Object Management Group

140 Kendrick Street
Building A Suite 300
Needham, MA 02494
USA

Telephone: +1-781-444-0404
Facsimile: +1-781-444-0320

Semantic Information Modeling for Federation (SIMF)

Request for Proposal

OMG Document: ad/2011-12-10

Letters of Intent due: March 15, 2012
Submissions due: August 13, 2012

Objective of this RFP

The SIMF RFP asks for submissions for a standard that addresses the federation of information across different representations, levels of abstraction, communities, organizations, viewpoints, and authorities. Federation, in this context, means using independently conceived information sets together for purposes beyond those for which the individual information sets were originally defined.

The purpose of SIMF is to help federate information across different authorities, vocabularies and formats. Current conceptual and logical information modeling approaches tend to be focused on a particular information modeling problem, using a particular technical approach. Examples of such technical approaches include object modeling, DBMS modeling and exchange schema modeling. SIMF seeks to address the problem of information federation by specifying standards for conceptual domain modeling, logical information modeling and model bridging relationships.

SIMF submissions will define, adopt and/or adapt languages to express the conceptual domain models, logical information models and model bridging relationships needed to achieve this federation.

Many if not all of these capabilities can be achieved with expert application of multiple standards and technologies. SIMF is intended to *unify* and tailor these capabilities, providing a standard for tools that reduce the barrier to entry and overhead required to achieve federated information.

For further details see Chapter 6 of this document.

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 Specific to this RFP*

Appendix B – *General References and Glossary*

1.3 Conventions

The key words "**must**", "**must not**", "**required**", "**shall**", "**shall not**", "**should**", "**should not**", "**recommended**", "**may**", and "**optional**" in this document are to be interpreted as described in RFC 2119 [RFC2119].

1.4 Contact Information

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*.

OMG documents (and information about the OMG in general) can be obtained from the OMG's web site *(http://www.omg.org/*). OMG documents may also be obtained by contacting OMG at *documents@omg.org*. Templates for RFPs (like this document) and other standard OMG documents can be found at the OMG Template Downloads Page at *http://www.omg.org/technology/template_download.htm*

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), XML Metadata Interchange [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]. In case of any inconsistency between this document and the [P&P] in all cases the [P&P] shall prevail.

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 organization must be a member of the TC that issued the RFP.

- *Voter Registration*

  Interested OMG members, other than Trial, Press and Analyst members, may participate in specification selection votes in the TF for an RFP. They may need to register to do so, 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. Member organizations that 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 submitters have the opportunity to revise their Submissions, if they so choose.

- *Revised Submissions*

  Revised 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 set new Revised Submission deadlines 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 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 taken by the BoD and is based on technical merit as well as business qualifications. The resulting draft standard is called the *Alpha Specification*.

- *Business Committee Questionnaire*

  The submitting members 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 TC that issued the RFP, to prepare an Alpha submission for publishing as a Formal (i.e. publicly available) specification, by fixing any problems that are reported by early users of the specification. Upon completion of its activity the FTF recommends adoption of the resulting Beta (draft) specification. The parent TC acts on the recommendation and recommends adoption to the BoD. OMG Technical Editors produce the Formal Specification document based on this Beta Specification.

- *Revision*

  A Revision Task Force (RTF) is normally chartered by a TC, after the FTF completes its work, to manage issues filed against the Formal Specification by implementers and users. The output of the RTF is a Beta specification reflecting minor technical changes, which the TC and Board will usually approve for adoption as the next version of the Formal Specification.

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 the submitter or submitters must be either Platform or Contributing members 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

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/06-03-02.*
>
> *<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/06-03-02.

Commercial considerations in OMG technology adoption

A1 Introduction

OMG wishes to encourage rapid commercial adoption of the specifications 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 organisations. Pre-product implementations are acceptable. Since use of OMG specifications should not be dependant 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.
- Demonstration of 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 organisations 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.

A2.3 Access to Intellectual Property Rights

OMG will not adopt a specification 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, unless OMG believes that such IPR owner will grant a license to organisations (whether OMG members or not) on non-discriminatory and commercially reasonable terms which wish to make use of the specification. Accordingly, the submitter must certify that it is not aware of any claim that the specification 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 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 commercialisation 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 licence 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.

A2.4 Publication of the specification

Should the submission be adopted, the submitter must grant OMG (and its sublicensees) a world- wide, royalty-free licence 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 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 requirements enumerated 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 confidential or proprietary information of any kind will be accepted in a submission to this RFP.

4.7 Copyright Waiver

Every submission document must contain: (i) a waiver of copyright for unlimited duplication by the OMG, and (ii) a limited waiver of copyright that allows each OMG member to make up to fifty (50) copies of the document for review purposes only. See Section 4.9.2 for recommended language.

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 the technical viability of their proposal to the satisfaction of the TF managing the evaluation process. OMG will favor proposals based on technology for which sufficient relevant experience has been gained.

4.9 Format of RFP Submissions

This section presents the structure of a submission in response to an RFP. *All submissions* must contain the elements itemized in section 4.9.2 below before they can be accepted as a valid response for evaluation or a vote can be taken to recommend for adoption.

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.
- The key words "**must**", "**must not**", "**required**", "**shall**", "**shall not**", "**should**", "**should not**", "**recommended**", "**may**", and "**optional**" shall be used in the submissions with the meanings as described in RFC 2119 [RFC2119].

4.9.2 Required Outline

A three-part structure for submissions is required. Part I is non-normative, providing information relevant to the evaluation of the proposed specification. Part II is normative, representing the proposed specification. Specific sections like Appendices may be explicitly identified as non-normative in Part II. Part III is normative specifying changes that must be made to previously adopted specifications in order to be able to implement the specification proposed in Part II.

PART I

- A cover page carrying the following information (a template for this is available [Inventory]):
  - The full name of the submission
  - The primary contact for the submission
  - The acronym proposed for the specification (e.g. UML, CORBA)
  - The name and document number of the RFP to which this is a response

  - The document number of the main submission document
  - An inventory of all accompanying documents, with OMG document number, short description, a URL where appropriate, and whether they are normative.

- List of OMG members making the submission (see 4.1) listing exactly which members are making the submission, so that submitters can be matched with LOI responders and their current eligibility can be verified.
- Copyright waiver (see 4.7), in a form acceptable to the OMG.

  One acceptable form is:

  "Each of the entities listed above: (i) grants to the Object Management Group, Inc. (OMG) a nonexclusive, royalty-free, paid up, worldwide license to copy and distribute this document and to modify this document and distribute copies of the modified version, and (ii) grants to each member of the OMG a nonexclusive, royalty-free, paid up, worldwide license to make up to fifty (50) copies of this document for internal review purposes only and not for distribution, and (iii) has agreed that no person shall be deemed to have infringed the copyright in the included material of any such copyright holder by reason of having used any OMG specification that may be based hereon or having conformed any computer software to such specification."

  If you wish to use some other form you must get it approved by the OMG legal counsel before using it in a submission.

- For each member making the submission, an individual contact point who is authorized by the member to officially state the member's position relative to the submission, including matters related to copyright ownership, etc. (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

The contents of this part should be structured based on the template found in [FORMS] and should contain the following elements as per the instructions in the template document cited above:

- Scope of the proposed specification
- Proposed conformance criteria

  Submissions should propose appropriate conformance criteria for implementations.
- Proposed normative references

  Submissions should provide a list of the normative references that are used by the proposed specification
- Proposed list of terms and definitions

  Submissions should provide a list of terms that are used in the proposed specification with their definitions.
- Proposed list of symbols

  Submissions should provide a list of special symbols that are used in the proposed specification together with their significance
- Proposed specification

PART III

- Changes or extensions required to existing 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 Adobe FrameMaker source, ODF (ISO/IEC 26300), OASIS Darwin Information Typing Architecture (DITA) or OASIS DocBook 4.x (or later).

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 using 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 *conformance criteria* 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 5.1.13 shall be taken into consideration to ascertain that an implementation of the proposal is securable in an environment requiring security.

