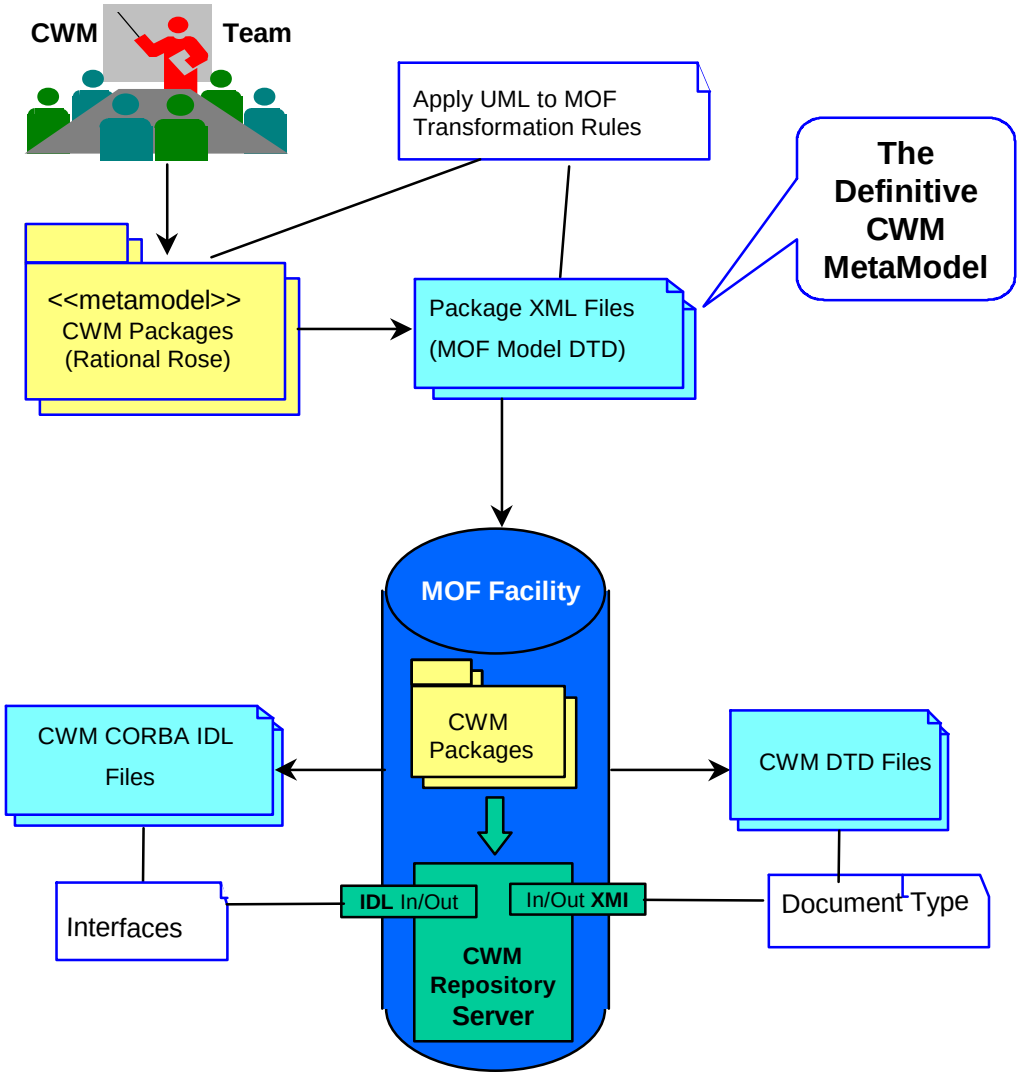


CWM Generation, Validation, and Extension

David Mellor
(dmellor@us.oracle.com)

