

Object Management Group

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Request for Proposal:

MOF 2.0 Query / Views / Transformations RFP

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Objective of this RFP

This Request for Proposal (RFP) is one of a series of RFPs related to developing the next major revision of the OMG Meta Object Facility specification, which will be referred to as MOF 2.0. Some of the RFPs pertain to specifying the technology neutral MOF itself, while others pertain to mapping the MOF to specific implementation technologies.

This RFP addresses a technology neutral part of MOF and pertains to:

1. Queries on models.
2. Views on metamodels.
3. Transformations of models.

1.0 Introduction

1.1 Goals of OMG

The Object Management Group (OMG) is the world's largest software consortium with an international membership of vendors, developers, and end users. Established in 1989, its mission is to help computer users solve enterprise integration problems by supplying open, vendor-neutral portability, interoperability and reusability specifications based on Model Driven Architecture (MDA). MDA defines an approach to IT system specification that separates the specification of system functionality from the specification of the implementation of that functionality on a specific technology platform, and provides a set of guidelines for structuring specifications expressed as models. OMG has established numerous widely used standards such as OMG IDL[IDL], CORBA[CORBA], Realtime CORBA [CORBA], GIOP/IIOP[CORBA], UML[UML], MOF[MOF], XMI[XMI] and CWM[CWM] to name a few significant ones.

1.2 Organization of this document

The remainder of this document is organized as follows:

Chapter 2 - *Architectural Context* - background information on OMG's Model Driven Architecture.

Chapter 3 - *Adoption Process* - background information on the OMG specification adoption process.

Chapter 4 - *Instructions for Submitters* - explanation of how to make a submission to this RFP.

Chapter 5 - *General Requirements on Proposals* - requirements and evaluation criteria that apply to all proposals submitted to OMG.

Chapter 6 - *Specific Requirements on Proposals* - problem statement, scope of proposals sought, requirements and optional features, issues to be discussed, evaluation criteria, and timetable that apply specifically to this RFP.

Appendix A – *References and Glossary*

Questions related to the OMG's technology adoption process may be directed to omg-process@omg.org. General questions about this RFP may be sent to responses@omg.org.

2.0 Architectural Context

MDA provides a set of guidelines for structuring specifications expressed as models and the mappings between those models. The MDA initiative and the standards that support it allow the same model specifying business system or application functionality and behavior to be realized on multiple platforms. MDA enables different applications to be integrated by explicitly relating their models; this facilitates integration and interoperability and supports system evolution (deployment choices) as platform technologies change. The three primary goals of MDA are portability, interoperability and reusability.

Portability of any subsystem is relative to the subsystems on which it depends. The collection of subsystems that a given subsystem depends upon is often loosely called the *platform*, which supports that subsystem. Portability – and reusability – of such a subsystem is enabled if all the subsystems that it depends upon use standardized interfaces (APIs) and usage patterns.

MDA provides a pattern comprising a portable subsystem that is able to use any one of multiple specific implementations of a platform. This pattern is repeatedly usable in the specification of systems. The five important concepts related to this pattern are:

1. *Model* - A model is a representation of a part of the function, structure and/or behavior of an application or system. A *representation* is said to be *formal* when it is based on a language that has a well-defined form (“syntax”), meaning (“semantics”), and possibly rules of analysis, inference, or proof for its constructs. The syntax may be graphical or textual. The semantics might be defined, more or less formally, in terms of things observed in the world being described (e.g. message sends and replies, object states and state changes, etc.), or by translating higher-level language constructs into other constructs that have a well-defined meaning. The optional rules of inference define what unstated properties you can deduce from the explicit statements in the model. In MDA, a *representation* that is not *formal* in this sense is not a model. Thus, a diagram with boxes and lines and arrows that is not supported by a definition of the meaning of a box, and the meaning of a line and of an arrow is not a model—it is just an informal diagram.
2. *Platform* – A set of subsystems/technologies that provide a coherent set of functionality through interfaces and specified usage patterns that any subsystem that depends on the platform can use without

concern for the details of how the functionality provided by the platform is implemented.

3. *Platform Independent Model (PIM)* – A model of a subsystem that contains no information specific to the platform, or the technology that is used to realize it.
4. *Platform Specific Model (PSM)* – A model of a subsystem that includes information about the specific technology that is used in the realization of that subsystem on a specific platform, and hence possibly contains elements that are specific to the platform.
5. *Mapping* – Specification of a mechanism for transforming the elements of a model conforming to a particular metamodel into elements of another model that conforms to another (possibly the same) metamodel. A mapping may be expressed as associations, constraints, rules, templates with parameters that must be assigned during the mapping, or other forms yet to be determined.

For example, in case of CORBA the platform is specified by a set of interfaces and usage patterns that constitute the CORBA Core Specification [CORBA]. The CORBA platform is independent of operating systems and programming languages. The OMG Trading Object Service specification [TOS] (consisting of interface specifications in OMG Interface Definition Language (OMG IDL)) can be considered to be a PIM from the viewpoint of CORBA, because it is independent of operating systems and programming languages. When the IDL to C++ Language Mapping specification is applied to the Trading Service PIM, the C++-specific result can be considered to be a PSM for the Trading Service, where the platform is the C++ language and the C++ ORB implementation. Thus the IDL to C++ Language Mapping specification [IDLC++] determines the mapping from the Trading Service PIM to the Trading Service PSM.

Note that the Trading Service model expressed in IDL is a PSM relative to the CORBA platform too. This highlights the fact that platform-independence and platform-specificity are relative concepts.

The UML Profile for EDOC specification [EDOC] is another example of the application of various aspects of MDA. It defines a set of modeling constructs that are independent of middleware platforms such as EJB [EJB], CCM [CCM], MQSeries [MQS], etc. A PIM based on the EDOC profile uses the middleware-independent constructs defined by the profile and thus is middleware-independent. In addition, the specification defines formal metamodels for some specific middleware

platforms such as EJB, supplementing the already-existing OMG metamodel of CCM (CORBA Component Model). The specification also defines mappings from the EDOC profile to the middleware metamodels. For example, it defines a mapping from the EDOC profile to EJB. The mapping specifications facilitate the transformation of any EDOC-based PIM into a corresponding PSM for any of the specific platforms for which a mapping is specified.