5.2.4 Conformance: Inspectability and Testability

The adequacy of proposed specifications for the purposes of conformance inspection and testing will be considered. Specifications should provide sufficient constraints on interfaces and implementation characteristics to ensure that conformance 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

6.1 Problem Statement

Our ability to share, manage, analyze, communicate and act upon information is at the foundation of the modern enterprise and open, collaborative government. Information sharing is essential for an integrated approach to enterprise supply chains, fighting terrorism, business and government intelligence, inter-organizational collaboration and integrating enterprise applications. Yet, this essential capability has remained difficult and expensive to achieve in information systems which are frequently isolated, stove piped, and difficult to integrate. The inability of our systems to share information hampers the ability of our organizations to collaborate and for our processes, services, and information resources to work together. Much of our information technology budgets are consumed by attempts to overcome this "semantic friction" in our systems and organizations are currently spending more on application integration than on building new applications [Gartner2011]. The overall human and financial cost to society from our failure to share and reuse information is many times the cost of the systems' operation and maintenance.

In general, information sharing can be understood at a number of different levels.

- *Infrastructure* is the technology used to maintain data and move it from one place to another.
- *Format* is the way data are structured.
- *Semantics* deals with how data is interpreted as meaningful information. For an information system, this interpretation is reflected in how the data is processed in order to carry out the business purpose of the system.

We are effective at dealing with data infrastructure today, and we are somewhat effective at handling multiple data formats, albeit via manual and point-to-point integrations. However, we are not very good at understanding how the semantics of data in independent data sources are related. Too often, how each system interprets shared data is implicit in the specific design and operation of the systems. Differences in structure, terminology, viewpoint, and notations make system-specific data structures hard to integrate, negatively impacting the capability to federate these systems.

Full semantic integration requires information systems to all properly and consistently interpret the data exchanged among the systems. This, in turn, requires that there be an explicit understanding of what the desired semantic interpretation *is* at a business level. A semantic *model* can be used to express this understanding in a way that can be validated by the business stakeholders of the systems being integrated. And, given a formal underpinning for such a model, it can then also be used for supporting analyses and deductions necessary to carry out the necessary integration.

Unfortunately, for most existing information systems, the desired semantics have not been properly modeled. The following are some scenarios in which semantic integration is, nevertheless, critical. Diverse and disparate efforts are currently being made to address these scenarios, examples of which are included with the scenario descriptions below. But, as of today, there is no consistent way to address modeling for semantic integration in general across all these areas.

- *Data integration between business systems.* Many large businesses have a critical need to better integrate systems in support of complex products. Not only may their business area have suffered financial distress, but there may be a need for new government reporting or new analytics and integration due to acquisitions. Such organizations typically have multiple layers of existing data bases, middleware specifications and XML schemas for use in web services, event brokers, etc. Most, if not all, of the existing systems and technologies still need to be supported. There may be dozens or even hundreds of enterprise systems involved and hundreds or thousands of small applications and spreadsheets.

  Example. A common approach chosen for integrating major business systems is to create a "canonical model" of the domain and then map data into and out of that model using data mapping tools. Unfortunately, while there are various proprietary tools to support such an effort, there is no widely available standard-based tooling for the job. For instance, while UML can be and is used for the modeling part of the job, a general modeling notation such as UML is far from ideal for the conceptual level of modeling required, and there is currently no standard profile to adapt it to the task nor for mapping data into and out of a canonical model in general. (The Model Driven Message Interoperability specification provides some support for the latter, but only limited to message format transformation for the financial services domain.)

- *Data federation across multi-disciplinary teams.* Developing complex systems often involves many parties who are widely distributed in location and time. Such development therefore requires efficient and effective information exchange during the complete development and operations lifecycle of the system. This can only be achieved by realizing semantic integration between all involved parties.

  Example. The European Cooperation for Space Standardization (ECSS)[1] addresses this issue by introducing the concept of *a global conceptual model.* This model is used in the implementation of "space system data repositories" as federations of physical databases. These databases are geographically dispersed and change over time but are logically integrated in an interoperable architecture, so that data can be exchanged effectively and reliably. Such data repositories need to be stable over a long period of time, so modeling must be at the semantic level *independent* of technology and tools. This modeling allows for upgrading the implementation technology without changing the model and data itself. The primary aim of this is to substantially reduce the system development and operation costs while achieving greater precision and federation.

- *Information federation across an industry.* Entire major industries, such as finance and telecommunications, need to deal with the representation of information relative to multiple contexts, taking into account different business processes, specific modeling goals and needs, visualization and implementation requirements or the existence of

[1] ECSS is an initiative established to develop a coherent, single set of user-friendly standards for use in all European space activities [ECSS].

overlapping modeling domains. These differing contexts and conditions may require emphasizing different aspects and characteristics of essentially the same information. The representation of a concept in one view may be different from the representation of the same concept in another view as the context-specific details that are relevant differ from view to view. Information can be described using different yet compatible paradigms (e.g., domain-specific languages vs. UML and profiles) yet the meaning and semantics of the information should stay the same regardless of the format. This, again, highlights the need to focus on a common core model of shared semantic concepts.

Examples. Some examples of efforts to deal with industry-level information federation are the Shared Information and Data (SID) Model, developed by the TM Forum [TMForum], the Common Information Model (CIM) developed by the Distributed Management Task Force [DMTF] and the Reference Information Model (RIM)developed by Health Level Seven [HL7].

- *Data federation across government organizations.* Information sharing has been recognized by governments as a key enabler for purposes as diverse as fighting terrorism to financial transactions. There has been some progress in standardizing exchange schemas, which is a big step ahead of no standards at all, but the need exists to ensure that there is no ambiguity in the semantics of the exchanged data in order to safely enable the reuse of that data. In addition, any such standard must accept that there are and will be other such standards and that these also need to be federated.

  Example. The U.S. Information Sharing Environment (ISE) "provides analysts, operators, and investigators with integrated and synthesized terrorism, weapons of mass destruction, and homeland security information needed to enhance national security and help keep our people safe" [ISE]. ISE depends on fixed schemas for information sharing, i.e., the National Information Exchange Model (NIEM) and the Universal Core (UCORE). These schemas provide XML Schema definitions that are claimed to be sufficiently common and universally understood by relevant stakeholders regardless of the IT systems being used within their intended domains. Even within NIEM, though, hundreds of overlapping schemas have been defined.

- *Model federation across different modeling metamodels*. The OMG itself has multiple standards related to modeling. These standards were originally created independently, resulting in difficulties when users try to use them together to share information embodied in models using the different standards. A conceptual model abstracting from the existing OMG modeling standards, would facilitate their comparison, acknowledging the commonality (or lack thereof) between the different concepts and definitions and bridging those concepts.

  Example. OMG specifications related to just process modeling include BPMN, UML Activities, BPDM, and SPEM. A case in point in the difficulty this has caused relates to the *UML Profile for DODAF and MoDAF* (UPDM), a wide ranging profile supporting US Department of Defense (DOD) and UK Ministry of Defence (MOD) architecture frameworks. The UPDM community wishes, for example, to be able to use BPMN process models in the context of their UML Profile. A stopgap tactic has been to define an additional *UML Profile for BPMN*, which allows BPMN-looking diagrams to be drawn in UML, but it is clear this is not a strategic approach. A better approach would be to create a "process modeling" conceptual domain model that would then permit model bridging relations between BPMN, UML, BPDM and SPEM models, allowing sharing across users' process models

- *Schema Evolution*. As information systems evolve to support changing enterprise needs, the datasets they use need to evolve as well. While some changes are additive and readily accommodated, others involve factoring and evolving concepts. At their core, such changes require the evolution of the dataset schema underlying the system and the migration of the data from the old to new schemas. Such changes also impact the logic that interacts with the dataset and every external interface and related data structure. While there is some tooling available for schema migration, there is little available to aid in the evolution of the logic and external interfaces. The absence of semantic understanding of the relationship between the schema and external interface data structures makes tooling to aid in the evolution problematic.