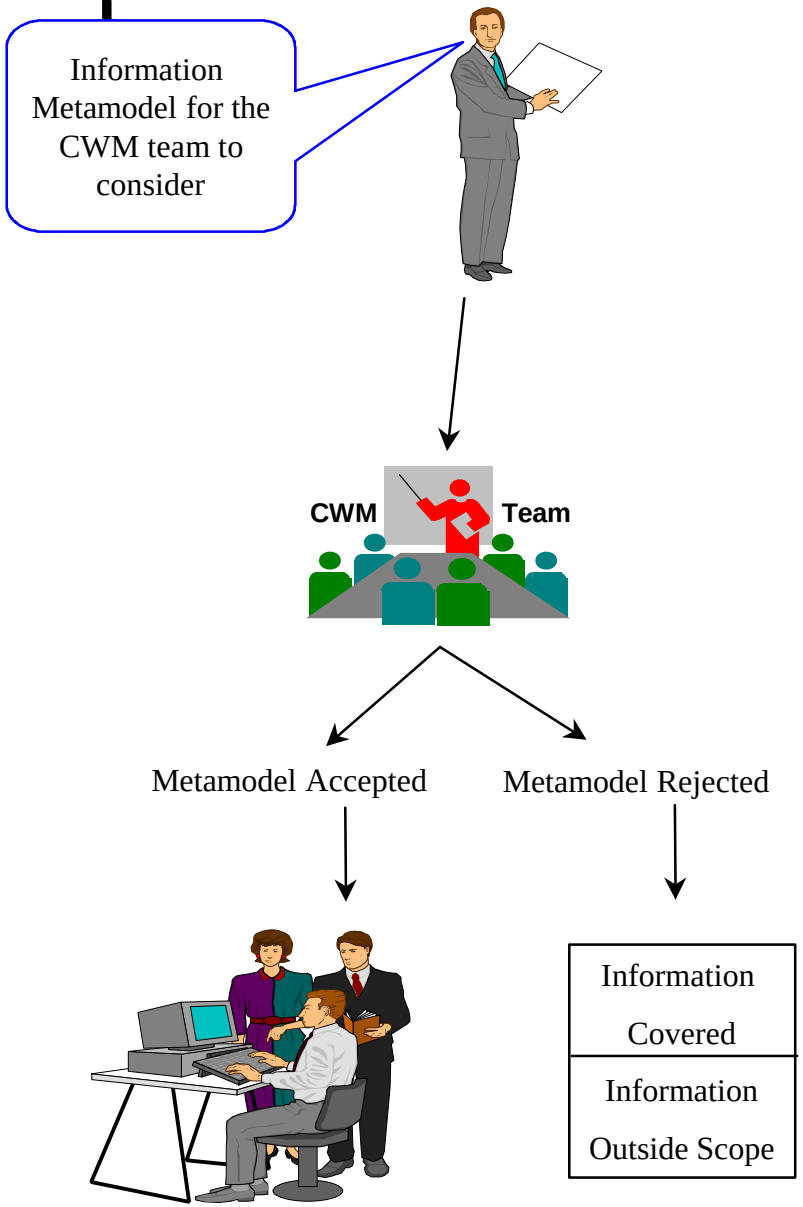
CWM Generation

- Metamodel
  - Single logical source
  - Multiple packages
- Generated for each package
  - XML document
  - CWM DTD
  - CWM IDL



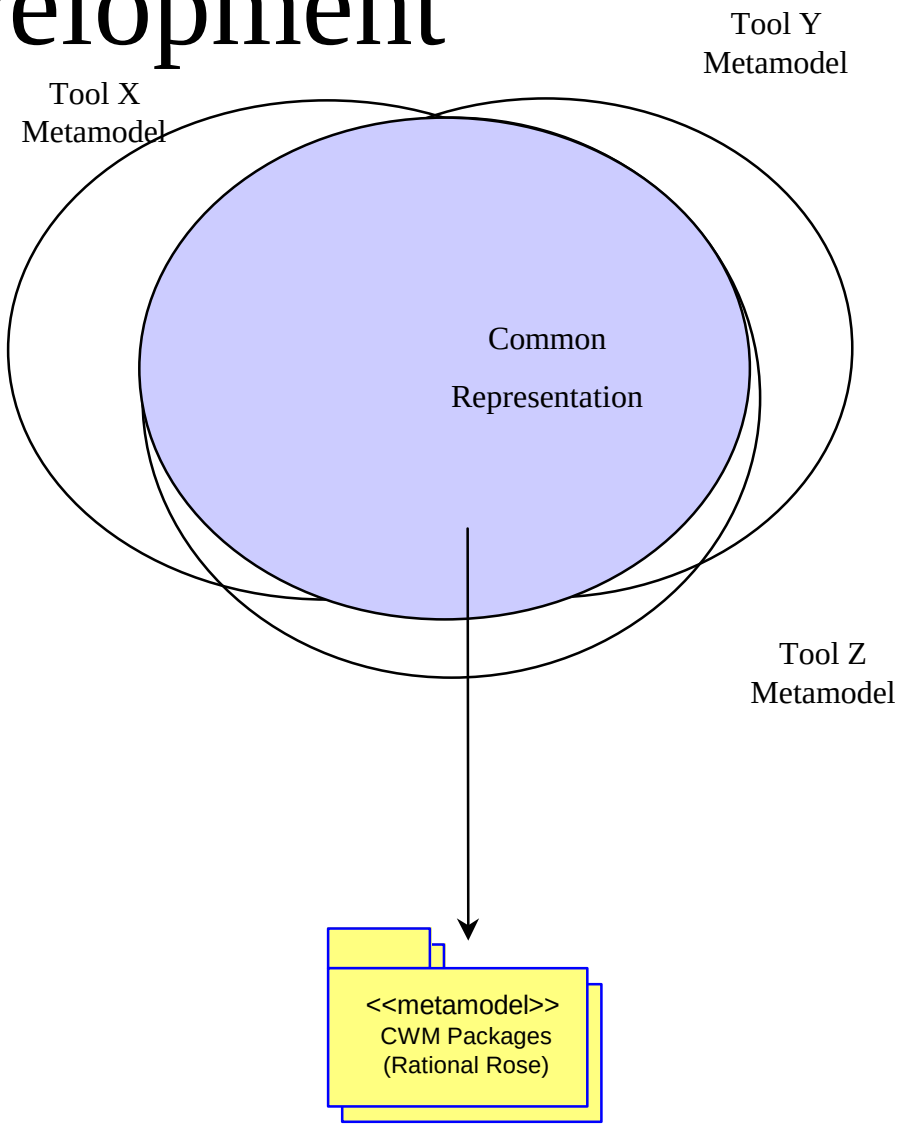
CWM Development

- Metamodel Proposal
  - An information metamodel is proposed to be included in the submission
  - Group analysis to determine if the metamodel should become part of CWM
- Model Team
  - A team is formed to develop a metamodel as part of the CWM submission



CWM Development

- Metamodel Development
  - Metamodels constructed by domain knowledgeable modelers
  - A CWM Metamodel is constructed by analyzing common portions of existing Warehouse tool models as well as public reference models
  - Tool logical models can be re-constructed using CWM as common starting point



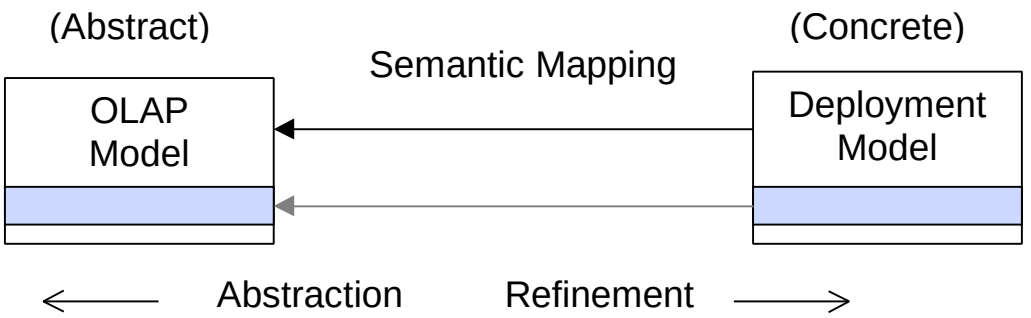
CWM Validation

- Use Case Scenarios
  - Develop use cases of the individual models
  - Develop representative use cases that involve several packages used in combination
  - Develop use cases that represent entire target tools

