

THE MODSPEC MODEL - A STANDARD FOR DESIGNING AND WRITING MODULAR STANDARDS

DRAFT STANDARD

DRAFT

Version: 1.1.0

Submission Date: 2025-02-12

Approval Date: 2025-xx-xx

Publication Date: 2025-xx-xx

Editor: Carl Reed, John Herring, Chuck Heazel

Notice: This document is not an OGC Standard. This document is an OGC Draft Standard and is therefore not an official position of the OGC membership. It is distributed for review and comment. It is subject to change without notice and may not be referred to as an OGC Standard. Further, an OGC Draft Standard should not be referenced as required or mandatory technology in procurements.

License Agreement

Use of this document is subject to the license agreement at <https://www.ogc.org/license>

Copyright notice

Copyright © 2024 Open Geospatial Consortium

To obtain additional rights of use, visit <https://www.ogc.org/legal>

Note

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The Open Geospatial Consortium shall not be held responsible for identifying any or all such patent rights.

Recipients of this document are requested to submit, with their comments, notification of any relevant patent claims or other intellectual property rights of which they may be aware that might be infringed by any implementation of the standard set forth in this document, and to provide supporting documentation.

CONTENTS

- I. PREFACEvii
- II. SECURITY CONSIDERATIONS viii
- III. SUBMITTING ORGANIZATIONS ix
- IV. DOCUMENT TERMS AND DEFINITIONSix
- V. DOCUMENT EDITORS ix
- VI. DOCUMENT CONTRIBUTORSix
- VII. REVISION HISTORYx
- VIII. FUTURE WORK x
- IX. FOREWORD x
- 1. SCOPE 2
 - 1.1. Understanding the ModSpec3
 - 1.2. ModSpec document structure3
- 2. CONFORMANCE 5
- 3. NORMATIVE REFERENCES 7
- 4. TERMS AND DEFINITIONS 9
 - 4.30. Core Terms and Definitions 17
 - 4.31. Concepts Terms and Definitions23
 - 4.32. Types Terms and Definitions 27
- 6. CONVENTIONS29
 - 6.1. Symbols (and abbreviated terms) 29
 - 6.2. Identifiers 29
 - 6.3. Abbreviated terms 30
 - 6.4. Finding requirements and recommendations30
- 7. STANDARDS FUNDAMENTALS 32
 - 7.1. Building Blocks 32
 - 7.2. Standardization Context – Goals and Targets 32
 - 7.3. Conformance, Requirements, and key information33

7.4. Documenting the Standard	34
8. MODSPEC REQUIREMENTS CLASS: CORE	37
8.1. General Requirements	37
9. MAPPING THE MODSPEC TO TYPES OF MODELS	52
9.1. Semantics	52
9.2. A Note on Data Models	52
ANNEX A (NORMATIVE) ABSTRACT CONFORMANCE TEST SUITE	54
A.1. Conformance Test Class: The Core	54
ANNEX B (NORMATIVE) OGC ONLY: CHANGES REQUIRED IN THE OGC STANDARDS	64
B.1. New OGC standards and revisions to existing OGC standards	64
ANNEX C (INFORMATIVE) MODSPEC UML MODEL, SEMANTICS, AND DEFINITIONS	66
C.1. Semantically ordered definitions	66
C.2. UML Model	68
C.3. Core Data Dictionary	69
C.4. Concepts Data Dictionary	81
C.5. Types Data Dictionary	86
ANNEX D (NORMATIVE) ACKNOWLEDGEMENTS	88
BIBLIOGRAPHY	90

LIST OF TABLES

Table 1	37
Table 2	37
Table 3	37
Table 4	38
Table 5	38
Table 6	38
Table 7	39
Table 8	39
Table 9	40
Table 10	40
Table 11	43
Table 12	45
Table 13	46

Table 14	48
Table 15	48
Table 16	48
Table 17	48
Table 18	48
Table C.1	69
Table C.2	70
Table C.3	70
Table C.4	71
Table C.5	72
Table C.6	72
Table C.7	72
Table C.8	73
Table C.9	73
Table C.10	74
Table C.11	74
Table C.12	75
Table C.13	75
Table C.14	76
Table C.15	76
Table C.16	77
Table C.17	78
Table C.18	78
Table C.19	79
Table C.20	80
Table C.21	80
Table C.22	81
Table C.23	81
Table C.24	82
Table C.25	82
Table C.26	83
Table C.27	83
Table C.28	84
Table C.29	85
Table C.30	85
Table C.31	86
Table C.32	86
Table C.33	86

LIST OF FIGURES

Figure 1 – Abstract superclass example	41
Figure C.1	68

LIST OF RECOMMENDATIONS

REQUIREMENT 1	39
REQUIREMENT 2	40
REQUIREMENT 3	41
REQUIREMENT 4	41
REQUIREMENT 5	42
REQUIREMENT 6	42
REQUIREMENT 7	43
REQUIREMENT 8	43
REQUIREMENT 9	43
REQUIREMENT 10	44
REQUIREMENT 11	45
REQUIREMENT 12	45
REQUIREMENT 13	46
REQUIREMENT 14	46
REQUIREMENT 15	46
REQUIREMENT 16	47
REQUIREMENT 17	47
REQUIREMENT 18	47
REQUIREMENT 19	48
REQUIREMENT 20	49
REQUIREMENT 21	49
REQUIREMENT 22	49
REQUIREMENT 23	50
REQUIREMENT 24	50



PREFACE

This OGC member developed and approved document, referred to as the ModSpec, defines a model and related requirements and recommendations for writing and structuring modular standards documents. Further, this model is designed to enable the consistent and verifiable testing of implementations of a standard that claim conformance. The ModSpec is a meta-standard: A standard specifying requirements for crafting and documenting testable standards.

The goal is to ensure that a standard specifies requirements in a common and consistent manner and that these requirements are testable.

NOTE: Historically, this document has been known and abbreviated as the “ModSpec”. For continuity and ease of understanding this document may also be referred to as the “OGC ModSpec”.

Suggested additions, changes, and comments on this document are welcome and encouraged. Such suggestions may be submitted through the OGC Change Request System (<http://ogc.standardstracker.org/>) or by creating an issue in the OGC ModSpec GitHub repository (<https://github.com/opengeospatial/ogc-modspec>).



SECURITY CONSIDERATIONS

No security considerations have been made for this document.

III

SUBMITTING ORGANIZATIONS

The following organizations submitted this Document to the Open Geospatial Consortium (OGC):

- Carl Reed, Charles Heazel, ImageMatters

IV

DOCUMENT TERMS AND DEFINITIONS

This document uses the standard terms defined in Subclause 5.3 of [OGC 05-008], which is based on the ISO/IEC Directives, Part 2. Rules for the structure and drafting of International Standards. In particular, the word “shall” (not “must”) is the imperative verb form used to indicate a requirement to be strictly followed to conform to the ModSpec.

