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Ontology, Model and Specification Integration and Interoperability (OntoIOp) Request For Proposal

OMG Document: ad/2013-08-02

Letters of Intent due: 24 February 2014
Submissions due: 18 December 2014

Objective of this RFP

This RFP solicits proposals for the following:

- A specification for an abstract meta-language with an associated meta-model targeted at cross-language interoperability among a class of concrete languages used to record logical expressions found in ontologies, models and specifications.
- A list of concrete languages and translations to be recognized and correctly processed by implementations of this specification.
- A description of constraints and conformance criteria for additional concrete languages and translations between concrete languages that are not explicitly supported, but nonetheless have equivalent uses that could be recognized and correctly processed by implementations.

For further details see Section 6 of this document.

1 Introduction

1.1 [...]

2 Architectural Context

[...]

3 Adoption Process

3.1 [...]

4 Instructions for Submitters

4.1 [...]

5 General Requirements on Proposals

[...]

6 Specific Requirements on Proposals

6.1 *Problem Statement*

Logical languages are used in several fields of computing for the development of formal, machine-processable texts that carry a formal semantics. Among those fields are 1) ontologies formalizing domain knowledge, 2) formal models of systems, and 3) the formal specification of systems.

A great diversity of logical languages with model-theoretic semantics is in use for these purposes:

- the ontology languages OWL [OWL2], RDF [RDF, RDF-Semantics], RDFS [RDFS],
- the modeling language UML [UML] (fUML [FUML] equips part of UML with a formal semantics)
- general-purpose first-order languages: TPTP FOF, TPTP TFF [TPTP], F-logic [FLogic], Common Logic [CL]
- more specialized specification logics like modal logics, temporal logics, higher-order logics, TPTP THF [TPTP]
- more complex fully-fledged specification languages like VDM [VDM], B [B], Z [Z], CASL [CASL]
- the rule languages in the RIF [RIF] (Rule Interchange Format) and RuleML [RuleML] families of languages, as well as in OMG PRR (at least as far they are based on monotonic logics; for non-monotonic logics, see the non-mandatory requirements section)
- further languages listed in the discussion section

This great diversity of languages is partly justified by different application areas and by different technical properties of the languages. However, often the diversity makes interoperability of ontologies, models, specifications and systems more difficult. Moreover, it is not possible to find a single logical language into which all others can be mapped; rather, it is necessary to adopt a heterogeneous approach to interoperability.

Heterogeneity can be seen at both the level of the ontology languages as well as the ontologies themselves. For example, it is possible to specify the metalogical relationships among the ontology languages currently being used:

For complex logical theories, often several of these languages are used together:

Use case 1

It is common practice to informally annotate OWL ontologies with FOL axioms (e.g. Keet's mereo-topological ontology[1], Dolce Lite[2], BFO-OWL[3]). Moreover, the OMG Ontology Definition Metamodel (ODM) provides a variety of transformations between languages. OntoIOp will free the user from the necessity to ban such FOL axioms into informal annotations, and provide means to replace such informal annotation by formal axioms in a suitable ontology language.

Use case 2

The OMG Date-Time Vocabulary (DTV) has been formulated in different languages, each of which addresses different audiences:

- SBVR: business users
- UML: software implementers
- OWL: ontology developers and users
- Common Logic: (foundational) ontology developers and users

With OntoIOp, one can e.g.

- formally relate the different formalizations,
- specify the OWL version to be an approximation of the Common Logic version, and
- extract submodules covering specific aspects.

Use case 3

A UML model involving different diagram types shall be checked for semantic consistency. Once a formal semantics for the different diagram types has been chosen[4], it is possible to define what overall consistency means, and check this by suitable tools.

Use case 4

A temporal logic specification shall be checked against some process model, which is then refined into some finite automaton.

Use case 5

Refinement of some UML protocol state machine (possibly enriched with some UML sequence diagrams and OCL constraints) to a UML behaviour state machine.