CWM Validation

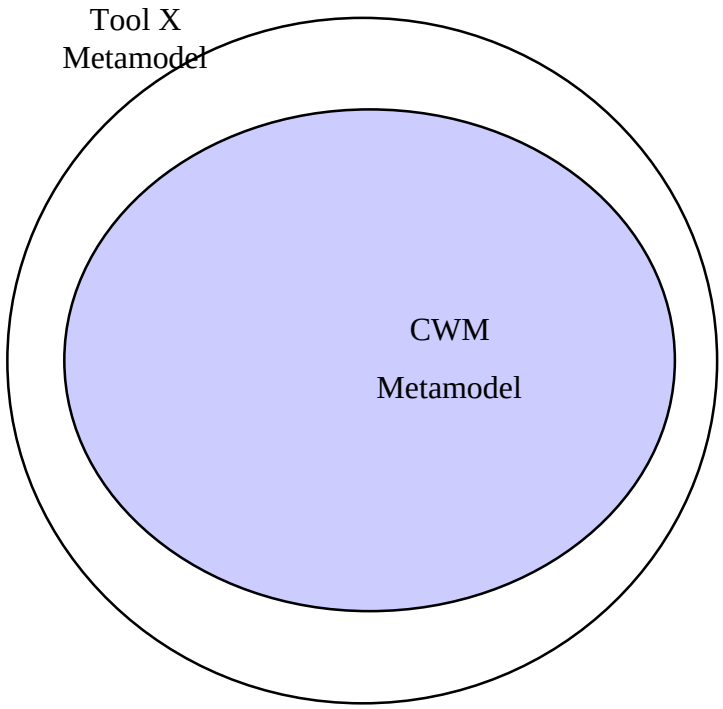
Validation

- Each Use Case defines a “slice” through the model being validated
- Use Cases represent “typical” problems that the model must solve

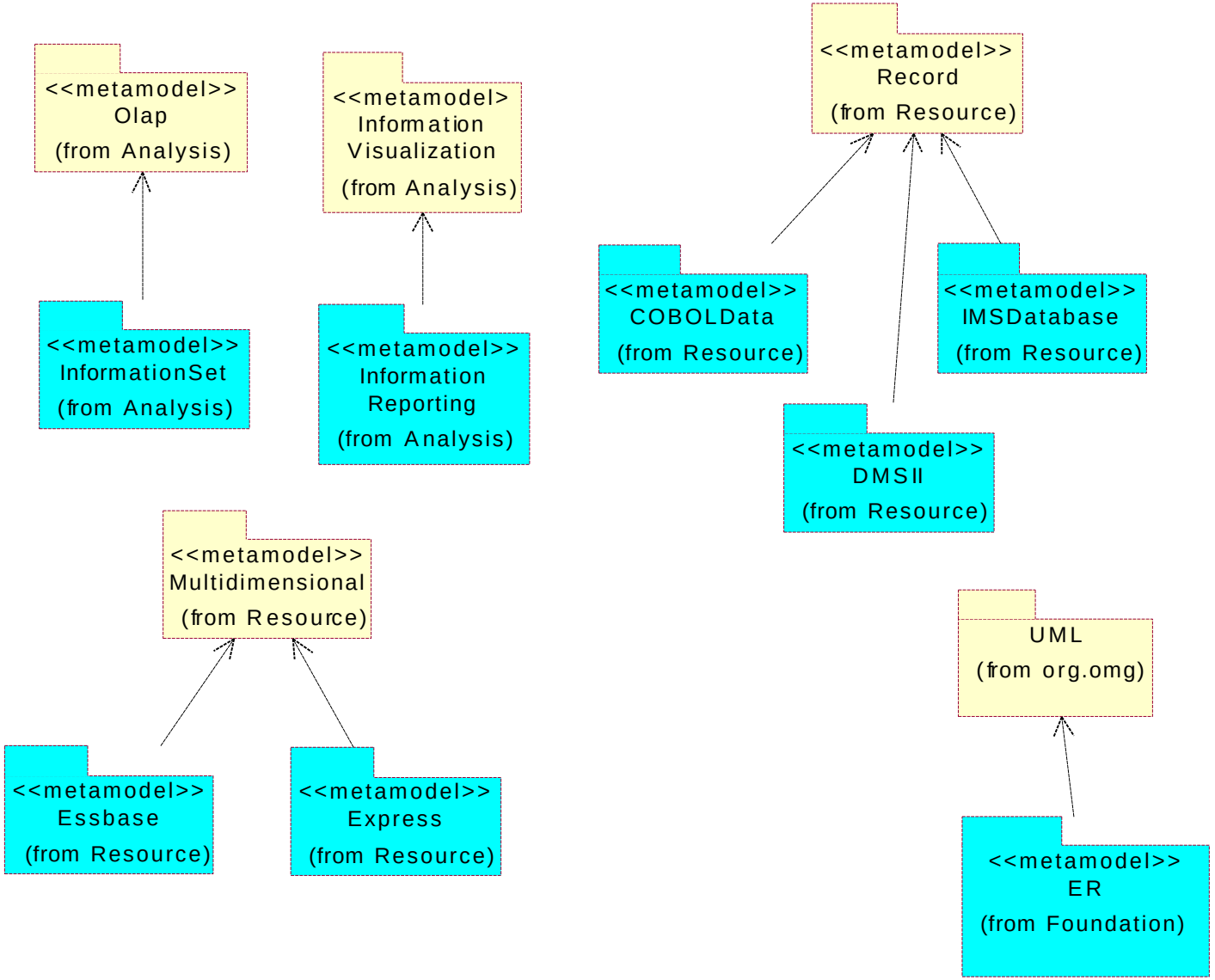


CWM Extensions

- CWM provides interchange of the common portions of warehouse tool meta models
- CWM should be used as the new foundation of a warehouse tool model
- Volume 3 of the Specification contains examples of CWM Extensions