V

DOCUMENT EDITORS

The following OGC Members participated in editing this document:

PERSON	ORGANIZATION REPRESENTED
Carl Reed	Carl Reed & Associates
Chuck Heazel	Charles Heazel

VI

DOCUMENT CONTRIBUTORS

The following OGC Members contributed and participated in developing Version 2 of the ModSpec.

PERSON	ORGANIZATION REPRESENTED
Simon Cox	CSIRO and OGC Fellow
Chuck Heazel	Charles Heazel
Clemens Portele	interactive instruments GmbH
Jeff Yutzler	ImageMatters

VII

REVISION HISTORY

This is the second normative version of this document.

VIII

FUTURE WORK

Improvements to this document will be made based on implementation and changing technical requirements. Planned extensions include:

- ModSpec Part providing requirements and recommendations for specifying requirements and conformance tests using RDFS, SHACL, and OWL.
- ModSpec Part providing requirements and recommendations for specifying requirements and conformance tests using JSON.

IX

FOREWORD

The OGC ModSpec — A Standard for Designing and Writing Modular Standards specifies a formal structure and requirements for writing modular standards documents. However, the ModSpec does not supply specific content. Where possible, this document is conformant with itself (with respect to the core requirements class and the conformance test class, Clause 8 and the Conformance Test Suite Annex A.1).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The Open Geospatial Consortium Inc. shall not be held responsible for identifying any or all such patent rights.

Recipients of this document are requested to submit, with their comments, notification of any relevant patent claims or other intellectual property rights of which they may be aware that might be infringed by any implementation of the standard set forth in this document, and to provide supporting documentation.



1

SCOPE

This OGC Standard for Designing and Writing Modular Standards, also known as the ModSpec:

- Specifies rules for the internal structure and organization of a standard.
- Defines requirements for specifying the structure of a standards document as organized sets of criteria, those that are to be tested (“requirements”) and those that are not tested (“recommendations” and “permissions”).
- Is designed to enable the clear and concise specification of requirements (the *shalls* or *musts* in a standard) that fully supports the ability to define implementable conformance tests.
- Formalizes implementing the requirements specified in the ModSpec so that reusable, modular standards can be developed.

The standardization goal of the ModSpec is to define characteristics and a structure for the specification of modular and testable Standards that will encourage implementation by minimizing difficulty determining requirements, mimicking implementation structure, and maximizing usability and interoperability. The ultimate goal of this approach is to enable interoperable implementations of a standard to be tested and deemed *conformant* or not.

Therefore, a standard that follows the rules specified in the ModSpec presents requirements organized in requirements classes which must be satisfied by passing the tests defined in a conformance suite (also known as the Abstract Test Suite in an OGC Standard). These tests are organized into conformance classes, each of which represents a mechanism for partial satisfaction of the standard. This results in a standard having a modular structure, where each requirements class has a corresponding conformance (test) class. In a well written standard, the normative clauses and any model or schema are organized in a manner that parallels the requirements and conformance clauses. A goal of the design pattern is the ability to define requirements classes and associated conformance classes that can be used across multiple standards. The approach modelled in the ModSpec has been referred to as the “core and extension model” due to its insistence on a modular structure throughout all parts of a standard and its implementation.

There are numerous examples of requirements/conformance classes that can be used not only in OGC Standards, but for geospatially focused standards defined by other organizations and Standards Development Organizations (SDOs). Some OGC examples can be found in the [OGC API – Common Part 1: Core Standard](#) and in the [CDB 2.0 Standard CRS Requirements Module](#). By formally implementing the requirements specified in the ModSpec, reusable, testable, modular standards can be developed.

1.1. Understanding the ModSpec

Reading the Terms and Definitions clause will help understanding the content and requirements stated in this document.

Also read Annex C. Annex C defines the UML model upon which the ModSpec is based. Annex C also contains informal and non-normative definitions ordered for ease of understanding. These two sections can be read first to aid in the understanding of the rest of the document.

NOTE: Please note that the ModSpec has been approved by the OGC Membership as a policy directive for the development and revision of any OGC Standard or Abstract Specification that has requirements. However, the ModSpec is written to be non-OGC specific and can be used by any Standards Development Organization (SDO) as a formal guide for structuring a standards document.

1.2. ModSpec document structure

Version 2.0 of the ModSpec is split into a Core standard and multiple Parts. These are:

- Core: contains all the core requirements and informational text that define the model and internal structure of a standard.
- Part 1: UML Model requirements
- Part 2: XML and Schematron Model requirements

Future Parts to the ModSpec Standard may include:

- Part 3: RDF/OWL requirements
- Part 4: JSON Schema



2

CONFORMANCE

Conformance to the ModSpec by technical implementation standards can be tested by inspection. The test suite is in Annex A.

The core of the ModSpec (this document) has one requirements class and one related conformance class:

1. The Core: Common requirements for specifying standards documents. See Clause 8 and Annex A.1

The ModSpec contains normative language and thus places requirements on conformance, or mechanism for adoption, of candidate standards to which the ModSpec applies. In particular:

- ModSpec Requirements Class: Core specifies the core requirements which shall be met by all standards claiming conformance to the ModSpec.
- Mapping the ModSpec to types of models gives information on how the ModSpec is to be applied to extensions to the core model for requirements and conformance clauses.

Such extensions are defined in additional Parts (volumes) to the Core.



3

NORMATIVE REFERENCES

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC: ISO/IEC 10000-1, ISO, IEC

ISO/IEC DIR 2, *ISO/IEC Directives, Part 2*. <https://www.iso.org/sites/directives/current/part2/index.xhtml>.

ISO: ISO 19105:2022, *Geographic information – Conformance and testing*. International Organization for Standardization, Geneva (2022). <https://www.iso.org/standard/76457.html>.

OMG Unified Modeling Language (OMG UML), Infrastructure, V2.5, OMG Document Number: formal/2015-03-01, Standard document URL: <https://www.omg.org/spec/UML/2.5>

OMG Unified Modeling Language (OMG UML), Superstructure, V2.4.1, OMG Document Number: formal/2012-05-07; Standard document URL: <https://www.omg.org/spec/UML/ISO/19505-2/PDF>

ISO/IEC: ISO/IEC 19757-3:2006, *Information technology – Document Schema Definition Languages (DSDL) – Part 3: Rule-based validation – Schematron*. International Organization for Standardization, International Electrotechnical Commission, Geneva (2006). <https://www.iso.org/standard/40833.html>.