  Example. It is common for an enterprise to represent the concept of *customer* as a composite of information about the person and the role that person plays with respect to the enterprise. Evolving needs, including regulatory requirements, require many enterprises to now factor this concept so that they can represent that the same person may play other roles as well, such as employee. Such semantic understanding is required to enforce constraints such as a prohibition against the same individual playing both the customer and employee role in a transaction. The absence of semantics-based tooling makes such changes labor intensive and error prone.

Current standards for information and data modeling may be effective at defining a particular data model for a particular application using a particular technology to solve a particular problem. But, as highlighted by the above examples, the methodology for using these standards at a higher level of abstraction – namely for cross-domain and cross-organizational semantic modeling – is not as well or as widely understood. As a consequence, the models available within a given organizational context are often not well suited to application across multiple dimensions or technologies, and so poorly support the needs for sharing and federation.

6.2 Scope of Proposals Sought

6.2.1 Overview

The purpose of SIMF is to provide a standard modeling language supporting information modeling for sharing and federation, addressing the demonstrated need for modeling of business concepts at a semantic level and an ability to bridge across conceptual, logical and physical information models. Clearly, addressing real-world needs for federation and integration, such as those described in Section 6.1, would involve other technologies and approaches in addition to modeling based on SIMF. However, the expectation is that SIMF can make a substantial difference in addressing these needs by providing a common, consistent modeling approach built on experience, such as that discussed in Section 6.1.

The SIMF approach should not presume that there is only one "right" conceptualization or representation of information, instead allowing for a choice of semantically equivalent models. It is therefore necessary to define conceptualizations and representations accurately and then relate them, through bridging relations, to other ways to conceptualize and represent the same or related information. It is not expected that the SIMF standard can fully solve this problem but that a partial solution will substantially reduce the semantic friction between information systems. Even a partial reduction in semantic friction would result in substantial cost reduction, increased usability of data and correspondingly more effective collaborative processes and services.

One approach to addressing this would be to just add model bridging relations to existing data and object modeling techniques. However, such relations, no matter how well defined semantically themselves, would be between models of data that lack an explicit definition for the semantic interpretation of the data being modeled. As indicated by the examples in Section 6.1, such an approach provides less than optimal results that cannot properly support federation and is not solving major integration problems today.

The problem is that there is insufficient meaning in a simple link between data model elements, without defining the semantics of the modeled data elements being related. As experience has repeatedly shown, semantic models are needed to provide the common grounding for information being modeled, in addition to the links between data models. Unfortunately, existing modeling techniques tend to be over-specialized to a particular software technical approach. Techniques such as object, relational or ontological modeling are not well-suited for the role of representing a federated perspective because they were originally designed for more specialized purposes than to address heterogeneous federation requirements.

In that many physical and logical data models already exist, it is not intended that the SIMF standard invent more physical data formats. Instead, SIMF must provide an information modeling language that is firmly based on the representation of semantics while providing a way to make connections from these existing physical schemas to the logical and conceptual layers. Model driven architecture techniques may also be used to produce schemas in these existing logical and physical schema languages based on SIMF models. Likewise, existing logical information models may be federated with SIMF and used with SIMF bridging capabilities.

Past experience shows that the necessary building blocks for SIMF already exist. The intent for SIMF is to bring together the best practices and best technologies into a standard that makes a substantial contribution to solving the information sharing and federation problem with mainstream solutions.

6.2.2 Modeling Scope of SIMF

As described in Section 6.2.1, the scope of SIMF encompasses conceptual domain modeling, logical information modeling and the modeling of bridging relations between models at all levels. Figure 1 summarizes the general organization of information models into conceptual, logical and physical layers and indicates the scope of SIMF within it. The following more precisely defines the terminology used to describe this scope.

- *Conceptual Domain Model (CDM).* A CDM is not a traditional data model, as such, but, rather, a model of the terms and concepts of an area of concern or *domain*, which may be a broad industry area such as telecommunications, finance or even metamodeling or may be more focused on a specific application area. It primarily addresses the semantics, concepts and terminology of a domain, capturing the meaning that usually is not available in a data model, while abstracting out data representation and application specific considerations. The objective of a CDM is to capture the semantics of one or more domains as a well defined set of (potentially federated) concepts, predicates (to express properties about the concepts and to relate them) and integrity rules (constraining instances). For a given domain, many CDMs may co-exist, e.g. CDMs that have been developed by different entities and express differing points of view.

For the purpose of this RFP, conceptual domain modeling is limited to modeling the information concerns of a domain. Modeling processes and services is considered out of scope. However, this does not imply that all modeling of the dynamics of concepts is necessarily out of scope. (Future RFPs may address further process-oriented conceptual modeling requirements.)

- *Logical Information Model (LIM).* A LIM acts as an intermediary between CDMs and physical data schema (see below). The objective of a LIM is to provide a purpose-specific but implementation technology-independent view of information in terms of logical data structures. There can be multiple different ways to represent the same information from different viewpoints and for specific purposes. Each viewpoint may have its own structure, local vocabulary and subset of all possible information in a domain. These purpose specific commitments are made in the LIM.

  Elements of a LIM are related to the CDM concepts, predicates and integrity rules they represent (using Model Bridging Relations, see below) and may extend or embed other logical elements. A LIM model addresses a specific viewpoint and purpose and, as such, selects those types, properties and relations of interest and structures them for that purpose.

- *Physical Data Schema (PDS).* A PDS describes how to implement a LIM in a database or exchange format of choice. That is, it defines the application- and technology-specific representations of data. There can be many PDS representations of the same LIM. PDSs grounded in LIMs (using Model Bridging Relations, see below) provide the basis for federation of data defined in those schemas. Such fixed schemas become a particular *projection* of information for a particular purpose, but not the only way to access the same information.

- *Model Bridging Relation (MBR).* An MBR defines a connection between different sets of elements in the same or different models. This connection may be between models across the conceptual, logical and physical modeling layers, or within models of a given layer. MBRs may bridge different models created as part of a single wider effort or they may address connections between independently conceived models. Linking the semantics of information in its different conceptual, logical and physical representations, MBRs are the foundation of federation.

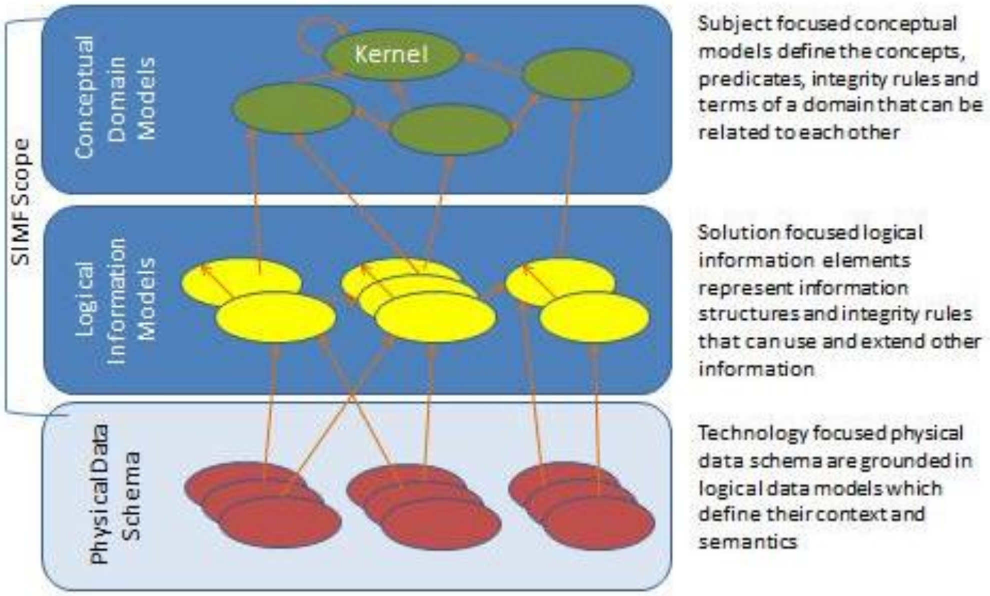

Figure 1 Information Modeling Layers and SIMF Modeling Scope

As indicated in Figure 1, the scope of SIMF includes CDMs, LIMs and MBRs (where the lines in the diagram represent MBRs). While PDSs are out of scope for SIMF, model bridging relations to PDSs are part of SIMF.