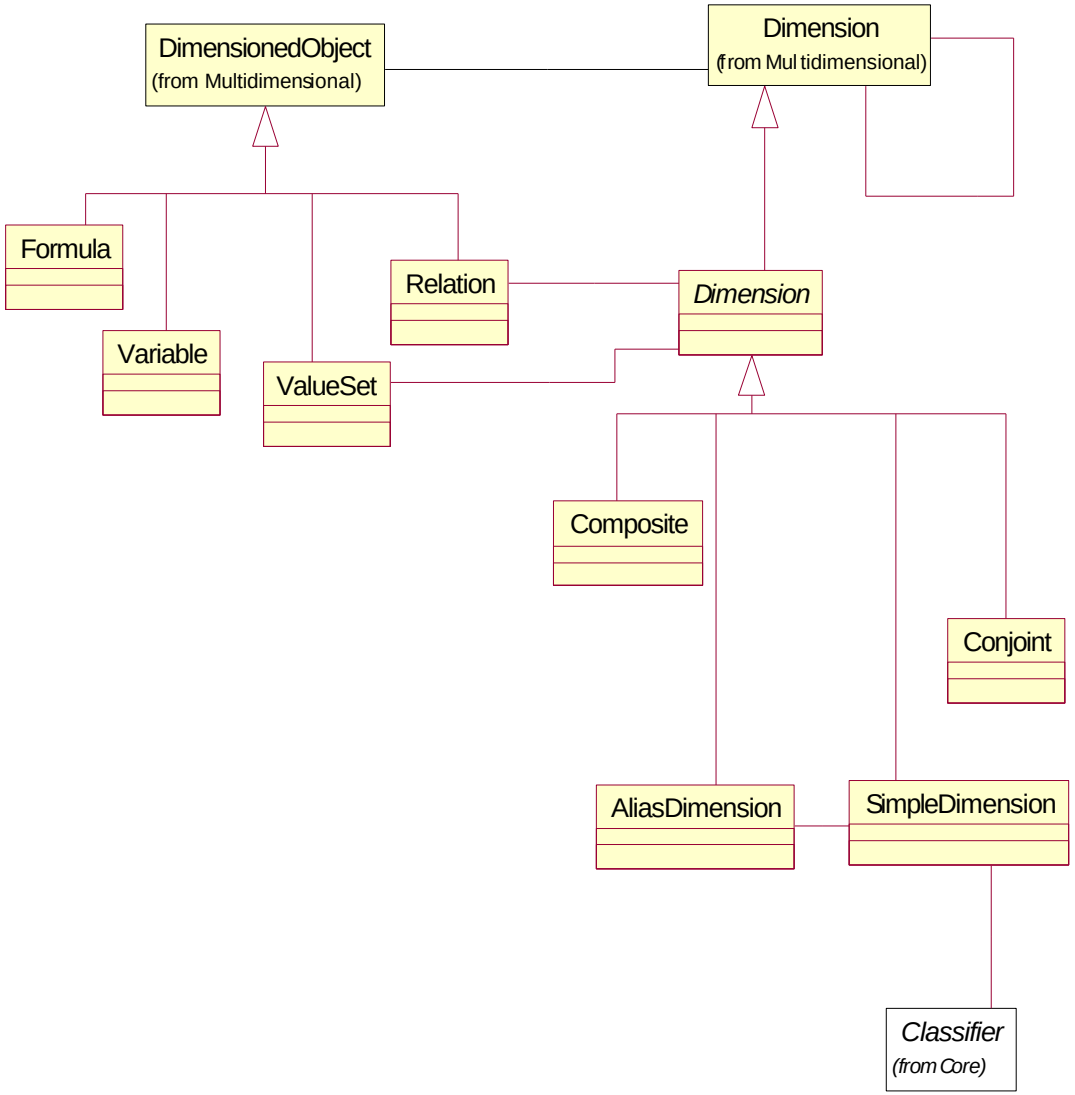


CWM Extension Packages



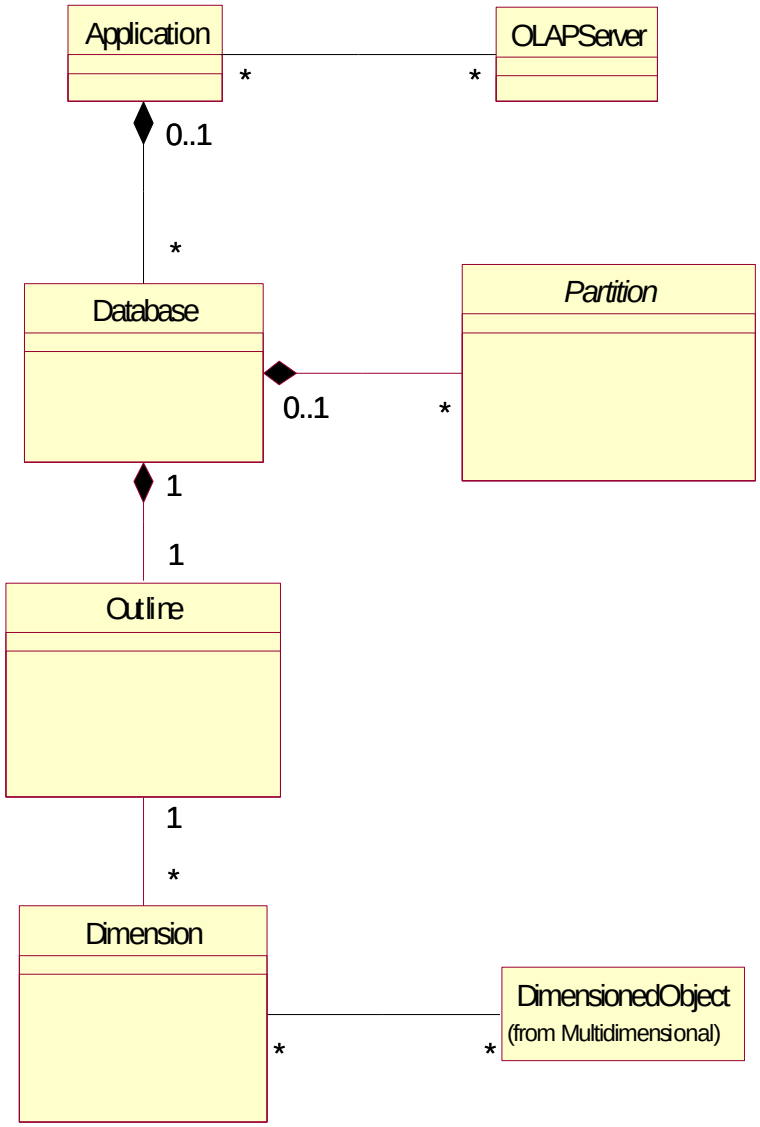
CWM Extensions

- CWM Extensions
  - Extensions
    - Published tool specific information for the purpose of interchange
    - Physical characteristics of databases not common in general but interchangeable in a heterogeneous environment



CWM Extensions

- CWM Extensions
  - Extensions
    - Common ancestry in base metamodel
    - Tool-specific default structures (e.g., Database)



Extending CWM

- Extending the model to redefine a working tool metamodel without generating a new DTD.
  - Categorized into three generic types:
    - Proprietary Attributes: Tool specific definitions not intended for interchange
    - Proprietary Associations and or Classes: Tool specific areas not common and not intended for interchange
    - Sharable Extensions: Tool specific definitions proposed for interchange via tagged value pairs

Extending CWM

- Extending the model to redefine a working tool metamodel without generating a new DTD.
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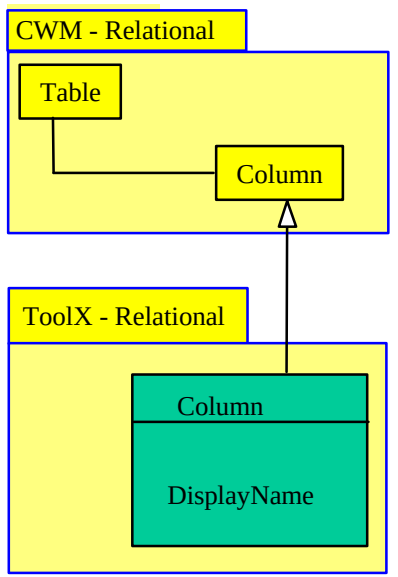

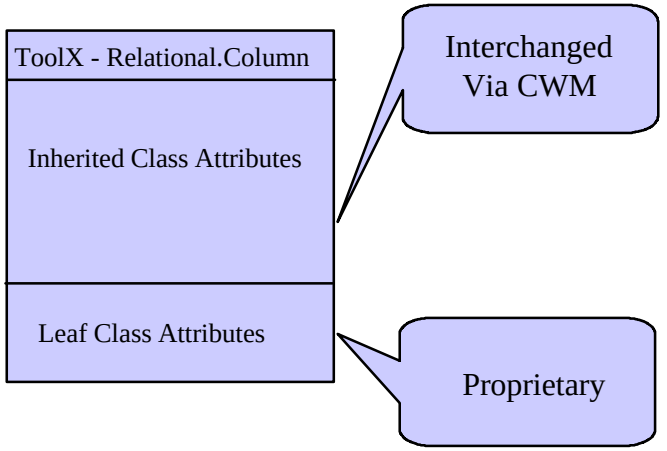

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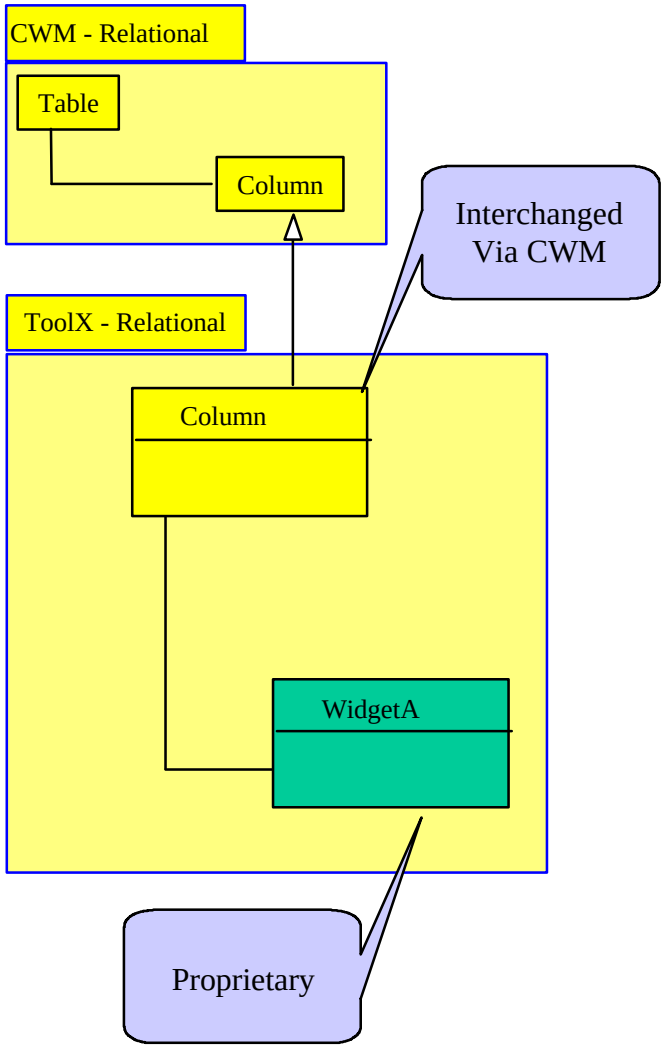