Use case 6

The use of RDFS or OWL to specify a taxonomy of sorts for a more expressive logic with many-sorted semantics (like CASL).

Use case 7

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1 Keet, C. M., and Artale, A. Representing and reasoning over a taxonomy of part–whole relations. Applied Ontology 3, 1 (2008), 91–110.

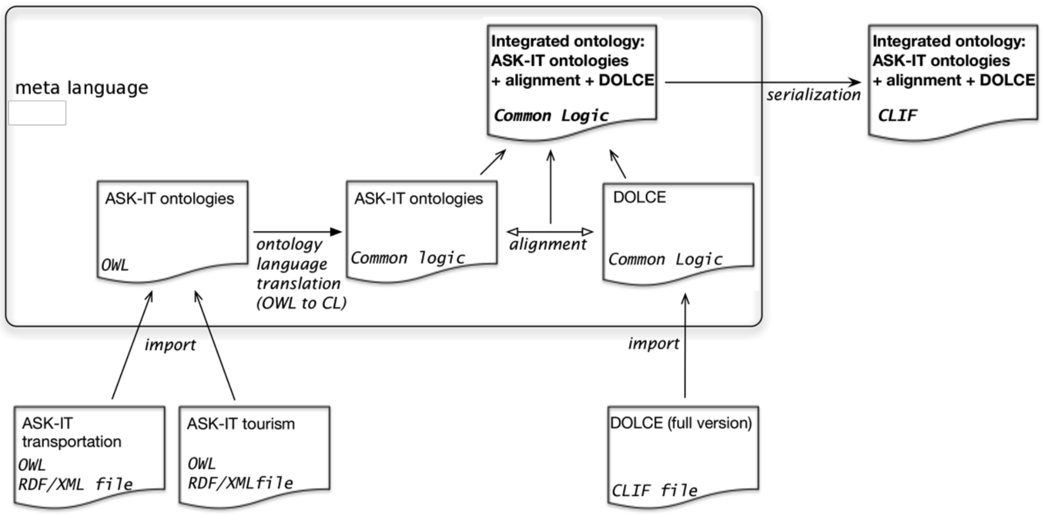
2 http://www.loa.istc.cnr.it/DOLCE.html

3 http://bfo.googlecode.com/svn/releases/2012-07-20-graz/owl-group/bfo.owl

4 See e.g. María Victoria Cengarle, Alexander Knapp, Andrzej Tarlecki, Martin Wirsing: A Heterogeneous Approach to UML Semantics

The use of Common Logic to express metadata concerning modelling assumptions for simulation (e.g. climate change) datasets (e.g. in Datalog). The Datalog representation assumes a closed world on the observed dataset. The Common Logic theory is open-world and describes the simulation model used to generate the dataset, including the conditions for validity of the physical laws in the model of the object of observation.

Use Case 8
A domain ontology written in OWL shall be integrated with a foundational ontology written in Common Logic (see figure).



Use Case 9
Two large ontologies shall be related, and an integrated version containing parts of both ontologies shall be produced. However, only the parts containing the relevant concepts and roles shall be selected.

There are however no systematic approaches to supporting such use cases, nor is there any way to choose the involved language translations.

Another diversity is that of various operations and relations on logical theories that are in use:

- matching and alignment of different ontologies covering one domain. Note that the task of finding or constructing matching and alignments is outside the scope of this RFP; proposals will only provide a meta-language for writing these down.
- interpretation and refinement of logical theories
- module extraction - get relevant information out of large logical theories
- approximation – model in an expressive language, reason fast in a lightweight one
- querying
- ontology-based database access/data management
- bridges between different axiomatizations, e.g. distributed description logics, E-connections
- translations of logical theories to other languages
- combinations of logical theories

There are no standardised methods (languages, workflows, tools) for dealing with this variety. Again, this is an obstacle for (formal) interoperability.

Hence, a main target of this RFP is to provide a meta-language for interoperability among logical theories, with a well-defined semantics and model theory.