Continuing with this example, one of the PSMs corresponding to the EDOC PIM could be for the CORBA platform. This PSM then potentially constitutes a PIM, corresponding to which there would be implementation language specific PSMs derived via the CORBA language mappings, thus illustrating recursive use of the Platform-PIM-PSM-Mapping pattern.

Note that the EDOC profile can also be considered to be a platform in its own right. Thus, a model expressed via the profile is a PSM relative to the EDOC platform.

An analogous set of concepts apply to Interoperability Protocols wherein there is a PIM of the payload data and a PIM of the interactions that cause the data to find its way from one place to another. These then are realized in specific ways for specific platforms in the corresponding PSMs.

Analogously, in case of databases there could be a PIM of the data (say using the Relational Data Model), and corresponding PSMs specifying how the data is actually represented on a storage medium based on some particular data storage paradigm etc., and a mapping from the PIM to each PSM.

OMG adopts standard specifications of models that exploit the MDA pattern to facilitate portability, interoperability and reusability, either through ab initio development of standards or by reference to existing standards. Some examples of OMG adopted specifications are:

1. *Languages* – e.g. IDL for interface specification, UML for model specification, OCL for constraint specification, etc.
2. *Mappings* – e.g. Mapping of OMG IDL to specific implementation languages (CORBA PIM to Implementation Language PSMs), UML Profile for EDOC (PIM) to CCM (CORBA PSM) and EJB (Java PSM), CORBA (PSM) to COM (PSM) etc.

3. *Services* – e.g. Naming Service [NS], Transaction Service [OTS], Security Service [SEC], Trading Object Service [TOS] etc.
4. *Platforms* – e.g. CORBA [CORBA].
5. *Protocols* – e.g. GIOP/IIOP [CORBA] (both structure and exchange protocol), [XMI] (structure specification usable as payload on multiple exchange protocols).
6. *Domain Specific Standards* – e.g. Data Acquisition from Industrial Systems (Manufacturing) [DAIS], General Ledger Specification (Finance) [GLS], Air Traffic Control (Transportation) [ATC], Gene Expression (Life Science Research) [GE], Personal Identification Service (Healthcare) [PIDS], etc.

For an introduction to MDA, see [MDAa]. For a discourse on the details of MDA please refer to [MDAc]. To see an example of the application of MDA see [MDAb]. For general information on MDA, see [MDAd].

Object Management Architecture (OMA) is a distributed object computing platform architecture within MDA that is related to ISO's Reference Model of Open Distributed Processing RM-ODP[RM-ODP]. CORBA and any extensions to it are based on OMA. For information on OMA see [OMA].

3.0 Adoption Process

3.1 Introduction

OMG adopts specifications by explicit vote on a technology-by-technology basis. The specifications selected each satisfy the architectural vision of MDA. OMG bases its decisions on both business and technical considerations. Once a specification adoption is finalized by OMG, it is made available for use by both OMG members and non-members alike.

Request for Proposals (RFP) are issued by a *Technology Committee* (TC), typically upon the recommendation of a *Task Force* (TF) and duly endorsed by the *Architecture Board* (AB).

Submissions to RFPs are evaluated by the TF that initiated the RFP. Selected specifications are *recommended* to the parent TC after being *reviewed* for technical merit and consistency with MDA and other adopted specifications and *endorsed* by the AB. The parent TC of the

initiating TF then votes to *recommend adoption* to the OMG Board of Directors (BoD). The BoD acts on the recommendation to complete the adoption process.

For more detailed information on the adoption process see the *Policies and Procedures of the OMG Technical Process* [P&P] and the *OMG Hitchhiker's Guide* [Guide].

3.2 Steps in the Adoption Process

A TF, its parent TC, the AB and the Board of Directors participate in a collaborative process, which typically takes the following form:

- *Development and Issuance of RFP*

RFPs are drafted by one or more OMG members who are interested in the adoption of a standard in some specific area. The draft RFP is presented to an appropriate TF, based on its subject area, for approval and recommendation to issue. The TF and the AB provide guidance to the drafters of the RFP. When the TF and the AB are satisfied that the RFP is appropriate and ready for issuance, the TF recommends issuance to its parent TC, and the AB endorses the recommendation. The TC then acts on the recommendation and issues the RFP.

- *Letter of Intent (LOI)*

A Letter of Intent (LOI) must be submitted to the OMG signed by an officer of the member organization, which intends to respond to the RFP, confirming the organization's willingness to comply with OMG's terms and conditions, and commercial availability requirements. (See section 4.3 for more information.). In order to respond to an RFP the respondent must be a member of the TC that issued the RFP.

- *Voter Registration*

Interested OMG members, other than Auditing members may need to register to participate in specification selection votes in the TF for an RFP, if so stated in the RFP. Registration ends on a specified date, 6 or more weeks after the announcement of the registration period. The registration closure date is typically around the time of initial submissions. Companies who have submitted an LOI are automatically registered to vote.

- *Initial Submissions*

Initial Submissions are due by a specified deadline. Submitters normally present their proposals at the first meeting of the TF after the deadline. Initial Submissions are expected to be complete enough to provide insight on the technical directions and content of the proposals.

- *Revision Phase*

During this time submitting companies have the opportunity to revise and/or merge their Initial Submissions, if they so choose.

- *Revised Submissions*

Revised (final) Submissions are due by a specified deadline. Submitters again normally present their proposals at the next meeting of the TF after the deadline. (Note that there may be more than one Revised Submission deadline. The decision to extend this deadline is made by the registered voters for that RFP.)