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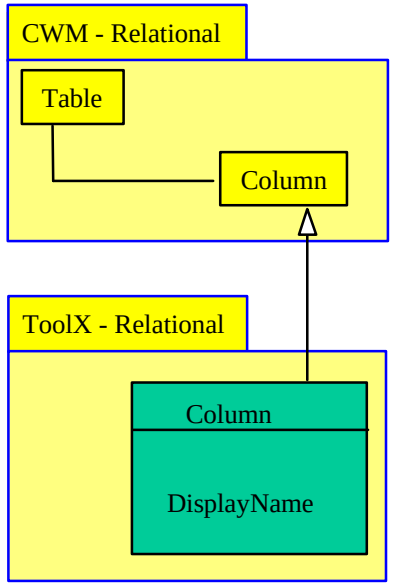
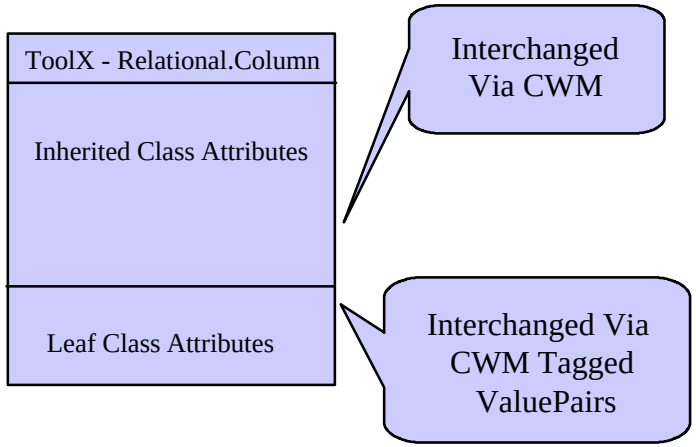




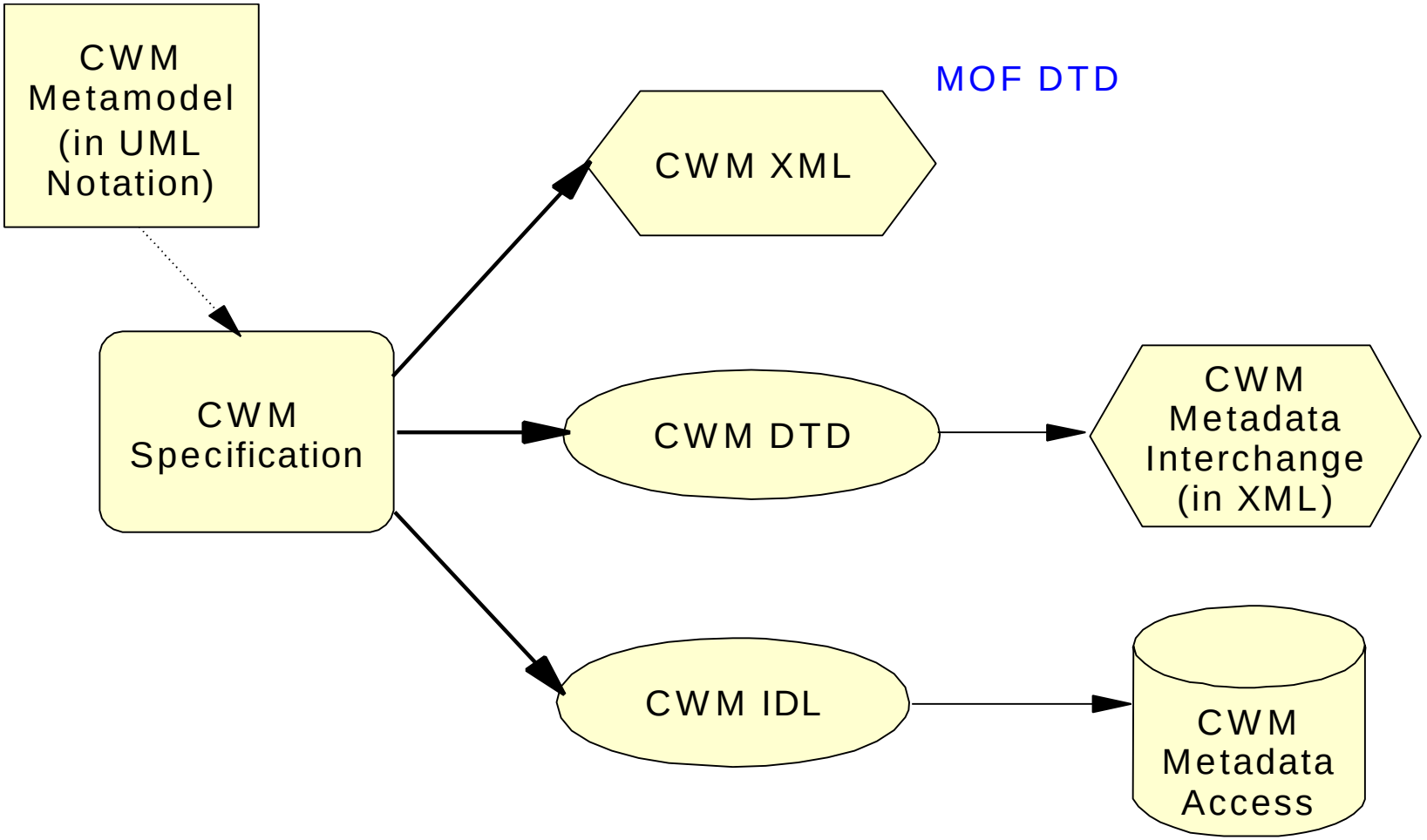
CWM
Summary and Actions

Dan Chang (dtchang@us.ibm.com)

CWM

- A **common specification** that defines, in **UML**, the structure and semantics of shared metadata in **data warehousing and business intelligence**
  - **Resource**: Object, Relational, Record, Multidimensional, XML
  - **Analysis**: Transformation, OLAP, Data Mining, Information Visualization, Business Nomenclature
- A **common specification** that defines, in **XML**, the interchange format and, in **IDL**, the access API for such shared metadata