[add some motivation in terms of users of/market for OntoIOp, based on use cases. Also motivate 6.5.3 to 6.5.6. Terry will try to provide some motivation for 6.5.6. Also discuss end usage and systems, not just the languages.]

6.2 *Scope of Proposals Sought*

Proposals shall face the diversity of languages, and not add to it by proposing yet another language that would subsume all the others. Instead, proposals shall accept the diverse reality and formulate means (on a sound and formal semantic basis) to compare and integrate logical theories (representing ontologies, models, specifications…) that are written in different formalisms.

Proposals shall specify a meta-language which shall be able to handle logical theories formulated in specific languages (as listed in 6.1), as well as provide means for expressing modularity operations and relations between logical theories, even if these are formalized in different logical languages.
Thus, the meta-language shall enable interoperability with a formal grounding and make heterogeneous logical theories based on them amenable to checking of coherence (e.g. consistency, conservativity, intended consequences, and compliance).

Within the OntoIOp framework, existing logical theories in conforming established languages shall remain as they are, acknowledging the wide tool support these languages enjoy. The proposed meta-language will enhance their modularity facilities to a superset of the modularity and annotation facilities they provide themselves. The meta-language's modularity constructs are semantically well-founded within a library of formal relationships between the logics underlying the different supported logical languages.
Proposals shall specify a meta-language providing constructs for

a) heterogeneous logical theories (ontologies, models and specifications) that combine parts written in different languages
b) links between distributed and heterogeneous (possibly structured) logical theories associating globally unique identifiers [URI, IRI, URI-Fragment] to any symbol, sentence, ontology and ontology link to allow for reference and annotation by means other than the meta-language itself
c) translations between different logical languages
d) a formal semantics of (a)–(d)
e) criteria for existing or future logical languages and translations to conform with OntoIOp

Proposals shall focus on the meta-language, while establishing OntoIOp-conformance of a small number of logical languages and translations to demonstrate the viability of the approach, as specified in 6.5.5. Establishing conformance of a larger set of logical languages and translations should be possible in principle, but is outside scope and will be left to the communities using OntoIOp. *[This paragraph addresses the feedback "1. This is too ambitious -- this project is trying to solve all interoperability problems."]*
The proliferation of specific ontologies and links between ontologies is outside the scope of OntoIOp. However, an informative annex may provide sample ontologies and links for the purpose of illustrating the constructs of the meta-language. *[This addresses part of point 3 of*

the feedback "will mappings between specific ontologies be part of the standard?"]

6.3 *Relationship to other OMG Specifications and activities*

6.3.1 Relationship to OMG specifications

- Ontology Definition Metamodel (ODM) provides a graph of ontology languages and translations. Note that it captures abstract syntax only (using MOF meta models), not model theory. Proposals shall build on and may extend this graph, and have to consider model theory.
- Model Driven Architecture (MDA)
- Meta Object Facility (MOF) – meta-language that will be used for the specification of abstract syntaxes of languages
- MOF Support for Semantic Structures (SMOF) - extension of MOF for multiple classifications and instantiations
- XML Metadata Interchange (XMI) - standard for exchanging metadata information via Extensible Markup Language (XML)
- MOF 2 XMI Mapping - mapping allowing the storage of MOF models as XMI/XML data
- MOF Model to Text Transformation Language (Mof2Text) - useful for specifying the transformation from the MOF model of the abstract syntax to the concrete syntax
- Unified Modeling Language (UML) – one specific language whose conformance with OntoIOp shall be established. Submitters shall use UML 2.4.1 or later
- Production Rule Representation (PRR) – one specific language whose conformance with OntoIOp may be established
- Semantics of Business Vocabulary and Business Rules (SBVR) – one specific language whose conformance with OntoIOp may be established (see discussion)
- Date-Time Vocabulary (DTV) – use case for OntoIOp, as it has been implemented in UML, OCL, SVBR, Common Logic and OWL