6.2.3 Language Scope of SIMF

This RFP asks for proposals for a SIMF Language to express CDMs, LIMs and MBRs, in support of information modeling and federation. The proposed Language is expected to use and build on existing standards and best practices to provide a purpose-specific capability for information modeling and federation that may be used to present a "business friendly" view of information models and the connections between them. Proposals must not only define the abstract and concrete syntax for the Language, but also provide a very well defined semantics for it, one grounded in formal logic (though knowledge of formal logic should not be required to use the Language).

As shown in Figure 2, the SIMF Language definition is required to include the following parts.

- *SIMF Conceptual Model.* This model defines the conceptual semantics for the SIMF Language. It can be thought of as a CDM for the domain of information modeling and federation, providing the common conceptual vocabulary, rules and structure for this domain. As such, it can itself be represented using the SIMF Language. The circularity of representing the SIMF Conceptual Model using the SIMF Language is similar to the representation of the Foundational UML (fUML) semantic model in fUML and is analogous to the circularity at the syntactic level of representing the UML abstract syntax model using the MOF subset of UML.

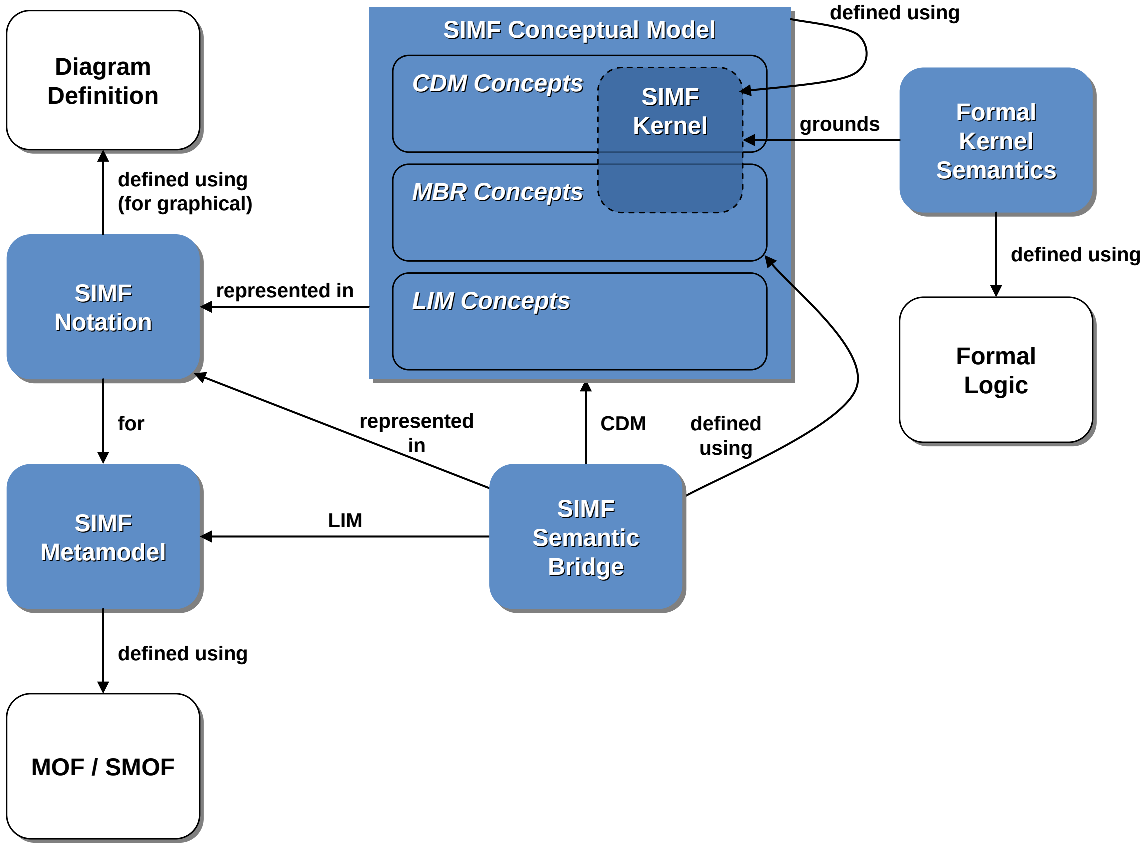

Figure 2 SIMF Language Definition

- *SIMF Metamodel.* This metamodel defines the abstract syntax for the SIMF Language. The intent of the SIMF Metamodel is to provide a logical representation of the concepts in its semantic domain, as represented by the SIMF Conceptual Model. Thus, if the SIMF Conceptual Model is thought of as a CDM, then the SIMF Metamodel can be thought of as a LIM for the SIMF Language. The SIMF Metamodel must be represented as a standard MOF Core model (possibly, at a submitter's discretion, also taking advantage of the extended capabilities of the Semantic MOF specification). This automatically allows for the interchange of models expressed in the SIMF Language using the XMI standard, which essentially provides a PDS representation for the Language in terms of XML technology.
- *SIMF Notation.* The SIMF Language must have both graphical and textual notations. To the greatest extent possible, these notations should be usable by a wide range of users, from domain experts to architects and data modelers. To achieve this, proposals may define multiple graphical and/or textual notations, targeted to different user communities. All graphical notations must be defined in terms of the SIMF Metamodel using the Diagram Definition standard.
- *SIMF Semantic Bridge.* The SIMF Conceptual Model models the semantics of the SIMF Language, while the SIMF Metamodel models the (abstract) syntax of the Language. Thus, a bridge between these models defines the semantics of the logical representation of a SIMF model (as specified by the SIMF Metamodel) in terms of concepts in the SIMF

semantic domain (as defined in the SIMF Conceptual Model). Considering the SIMF Conceptual Model to be a CDM and the SIMF Metamodel to be a LIM, the SIMF Semantic Bridge between them is then simply an MBR model. As such, it can itself also be represented using the SIMF Language.

- *SIMF Kernel.* At some point, the circularity of representing the SIMF Conceptual Model and the SIMF Semantic Bridge using the SIMF Language itself must be broken in order to provide a well-grounded language definition. This may be done by identifying the *Kernel* for the SIMF Conceptual Model, that is, the smallest subset of the Conceptual Model such that all other parts of the Conceptual Model can be defined in terms of concepts within the Kernel. Proposals must then provide an independent definition of the semantics of the Kernel in terms of formal logic.

Finally, the SIMF standard must itself be federated, with MBRs required between the SIMF Metamodel and the information modeling capabilities of UML, SQL, ER, RDF/S, OWL and XSD data schemas. One must be able to use SIMF with these mainstream technologies and be able to federate information models in them.

6.3 Relationship to Other OMG Specifications and Activities

6.3.1 Relationship to OMG Model Driven Architecture (MDA)

There is a close alignment between the basic scoping of SIMF as discussed in Sections 6.1 and 6.2 of this RFP and OMG's classic Model Driven Architecture (MDA) approach.

As defined in the OMG MDA Guide v1.0.1 (omg/2003-06-01), MDA is an approach "separating the specification of the operation of a system from the details of the way that system uses the capabilities of its platform." This separation of concerns is reflected in the well-known MDA organization of the models used to specify a system into:

- Computation Independent Models (CIMs) that model the (business) environment in which the system will operate
- Platform Independent Models (PIMs) that model the operation of the system independently of its implementation platform
- Platform Specific Models (PSMs) that model the system in the context of a specific platform choice.

In the context of information federation, the "platform" is the information sharing infrastructure technology and technology-specific data formatting described in Section 6.1. Since, as discussed in Section 6.2.2, a SIMF PDS is specific to such a platform, PDSs are the PSMs of information modeling. Since LIMs are technology-independent they are correspondingly PIMs. And, finally, CDMs are CIMs, providing the business-level conceptual model necessary for information federation.