4

TERMS AND DEFINITIONS

For the purposes of this document, the following terms and definitions shall apply. Terms not defined here take their meaning from computer science or from their Standard English (common US and UK) meanings. The form of the definitions is defined by ISO Directives.

Many of these definitions depend upon the model given in Annex C: ModSpec UML Model, Semantics, and Definitions.

4.1. building block

a requirements class or a requirements module with no direct dependencies on other requirements classes or modules and their associated compliance test class or compliance test module.

4.2. certificate of conformance

evidence of conformance to all or part of a standard, awarded for passing one or more of the *conformance test classes* (Clause 4.6) specified in that standard

Note 1 to entry: “Certificates” do not have to be instantiated documents. Having proof of passing the conformance test class is sufficient. For example, the OGC currently keeps an online list of conformant applications at <https://www.ogc.org/resources/certified-products/>.

Each certificate of conformance is awarded to a *standardization target* (Clause 4.26).

4.3. conformance test

test, abstract or real, of a single *requirements* (Clause 4.21) contained within a standard, or set of standards

4.4. conformance test case

test for a particular requirement or a set of related requirements

Note 1 to entry: When no ambiguity, the word “case” may be omitted. i.e. conformance test is the same as conformance test case.

4.5. conformance test module

set of related tests for a given requirements module all with the same standardization target

Note 1 to entry: When there is no ambiguity, the word “test” may be omitted. i.e. conformance test module is the same as conformance module. Conformance modules may be nested in a hierarchical way.

4.6. conformance test class

conformance class ALTERNATIVE

set of conformance tests that must be passed to receive a single *certificate of conformance* (Clause 4.2)

Note 1 to entry: When no ambiguity is possible, the word “test” may be left out, so conformance test class maybe called a conformance class.

In the ModSpec, the set of *requirements* (Clause 4.21) tested by the conformance tests within a conformance class is a requirements class and its dependencies. Optional requirements will be in a separate *requirements class* (Clause 4.22) with other requirements that are part of the same option. Each requirements class corresponds to a separate conformance test class.

Each requirements class will be in a 1 to 1 correspondence to a similarly named *conformance test class* (Clause 4.6) that tests all of the requirements in a requirements class.

All *requirements* (Clause 4.21) in a conformance class will have the same *standardization target* (Clause 4.26).

4.7. conformance suite

conformance test suite ALTERNATIVE

abstract test suite ALTERNATIVE

set of conformance classes that define tests for all requirements of a standard or abstract specification

Note 1 to entry: The conformance suite is the union of all conformance classes. It is by definition the conformance class of the entire standard or abstract specification.

In the ModSpec, each *requirement* (Clause 4.21) is mandatory within its conformance class and each *requirement* (Clause 4.21) is tested in at least one *conformance test* (Clause 4.3).

4.8. core requirements class

unique *requirements class* (Clause 4.22) that must be satisfied by any conformant *standardization targets* (Clause 4.26) associated to the standard

Note 1 to entry: The core requirements class is unique because if it were possible to have more than one, then each **core** would have to be implemented to pass any *conformance test class* (Clause 4.6), and thus would have to be contained in any other **core**. The **core** may be empty, or all or part of another standard or related set of standards.

The “**core**” can refer to this requirements class, its associated *conformance test class* (Clause 4.6) or the software module that implements that requirements class.

4.9. direct dependency (of a requirements class)

another *requirements class* (Clause 4.22) (the dependency) whose *requirements* (Clause 4.21) are defined to also be requirement(s) of this requirements class

Note 1 to entry: A direct dependency (of a requirements class) of the current requirements class will have the same *standardization target* (Clause 4.26) as the current requirements class. This is another way of saying that the current requirements class extends, or uses all the aspects of the direct dependency (of a requirements class). Any tests associated with this direct dependency (of a requirements class) can be applied to this requirements class.

When testing a direct dependency of a requirements class, the standardization target is directly subject to the test in the specified *conformance test class* (Clause 4.6) of the direct dependency of a requirements class.

4.10. indirect dependency (of a requirements class)

requirements class (Clause 4.22) with a different *standardization target* (Clause 4.26) which is used, produced or associated to by the implementation of this requirements class

Note 1 to entry: In this instance, as opposed to the direct dependency of a requirements class, the test against the consumable or product used or produced by the requirements class does not directly test the requirements class, but tests only its side effects. Hence, a particular type of feature service could be required to produce valid XML documents, but the test of validity for the XML document is not directly testing the service, but only indirectly testing the validity of its output. Direct dependencies test the same *standardization target* (Clause 4.26), but indirect dependencies test related but different standardization targets.

For example, if a DRM-enabled service is required to have an association to a licensing service, then the requirements of a licensing service are indirect requirements for the DRM-enabled service. Such a requirement may be stated as the associated licensing service has a *certificate of conformance* (Clause 4.2) of a particular kind.

4.11. extension (of a requirements class)

requirements class (Clause 4.22) which has a direct dependency on another requirements class

Note 1 to entry: Here an extension of a requirements class is defined on requirements class so that their implementation may be software extensions in a manner analogous to the extension relation between the requirements classes.

4.12. general recommendation

recommendation applying to all entities in a standard

4.13. home (of a requirement or recommendation)

official statement of a *requirement* (Clause 4.21) or *recommendation* (Clause 4.20) that is the precedent for any other version repeated or rephrased elsewhere in a standard

Note 1 to entry: Explanatory text associated with normative language often repeats or rephrases the requirement to aid in the discussion and understanding of the official version of the normative language. Since such restatements are often less formal than the original source

and potentially subject to alternate interpretation, it is important to know the location of the **home** official version of the language.

4.14. model

abstract model **ALTERNATIVE**

conceptual model **ALTERNATIVE**

theoretical construct that represents something, with a set of variables and a set of logical and quantitative relationships between them.

4.15. module

each of a set of standardized parts or independent units that can be used to construct a more complex structure

Note 1 to entry: The concept 'module' is key to the ModSpec structure and model. Modules have a direct relationship to the concept building blocks. The power of the concept is that modules can be reused in different systems (specify once, use many). Modules can be imported from other programs. Modules can be replaced without affecting the rest of the system.

4.16. optional requirements class

An optional requirements class may or may not be implemented or specified in a profile or extension. However, if a profile, extension, or implementation specifies the use of an optional requirements class, then every requirement in that requirements class *shall* be implemented.

4.17. part of a requirement

Collection of sub-requirements that are parts of a requirement. Satisfaction of all requirement parts are necessary for this requirement to be satisfied. The use of parts is optional.