6.3.2 Relationship to other OMG Documents and work in progress

- Application Programming Interfaces to Knowledge Bases (API4KB) – API for heterogeneous knowledge bases, for which OntoIOp can provide a language and semantic basis. Vice versa, API4KB will be of importance when implementing OntoIOp, and developing OntoIOp-related APIs (see discussion).
- Semantic Information Modeling for Federation (SIMF) – RFP related to OntoIOp but with a different scope

6.4 *Related non-OMG Activities, Documents and Standards*

ISO

- WD (Working Draft) 17347 OntoIOp (ontoiop.org) developed within ISO TC 37/SC 3/WG 3 - initiative similar to the present one that has been cancelled in the meantime; the aim is to have a liaison with ISO
- Metadata Repository (ISO 19763, ISO 11179), Terminology, Metamodeling - standards for metadata. In particular, these standard's practices for allocating identifiers, and for associating downloadable human- and machine-readable encodings of descriptions of logical languages with such identifiers will be of interest of OntoIOp.
- Common Logic (ISO 24707) - family of languages that may be shown to be conformant with OntoIOp
- SQL - individual language that may be shown to be conformant with OntoIOp

W3C

- OWL, RDF, RDFS, RIF, SKOS - these are W3C standards defining individual languages that may (or, in the case of OWL and RDF; shall) be shown to be conformant with OntoIOp

Other

- Open Ontology Repository Initiative (OOR) - aims at ontology repositories covering multiple ontology languages
- NeOn project - defines a number of modularity operations
- Future Internet Enterprise Systems (FInES)
- Software Platform for Integration of Engineering and Things (SPRINT)
- schema.org - RDFS-like schema developed by big search engines with the goal of structuring meta data for web pages

6.5 *Mandatory Requirements*

[6.5.1 and 6.5.2 motivate the requirements by refering to use cases. This addresses point 4 of the feedback "What is the need for the metalanguage? This justification needs to be aligned with the mandatory requirements. Show how the requirements and related to the use cases." Do we also need motivation for 6.5.3 to 6.5.6?]

6.5.1 Metalogical Relationships

Proposals shall provide a specification of a meta-language for the following relationships:

- logically heterogeneous logical theories, particularly in the case in which the application T(Th) of a language translation T : L1 → L2 to a logical theory Th written in language L1 (this will be needed by almost all use cases), ,
- modular logical theories (cf. use cases 2 and 9),
- relationships between logical theories and their extracted modules e.g. the whole theory is a conservative extension of the module (cf. use cases 2 and 9),
- approximations of logical theories in less expressive languages such that the approximation is logically implied by the original theory, where the approximation generally has to be maximal in some suitable sense (cf. use case 2), *[This addreses point 5 of the feedback "How detailed are the metalevel relationships? For example, consider the Date-Time Vocabulary (dtv). Do we simply say that dtv_owl is an approximation of dtv_cl or does the standard specify in what way it is an approximation, saying what is lost and what is preserved."]*
- links such as imports, interpretations, equivalences, and alignments between logical theories/modules (cf. use cases 1,2,4,5,8),
- combination of logical theories along links (cf. use cases 8 and 9).

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6.5.2 Applicability to Multiple Logics

The constructs of the meta-language shall be applicable to different logics (cf. all use cases).

- The meta-language shall neither be restricted to logical theories in a specific domain, nor to logical theories represented in a specific logical language (cf. all use cases).
- The meta-language shall provide syntactic constructs for ???????????
    - The meta-language shall not provide its own constructs for expressing sentences. Instead, it shall inherit the logical language aspects of conforming logical languages.
    - structuring logical theories regardless of the logic in which their sentences are formalized (cf. use case 1, 7, 8, 9);
    - basic and structured logical theories and facilities to identify them in a globally unique way (cf. all use cases);

6.5.3 Specification of the Metalanguage

Proposals shall provide the following specifications for the meta-language:

- an abstract syntax specified as an SMOF compliant meta model;
- a human-readable lexical concrete syntax in EBNF [EBNF] and serialization in XML [XML];
- complete round-trip mappings from the human-readable concrete syntax to the abstract syntax and vice versa;
- a formal semantics for the abstract syntax, including the relationships in 6.5.1 and the constructs in 6.5.2.