- *Selection Votes*

When the registered voters for the RFP believe that they sufficiently understand the relative merits of the Revised Submissions, a selection vote is taken. The result of this selection vote is a recommendation for adoption to the TC. The AB reviews the proposal for MDA compliance and technical merit. An endorsement from the AB moves the voting process into the issuing Task Force's parent Technology Committee. An eight-week voting period ensues in which the TC votes to recommend adoption to the OMG Board of Directors (BoD). The final vote, the vote to adopt, is made by the BoD and is made on technical merit as well as business qualifications. The resulting draft standard is called the *Adopted Specification*.

- *Business Committee Questionnaire*

The submitting organizations whose proposal is recommended for adoption need to submit their response to the BoD Business Committee Questionnaire [BCQ] detailing how they plan to make use of and/or make the resulting standard available in products. If no organization commits to make use of the standard, then the BoD will typically not act on the recommendation to adopt the standard. So it is very important to fulfill this requirement.

- *Finalization*

A Finalization Task Force (FTF) is chartered by the issuing Task Force's parent TC to prepare an *adopted* submission for publishing as a

formal, publicly available specification. Its responsibility includes production of one or more prototype implementations and fixing any problems that are discovered in the process. This ensures that the final available standard is actually implementable and has no show-stopping bugs. Upon completion of its activity the FTF recommends adoption of the resulting draft standard called the *Available Standard*. The FTF must also provide evidence of the existence of one or more prototype implementations. The parent TC acts on the recommendation and recommends adoption to the BoD. OMG Technical Editors produce the *Formal Published Specification* document based on this *Available Specification*.

- *Revision*

A Revision Task Force (RTF) is normally chartered after the FTF completes its work, to manage issues filed against the *Available Specification* by implementers and users. The output of the RTF is a revised specification reflecting minor technical changes.

3.3 Goals of the evaluation

The primary goals of the TF evaluation are to:

- Provide a fair and open process
- Facilitate critical review of the submissions by members of OMG
- Provide feedback to submitters enabling them to address concerns in their revised submissions
- Build consensus on acceptable solutions
- Enable voting members to make an informed selection decision

Submitters are expected to actively contribute to the evaluation process.

4.0 Instructions for Submitters

4.1 OMG Membership

To submit to an RFP issued by the Platform Technology Committee an organization must be a Platform or Contributing member on the date of the submission deadline, while for Domain Technology RFPs the submitter or submitters must be either Contributing or Domain members. Submitters sometimes choose to name other organizations that support a submission in some way; however, this has no formal status

within the OMG process, and for OMG's purposes confers neither duties nor privileges on the organizations thus named.

4.2 Submission Effort

Unlike a response to an OMG Request For Information (RFI), an RFP submission may require significant effort in terms of document preparation, presentations to the issuing TF, and participation in the TF evaluation process. Several staff months of effort might be necessary. OMG is unable to reimburse submitters for any costs in conjunction with their submissions to this RFP.

4.3 Letter of Intent

A Letter of Intent (LOI) must be submitted to the OMG Business Committee signed by an officer of the submitting organization signifying its intent to respond to the RFP and confirming the organization's willingness to comply with OMG's terms and conditions, and commercial availability requirements. These terms, conditions, and requirements are defined in the *Business Committee RFP Attachment* and are reproduced verbatim in section 4.4 below.

The LOI should designate a single contact point within the submitting organization for receipt of all subsequent information regarding this RFP and the submission. The name of this contact will be made available to all OMG members. The LOI is typically due 60 days before the deadline for initial submissions. LOIs must be sent by fax or paper mail to the "RFP Submissions Desk" at the main OMG address shown on the first page of this RFP.

Here is a suggested template for the Letter of Intent:

This letter confirms the intent of <__organization required__> (the organization) to submit a response to the OMG <__RFP name required__> RFP. We will grant OMG and its members the right to copy our response for review purposes as specified in section 4.7 of the RFP. Should our response be adopted by OMG we will comply with the OMG Business Committee terms set out in section 4.4 of the RFP and in document omg/02-04-02.

<__contact name and details required__> will be responsible for liaison with OMG regarding this RFP response.

The signatory below is an officer of the organization and has the approval and authority to make this commitment on behalf of the organization.

<__signature required__>

4.4 Business Committee RFP Attachment

This section contains the text of the Business Committee RFP attachment concerning commercial availability requirements placed on submissions. This attachment is available separately as an OMG document [omg/02-04-02](#).

Commercial considerations in OMG technology adoption

A1 Introduction

OMG wishes to encourage rapid commercial adoption of the technologies (specifications and support measures) it publishes. To this end, there must be neither technical, legal nor commercial obstacles to their implementation. Freedom from the first is largely judged through technical review by the relevant OMG Technology Committees; the second two are the responsibility of the OMG Business Committee. The BC also looks for evidence of a commitment by a submitter to the commercial success of products based on the submission.

A2 Business Committee evaluation criteria

A2.1 Viable to implement across platforms

While it is understood that final candidate OMG submissions often combine technologies before they have all been implemented in one system, the Business Committee nevertheless wishes to see evidence that each major feature has been implemented, preferably more than once, and by separate organizations. Pre-product implementations are acceptable. Since use of OMG specifications should not be dependent on any one platform, cross-platform availability and interoperability of implementations should be also be demonstrated.

A2.2 Commercial availability

In addition to demonstrating the existence of implementations of the specification, the submitter must also show that products based on the specification are commercially available, or will be within 12 months of the date when the specification was recommended for adoption by the appropriate Task Force. Proof of intent to ship product within 12 months might include:

- A public product announcement with a shipping date within the time limit.*
- A prototype implementation and accompanying draft user documentation.*

Alternatively, and at the Business Committee's discretion, submissions may be adopted where the submitter is not a commercial software provider, and therefore will not make implementations commercially available. However, in this case the BC will require concrete evidence of two or more independent implementations of the specification being used by end-user organizations as part of their businesses.

Regardless of which requirement is in use, the submitter must inform the OMG of completion of the implementations when commercially available.

In the case of the proposed adoption of support measures, the BC needs to have proof of the intent to use or recommend such support measures within 12 months of the date when the support measures were recommended for adoption by the appropriate Task Force.