The MDA Guide also defines model transformation as "the process of converting one model to another model of the same system." Given the above alignment of model levels, SIMF MBR model can be understood to some extent as the specification of a transformation between model levels, though MBRs are declarative specifications of model relationships, not necessarily operational transformations. Further, while MDA focuses primarily on just the transformation from PIM to PSM, SIMF must support bridging not only between LIMs and PDSs, but also between CDMs and LIMs, as required to ground information sharing and federation in the domain-level semantic concepts defined in the CDM.

6.3.2 Relationship to OMG Specifications

6.3.2.1 Meta Object Facility (MOF)

The abstract syntax for the SIMF Language is required to be defined as a MOF metamodel. (Submitters also have the option to use the additional facilities, such as multiple classification, available in the Semantic MOF (SMOF) extension of MOF.) This allows for the interchange of SIMF models using XML Metadata Interchange (XMI). Further the concrete graphical syntax for the Language is required to be defined using the MOF-based Diagram Definition (DD) standard.

- Meta Object Facility (MOF) v2.4.1 – http://www.omg.org/spec/MOF/2.4.1
- Semantic Meta Object Facility (SMOF) v1.0 – http://www.omg.org/spec/SMOF/1.0/Beta1
- XML Metadata Interchange (XMI) v2.4.1 – http://www.omg.org/spec/XMI/2.4.1
- Diagram Definition(DD) – http://www.omg.org/spec/DD/1.0/Beta1

6.3.2.2 Unified Modeling Language (UML)

UML is the general purpose OMG modeling language standard. It is further supported by the Object Constraint Language (OCL), which provides a language for specifying constraints within UML models.

As noted in Section 6.1, UML has been used for information and data modeling at all levels. However, applying UML at each of the levels of CDMs, LIMs and PDSs requires different adaptations of the general UML notation. Further, particularly for CDMs, there is a need for a precision of model semantics that is not provided in the UML specification.

The Foundational UML (fUML) subset of UML has been given a precise semantics, but this semantics is focused on executable models. While the fUML subset does include semantics for basic UML class modeling, the constructs included are not sufficient to handle all the model requirements for SIMF. However, the fUML specification does provide an example of formally grounding the semantics of a modeling language using Common Logic.

It is also required that the SIMF specification provide bridging relationships from the SIMF Conceptual Model to UML. It is expected that this will allow the federation of information models expressed in UML with other forms of information modeling. No changes to UML itself are anticipated.

There is an optional requirement for submitters to propose a UML profile for expressing some or all of the SIMF Language.

- Unified Modeling Language (UML) v2.4.1 – http://www.omg.org/spec/UML/2.4.1
- Object Constraint Language (OCL) v2.3 – http://www.omg.org/spec/OCL/2.3/Beta2
- Semantics of a Foundational Subset for Executable UML Models (fUML) v1.0 – http://www.omg.org/spec/FUML/1.0

6.3.2.3 Semantics of Business Vocabulary and Business Rule (SBVR)

SBVR "defines the vocabulary and rules for documenting the semantics of business vocabularies, business facts, and business rules" in a way that is "is interpretable in predicate logic with a small extension in modal logic" (SBVR Specification, Clause 1 Scope). The SBVR metamodel, particularly its vocabulary model, is thus relevant to conceptual modeling in SIMF.

However, while SBVR "supports linguistic analysis of text for business vocabularies and rules", such linguistic analysis is outside the scope of the SBVR standard. As such, SBVR provides no normative notation for expressing business vocabularies and rules. Nevertheless, it provides non-normative examples of controlled natural language notation that may be applicable to SIMF.

It is also required that the SIMF specification provide bridging relationships from the SIMF Conceptual Model to SBVR. It is expected that this will allow the federation of vocabulary models expressed in SBVR with other forms of information modeling. No changes to SBVR itself are anticipated.

- Semantics of Business Vocabulary and Business Rules (SBVR) v1.0 – http://www.omg.org/spec/SBVR/1.0

6.3.2.4 Model Driven Message Interoperability (MDMI)

The goal of MDMI is "to provide a declarative, model-driven mechanism to perform message data transformation" (MDMI Specification, Clause 1 Scope) for the financial services domain. The basic approach of MDMI has some similarity to the modeling scope of SIMF described in Section 6.2.2. A message data transformation is to be carried out in two steps (as summarized in MDMI Clause 6.3 Basic Approach for the User of This Specification):

1. A Message Syntax Model is used to define how values are extracted from a source message and identified as Semantics Elements, which are "the smallest semantic entities contained in a message format."
2. The source Semantic Elements are then mapped to Business Elements from a central Domain Dictionary, which can then be used to derive equivalent Semantic Elements for the target message format. The Message Syntax Model for the target message format can then be used to generate the target message from its Semantic Elements.

However, despite the terminology "Semantic Elements", the MDMI standard is really focused primarily on message format conversion, not information semantics. The semantics of Semantic Elements is given solely by reference to Business Elements in a Domain Dictionary, the specification of which is outside the scope of the MDMI standard. Thus, MDMI essentially provides capabilities relevant to SIMF LIMs and bridging between PDSs and LIMS, but it does not include the semantic capabilities of conceptual modeling required for CDMs.

Further, the MDMI specification specifically states that "that this specification is intended for use by the financial services community, and has been developed with its specific needs and requirements in mind" (MDMI Clause 1). Further, while it is noted that MDMI concepts may have wider applicability, it is not the intent of the specification to "to cover other than the financial services domain." This is a much more specialized scope than SIMF.

- Model Driven Message Interoperability (MDMI) v1.0 – http://www.omg.org/spec/MDMI/1.0/

6.3.2.5 Common Terminology Services 2 (CTS2)

CTS2 is "intended to mediate among disparate terminology sources by providing a standard service information and computational model" (CTS2 Specification, Clause 1 Scope). In particular, CTS2 includes an Information model that "specifies the structural definition, attributes and associations of *Resources* common to structured terminologies", which may be relevant to SIMF for CDMs and LIMs. However, CTS2 focuses on "enumerated concept domains", that is "fields that represent discrete collections of 'meanings', each of which is represented by a permissible value" (CTS2 Specification, Clause 6.2 Guide to Specification), which is significantly more restricted than SIMF conceptual modeling requirements.

- Common Terminology Services 2 (CTS2) v1.0 – http://www.omg.org/spec/CTS2/1.0/Beta1

6.3.2.6 Ontology Definition Metamodel (ODM)

ODM provides MOF and UML representations of multiple ontology languages including OWL, RDF/S and Common Logic. As such, it may be used as a source for MOF representations of concepts from these languages that may be included in the SIMF Language. It also provides a UML notation for OWL that has been used for conceptual modeling. In addition, ODM models concepts in formal languages that may be used for the SIMF Kernel.

SIMF is also required to have bridging relationships from the SIMF Conceptual Model to OWL and RDF/S, with the metamodels for those languages as given in ODM acting as the target. It is expected that this will allow the federation of semantic models expression in OWL and RDF/S with other forms of information modeling.

- Ontology Definition Metamodel (ODM) v1.0 – http://www.omg.org/spec/ODM/1.0

6.3.3 Related OMG Activities

The following activities relate to OMG RFPs for which submissions are still in progress.

6.3.3.1 Information Management Metamodel (IMM)

The IMM RFP solicits proposals for a standard metamodel to address the needs of Information Management. IMM will provide representations for logical (LIM) and physical domain schema (PDS) and other abstractions that may be reused in SIMF. At a minimum, SIMF proposals are required to provide bridging relationships from the entity-relationship modeling, SQL Data-Definition Language and XML schema definitions using target metamodels aligned with ongoing IMM proposals. IMM may or may not be impacted by SIMF.

- Information Management Metamodel (IMM) RFP – http://doc.omg.org/ab/2005-12-2

6.3.3.2 MOF to RDF Structural Mapping in Support of Linked Open Data (MOF2RDF)

MOF2RDF will specify an RDF representation of the MOF metamodel constructs and transformations for any models. MOF2RDF may be informative for the optional requirement for an RDF representation of SIMF.