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6.5.4 Scope of Conformant Logical Languages and Translations

Proposals shall be applicable to any logical language which either has a formal, logic-based semantics with notions of satisfiability and entailment, or which has a semantics defined by translation to another logical language with such a formal semantics.

- Existing logical theories in existing serializations (e.g. the XML-based XCL serialization of Common Logic, or the text-based OWL Manchester Syntax) shall validate as logical theories the meta-language with a minimum amount of syntactic adaptation.
- It shall be possible to refer to existing files/documents from a logical theory implemented in the meta-language without the need for modification
- Translations between logical languages shall preserve (possibly to different degrees) the semantics of the logical languages. Between a given pair of logical languages, several translations are possible (one of them may be marked as default). *[This addresses part of point 3 of the feedback "The role of translations and mappings - will translations between specific languages (e.g. OWL-2 and CL) be part of the standard? - if so, will only one translation be allowed? - what is the relationship between different translations between the same two languages?"]*

6.5.5 Conformance Criteria

Proposals shall specify formal criteria for establishing the conformance of a logical language and/or translation as required in 6.5.4.

Conformance criteria must be specified in enough detail such that they are testable. See [Institution] for an example meta notion that could be used. *[This addresses the feedback, point 6 "Are the conformance criteria for logical languages specified with enough detail to be testable?"]*

- Informative annexes shall establish the conformance of a number of relevant logical languages. An initial set of language translations may be part of an informative annex,
- Conformance of the following subset of logical languages (see 6.1 above) shall be established: OWL2 (with profiles EL, RL, QL, see [OWL2-Profiles]), CLIF [CL], RDF, RIF-Core, as well as a set of suitable translations among these. *[This also addresses point 3 of the feedback, see 6.5.4 above.]*

6.5.6 Registry of Logical Languages

Proposals shall specify the technology and the rules and procedures for maintaining a *registry* of all conforming logical languages.

- The registry shall be freely readable for humans and machines (see below for serializations), using globally unique identifiers for logical languages (so that for any logical theory that occurs in a context of the meta-language one can explicitly refer to the language it is expressed in), and it shall offer the possibility to add further (also non-standardized) languages.
- The registry shall assign globally unique identifiers to logical theories, their parts, and links between them.
- Existing standards and best practices for allocating identifiers, and for associating downloadable

human- and machine-readable encodings of descriptions of logical languages with such identifiers, shall be reused, e.g. ISO/IEC 11179 or Linked Data.

6.6 *Non-mandatory features*

6.6.1 Alignments

Links between ontologies may include alignments between ontologies (in the sense of the Ontology Alignment API).

6.6.2 Languages without a standardized model theory

There are a number of languages the inclusion of which into OntoIOp would be beneficial, and which fit in principle into the Onto framework, because they have been equipped with at least one (often several) model theoretic semantics in the research literature. The problem is that there generally is no agreement on a standardized semantics that could be used in an off-the-shelf way for OntoIOp. Submissions may include such logic together with a proposal of a particular semantics; they may also propose the use of several alternative semantics.
These languages include:

- the database description languages EER (Enhanced Entity-Relationship Diagrams), Datalog, ORM (object role modelling)
- the ontology language SKOS, insofar it is not regarded as just a specific ontology, but a framework that is axiomatized (e.g. in first-order logic)
- the ontology language OBO, insofar it has a formal semantics (e.g. through translation to OWL 2)
- OMG SBVR, insofar it has a formal semantics (e.g. through first-order deontic-alethic logic)
- the Common Logic extension IKL, insofar problems with consistency can be solved
- the meta model of schema.org
- rule languages such as Rulelog, Prova, and Flora-2
- fuzzy logics