A2.3 Access to Intellectual Property Rights

OMG will not adopt a specification or support measure if OMG is aware of any submitter, member or third party which holds a patent, copyright or other intellectual property right (collectively referred to in this policy statement as "IPR") which might be infringed by implementation or recommendation of such specification or support measure, unless OMG believes that such IPR owner will grant a license to organizations (whether OMG members or not) on non-discriminatory and commercially reasonable terms which wish to make use of the specification or support measure. Accordingly, the submitter must certify that it is not aware of any claim that the specification or support measure infringes any IPR of a third party or that it is aware and believes that an appropriate non-discriminatory license is available from that third party. Except for this certification, the submitter will not be required to make any other warranty, and specifications will be offered by OMG for use "as is". If the submitter owns IPR to which an use of a specification or support measure based upon its submission would necessarily be subject, it must certify to the Business Committee that it will make a suitable license available to any user on non-discriminatory and commercially reasonable terms, to permit development and commercialization of an implementation that includes such IPR.

It is the goal of the OMG to make all of its technology available with as few impediments and disincentives to adoption as possible, and therefore OMG strongly encourages the submission of technology as to which royalty-free licenses will be available. However, in all events, the submitter shall also certify that any necessary license will be made available on commercially reasonable, non-discriminatory terms. The submitter is responsible for disclosing in detail all known restrictions, placed either by the submitter or, if known, others, on technology necessary for any use of the specification or support measure.

A2.4 Publication of the specification

Should the submission or support measures be adopted, the submitter must grant OMG (and its sublicensees) a worldwide, royalty-free license to edit, store, duplicate and distribute both the specification and works derived from it (such as revisions and teaching materials). This requirement applies only to the written specification, not to any implementation of it.

A2.5 Continuing support

The submitter must show a commitment to continue supporting the technology underlying the specification or support measure after OMG adoption, for instance by showing the BC development plans for future revisions, enhancement or maintenance.

4.5 Responding to RFP items

4.5.1 Complete proposals

A submission must propose full specifications for all of the relevant requirements detailed in Chapter 6 of this RFP. Submissions that do not present complete proposals may be at a disadvantage.

Submitters are highly encouraged to propose solutions to any optional features identified in Chapter 6.

4.5.2 Additional specifications

Submissions may include additional specifications for items not covered by the RFP that they believe to be necessary and integral to their proposal. Information on these additional items should be clearly distinguished.

Submitters must give a detailed rationale as to why these specifications should also be considered for adoption. However submitters should note that a TF is unlikely to consider additional items that are already on the roadmap of an OMG TF, since this would pre-empt the normal adoption process.

4.5.3 Alternative approaches

Submitters may provide alternative RFP item definitions, categorizations, and groupings so long as the rationale for doing so is clearly stated. Equally, submitters may provide alternative models for how items are provided if there are compelling technological reasons for a different approach.

4.6 Confidential and Proprietary Information

The OMG specification adoption process is an open process. Responses to this RFP become public documents of the OMG and are available to members and non-members alike for perusal. No confidentiality or proprietary information of any kind will be accepted in a submission to this RFP.

4.7 Copyright Waiver

If a submitted document is copyrighted, a waiver of copyright for unlimited duplication by the OMG is required to be stated in the document. In addition, a limited waiver of copyright is required that allows each OMG member to make up to fifty (50) copies of the document for review purposes only.

4.8 Proof of Concept

Submissions must include a “proof of concept” statement, explaining how the submitted specifications have been demonstrated to be technically viable. The technical viability has to do with the state of development and maturity of the technology on which a submission is based. This is not the same as commercial availability. Proof of concept statements can contain any information deemed relevant by the submitter; for example:

“This specification has completed the design phase and is in the process of being prototyped.”

“An implementation of this specification has been in beta-test for 4 months.”

“A named product (with a specified customer base) is a realization of this specification.”

It is incumbent upon submitters to demonstrate to the satisfaction of the issuing TF the technical viability of their proposal. OMG will favor proposals based on technology for which sufficient relevant experience has been gained.

4.9 Format of RFP Submissions

This section provides guidance on how to structure a RFP submission.

4.9.1 General

- Submissions that are concise and easy to read will inevitably receive more consideration.
- Submitted documentation should be confined to that directly relevant to the items requested in the RFP. If this is not practical, submitters must make clear what portion of the documentation pertains directly to the RFP and what portion does not.

4.9.2 Required Outline

A three-part structure for submissions is required. Part II is normative, representing the proposed specification. Parts I and III are non-normative, providing information relevant to the evaluation of the proposed specification.

PART I

- Copyright Waiver (see 4.7)
- Submission contact point (see 4.3)
- Overview or guide to the material in the submission
- Overall design rationale (if appropriate)
- Statement of proof of concept (see 4.8)
- Resolution of RFP requirements and requests

Explain how the proposal satisfies the specific requirements and (if applicable) requests stated in Chapter 6. References to supporting material in Part II should be given.

In addition, if the proposal does not satisfy any of the general requirements stated in Chapter 5, provide a detailed rationale.

- Responses to RFP issues to be discussed

Discuss each of the “Issues To Be Discussed” identified in Chapter 6.

PART II

- Proposed specification
- Proposed compliance points

Submissions should propose appropriate compliance points for implementations.

PART III

- Summary of requests versus requirements.

Submissions must clearly distinguish requirements that all implementations must support from RFP requests that may be optionally supported.

- Changes or extensions required to adopted OMG specifications

Submissions must include a full specification of any changes or extensions required to existing OMG specifications. This should be in a form that enables “mechanical” section-by-section revision of the existing specification.