4.18. permission

uses “may” and is used to prevent a requirement from being “over interpreted” and as such is considered to be more of a “statement of fact” than a “normative” condition.

4.19. profile

specification or standard consisting of a set of references to one or more base standards and/or other profiles, and the identification of any chosen *conformance test classes* (Clause 4.6), conforming subsets, options and parameters of those base standards, or profiles necessary to accomplish a particular function.

Note 1 to entry: In the usage of the ModSpec, a profile will be a set of requirements classes or conformance classes (either preexisting or locally defined) of the base standards.

This means that a *standardization target* (Clause 4.26) being conformant to a profile implies that the same **target** is conformant to the standards referenced in the *profile* (Clause 4.19).

[SOURCE: ISO/IEC 10000-1]

4.20. recommendation

expression in the content of a standard conveying that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required, or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited

Note 1 to entry: Although using normative language, a recommendation is not a *requirement* (Clause 4.21). The usual form replaces the “shall” (imperative or command) of a requirement with a “should” (suggestive or conditional).

Note 2 to entry: Recommendations are **not** tested and therefore have no related conformance test.

[SOURCE: ISO/IEC DIR 2]

4.21. requirement

expression in the content of a standard conveying criteria to be fulfilled if compliance with the standard is to be claimed and from which no deviation is permitted

Note 1 to entry: Each requirement is a normative criterion for a single **type of standardization target**. In the ModSpec, requirements are associated to *conformance tests* (Clause 4.3) that can be used to prove compliance to the underlying criteria by the *standardization target* (Clause 4.26).

The implementation of a requirement is dependent on the type of standard being written. A data standard requires data structures, but a procedural standard requires software implementations. The view of a standard in terms of a set of testable requirements allows for using set descriptions of both the standard and its implementations.

Requirements use normative language and are commands and use the imperative “shall” or similar imperative constructs. Statements in standards which are not requirements and need to be either conditional or future tense normally use “will” and should not be confused with requirements that use “shall” imperatively.

[SOURCE: ISO/IEC DIR 2]

4.22. requirements class

aggregate of all *requirements* (Clause 4.21) with a single standardization target that must all be satisfied to pass a *conformance test class* (Clause 4.6)

Note 1 to entry: There is some confusion possible here, since the testing of indirect dependencies seems to violate this definition. But the existence of an indirect dependency implies that the test is actually a test of the existence of the relationship from the original target to something that has a property (satisfies a condition or requirement from another requirements class).

4.23. requirements module

collection of *requirements classes* (Clause 4.22), *recommendations* (Clause 4.20) and *permissions* (Clause 4.18) with a single *standardization target* (Clause 4.26)

4.24. specification

document containing *recommendations* (Clause 4.20), *requirements* (Clause 4.21) and *conformance tests* (Clause 4.6)

Note 1 to entry: This definition is included for completeness.

Note 2 to entry: In the OGC, there are Abstract Specifications and Implementation Standards. Abstract Specifications may or may not be testable. Further, Abstract Specifications may not be directly implementable. Implementation Standards are always testable and contain a *conformance test suite* (Clause 4.7).

4.25. standard

document that has been approved by a legitimate Standards Body

Note 1 to entry: This definition is included for completeness. *Standard* (Clause 4.25) and *specification* (Clause 4.24) can apply to the same document. While specification is always valid, standard only applies after the adoption of the document by a legitimate standards organization.

4.26. standardization target

entity to which some *requirements* (Clause 4.21) of a *standard* (Clause 4.25) apply

Note 1 to entry: The standardization target is the entity which may receive a *certificate of conformance* (Clause 4.2) for a *requirements class* (Clause 4.22).

4.27. standardization target type

type of entity or set of entities to which the *requirement* (Clause 4.21) of a *standard* (Clause 4.25) apply

Note 1 to entry: For example, the standardization target type for The OGC API – Features Standard are Web APIs. The standardization target type for the CDB Standard is “datastore”. It is important to understand that a standard’s root standardization target type and can have sub-types and that there can be a hierarchy of target types. For example, a Web API can have

sub types of client, server, security, and so forth. As such, each requirements class can have a standardization target type that is a sub-type of the root.

4.28. statement

expression in a document conveying information

Note 1 to entry: Includes all statements in a document not part of the normative *requirements* (Clause 4.21), *recommendations* (Clause 4.20) or *conformance tests* (Clause 4.6). Included for completeness.

[SOURCE: ISO/IEC DIR 2]

4.29. will

In informative sections, the word “will” implies that something is an implication of a requirement. The “will” statements are not requirements, but explain the consequence of requirements.

4.30. Core Terms and Definitions

4.30.1. ConformanceClass

set of conformance tests that must be passed to receive a single certificate of conformance (Clause 4.2) NOTE:: When no ambiguity is possible, the word test may be left out, so conformance test class may be called a conformance class.

In the ModSpec, the set of requirements tested by the conformance tests within a conformance class is a requirements class and its dependencies. Optional requirements will be in a separate requirements class with other requirements that are part of the same option. Each requirements class corresponds to a separate conformance class

Each requirements class will be in a 1 to 1 correspondence to a similarly named conformance class that tests all of the requirements class’s requirements.

All requirements in a conformance class will have the same standardization target type.

4.30.2. ConformanceModule

a set of related tests, all within a single conformance test class

NOTE When there is no ambiguity, the word test may be omitted, i.e. conformance test module is the same as conformance module. Conformance modules may be nested in a hierarchical way.
This term and those associated with it are included here for consistency with ISO 19105.

4.30.3. ConformanceSuite

set of conformance classes that define tests for all requirements of a standard or abstract specification

NOTE The conformance suite is the union of all conformance classes. It is by definition the conformance class of the entire specification.

In this standard, each requirement is mandatory within its conformance class and each requirement is tested in at least one conformance test.

4.30.4. ConformanceTest

test, abstract or real, of one or more requirements contained within a standard, or set of standards

4.30.5. ConformanceTestCase

test for a particular requirement or a set of related requirements

NOTE When there is no ambiguity, the word case may be omitted. i.e. conformance test is the same as conformance test case.

4.30.6. ConformanceTestMethod

4.30.7. CoreRequirementsClass

Original

unique requirements class that must be satisfied by any conformant standardization targets associated to the specification

NOTE The core requirements class is unique because if it was possible to have more than one, then each core would have to be implemented to pass any conformance test class, and thus would have to be contained in any other core. The core may be empty, or all or part of another standard or related set of standards.

The core can refer to this requirements class, its associated conformance test class or the software module that implements that requirements class.