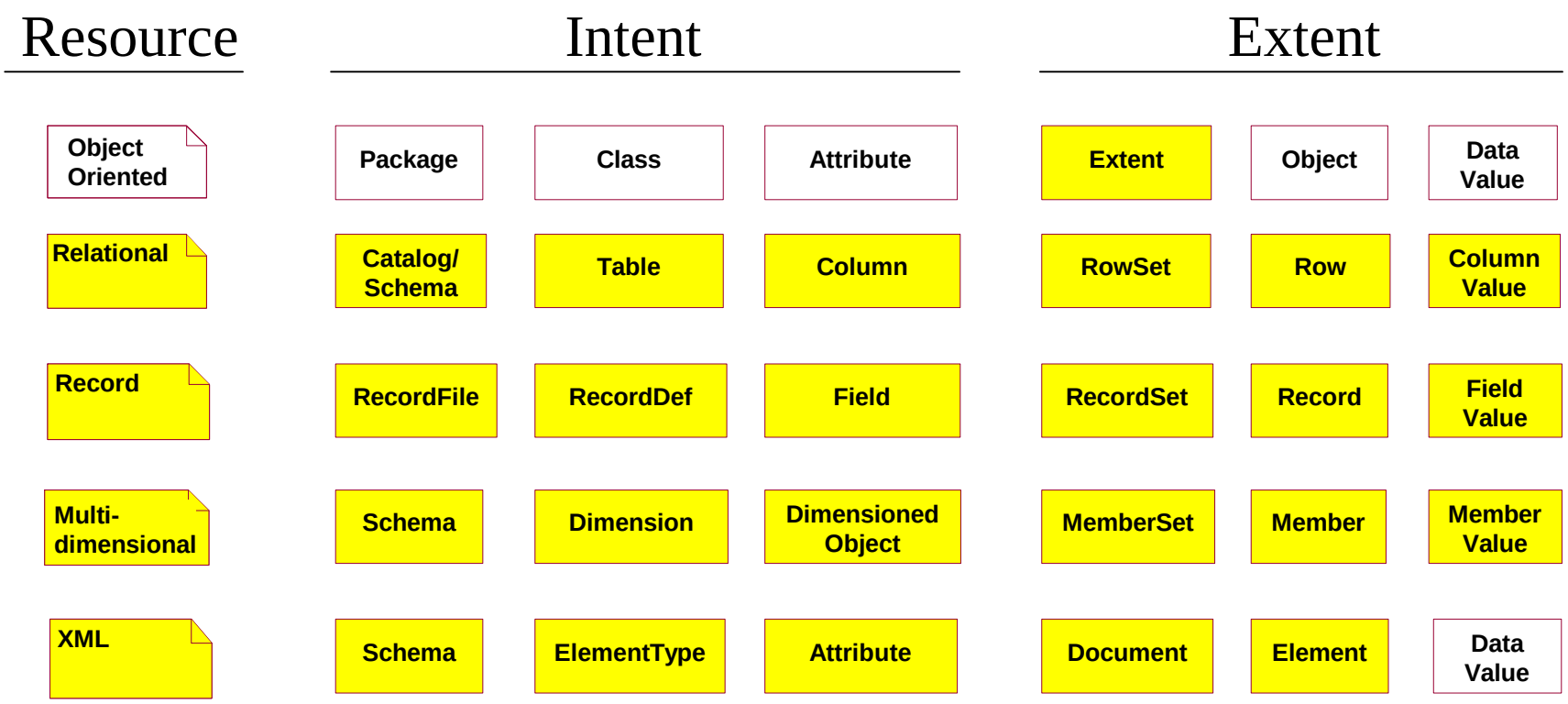
CWM Specification:
CWM XML, CWM DTD, CWM IDL



CWM Extensions (CWMX)

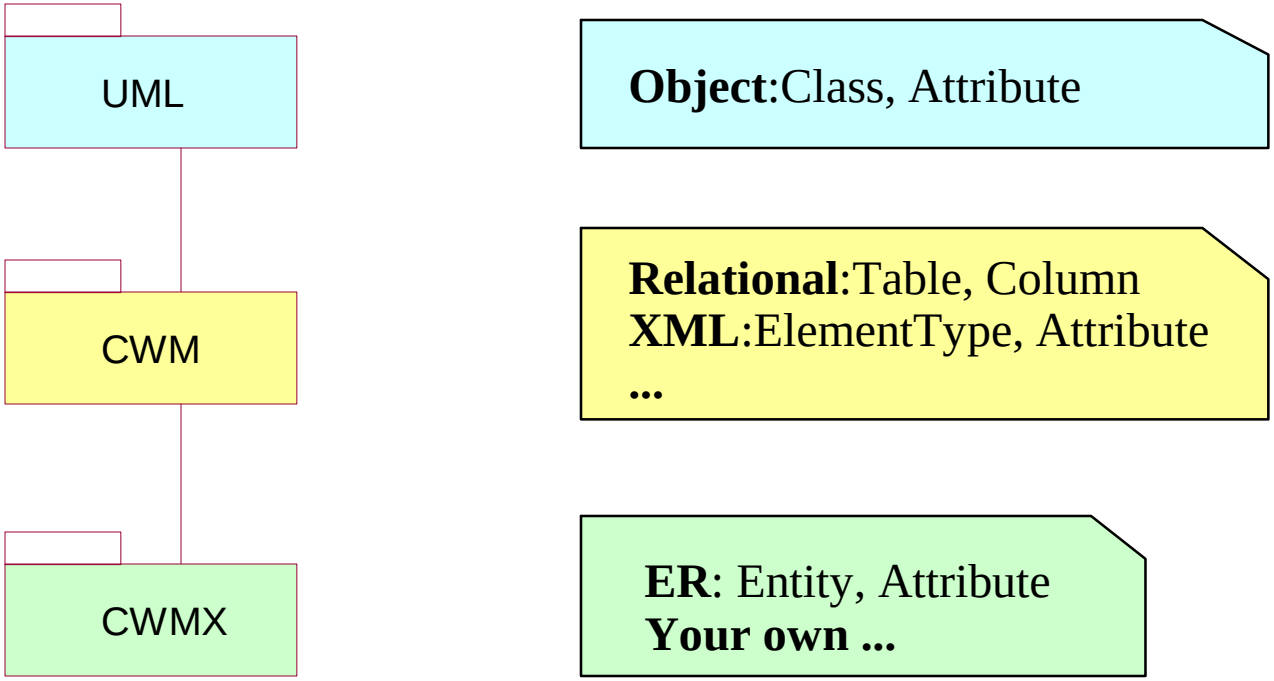
- Published vendor specific metamodel for the purpose of metadata interchange (Volume 3 & Volume 4, non-normative)
  - Common ancestry in the CWM metamodel
  - Demonstrates the validity of the CWM metamodel
  - Demonstrates the extensibility of the CWM metamodel