- MOF to RDF Structural Mapping in Support of Linked Open Data RFP – http://doc.omg.org/ad/2009-12-9

6.3.3.3 UML Specification Simplification (UML 2.5)

The UML Simplification RFP solicits proposals for producing a normative, merged metamodel for UML that eliminates the current multiple compliance levels and a rewritten specification document based on that metamodel that is "organized to remove redundancy and correct inconsistencies". The adopted proposal will become UML version 2.5.

The RFP specifically constrains the simplification to be of the *specification* of UML, while maintaining the basic normative syntax and semantics for UML models as of UML 2.4.1. Nevertheless, the planned structural simplification of the metamodel to eliminate the use of package merge as well as the removal of redundancy and inconsistencies in the specification document should greatly clarify what the standard semantics of UML are. Therefore, as UML 2.5 becomes available, submitters should use it as the referenced version of UML.

- UML Specification Simplification RFP – http://doc.omg.org/ad/2009-12-10

6.4 Related Non-OMG Activities, Documents and Standards

6.4.1 ISO Standards

6.4.1.1 Vocabularies, Core Components and Metadata Standards

ISO Standards for vocabularies, core components and metadata are relevant to SIMF and submitters are strongly encouraged to consider use and reuse of these standards in SIMF. ISO Standards of interest include:

- ISO/IEC 11179, Information Technology -- Metadata registries (MDR)
- ISO 704, Terminology work -- Principles and methods
- ISO 1087-1, Terminology work -- Vocabulary -- Part 1: Theory and application
- ISO 1087-2, Terminology work -- Vocabulary -- Part 2: Computer applications
- ISO 24707, Common Logic
- ISO 20022, Universal financial industry message scheme
- ISO 19763, Metamodel framework for interoperability
- ISO 80000, Quantities and units

6.4.1.2 SQL

SQL is the standard language used for defining relational database schemas and writing queries against such schemas. The SIMF specification is required to provide bridging relations from the SIMF Conceptual Model to SQL Data Definition Language. It is expected that this will offer users new possibilities of federating relational data models with other ways to model and express information.

- ISO/IEC 9075-1, Information technology – Database languages – SQL – Part 1: Framework (SQL/Framework)

6.4.2 World-Wide Web Consortium (W3C) Standards

6.4.2.1 Web Ontology Language (OWL)

OWL is the ontology language for the Semantic Web. As defined for OWL, an "ontology defines the terms used to describe and represent an area of knowledge" that is "used by people, databases, and applications that need to share domain information" (OWL Use Cases and Requirements, Section 1.1 What is an ontology?). Such an ontology thus essentially serves the purpose of a SIMF CDM, and submitters are therefore strongly encouraged to consider and reuse constructs from OWL as appropriate in the SIMF Language. Of particular interest is the formal OWL semantics provided for reasoning and deduction (see OWL 2 Language Document Overview, Section 2.3 Semantics).

However, the requirements for OWL were specifically "motivated by potential use cases and general design objectives that take into account the difficulties in applying the standard notion of ontologies to *the unique environment of the Web*" [emphasis added] (OWL Use Cases and Requirements, Section 1.1). While a goal of OWL is essentially to support semantic integration across the Web, its original motivating use cases do not include the case of information federation across disparate modeling languages and data representations in the sense described for SIMF in Section 6.2 of this RFP (see OWL Use Cases and Requirements, Section 2 Use Cases and Section 3 Design Goals). OWL 2 has introduced two new profiles, OWL 2 QL and OWL 2 RL, to allow tighter integration specifically with relational database and rule engine technologies (see OWL 2 New Features and Rationale, Section 3.1 Profiles). But there is still no standard capability that directly addresses the full requirements for LIMs and MBRs in SIMF. OWL also does not provide standard graphical model representations, as required for SIMF.

Regardless of the extent to which OWL may be reused in the definition of the SIMF Language, it is required that the SIMF specification provide bridging relationships from the SIMF Conceptual Model to the OWL metamodel as defined in ODM. Within the full context of SIMF, it is expected that this will allow the federation of semantic models expressed in OWL with other forms of information modeling.

There is also an optional requirement for proposals to provide a direct mapping of the SIMF Metamodel to OWL as an exchange format beyond that provided by XMI.

- OWL 2 Web Ontology Language – http://www.w3.org/TR/owl2-overview/

6.4.2.2 Resource Description Framework (RDF) and RDF Schema (RDF/S)

RDF is a general purpose "language for representing information about resources in the World Wide Web" (RDF Primer, Abstract). The RDF/S specification "describes how to use RDF to describe RDF vocabularies" (RDF Schema, Abstract). The SIMF specification is required to provide bridging relations from the SIMF Conceptual Model to RDF/S. It is expected that this will offer users new possibilities of federating information on the Semantic Web with other ways to model and express information.

There is also an optional requirement for proposals to provide a direct mapping of the SIMF Metamodel to RDF and/or RDF/S as an exchange format beyond that provided by XMI.

- RDF Primer – http://www.w3.org/TR/rdf-primer/

- RDF Vocabulary Description Language 1.0: RDF Schema – http://www.w3.org/TR/rdf-schema/

6.4.2.3 XML Schema Definition (XSD)

The XML Schema definition language "offers facilities for describing the structure and constraining the contents of XML 1.0 documents" (XML Schema Part 1, Abstract). Considering XML to be a specific technology for data representation, XSDs are a kind of SIMF PDS. Since XSDs are perhaps the most common method for defining and validating the structure of complex XML documents, it is required that the SIMF specification provide bridging relationships from the SIMF Conceptual Model to XSDs. It is expected that this will allow the federation of XSDs considered as PDSs for XML documents with other forms of information modeling.

SIMF offers XSD users new possibilities of associating the XSD abstract syntax to other ways to model and express information. SIMF will be federated with XSD.

- XML Schema v1.1 – http://www.w3.org/XML/Schema

6.4.2.4 Rule Interchange Format (RIF)

RIF is the W3C Standard for the interchange of rules. RIF may also be used in conjunction with RDF and OWL. Such rules may be applicable to the SIMF model bridging relations. Submitters are encouraged to consider this for SIMF responses.

- RIF Overview – http://www.w3.org/TR/rif-overview/
- RIF RDF and OWL Compatibility – http://www.w3.org/TR/2010/REC-rif-rdf-owl-20100622/

6.4.2.5 Simple Knowledge Organization System (SKOS)

SKOS is a common data model for sharing and linking knowledge organization systems such as thesauri, classification schemes, subject heading systems and taxonomies within the framework of the Semantic Web. Use and reuse of SKOS in SIMF is encouraged.

- SKOS Simple Knowledge Organization System Reference – http://www.w3.org/TR/skos-reference/

6.4.2.6 Linked Open Data

Linked open data provides a vision and approach to information publication, making it accessible and linked across the Web. In support of this, the contents of SIMF models are required to be Web addressable resources. Proposals can choose to further support linked open data by addressing the optional requirement to provide a direct mapping from the SIMF Metamodel to RDF, RDF/S and/or OWL, as a Web-native model interchange format.

- W3c Linked Data – http://www.w3.org/standards/semanticweb/data
- Linked Data Home Page – www.linkeddata.org.

6.4.3 United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) Core Components

The Core Components Technical Specification (CCTS) defines a metamodel and rules necessary for describing the structure and contents of conceptual and logical data models and information exchange models. Use and reuse of Core Components in SIMF is encouraged.

- Core Components Technical Specification (CCTS) v3.0 – http://www.unece.org/cefact/codesfortrade/CCTS/CCTS-Version3.pdf

6.4.4 Other Initiatives

The following are other initiatives relevant to SIMF that are currently in progress.

6.4.4.1 Open Ontology Repository Initiative (OOR)

The Open Ontology Repository project seeks to provide a foundation for access to reference ontologies that could provide a basis for parts of the SIMF. Alternatively SIMF may contribute to these efforts.

- OOR Initiative Home Page – http://ontolog.cim3.net/cgi-bin/wiki.pl?OpenOntologyRepository

Also see the communiqué from the ontology community: http://ontolog.cim3.net/cgi-bin/wiki.pl?OntologySummit2008_Communique

6.4.4.2 Sharing and Integrating Ontologies Project (SIO)

SIO seeks to define a set of reference ontologies that could serve as a foundation for parts of the SIMF kernel conceptual domain models.