4.30.8. GeneralRecommendation

Original

recommendation applying to all entities in a specification model

4.30.9. InformativeStatement

expression in a document conveying information

Note 1 to entry: Includes all statements in a document not part of the normative requirements, recommendations, or conformance tests. Included for completeness.

4.30.10. NormativeStatement

expression in a document conveying information

Note 1 to entry: Includes all statements in a document not part of the normative requirements, recommendations, or conformance tests. Included for completeness.

4.30.11. Permission

uses “may” and is used to prevent a requirement from being “over interpreted” and as such is considered to be more of a “statement of fact” than a “normative” condition.

4.30.12. Principal

4.30.13. Recommendation

expression in the content of a standard conveying that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required, or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited

NOTE Although using normative language, a recommendation is not a requirement. The usual form replaces the shall (imperative or command) of a requirement with a should (suggestive or conditional).

4.30.14. Requirement

expression in the content of a standard conveying criteria to be fulfilled if compliance with the standard is to be claimed and from which no deviation is permitted

NOTE Each requirement is a normative criterion for a single standardization target type. In this standard, requirements will be associated to conformance

tests that can be used to prove compliance to the underlying criteria by the standardization target.

The implementation of a requirement is dependent on the type of specification being written. A data specification requires data structures, but a procedural specification requires software implementations. The view of a standard in terms of a set of testable requirements allows us to use set descriptions of both the standard and its implementations.

The specification of a requirement is usually expressed in terms of a model of the standardization target type, such as a UML model, or an XML or SQL schema. Anything without a defined test is a priori not testable and thus would be better expressed as a recommendation.

Requirements use normative language and in particular are commands and use the imperative shall or similar imperative constructs. Statements in standards which are not requirements and need to be either conditional or future tense normally use will and should not be confused with requirements that use shall imperatively

4.30.15. RequirementsClass

aggregate of all requirements (Clause 4.21) that must all be satisfied to satisfy a conformance test Class

NOTE There is some confusion possible here, since the testing of indirect dependencies seems to violate this definition. But the existence of an indirect dependency implies that the test is actually a test of the existence of the relationship from the original target to something that has a property (satisfies a condition or requirement from another requirements class).

4.30.16. RequirementsModule

a set of related requirements (Clause 4.22), recommendations (Clause 4.20) and permissions (Clause 4.18) all with a single requirements class (Clause 4.26)

NOTE This term is included to be consistent with the use of modules in ISO 19105.

4.30.17. Specification

document containing recommendations, requirements and conformance tests for those requirements

NOTE This definition is included for completeness. See Clause 5.3. This does not restrict what else a specification may contain, as long as it does contain the three types of element cited.

4.30.18. **Standard**

document containing recommendations (Clause 4.20), requirements (Clause 4.21) and conformance tests (Clause 4.6) that has been approved by a legitimate Standards Body

(original) specification that has been approved by a legitimate Standards Body

NOTE This definition is included for completeness. Standard and specification can apply to the same document. While specification is always valid, standard only applies after the adoption of the document by a legitimate standards organization. The legitimate Standards Bodies for OGC consist of OGC, ISO and any of the other standards bodies accepted and used as a source of normative references by OGC or ISO in their standards. In the normal meaning of the word standard, there are other conditions that may be required, but this standard has chosen to ignore them in the process of abstraction.

4.30.19. **StandardizationTarget**

entity to which some requirements of a standard apply **NOTE** The standardization target is the entity which may receive a certificate of conformance for a requirements class.

4.30.20. **StandardizationTargetType**

type of entity or set of entities to which the requirement (Clause 4.21) of a standard (Clause 4.25) apply

NOTE The standardization target types give the standardization targets a typing system similar to the UML classifiers. In general, the types inherit from one another in the same way that UML classes do. The same class/metaclass semantics apply, and two targets can be considered to have the same type (in a particular situation) if their instantiation types share the appropriate supertype, as is the case in UML. In OGC for example, all service types that must pass the OWS (Open Web Services) Common specification are some extension of the Open Web Service standardization target type. This makes OWS Common a default global core for all OGC Services.

In some cases, the standardization target type may be another specification. A GML application schema is a standardization target for the GML standard, but is in turn a specification of instances of that application schema.

4.30.21. Statement

Original

expression in a document conveying information

NOTE	Includes all statements in a document not part of the normative requirements, recommendations or conformance tests. Included for completeness.
------	--

4.30.22. TestType

4.31. Concepts Terms and Definitions

4.31.1. CertificateOfConformance

evidence of conformance to all or part of a standard, awarded for passing one or more of the conformance test classes specified in that standard

NOTE	Certificates do not have to be instantiated documents; having proof of passing the conformance test class is sufficient. For example, the OGC currently keeps an online list of conformant applications at http://www.opengeospatial.org/resource/products . Each certificate of conformance is awarded to a standardization target.
------	--

4.31.2. DirectDependency

Original

another requirements class (the dependency) whose requirements are defined to also be requirements of this requirements class

NOTE A direct dependency of the current requirements class will have the same standardization target as the current requirements class. This is another ways of saying that the current requirements class extends, or uses all the aspects of the direct dependency. Any tests associated to this dependency can be applied to this requirements class.

When testing a direct dependency, the standardization target is directly subject to the test in the specified conformance test class of the direct dependency.

4.31.3. Extension

Original requirements class which has a direct dependency on another requirements class

NOTE Here extension is defined on requirements class so that their implementation may be software extensions in a manner analogous to the extension relation between the requirements classes.

4.31.4. Home

Original

official statement of a requirement or recommendation that is the precedent for any other version repeated or rephrased elsewhere

NOTE Explanatory text associated to normative language often repeats or rephrases the requirement to aid in the discussion and understanding of the official version of the normative language. Since such restatements are often less formal than the original source and potentially subject to alternate interpretation, it is important to know the location of the home official version of the language. These alternative statements use non-normative language and are statements using the definitions of the ISO Directives Part 2.

4.31.5. IndirectDependency

Original

requirements class with a different standardization target which is used, produced or associated to by the implementation of this requirements class

NOTE In this instance, as opposed to the direct dependency, the test against the consumable or product used or produced by the requirements class does not directly test the requirements class, but tests only its side effects. Hence, a particular type of feature service could be required to produce valid XML documents, but the test of validity for the XML document is not directly testing the service, but only indirectly testing

the validity of its output. Direct dependencies test the same standardization target, but indirect dependencies test related but different standardization targets. The standardization target of the indirect dependency is different from the target of —this requirements class|| but it may be of the same or related standardization target type. For example, if one service is related to another second service, then a service requirement may be placed against the second associated service to assure that the first service has access to its functionality. For example, if a DRM-enabled service is required to have an association to a licensing service, then the requirements of a licensing service are indirect requirements for the DRM-enabled service. Such a requirement may be stated as the associated licensing service has a certificate of conformance of a particular kind.