6.6.3 Non-monotonic logics

Proposals may provide constructs for non-monotonic logics. Support for non-monotonic logics may be provided at the level of individual languages (e.g. negation as failure), as well as at the level of the meta-language structuring constructs (e.g. circumscription). Note that rule language families like RIF, Rule-ML, Rulelog, Prova, and Flora-2 include non-monotonic languages.
A particular challenge for the inclusion of non-monotonic logics is the fact that logical entailment cannot be defined in the standard model-theoretic sense (all models of the premises must be models of the conclusion), because this definition always leads to a monotonic entailment. Hence, a suitable meta framework for non-monotonic logics should be provided.

6.6.4 Trade-offs among different translations

A characterization of the trade-offs among different translations may ease the user's choice.
[expand]

6.7 *Issues to be discussed*

Proposals should discuss whether existing language standards need to be extended or

adapted in order to make them OntoIOp conformant

If existing language standards need to be extended or adapted in order to make them OntoIOp conformant, this shall be discussed. Preference is that languages can be used as-is without any modifications; however, it may not always possible to meet this goal when created a unified meta framework.

Proposals should discuss whether the semantics of the meta-language shall be included into the standard

Proposals definitely shall provide a meta-language that is equipped with a formal semantics. However, it may be debatable whether this formal semantics (which can be quite long and technical) should be included into the standard, or whether it should be provided as a separate technical document.

Proposals should discuss the rationale for the list of logics and logic translations whose conformance they establish

Section 6.1 lists a number of logics that are in use. In principle, it should be possible to establish OntoIOp conformance for all of these logics. However, it may be the case that only part of these conformances will be actually part of the standard. Moreover, we can refer to the ODM for a number of logics.

A similar remark holds for logic translations.

Proposals should discuss a meta ontology of logical languages and theories

Proposals should discuss the role of a meta ontology for describing languages, including their semantic and syntactic features, as well as logical theories. They also may provide such a meta ontology. It would be useful to coordinate this meta ontology with related meta ontologies (OMV, API4KB).

Proposals should discuss a concrete syntax for describing registry entries about logical languages

Any proposal shall specify a registry of logical languages (see section 5). Proposals should discuss a concrete syntax for describing logical languages in such registry entries. This syntax should support an extensible description vocabulary, which should be based on the meta ontology mentioned in the previous paragraph. It should be optimized for machine-comprehensibility.

Proposals should discuss the use of QVT for expressing logic translations

Since the syntax of logical languages will be expressed in MOF, it is natural to express translations between logical languages using QVT. Of course, QVT can only cover the syntactic aspect of translations. Propsals should discuss whether they want to use QVT or some other formalism here. Proposals should also discuss how semantic correctness of the translations is ensured.

Proposals should discuss the role of APIs

Proposals may include a set of APIs used to deliver OntoIOp services. And OntoIOp registry and repository could provide information about languages, translations, logical theories, their links, and suitable metadata. It would be useful to coordinate these APIs with related APIs (API4KB, OOR).

These issues will be considered during submission evaluation. They should not be part of the proposed normative specification. Place your responses to these Issues in Section 0 of your submission.

6.8 *Evaluation Criteria*

Proposals covering a broader range of features and of examples will be favored. An initial set of examples is provided, using some preliminary syntax for the meta-language.[5]

Proposals covering the same set of features with a more compact, orthogonal syntax will be favored.

Proposals covering existing language standards without (or with fewer) modifications will be favored.

Proposals establishing actually (or making this at least possible in theory) OntoIOp conformance of more logical languages and translations will be favored. Preference is given to logical languages that have been standardized by standardization bodies such as OMG, ISO or W3C. Recall that the minimum set of covered languages is OWL2 (with profiles EL, RL, QL), CLIF, RDF, RIF-Core.