- SIO Project Home Page – http://ontolog.cim3.net/cgi-bin/wiki.pl?SharingIntegratingOntologies

6.4.4.3 ISO TC37/SC3 - Systems to Manage Terminology, Knowledge and Content

This initiative seeks interoperability both among ontologies (i.e. concerning matching, alignment and suitable means to write these down) as well as among ontology languages (e.g. OWL, UML, Common Logic, or F-logic and translations among these). The idea is to have all these languages as part of a meta-standard, such that ontology designers can bring in their ontologies verbatim as they are, and yet relate them to other ontologies (e.g. check that an OWL version of some ontology is entailed by its first-order formulation).

- ISO TC37/SC3 Systems to manage terminology, knowledge and content – http://www.iso.org/iso/iso_technical_committee.html?commid=48136

6.4.4.4 Systems, Capabilities, Operations, Programs, and Enterprises (SCOPE) Model

The Net Centric Operations Industry Group (NCOIC) SCOPE model is designed to characterize interoperability-relevant aspects or capabilities of a system or set of systems over a network in terms of a set of dimensions and values along those dimensions.

- Systems, Capabilities, Operations, Programs, and Enterprises (SCOPE) Model for Interoperability Assessment – https://www.ncoic.org/apps/group_public/download.php/8504/SCOPE_MODEL_VER1.0.pdf

6.5 Mandatory Requirements

This specifies the required contents of a SIMF standard. See the discussion in Section 6.2 and the glossary at the end of this RFP for definitions of various terms used in the requirements below, including *Conceptual Domain Model (CDM), Logical Information Model (LIM), Model Bridging Relation (MBR), context, view* and *viewpoint*.

6.5.1 SIMF Conceptual Model

6.5.1.1 Proposals shall define the *SIMF Conceptual Model* as a model of the concepts required to model information and achieve federation using SIMF. This model shall be a conceptual domain model of SIMF itself, expressed in the SIMF Notation (see requirement 6.5.2.2).

6.5.1.2 The SIMF Conceptual Model shall define the concepts necessary for creating conceptual domain models (CDMs), sufficiently general to express the semantics being represented by the information modeling constructs in the languages identified in requirement 6.5.3.1, including the following capabilities:

a. General capabilities for modeling all relevant aspects (i.e., all rules, laws, etc.) of concepts, including (but not necessarily limited to) the definition of: individual things, relationships, classification of individual things (including multiple classification), sub-classification and inheritance (including multiple inheritance), roles (that describe how individual things are involved in various processes, compositions and relationships), composition and constraints.

b. Definition of one or more names by which users refer to a concept, as well as one or more *separate* reference identifiers that would normally be hidden from users. (This is required to maintain the stability of concept references across multiple languages, communities and viewpoints.)

c. Definition of the *context* of concepts, allowing for the grouping of concepts such that no single dominant decomposition is required (that is, in addition to just a hierarchical grouping, allow for a multi-dimensional separation of concerns [Ossher1999] delineated by multiple contexts).

d. Definition of *patterns* of reusable, parameterized conceptual structures and the use of such patterns within a context.

e. Definition of *units* that describe what can be measured about various conceptual *quantities* and asserting that some conceptual quantity is measured in specific units.

f. Ability for *federated definition* of concepts; that is, allowance for the definition of a concept in a CDM such that it can be modified and/or extended across multiple contexts and models.

6.5.1.3 The SIMF Conceptual Model shall define the concepts necessary for creating logical information models (LIMs), capable of representing information context, information structures, integrity rules, derivation rules, views and viewpoints as may be found in the languages referenced in requirement 6.5.3.1, but not be bound to any particular data representation or schema language, including the following capabilities:

a. Usage of one or more terms and/or concepts defined in a CDM, as identified by MBRs between a LIM and the CDM, to define the semantics of information elements in one or more LIMs.

b. Identification of concepts from a CDM (“what can be known about a subject domain”) as being required or optional in a LIM (“what may or must be included in a particular information structure”), with appropriate cardinalities.

c. Ability for different LIMs related to the same CDM to represent different (and possibly incompatible) subsets of information about conceptually the same things (as semantic precision does not imply universal agreement).

d. Ability for a LIM to *close* the definition of a concept that has a federated definition in the related CDM, fixing it relative to a specific context in the CDM relevant to the LIM. (Once a definition is closed, it can then be assumed that no further statements will be made about that concept within the context relevant to a particular LIM thus allowing for the application of defaults and constraints impacting that concept.)

e. Ability to define *viewpoints* that specify *views* on a CDM or LIM that act as effective contexts for a particular purpose relevant to one or more other LIMs, including formation of views from composite concepts.

6.5.1.4 The SIMF Conceptual Model shall define the concepts necessary for creating model bridging relations (MBRs), sufficient to enable independently conceived models at all levels (CDM, LIM, PDS) to be federated, such that the similarities and differences between elements defined in each can be expressed, including the following capabilities:

a. Ability to relate identical and similar information concepts that have been independently conceived and represented in information models using the same or different information modeling languages or physical schema.

b. Ability to handle differences in name, structure, representation, property sets and underlying semantic theories.

c. Ability to relate the same information across views that share the same underlying concepts and to specify one view of a model from another (*projection*).

d. Ability to state the *purpose* for an information structure in one model relative to the related structure in another model. (Examples of purposes include creating, reading, updating and deleting recorded information and providing a snapshot in time, measurement, expected value or required value of a property of or association between information records.)

6.5.1.5 Proposals shall define a *Kernel* as a subset of the SIMF Conceptual Model with the minimum set of foundational concepts necessary in order to precisely define all other concepts within the SIMF Conceptual Model. Proposals shall provide a formal logic interpretation of the semantics of the SIMF Kernel, expressed in a formal logic such as Common Logic as defined in ISO standard 24707.

6.5.2 SIMF Metamodel and Notation

6.5.2.1 Proposals shall define a *SIMF Metamodel* as a MOF or SMOF model of the abstract syntax of a modeling notation sufficient for completely defining any conceptual data model (CDM), logical information models (LIM) or model bridging relation (MBR).

6.5.2.2 Proposals shall define at least one graphical concrete and at least one textual concrete syntax for the SIMF Metamodel. The graphical notations shall be specified using the OMG diagram definition standard based on the abstract syntax.

6.5.2.3 To the greatest extent practical, the SIMF Metamodel and notations shall be based on reuse or adaptation of existing modeling and logic languages. Proposals shall provide justification when this is not considered to be the best solution.

6.5.2.4 The content of models expressed using the SIMF Metamodel shall be Web addressable resources, each having a unique Web identity in support of Linked Open Data.

6.5.2.5 Proposals shall provide an MBR model bridging from the SIMF Conceptual Model to the SIMF Metamodel, specifying how CDMs, LIMs and MBRs based on concepts defined in the SIMF Conceptual Model may be represented using the SIMF Metamodel and so expressed in SIMF notations. Conversely, all statements made as part of any model represented using the SIMF Metamodel shall have a precise and well-defined semantic mapping to the SIMF Conceptual Model.

6.5.3 Supporting Models

6.5.3.1 Proposals shall define normative MBR models, in the SIMF Language, that bridge the SIMF Conceptual Model to metamodels for the following existing languages, in order support the federation of information defined in these languages.

a. Entity-relationship (ER) modeling, with a metamodel such as that proposed for IMM

b. SQL Data Definition Language (DDL), with a metamodel such as that proposed for IMM

c. XML schema definitions (XSDs), with a metamodel such as that proposed for IMM

d. Unified Modeling Language (UML)

e. Semantics of Business Vocabularies and Rules (SBVR)

f. OWL web ontology language, with the metamodel as given in ODM

g. RDF Schema (RDF/S), with the metamodel as given in ODM

6.5.3.2 Proposals shall provide a minimum of four non-normative examples drawn from different domains, demonstrating the overall applicability of the proposed SIMF

Language to the definition, extension, validation, federation and integration of information models and their physical schema representations.