4.31.6. LeafPackage

Original

UML model package that does not contain any subpackages, but contains classifiers

4.31.7. Model

Original

theoretical construct that represents something, with a set of variables and a set of logical and quantitative relationships between them.

NOTE Derived from Wikipedia

The “theoretical construct” is essentially a conceptual metaphor with the target of the metaphor as the thing being modeled, and the source of the metaphor as the model. The terms are almost interchangeable, with model being preferred when the source is a constructed entity, and metaphor being preferred when the source already exists, and the emphasis is the mapping between it and the target.

The definition in ISO 19101, Clause 4.4 is conceptual model — model that defines concepts of a universe of discourse. While adequate in the context of a —universe of discourse|| as the

something addressed by a standard, a model need not have any —universality|| property at all. Most often models are representative of only a relatively small portion of a larger universe, and part of the process of modeling is to factor out the properties and things to which no interest is directed within the present standard. It also fails to define —model|| which is in fact the central issue within this discussion. The abstract or conceptual is actually redundant and will often be dropped in the text. Models are by their very nature not the same as what they are describing, and thus must contain a conceptual metaphor to describe their relationship to the target (the thing being described) of the model. This inherently makes them abstractions.

4.31.8. Profile

Original

specification or standard consisting of a set of references to one or more base standards and/or other profiles, and the identification of any chosen conformance test classes, conforming subsets, options and parameters of those base standards, or profiles necessary to accomplish a particular function.

NOTE	This definition has been adopted from ISO 10000: Part 1. The wording has been changed to accommodate the shared vocabulary of OGC and ISO TC 211 and for editorial reasons. The original text is —A set of one or more base standards and/or ISPs, and, where applicable, the identification of chosen classes, conforming subsets, options and parameters of those base standards, or ISPs necessary to accomplish a particular function. In the usage of this standard, a profile will be a set of requirements classes or conformance classes (either preexisting or locally defined) of the base standards. This means that a standardization target being conformant to a profile implies that the same target is conformant to the standards referenced in the profile.
-------------	---

4.32. Types Terms and Definitions

4.32.1. RichText

4.32.2. DateTime

4.32.3. String



6

CONVENTIONS

6.1. Symbols (and abbreviated terms)

All symbols used in this document are either:

1. Common mathematical symbols
2. UML 2 (Unified Modeling Language) as defined by OMG and accepted as a publicly available standard (PAS) by ISO in its earlier 1.3 version.

6.2. Identifiers

The normative provisions in this standard are denoted by the URI namespace

<https://www.opengis.net/spec/modspec/1.1/>

All requirements that appear in this document are denoted by partial URIs which are relative to the namespace shown above.

For the sake of brevity, the use of “req” in a requirement URI denotes:

<https://www.opengis.net/spec/modspec/1.1/>

An example might be:

[/req/core/crs](#)

All conformance tests that appear in this document are denoted by partial URIs which are relative to the namespace shown above.

For the sake of brevity, the use of “conf” in a requirement URI denotes:

<https://www.opengis.net/spec/modspec/1.1/>

The same convention is used for permissions (per) and recommendations (rec).

6.3. Abbreviated terms

In this document the following abbreviations and acronyms are used or introduced:

ERA	Entity, Relation, Attribute (pre-object modeling technique)
ISO	International Organization for Standardization (from Greek for “same”)
OGC	Open Geospatial Consortium (http://www.opengeospatial.org/)
OMG	Object Management Group (http://www.omg.org/)
SQL	ISO/IEC 9075 query language for relational databases, not originally an acronym, but now often cited as “Structured Query Language”
TC	Technical Committee (usually either in ISO or OGC)
UML	Unified Modeling Language (an object modeling language)
XML	eXtensible Markup Language

6.4. Finding requirements and recommendations

Each normative statement in the ModSpec is stated in one and only one place, in a standard format, with a unique label, such as REQ001, REC001, or PER001. A requirement, recommendation, or permission may be repeated for clarification. The statement with the unique label is considered the official statement of the normative requirement or recommendation.

In this document, all requirements are associated with tests specified in the test suite in Annex A. The reference to the requirement in the test case is done by a requirements label. Recommendations are not tested although they still are documented using a standard template and have unique identifiers.

Requirements classes are separated into their own clauses and named, and specified according to inheritance (direct dependencies). The Conformance test classes in the test suite are similarly named to establish an explicit link between requirements classes and conformance test classes.



STANDARDS FUNDAMENTALS

7.1. Building Blocks

In software development technology, there is a concept called *building block*. In software development, building blocks are used to support the software build process where source code files/libraries can be accessed from multiple sources, converted into executable code, and linked together in the proper order until a complete set of executable files is generated. The same concept can be applied to OGC Standards development: Requirements classes and/or modules can be linked together from one or more standards to create a new standard not originally envisioned when the requirements were originally defined.

The Open Group suggests that building blocks have the following characteristics:

1. A building block is a package of functionality defined to meet business or domain needs.
2. A building block may interoperate with other, inter-dependent, building blocks.
3. A good building block has the following characteristics:
 - a) Considers implementation and usage, and evolves to exploit technology and standards.
 - b) May be assembled from other building blocks.
 - c) May be a subassembly of other building blocks.
 - d) Ideally a building block is re-usable and replaceable, and well specified.
4. A building block may have multiple implementations but with different inter-dependent building blocks.

These characteristics are slightly modified from the Open Group definitions to accommodate the use of the building block concept in standards work.

7.2. Standardization Context – Goals and Targets

Every standards document should include a Standardization Goal. This is a concise statement of the problem that the standard helps address and the strategy envisioned for achieving a solution. This strategy typically identifies real-world entities that need to be modified or

constrained. At the abstract level, those entities are the Standardization Target Types. These are the classes of entities to be standardized. A Standard defines the requirements levied on one or more Standardization Target Types.

Instances of a Standardization Target Type are the Standardization Targets. These are the real-world manifestations of the Standardization Target Type. In summary:

- Standardization Goal – identifies the problem and identifies the actors and entities involved in solving that problem
- Standardization Target Type – An abstract representation of one of the actors or entities identified in the Standardization Goal
- Standardization Target – an implementation of a Standardization Target Type. These are the real-world entities which can be tested for conformance with the requirements documented in the Standard.

Standardization Target Types can be hierarchical. The Conceptual, Logical, Physical hierarchy is one example where the Standardization Target Types are information models. Another example would be implementations of OGC API – Features Part 2 which support XML data exchange.