Data Resource Matrix



CWM

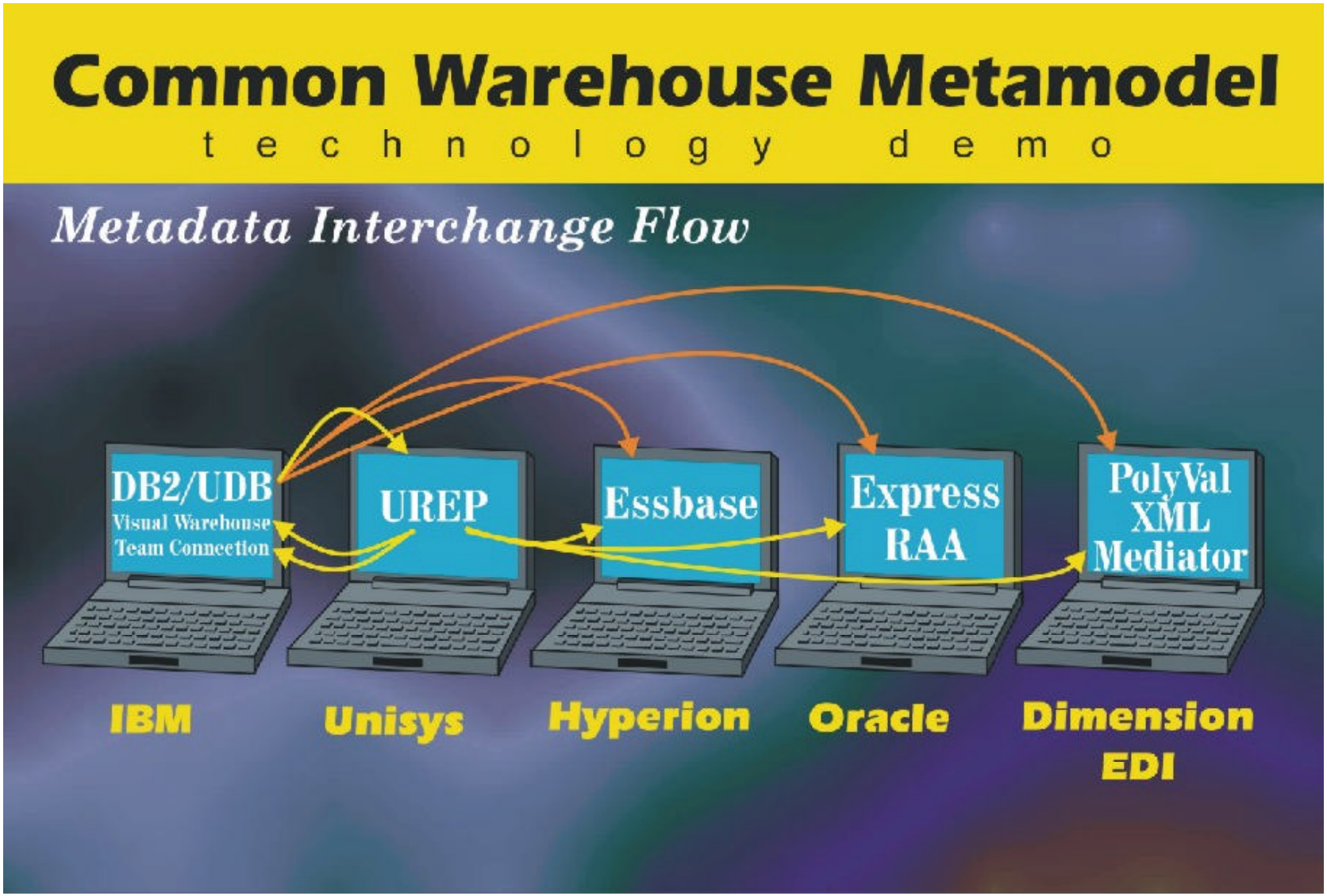
- Enables interchange and access of shared metadata at *three abstraction levels*

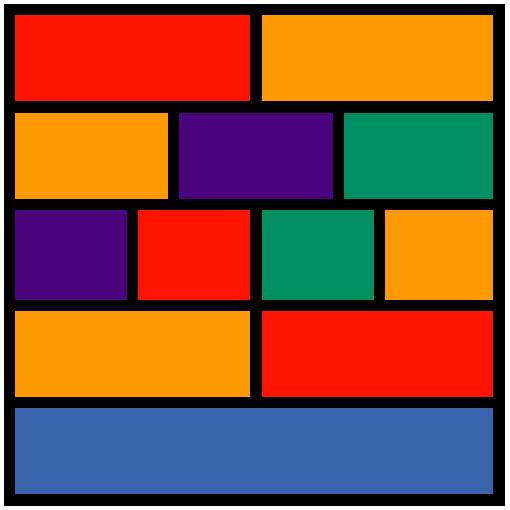


CWM: Past, Present and Future

- Past
  - Initial submission: 9/17/99
  - OMG Demo: 11/99
  - Evaluation: 9/99 - 1/00
- Present
  - Final submission: 2/11/00
  - Evaluation: 2/00 - present
- Future
  - **Adopted specification**: 3/10/00 *(we hope!)*
  - **CWM FTF** : 3/10/00 *(we hope!)*
  - Available specification: 9/00 (we plan)
  - Product enablement and interoperability showcase

November 1999 OMG Demo





CWM

common warehouse metamodel

http://www.cwmforum.org