4.10 How to Submit

Submitters should send an electronic version of their submission to the *RFP Submissions Desk* (omg-documents@omg.org) at OMG Headquarters by 5:00 PM U.S. Eastern Standard Time (22:00 GMT) on the day of the Initial and Revised Submission deadlines. Acceptable formats are Postscript, ASCII, PDF, Adobe FrameMaker, Microsoft Word, and WordPerfect. However, it should be noted that a successful (adopted) submission must be supplied to OMG’s technical editors in FrameMaker source format, using the most recent available OMG submission template (see [FORMS]). The AB will not endorse adoption of any submission for which appropriately formatted FrameMaker sources are not available; it may therefore be convenient to prepare all stages of a submission using this template.

Submitters should make sure they receive electronic or voice confirmation of the successful receipt of their submission. Submitters should be prepared to send a single hardcopy version of their

submission, if requested by OMG staff, to the attention of the “RFP Submissions Desk” at the main OMG address shown on the first page of this RFP.

5.0 General Requirements on Proposals

5.1 Requirements

- 5.1.1 Submitters are encouraged to express models via OMG modeling languages such as UML, MOF, CWM and SPEM (subject to any further constraints on the types of the models and modeling technologies specified in Chapter 6 of this RFP). Submissions containing models expressed via OMG modeling languages shall be accompanied by an OMG XMI [XMI] representation of the models (including a machine-readable copy). A best effort should be made to provide an OMG XMI representation even in those cases where models are expressed via non-OMG modeling languages.
- 5.1.2 Chapter 6 of this RFP specifies whether PIM(s), PSM(s), or both are being solicited. If proposals specify a PIM and corresponding PSM(s), then the rules specifying the mapping(s) between the PIM and PSM(s) shall either be identified by reference to a standard mapping or specified in the proposal. In order to allow possible inconsistencies in a proposal to be resolved later, proposals shall identify whether the mapping technique or the resulting PSM(s) are to be considered normative.
- 5.1.3 Proposals shall be *precise* and *functionally complete*. All relevant assumptions and context required for implementing the specification shall be provided.
- 5.1.4 Proposals shall specify *compliance points* that clearly state what features all implementations must support and which features (if any) may *optionally* be supported.
- 5.1.5 Proposals shall *reuse* existing OMG and other standard specifications in preference to defining new models to specify similar functionality.
- 5.1.6 Proposals shall justify and fully specify any *changes or extensions* required to existing OMG specifications. In general, OMG favors proposals that are *upwards compatible* with existing standards and that minimize changes and extensions to existing specifications.

- 5.1.7 Proposals shall factor out functionality that could be used in different contexts and specify their models, interfaces, etc. separately. Such *minimalism* fosters re-use and avoids functional duplication.
- 5.1.8 Proposals shall use or depend on other specifications only where it is actually necessary. While re-use of existing specifications to avoid duplication will be encouraged, proposals should avoid gratuitous use.
- 5.1.9 Proposals shall be *compatible* with and *usable* with existing specifications from OMG and other standards bodies, as appropriate. Separate specifications offering distinct functionality should be usable together where it makes sense to do so.
- 5.1.10 Proposals shall preserve maximum *implementation flexibility*. Implementation descriptions should not be included and proposals shall not constrain implementations any more than is necessary to promote interoperability.
- 5.1.11 Proposals shall allow *independent implementations* that are *substitutable* and *interoperable*. An implementation should be replaceable by an alternative implementation without requiring changes to any client.
- 5.1.12 Proposals shall be compatible with the architecture for system distribution defined in ISO's Reference Model of Open Distributed Processing [RM-ODP]. Where such compatibility is not achieved, or is not appropriate, the response to the RFP must include reasons why compatibility is not appropriate and an outline of any plans to achieve such compatibility in the future.
- 5.1.13 In order to demonstrate that the specification proposed in response to this RFP can be made secure in environments requiring security, answers to the following questions shall be provided:
- What, if any, are the security sensitive elements that are introduced by the proposal?
 - Which accesses to security-sensitive elements must be subject to security policy control?
 - Does the proposed service or facility need to be security aware?
 - What default policies (e.g., for authentication, audit, authorization, message protection etc.) should be applied to the security sensitive

elements introduced by the proposal? Of what security considerations must the implementers of your proposal be aware?

The OMG has adopted several specifications, which cover different aspects of security and provide useful resources in formulating responses. [CSIV2] [SEC] [RAD].

- 5.1.14 Proposals shall specify the degree of internationalization support that they provide. The degrees of support are as follows:
- a) Uncategorized: Internationalization has not been considered.
 - b) Specific to <region name>: The proposal supports the customs of the specified region only, and is not guaranteed to support the customs of any other region. Any fault or error caused by requesting the services outside of a context in which the customs of the specified region are being consistently followed is the responsibility of the requester.
 - c) Specific to <multiple region names>: The proposal supports the customs of the specified regions only, and is not guaranteed to support the customs of any other regions. Any fault or error caused by requesting the services outside of a context in which the customs of at least one of the specified regions are being consistently followed is the responsibility of the requester.
 - d) Explicitly not specific to <region(s) name>: The proposal does not support the customs of the specified region(s). Any fault or error caused by requesting the services in a context in which the customs of the specified region(s) are being followed is the responsibility of the requester.

5.2 Evaluation criteria

Although the OMG adopts model-based specifications and not implementations of those specifications, the technical viability of implementations will be taken into account during the evaluation process. The following criteria will be used:

5.2.1 Performance

Potential implementation trade-offs for performance will be considered.

5.2.2 Portability

The ease of implementation on a variety of systems and software platforms will be considered.

5.2.3 Securability

The answer to questions in section 5.1.14 shall be taken into consideration to ascertain that an implementation of the proposal is securable in an environment requiring security.

5.2.4 Compliance: Inspectability and Testability

The adequacy of proposed specifications for the purposes of compliance inspection and testing will be considered. Specifications should provide sufficient constraints on interfaces and implementation characteristics to ensure that compliance can be unambiguously assessed through both manual inspection and automated testing.

5.2.5 Standardized Metadata

Where proposals incorporate metadata specifications, usage of OMG standard XMI metadata [XMI] representations must be provided as this allows specifications to be easily interchanged between XMI compliant tools and applications. Since use of XML (including XMI and XML/Value [XML/Value]) is evolving rapidly, the use of industry specific XML vocabularies (which may not be XMI compliant) is acceptable where justified.