Notice that the Standardization Targets and Standardization Target Types no longer form a simple taxonomy. The Standardization Target Types, Standardization Targets, and Standardization Goal provide a well-defined context for the standard. This will help users of standards to quickly understand the scope of a standard and to select those standards appropriate for their needs. It also will help keep standards developers focused on the intended use of their standards, avoiding standards which are overly broad and/or unfocused.

7.3. Conformance, Requirements, and key information

In the conformance test suite, there will be a test defined to verify the validity of the claim that an implementation of the standard (standardization target) satisfies each mandatory requirement specified in the standard. Since the normative language of the body of the standard and the conformance test classes both define what conformance to the standard means, they will be equivalent in a well-written standard. The ModSpec requires a standards document to be well-written, at least in stating requirements and conformance tests.

Conformance tests are aggregated into conformance classes that specify how certain “certificates of conformance” are achieved. The natural inclination is to aggregate the requirements. The issue that blocks this approach is that some requirements are optional while others are mandatory. To achieve a cleaner separation of requirements, the ModSpec separates them into sets (called “requirements classes”), each of which has no optional components. Since the normative statement of each requirement is only declared once and is uniquely identified as such, each requirement will be in a clause associated to its requirements class.

Therefore, the ModSpec defines a “requirements class” as a set of requirements that must all be passed to achieve a particular conformance class (see Clause 4.6). This document also includes a “middle” structure called a conformance test module. Requirements modules parallel the

conformance test modules. A standard written to the ModSpec may use this “module” structure in any manner consistent with the rest of the ModSpec.

A standard may have mandatory and optional requirements classes. This allows the options in the testing procedure to be grouped into non-varying mandatory and optional conformance classes. Each requirement within an optional requirements class is mandatory when that requirements class is implemented. When needed, a particular requirements class may contain only a single requirement.

However, care must be taken, since the requirements classes may not always in a one-to-one correspondence to conformance classes in other standards which may be the source of requirements for a standard conformant to the ModSpec. If other standards are used, their options shall be specified to be useable within a standard conformant to the ModSpec, see Clause 8.1.4.1.

Conformance classes may contain dependencies on one another. These are represented by tests in one conformance class that state that another conformance class must be passed to qualify to pass this conformance class. In terms of requirements, that says that the dependent conformance class contains tests (by reference) for all requirements of the “included” conformance class.

As defined in the ModSpec, one requirements class is dependent on another if the other is included through such a reference. In this manner, requirements classes can be treated as sets of requirements (each in a single requirements class but included in others by reference to its “home” requirements class).

In the ModSpec, each conformance requirement is separated in its own labeled paragraph, such as seen in Requirement 1 below.

The distribution of the information in a standard is not restricted. The only requirement is that requirements be grouped in a manner consistent with the conformance test classes, see Requirement 6 and Requirement 7.

7.4. Documenting the Standard

NOTE: OGC Standards are written using an OGC Member approved template that is conformant with the requirements stated in the ModSpec

This form should be specified by the following descriptions:

1. A standards document contains Clauses (corresponding to numbered sections as they might appear in a table of contents) which describe its standardization target and its requirements.
2. A standard contains Annexes or is associated to other documents (both a logical type of Clause), one of which is the Conformance Test Suite (which may be an abstract description of the test suites to be implemented separately). In OGC Documents, this is Annex A – Abstract Test Suite.

3. All requirements, recommendations, permissions, and models are introduced and defined first in the numbered Clauses.
4. All requirements are identifiable as requirements.
5. All requirements in a document are uniquely numbered.
6. All tests for conformance to those requirements are defined in the Conformance Test Suite.
7. Tests are be grouped for convenience into conformance test classes and if desired the classes are grouped into conformance test modules.
8. The tests, if conducted, determine to some degree of certainty whether an implementation meets the requirements which the tests reference.
9. The tests are organized into some number of conformance “classes” where each conformance class has a one to one relationship with a requirements class. If a standard does not do this, it is has by default only one “conformance class”.
10. Certificates of conformance are awarded by a testing entity based on these conformance classes.
11. There is a clear distinction between normative and informative parts of the text.
12. Examples and notes are informative, and do not use “normative” language.

The ModSpec defines a “requirement” of a standard as an atomic testable criterion. See the formal definition of requirement in Clause 4.21

A UML representation of important properties of this model is given in Annex C, Section 2.



8

MODSPEC REQUIREMENTS

CLASS: CORE

This clause specifies the requirements and recommendations for the content and structure of a modular standard. This collection of requirements, recommendations, and permissions are also known as the core of the ModSpec. All the requirements specified in this ModSpec core comprise the ModSpec Core Requirements Class.

8.1. General Requirements

The following requirement states that every requirement in a standards document is associated with one or more requirements class(es).

Table 1

Requirement 0	/req/core/reqs-are-in-class
A	Each requirement in a standard <i>SHALL</i> be associated with a requirements class.

There may be one or more requirements in a requirements class.

The following requirement states that every requirement is testable.

Table 2

Requirement 1	/req/core/reqs-are-testable
A	All parts of a requirement <i>SHALL</i> be testable.
B	Failure to pass any part of a requirement <i>SHALL</i> be a failure to pass the associated conformance test.

Therefore, by definition, any requirements class that contains the requirement that failed to pass also fails to pass.

The following requirement states that every component of a standard will have a unique identifier

Table 3

Requirement 2	/req/core/all-components-assigned-unique-identifier
---------------	---

A	Each component of the standard, including requirements, requirements modules, requirements classes, conformance test, conformance modules, and conformance test classes <i>SHALL</i> be assigned a unique identifier or label.
---	--

The following recommendation encourages the consistent use of these unique identifiers/labels in the standard as well as any external documentation referencing that standard.

Table 4

	/req/core/uri-external-use
REC001	These unique identifiers/labels <i>SHOULD</i> be used in any external documentation that reference these component elements in a normative manner, including but not limited to other standards, implementations of the conformance test suite, or certificates of conformance for implementations conformant to the standard in question.

While a requirement may be referenced in more than one place in a standard, the normative definition of a requirement shall be its “**home**” (see Clause 6.4) and will be the only place where full normative language is used.

The following permissions relate to possible content specified in the core of a standard.

Table 5

	/per/core/informational-content-in-core
PER001	The informational and structural universals of the standard <i>MAY</i> be included in the core text of the standard without violations of the ModSpec. This is true if the requirements of the extension are not implicit in what is included in the core.

In this manner, the core requirements class and its associated content can be thought of not only as the requirements of the core conformance class, but as a form of reference model for establishing core vocabularies and schemas for the entire standard.