6.6 Optional Requirements

6.6.1 Support for RDF and Linked Open Data

Proposals may provide a direct mapping from the SIMF Metamodel to RDF, RDF/S and/or OWL, as an exchange format beyond that provided by XMI based on the SIMF Metamodel abstract syntax.

6.6.2 UML Profile for SIMF

6.6.2.1 Proposals may define a profile of UML that represents all or part of SIMF using UML stereotypes, tagged values and OCL constraints.

6.6.2.2 If a UML Profile is included, an MBR shall be defined between the profile and the SIMF Metamodel.

6.6.2.3 If a UML Profile is included, proposals shall describe the fidelity of the profile and any information loss between the profile and corresponding models expressed in SIMF notation.

6.7 Issues to be discussed

6.7.1 References to and naming of individuals.

6.8 Evaluation Criteria

RFP submissions will be evaluated on the following, in no particular order:

- Completeness of conceptual models
- Ability to support information federation
- Simplicity
- Degree of coherence
- Compatibility with existing, complementary standards
- Re-use of relevant parts of existing OMG standards, where possible. This includes but is not limited to:
    - IMM
    - MDMI
    - ODM
    - SBVR
- Use and reuse of established standards and best practices. This includes, but is not limited to:
    - ISO Specifications cited above

    - OWL, RIF, RDF and RDF/S
    - SKOS
- Ease of use and understanding of the graphical and textual notation(s) for business users
- Support for validation of models with business users, per the “100% principle” of [ISOTR9007]
- Semantic Precision
- Generality

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 or its parent TC 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 at the OMG Work In Progress page at http://www.omg.org/schedules under the item identified by the name of this RFP.

Event or Activity	Projected Date
Preparation of RFP by TF	
RFP placed on OMG document server	*November 14, 2011*
Approval of RFP by Architecture Board *Review by TC*	*December 15, 2011*
TC votes to issue RFP	*December 2011*
LOI to submit to RFP due	*March 15, 2012*
Initial Submissions due and placed on OMG document server ("Four week rule")	*August 13, 2012*
Voter registration closes	*September 1, 2012*
Initial Submission presentations	*September 12, 2012*
Preliminary evaluation by TF	*September 12, 2012*
Revised Submissions due and placed on OMG document server ("Four week rule")	*May 22, 2013*
Revised Submission presentations	*June 19, 2013*
Final evaluation and selection by TF *Recommendation to AB and TC*	*September, 2013*
Approval by Architecture Board *Review by TC*	*September, 2013*
TC votes to recommend specification	*September, 2013*
BoD votes to adopt specification	*December, 2013*

Appendix A References and Glossary Specific to this RFP

A.1 References Specific to this RFP

The following references provide background on the concepts and evolution of modeling as discussed in this RFP.

[DMTF] Distributed Management Task Force, *http://www.dmtf.org*

[ECSS] ECSS 2009, *European Cooperation for Space Standardization*, ECSS-E-TM-10-23A, 'Engineering Database Version 2.0', *http://www.ecss.nl*

[Gartner2011] Benoit J. Lheureux, Jess Thompson, Yefim V. Natis, Massimo Pezzini, Paolo Malinverno, Timothy Weaver, Ted Friedman, "Predicts 2012: Application Integration Will Increase in Scope and Complexity", Gartner report G00226113, 10 November 2011

[HL7] Health Level Seven International, *http://www.hl7.org*

[IEEE1471] ISO/IEC 42010:2007, Systems and software engineering – Recommended practice for architectural description of software-intensive systems, *http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=45991*

[ISOTR9007] ISO TR9007:1987, Information processing systems -- Concepts and terminology for the conceptual schema and the information base, http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=16549

[ISE] Information Sharing Environment, *http://www.ise.gov*

[Ossher1999] Harold Ossher and Peri Tarr, "Multi-Dimensional Separation of Concerns in Hyperspace", IBM Research Report RC21452(96717)16APR99, http://domino.watson.ibm.com/library/cyberdig.nsf/1e4115aea78b6e7c85256b360066f0d4/5af350e4286e003985256766004ebe71?OpenDocument

[TMForum] TM Forum, *http://www.tmforum.org*

A.2 Glossary Specific to this RFP

Note that the full set of consistent definitions of SIMF terminology is a required output of the SIMF standard. Some initial definitions are included below.

Concept – A concept is anything conceived of by a person or community. A concept must have at least one definition in a formal or natural language. Concepts include types, properties, relationships and predicates.

Conceptual Domain Model (CDM) – A model of the subject area of a domain independent of a particular application or usage in a data context. The CDM is a model specified at the MDA CIM level, consisting of the types, predicates, the associated integrity rules and the associated set of concept definitions. The primary stakeholders are business persons and domain experts.

Context – A concept representing a set of concepts or assertions that are applicable within a particular scope or situation. When a concept or assertion is grouped by a context it is said to be "in" that context and the context "contextualizes" the concept or assertion. Where a context is asserted the set of assertions in that context are asserted by implication and the set of concepts in that context are defined by implication. Contexts may be overlapping and/or nested, so a concept or assertion may be in multiple contexts.

Domain – Any subset of a universe of discourse, the subject area of a model. For example: Oncology, Marriage, Drivers Licenses, etc.

Federation – Federation combines independently managed or conceived resources for a unified purpose. In the context of this RFP, federation is focused on combining information and information models so that they can be used together, even if from independent sources.

Logical Information Model (LIM) – A purpose specific representation of information representing CDM concepts. Acting as an intermediate between conceptual domain models and physical data models, the objective of a LIM is to represent the information in terms of logical structures that satisfy a stated purpose. The LIM is grounded in one or more CDMs.

Model Bridging Relations (MBR) – Semantic relations between information model elements at all levels (CDM, LIM, PDS).

Physical Data Schema (PDS) – Describes how to implement a LIM in a database or exchange format of choice, i.e. defining the technology specific representations of data. There can be many different physical representations of the same LIM.

Projection – A view of a model that is derived from another view.

Semantics – How data is interpreted as meaningful information. For an information system, this interpretation is reflected in how the data is processed in order to carry out the business purpose of the system. (For the purposes of this RFP, only the semantics of information is relevant.)

Semantic Integration **–** The ability of two or more systems to exchange data such that all the systems semantically interpret the data in a consistent way, in order to carry out an overall, federated business purpose.

System – A system is a way to conceive and understand how a set of entities and relations between these entities are composed to form something that, in some way, acts as a whole. Examples of systems include: an information system, an enterprise, an agency, a process and a distributed community.

View – A representation of a system from the perspective of a related set of concerns. [IEEE1471]

Viewpoint – A specification of the conventions for constructing and using a view. A pattern or template from which to develop individual views by establishing the purposes and audience for a view and the techniques for its creation and analysis. [IEEE1471]

Appendix B General Reference and Glossary

B.1 General 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/technology/documents/formal/components.htm*

[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/technology/documents/formal/dais.htm*

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

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

[FORMS] “ISO PAS Compatible Submission Template”. *http://www.omg.org/cgi-bin/doc?pas/2003-08-02*

[GE] Gene Expression, *http://www.omg.org/technology/documents/formal/gene_expression.htm*

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

[Guide] The OMG Hitchhiker's Guide,, *http://www.omg.org/cgi-bin/doc?hh*

[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/docs/omg/01-12-01.pdf*

[MDAc] “MDA Guide” (*http://www.omg.org/docs/omg/03-06-01.pdf*)

[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/technology/documents/formal/resource_access_decision.htm*

[RFC2119] IETF Best Practices: Key words for use in RFCs to Indicate Requirement Levels, (*http://www.ietf.org/rfc/rfc2119.txt*).

[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/technology/documents/formal/profile_corba.htm*

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

[XML/Value] XML Value Type Specification, *http://www.omg.org/technology/documents/formal/xmlvalue.htm*

B.2 General 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.

Normative – Provisions that one must conform to in order to claim compliance with the standard. (as opposed to non-normative or informative which is explanatory material that is included in order to assist in understanding the standard and does not contain any provisions that must be conformed to in order to claim compliance).

Normative Reference – References that contain provisions that one must conform to in order to claim compliance with the standard that contains said normative reference.

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.