6.0 Specific Requirements on Proposals

MOF is the standard facility of the OMG to define metamodels for languages. E.g. UML and CWM are formally defined in MOF. The MOF 2.0 and UML 2.0 RFPs require that both technologies are based on the same core.

The MDA Technical Perspectives white paper states that relationships between models should be defined at the same level of abstraction as their metamodels. Given that all the OMG metamodels are defined using MOF, this enables a single transformation language to define mappings between any pair of models expressed in these languages. Furthermore, mappings may be defined in this single language to any non-OMG language for which a MOF metamodel is defined. For example, mappings are facilitated between UML and the CORBA Component Model (as it is a standard MOF metamodel), between models expressed in UML 1.4, and models expressed in UML 2.0 (as it will have a MOF metamodel). Other examples include mappings between EDOC-ECA and EAI, UML and EJB, etc...

6.1 Problem Statement

This RFP addresses the need for standardizing the way mappings are achieved between models whose languages are defined using MOF. In addition the RFP calls for a standard way of querying MOF models, and creating views onto these models. This is similar to the need for XSLT for XML, where an XSLT script defines the mapping between a pair of DTDs and dictates how XMLs (compliant with the DTDs) are transformed.

Queries on MOF models are required both to filter and select elements from a model on an ad-hoc basis, as well as to select elements that are the sources for transformations. This is similar to the need for Xpath within XSLT.

A view reveals specific aspects of a modeled system. A view is a model that is derived from another model. This RFP requests a mechanism for creating views. The RFP also addresses a common problem in current OMG specifications (such as MOF 1.x, XMI 1.x) and in many emerging Java Community Process JSRs (such as JMI). In these specifications transformation rules are described in English text, BNF and other mechanisms and there is no single standard way of defining them formally.

6.2 Scope

The following family of 'proposed' MOF 2.0 RFPs is planned over the next 12 to 18 months based on ADTF member's feedback. Because of the wide range of interests in the MOF community, it was decided to have a number of narrowly focused RFPs, rather than having one or two general RFPs that cover many different topics. This document is the sixth of the MOF 2.0 RFPs.

1. MOF 2.0 Core RFP
2. XMI for MOF 2.0 RFP
3. MOF 2.0 to CORBA IDL mapping RFP
4. MOF 2.0 to Java (JMI2) mapping. (This is expected to be handled through a new JSR issued under the Java Community Process umbrella to revise JMI 1.x)
5. MOF 2.0 Versioning and Life Cycle Management RFP
6. **MOF 2.0 Query/Views/Transformations RFP (This document)**
7. MOF 2.0 Federation/Facility/Directory RFP

This RFP depends on the details to be determined by the MOF 2.0 Core RFP process.

This RFP does not request a solution to render concrete syntaxes into the actual files; nor does it request mappings to other non-MOF technologies.

6.3 Relationship to Existing OMG Specifications

1. MOF 1.x uses OCL (defined in UML 1.x) for defining constraints and operation semantics. MOF 2.0 will depend even more on the UML 2.0 infrastructure. It is likely that OCL plays an important role in queries on metadata. While issuing this RFP there is another RFP for UML 2.0 OCL in progress.
2. Many OMG specifications and proposed specifications (e.g. MOF 1.x, EDOC and EAI) have defined transformation rules on metadata. These transformations should be definable in a standard way using the proposed solution.

3. CWM has a transformation model. The experience gained in the CWM transformation model is worth investigating.
4. UML Action Semantics contains mechanisms for manipulating object state. Some of these mechanisms should be considered for re-use.
5. Transformations and mappings are key aspects of MDA since many PIMS and PSMs will be standardized over the next several years. Submitters should be familiar with the MDA terminology by reviewing the MDA Technical perspectives and related white papers.
6. The in-progress CWM Metadata Interchange Patterns RFP includes a request for “a generic mechanism for expressing CWM metadata interchange patterns” which “must be specified in terms of MOF concepts”. There is potential for common approaches between this and the definition of MOF-based queries and views in response to this RFP.

6.4 Related Documents and Standards

- [1] MOF 1.3 Specification: OMG document `formal/2001-10-41`
- [2] MOF 1.4 Specification: OMG document `ptc/2001-10-04`
- [3] UML 2.0 Infrastructure RFP: OMG document `ad/00-09-01`
- [4] XML Metadata Interchange 1.2: OMG document `ptc/2001-08-22`
- [5] Java Metadata Interface: <http://jcp.org/jsr/detail/40.jsp>
- [6] XMI Production of XML Schema: OMG document `ad/2001-06-12`
- [7] UML 2.0 OCL RFP: OMG document `ad/00-09-03`
- [8] MOF 2.0 Core RFP: OMG document `ad/01-11-14`
- [9] MOF 2.0 IDL RFP: OMG document `ad/01-11-07`
- [10] MOF 2.0 XMI RFP: OMG document `ad/01-11-13`
- [11] MDA - A Technical Perspective: OMG document `ormsc/01-07-01`
- [12] CWM 1.0: OMG document `formal/2001-10-01`
- [13] CWM 1.1: OMG document `ptc/2002-01-04`
- [14] UML Action Semantics: OMG document `ptc/2002-01-09`
- [15] OQL: <http://www.odmg.org/>
- [16] SQL3: <http://www.ansi.org/>
- [17] XSLT: <http://www.w3.org/TR/xslt>
- [18] CWM Metadata Interchange Patterns RFP: OMG document `ad/2001-04-11`

6.5 Mandatory Requirements

1. Proposals shall define a language for querying models. The query language shall facilitate ad-hoc queries for selection and filtering of model elements, as

well as for the selection of model elements that are the source of a transformation.