6.9 *Other information unique to this RFP*

6.10 *IPR Mode*

Every OMG Member that makes any written Submission in response to this RFP shall provide the Non-Assertion Covenant found in Appendix A of the OMG IPR Policy [IPR].

6.11 *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	Date
Letter of Intent (LOI) deadline	*24 February 2014*
Initial Submission deadline	*18 November 2014*
Voter registration closes	*1 December 2014*
Initial Submission presentations	*15 December 2014*

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Revised Submission deadline	*23 May 2015*
Revised Submission presentations	*23 June 2015*

7 Appendix A References & Glossary Specific to this RFP

7.1 *A.1 References Specific to this RFP*

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[RIF] Rule Interchange Format
http://www.w3.org/2005/rules/wiki/RIF_Working_Group

[RuleML] The Rule Markup Initiative
http://ruleml.org/

[Structuring1] Donald Sannella, Andrzej Tarlecki: Specifications in an Arbitrary Institution. Inf. Comput. 76(2/3): 165-210 (1988)

[Structuring2] Donald Sannella, Andrzej Tarlecki: Foundations of Algebraic Specification and Formal Software Development. EATCS Monographs on theoretical computer science, Springer 2012, ISBN 978-3-642-17335-6

[Structuring3] Răzvan Diaconescu, Joseph Goguen, Petros Stefaneas: Logical support for modularisation. Papers presented at the second annual Workshop on Logical environments. Pages 83-130. Cambridge University Press New York, NY, USA 1993.

[TPTP] The TPTP Problem Library for Automated Theorem Proving
http://www.tptp.org

[URI-Fragment] IETF/RFC 5147, URI Fragment Identifiers for the text/plain Media Type. April 2008.
http://tools.ietf.org/html/rfc5147

[URI] IETF/RFC 3986, Uniform Resource Identifier (URI): Generic Syntax. January 2005.
http://tools.ietf.org/html/rfc3986

[VDM] The Vienna Development Method
http://www.vdmportal.org

[XML] W3C/TR REC-xml:2008, Extensible Markup Language (XML) 1.0 (Fifth Edition). W3C Recommendation, 26 November 2008.
http://www.w3.org/TR/2008/REC-xml-20081126/

[Z] The Z notation
http://www.cs.york.ac.uk/hise/Zstandard/

7.2 A.2 Glossary Specific to this RFP

[Added lots of references in order to addresse feedback, point 2 "This sounds like a research project, not a standards project. Response: Provide formal definitions with citations to the literature where these definitions have been stated. e.g. what is the definition of a logically heterogeneous ontology?" Do we really need the formal definitions here? - No] [Italicise all first occurences of terms, and also provide the references there]
Alignment - flexible, relational link that does not always have a formal, logic-based semantics. See [Alignment1-2]

Approximation - reduction of a theory to a less expressive logical language, such that the original theory implies the approximation. See [Approx1-7]

Axiom - sentence postulated to be valid (i.e. true in every model), party of a logical theory. See [Logic]

Basic logical theory - set of non-logical symbols, sentences, annotations about them, which is used as a building block for a larger logical theory. See [Logic]

Conservativity - property of an extension of theories, ensuring that the extension does not add new logical content. See [Logic]

Combination - aggregation of several logical theories along links to a new logical theory where (only) the linked non-logical symbols of the involved logical theories are identified. See [CategoricalManifesto], [Colimits]

Heterogeneous Logical Theory - logical theory that involves several logical languages (mediated by translations). See [GrothendieckInst], [HyperOnto], [Heterogeneous1-2], [Structuring2]

Interpretation - logical link that postulates a relation between two logical theories. See [Logic]

Language translation - mapping from constructs in the source logical language to their equivalents in the target logical language. See [Morphisms]

Link - relationship between two logical theories, relating their non-logical symbols. Can be either an alignment or an interpretation

Logical theory - set of expressions (like non-logical symbols, sentences and structuring elements) in a given logical language. See [Logic]