2. Proposals shall define a language for transformation definitions. Transformation definitions shall describe relationships between a source MOF metamodel S, and a target MOF metamodel T, which can be used to generate a target model instance conforming to T from a source model instance conforming to S. The source and target metamodels may be the same metamodel.
3. The abstract syntax for transformation, view and query definition languages shall be defined as MOF (version 2.0) metamodels.
4. The transformation definition language shall be capable of expressing all information required to generate a target model from a source model automatically.
5. The transformation definition language shall enable the creation of a view of a metamodel.
6. The transformation definition language shall be declarative in order to support transformation execution with the following characteristic:
 - Incremental changes in a source model may be transformed into changes in a target model immediately.
7. All mechanisms specified in Proposals shall operate on model instances of metamodels defined using MOF version 2.0.

6.6 Optional Requirements

1. Proposals may support transformation definitions that can be executed in two directions. There are two possible approaches:
 - Transformations are defined symmetrically, in contrast to transformations that are defined from source to target.
 - Two transformation definitions are defined where one is the inverse of the other.
2. Proposals may support traceability of transformation executions made between source and target model elements.
3. Proposals may support mechanisms for reusing and extending generic transformation definitions. For example: Proposals may support generic

definitions of transformations between general metaclasses that are automatically valid for all specialized metaclasses. This may include the overriding of the transformations defined on base metaclasses. Another solution could be support for transformation templates or patterns.

4. Proposals may support transactional transformation definitions in which parts of a transformation definition are identified as suitable for commit or rollback during execution.
5. Proposals may support the use of additional data, not contained in the source model, as input to the transformation definition, in order to generate a target model. In addition proposals may allow for the definition of default values for this data.
6. Proposals may support the execution of transformation definitions where the target model is the same as the source model; i.e. allow transformation definitions to define updates to existing models. For example a transformation definition may describe how to calculate values for derived model elements.

6.7 Issues to be discussed

1. The OMG CWM specification already has a defined transformation model that is being used in data warehousing. Submitters shall discuss how their transformation specifications compare to or reuse the support of mappings in CWM.
2. The OMG Action Semantics specification already has a mechanism for manipulating instances of UML model elements. Submitters shall discuss how their transformation specifications compare to or reuse the capabilities of the UML Action Semantics.
3. How is the execution of a transformation definition to behave when the source model is not well-formed (according to the applicable constraints?). Also should transformation definitions be able to define their own preconditions. In that case: What's the effect of them not being met? What if a transformation definition applied to a well-formed model does not produce a well-formed output model (that meets the constraints applicable to the target metamodel)?
4. Proposals shall discuss the implications of transformations in the presence of incremental changes to the source and/or target models.

6.8 Evaluation Criteria

1. Proposals are preferred that support transformations of relatively high complexity. A simple transformation is for example, a transformation of one instance of "model.Attribute" (the source) to one instance of "uml.foundation.core.Attribute" (the target), both having an attribute called "name". A more complex transformation would be transforming an object-oriented model into a relational model including the mapping of the same attribute to different columns for foreign key membership.
2. Proposals shall be preferred that support reusable transformation definitions. For example, by supporting inheritance of transformation rules templates, or patterns.
3. Proposals shall be preferred that support extendable transformation definitions. In real-world situations users of an "off-the-shelf transformation" want to be able to override or extend aspects of that definition.

6.9 Other information unique to this RFP

None.

6.10 RFP Timetable

The timetable for this RFP is given below. Note that the TF may, in certain circumstances, extend deadlines while the RFP is running, or may elect to have more than one revised submission step. The latest timetable can always be found in the Member Services section of OMG's Web page (URL <http://www.omg.org/>)

Approx Day	Event or Activity	Actual Date
	<i>Preparation of RFP by TF</i>	
	<i>Approval of RFP by Architecture Board Review by TC (“Three week rule”)</i>	
<i>0</i>	<i>TC votes to issue RFP</i>	<i>April 26, 2002</i>
<i>68</i>	<i>LOI to submit to RFP due</i>	<i>June 1, 2002</i>
<i>218</i>	<i>Initial submissions due</i>	<i>October 28, 2002</i>
<i>218</i>	<i>Voter registration closes</i>	<i>October 28, 2002</i>
<i>241</i>	<i>Initial submission presentations</i>	<i>November 20 , 2002</i>
	<i>Preliminary evaluation by TF</i>	
<i>358</i>	<i>Revised submissions due</i>	<i>March 17, 2003</i>
<i>381</i>	<i>Revised submission presentations</i>	<i>April 9, 2003</i>
	<i>Final evaluation and selection by TF Recommendation to AB and TC</i>	
	<i>Approval by Architecture Board Review by TC (“Three week rule”)</i>	
<i>453</i>	<i>TC votes to recommend specifications</i>	<i>June 20, 2003</i>
<i>481</i>	<i>BOD votes to adopt specifications</i>	<i>June/July 2003</i>

Appendix A References and Glossary

A.1 References

The following documents are referenced in this document:

[ATC] Air Traffic Control Specification,
http://www.omg.org/technology/documents/formal/air_traffic_control.htm

[BCQ] OMG Board of Directors Business Committee Questionnaire,
<http://www.omg.org/cgi-bin/doc?bc/02-02-01>

[CCM] CORBA Core Components Specification,
http://www.omg.org/techprocess/meetings/schedule/Components_December_2000_FTF.html

[CORBA] Common Object Request Broker Architecture
(CORBA/IIOP),
http://www.omg.org/technology/documents/formal/corba_iiop.htm

[CSIV2] [CORBA] Chapter 26

[CWM] Common Warehouse Metamodel Specification,
<http://www.omg.org/technology/documents/formal/cwm.htm>

[DAIS] Data Acquisition from Industrial Systems,
<http://www.omg.org/cgi-bin/doc?dtc/2001-07-03>

[EDOC] UML Profile for EDOC Specification,
http://www.omg.org/techprocess/meetings/schedule/UML_Profile_for_EDO_C_FTF.html

[EJB] “Enterprise JavaBeans™”,
<http://java.sun.com/products/ejb/docs.html>

[FORMS] Download of OMG templates and forms,
http://www.omg.org/technology/template_download.htm

[GE] Gene Expression, <http://www.omg.org/cgi-bin/doc?dtc/2002-02-04>

[GLS] General Ledger Specification 1.0,
http://www.omg.org/technology/documents/formal/gen_ledger.htm

[Guide] The OMG Hitchhiker's Guide, Version 6.1,
<http://www.omg.org/cgi-bin/doc?omg/2002-03-03>

[IDL] ISO/IEC 14750 also see [CORBA] Chapter 3.