Logical language - language that is used for writing down logical theories (e.g. formal ontologies, models and specification), equipped with a formal, declarative, logic-based semantics, plus non-logical annotations. See [Logic], [Institution], [HyperOnto]

Matching - algorithmic procedure that generates an alignment for two given logical theories. See [Alignment1-2]

Model - semantic interpretation of all non-logical symbols of a logical theory, satisfying the theory's axioms. See [Logic]

Module - subtheory that conservatively extends to the whole logical theory. See [Modules1-4]

Module extraction - activity of obtaining from anlogical theory concrete modules to be used for a particular purpose (e.g. to contain a particular sub-signature of the original logical theory). See [Modules1-4]

Non-logical symbol - atomic expression or syntactic constituent of a logical theory that requires an interpretation through a model. See [Logic]

Satisfaction relation - relation between models and sentences indicating which sentences hold true in the model. See [Logic]

Sentence - term that is either true or false in a given model, i.e. which is assigned a truth value in this model. See [Logic]

Structured logical theory - logical theory that results from other logical theories by import, union, combination, renaming or other structuring operations. See [Structuring1-3]

Theorem - sentence that has been proven (in some logical theory) from other axioms and theorem. See [Logic]

8 Appendix B General Reference and Glossary

8.1 *B.1 General References*

The following documents are referenced in this document:

[BCQ] OMG Board of Directors Business Committee Questionnaire,
http://doc.omg.org/bcq

[CCM] CORBA Core Components Specification
http://www.omg.org/spec/CCM/

[CORBA] Common Object Request Broker Architecture (CORBA)
http://www.omg.org/spec/CORBA/

[CORP] UML Profile for CORBA,
http://www.omg.org/spec/CORP

[CWM] Common Warehouse Metamodel Specification
http://www.omg.org/spec/CWM

[EDOC] UML Profile for EDOC Specification
http://www.omg.org/spec/EDOC/

[Guide] The OMG Hitchhiker's Guide
http://doc.omg.org/hh

[IDL] Interface Definition Language Specification
http://www.omg.org/spec/IDL35

[INVENT] Inventory of Files for a Submission/Revision/Finalization
http://doc.omg.org/inventory

[IPR] IPR Policy
http://doc.omg.org/ipr

[ISO2] ISO/IEC Directives, Part 2 – Rules for the structure and drafting of International Standards
http://isotc.iso.org/livelink/livelink?func=ll&objId=4230456

[LOI] OMG RFP Letter of Intent template
http://doc.omg.org/loi

[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/mda/papers.htm

[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/spec/MOF/

[NS] Naming Service
http://www.omg.org/spec/NAM

[OMA] Object Management Architecture

http://www.omg.org/oma/

[OTS] Transaction Service
http://www.omg.org/spec/OTS

[P&P] Policies and Procedures of the OMG Technical Process
http://doc.omg.org/pp

[RAD] Resource Access Decision Facility
http://www.omg.org/spec/RAD

[ISO2] ISO/IEC Directives, Part 2 – Rules for the structure and drafting of International Standards
http://isotc.iso.org/livelink/livelink?func=ll&objId=4230456

[RM-ODP]
ISO/IEC 10746

[SEC] CORBA Security Service
http://www.omg.org/spec/SEC

[TEMPL] Specification Template
http://doc.omg.org/submission-template

[TOS] Trading Object Service
hptp://www.omg.org/spec/TRADE

[UML] Unified Modeling Language Specification, *http://www.omg.org/spec/UML*

[XMI] XML Metadata Interchange Specification, *http://www.omg.org/spec/XMI*

8.2 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 to which an implementation shall conform to in order to claim compliance with the standard (as opposed to non-normative or informative material, included only to assist in understanding the standard).

Normative Reference – References to documents that contain provisions to which an implementation shall conform to in order to claim compliance with the standard.

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 an OMG Technology Committee.

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 – the *Platform TC* (PTC) focuses on IT and modeling infrastructure related standards; while the *Domain TC* (DTC) focuses 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.