[IDLC++] IDL to C++ Language Mapping,
<http://www.omg.org/technology/documents/formal/c++.htm>

[MDAa] OMG Architecture Board, "Model Driven Architecture - A Technical Perspective", <http://www.omg.org/mda/papers.htm>

[MDAb] "Developing in OMG's Model Driven Architecture (MDA)," <http://www.omg.org/cgi-bin/doc?omg/2001-12-01>

[MDAc] "MDA Guide" (to be published)

[MDAd] "MDA "The Architecture of Choice for a Changing World™", <http://www.omg.org/mda>

[MOF] Meta Object Facility Specification,
<http://www.omg.org/technology/documents/formal/mof.htm>

[MQS] "MQSeries Primer",
<http://www.redbooks.ibm.com/redpapers/pdfs/redp0021.pdf>

[NS] Naming Service,
http://www.omg.org/technology/documents/formal/naming_service.htm

[OMA] "Object Management Architecture™",
<http://www.omg.org/oma/>

[OTS] Transaction Service,
http://www.omg.org/technology/documents/formal/transaction_service.htm

[P&P] Policies and Procedures of the OMG Technical Process,
<http://www.omg.org/cgi-bin/doc?pp>

[PIDS] Personal Identification Service,
http://www.omg.org/technology/documents/formal/person_identification_service.htm

[RAD] Resource Access Decision Facility, <http://www.omg.org/cgi-bin/doc?formal/01-04-01>

[RM-ODP] ISO/IEC 10746

[SEC] CORBA Security Service,
http://www.omg.org/technology/documents/formal/security_service.htm

[TOS] Trading Object Service,
http://www.omg.org/technology/documents/formal/trading_object_service.htm

[UML] Unified Modeling Language Specification,
<http://www.omg.org/technology/documents/formal/uml.htm>

[UMLC] UML Profile for CORBA, <http://www.omg.org/cgi-bin/doc?ptc/01-01-06>

[UMLM] Chapter 6 of UML Profile for EDOC,
<http://www.omg.org/cgi-bin/doc?ptc/02-02-05>

[XMI] XML Metadata Interchange Specification,
<http://www.omg.org/technology/documents/formal/xmi.htm>

[XML/Value] XML Value Type Specification, <http://www.omg.org/cgi-bin/doc?ptc/2001-04-04>

These documents (and information about the OMG in general) can be obtained from the OMG's web site (<http://www.omg.org>). Documents may also be obtained by contacting OMG at documents@omg.org. Questions related to the OMG's technology adoption process may be directed to omg-process@omg.org. General questions about this RFP may be sent to responses@omg.org.

A.2 Glossary

Architecture Board (AB) - The OMG plenary that is responsible for ensuring the technical merit and MDA-compliance of RFPs and their submissions.

Board of Directors (BoD) - The OMG body that is responsible for adopting technology.

Common Object Request Broker Architecture (CORBA) - An OMG distributed computing platform specification that is independent of implementation languages.

Common Warehouse Metamodel (CWM) - An OMG specification for data repository integration.

CORBA Component Model (CCM) - An OMG specification for an implementation language independent distributed component model.

Interface Definition Language (IDL) - An OMG and ISO standard language for specifying interfaces and associated data structures.

Letter of Intent (LOI) - A letter submitted to the OMG BoD's Business Committee signed by an officer of an organization signifying its intent to respond to the RFP and confirming the organization's willingness to comply with OMG's terms and conditions, and commercial availability requirements.

Mapping - Specification of a mechanism for transforming the elements of a model conforming to a particular metamodel into elements of another model that conforms to another (possibly the same) metamodel.

Metadata - Data that represents models. For example, a UML model; a CORBA object model expressed in IDL; and a relational database schema expressed using CWM.

Metamodel - A model of models.

Meta Object Facility (MOF) - An OMG standard, closely related to UML, that enables metadata management and language definition.

Model - A formal specification of the function, structure and/or behavior of an application or system.

Model Driven Architecture (MDA) - An approach to IT system specification that separates the specification of functionality from the specification of the implementation of that functionality on a specific technology platform.

Platform - A set of subsystems/technologies that provide a coherent set of functionality through interfaces and specified usage patterns that any subsystem that depends on the platform can use without concern for the details of how the functionality provided by the platform is implemented.

Platform Independent Model (PIM) - A model of a subsystem that contains no information specific to the platform, or the technology that is used to realize it.

Platform Specific Model (PSM) - A model of a subsystem that includes information about the specific technology that is used in the realization

of it on a specific platform, and hence possibly contains elements that are specific to the platform.

Request for Information (RFI) - A general request to industry, academia, and any other interested parties to submit information about a particular technology area to one of the OMG's Technology Committee subgroups.

Request for Proposal (RFP) - A document requesting OMG members to submit proposals to the OMG's Technology Committee. Such proposals must be received by a certain deadline and are evaluated by the issuing task force.

Task Force (TF) - The OMG Technology Committee subgroup responsible for issuing a RFP and evaluating submission(s).

Technology Committee (TC) - The body responsible for recommending technologies for adoption to the BoD. There are two TCs in OMG - *Platform TC* (PTC), that focuses on IT and modeling infrastructure related standards; and *Domain TC* (DTC), that focus on domain specific standards.

Unified Modeling Language (UML) - An OMG standard language for specifying the structure and behavior of systems. The standard defines an abstract syntax and a graphical concrete syntax.

UML Profile - A standardized set of extensions and constraints that tailors UML to particular use.

XML Metadata Interchange (XMI) - An OMG standard that facilitates interchange of models via XML documents.