Table 6

	/per/core/core-may-contain-schema-terms
PER002	The core <i>MAY</i> contain the definition and schema of commonly used terms and data structures for use in other components and/or structures throughout the standard.

The following states how and where vocabularies are specified in relation to a requirements class.

Table 7

Requirement 3	/req/core/vocabulary-and-parent-req-class
A	Requirements on the use and interpretation of vocabulary <i>SHALL</i> be in the requirements class where that use or interpretation is used.

Table 8

	/per/core/external-vocabs-core
PER004	Importation of external vocabularies and schemas <i>MAY</i> be in the core of a standard.

Example: In the specification of a metadata service, the Dublin Core concept of a “Title” and the XML schema structure used for its specification can be in the core of the service specification. How a particular request-response pair uses the data structure to mean the title of a particular document or dataset will be specified in the requirements class in which the request-response pair is defined and set against requirements.

8.1.1. Using the model

The primary difficulty in speaking about standards (or candidate standards)¹ as a group is their diverse nature. Some standards use UML to define behavior, others use XML to define data structures, and others use no specific modeling language at all. However, they all must model the standardization target to which they apply since they need to use unambiguous language to specify requirements. Thus, the only thing they have in common is that they define testable requirements against some model of an implementation of the standard (the standardization target). For completeness, they should also specify the conformance tests for these requirements that are to be run for validation of the implementations against those requirements.

The assumption is that each standard has a single (root) standardization target type from which all extensions inherit. If this is not true, then the standard can be logically factored into parts each corresponding to a “root” standardization target type, and that the standard addresses each such part separately (see the definition of requirements class in Clause 4.22). In this sense, the next requirement divides standard into parts more than restricting their content.

REQUIREMENT 1

IDENTIFIER /req/core/single-standardization-target

A Each requirement in a conformant standard *SHALL* have a single standardization target type.

¹This is purposely written as “as not yet adopted” standards, since it is during the authoring process that the ModSpec must be considered, not *post facto*.

In practice, the standardization target of the core requirements class is the root of an inheritance tree where extensions all have the core's target as an ancestor, and thus can be considered as belonging to the same "class" or type as the core's target.

REQUIREMENT 2	
IDENTIFIER /req/core/test-class-single-standardization-target	
A	All conformance tests in a single conformance test class in a conformant standard SHALL have the same standardization target.

This means that all requirements are considered as targeting the same entity being tested for a particular certificate of conformance. The test may specify other types as intermediaries or indirect dependencies (see Clause 4.10).

Table 9

/per/core/repeated-requirements	
PER005	If needed, a requirement MAY be repeated word for word in another requirement up to but not including the identification of the standardization target type.

This second statement will be in a separate requirements class, since it will have a separate standardization target and thus belong to the requirements to be tested by a separate conformance class. For example, in a service interface, a standard may be written that requires both the client and server to use a particular language for data transmission. Since the client and server are different standardization targets types (except in some special circumstances), they will have different conformance test classes.

One solution is to state the requirement twice, once for each target. The most common alternative is to introduce a new "superclass".

Table 10

/per/core/abstract-superclass	
PER006	The standard MAY introduce an abstract superclass of all affected standardization target types and use this for the requirements common to all of the affected target types. This is diagrammed in Figure 1.

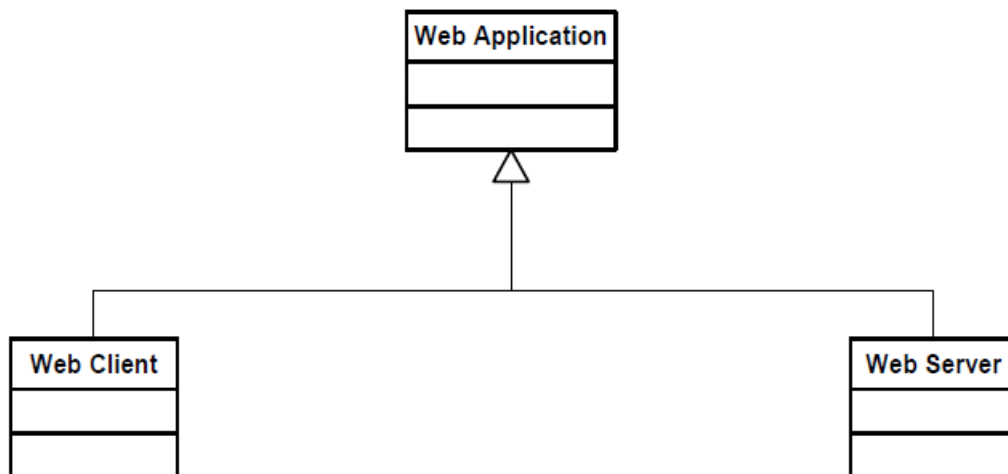


Figure 1 – Abstract superclass example

Example – Abstract Superclass:

8.1.2. The “standards” document

Each standard document is comprised of a set of requirements and their associated conformance tests.

REQUIREMENT 3

IDENTIFIER /req/core/requirements-grouped

- A** Requirements SHALL be grouped together in clauses (numbered sections) of the document in a strictly hierarchical manner, consistent with requirements classes.

REQUIREMENT 4

IDENTIFIER /req/core/requirements-test-suite-structure

- A** The requirements structure of the document SHALL be in a logical correspondence to the test suite structure.

If two requirements are in the same requirements class, they should be tested in the same conformance class in the conformance suite. Each requirement is separately identifiable either by a label as is done in the ModSpec.

In summary, the structure of the requirements and requirements classes of the model should be reflected in the organization of the conformance tests and classes, and also in the structure of the normative clauses in the specification document.

8.1.3. Conformance Test Suite

The requirements specified in this clause will be applied directly to the test suite, and in particular to the conformance classes. By definition, a “test suite” is a collection of identifiable conformance classes. A conformance class is a well-defined set of conformance tests. Each conformance test is a concrete or abstract (depending on the type of suite) description of a test to be performed on each candidate conformant implementation, to determine if it meets a well-defined set of requirements as stated in the normative clauses of the standards document.

NOTE: The Test Suite is normative in the sense that it describes the tests to be performed to pass conformance, but it specifies no requirements in any other sense. The requirements are specified in the body of the standard. The test suite only describes in detail how those requirements should be tested.

In each of the profiles defined in the Clauses to follow, some set of entities, types, elements, or objects are defined and segregated into implementation requirements classes.

REQUIREMENT 5

IDENTIFIER /req/core/requirements-class-correspondence-to-conformance-classes

A The requirements classes SHALL be in a one-to-one correspondence to the conformance test classes, and thus to the various certificate of conformance types possible for a candidate implementation.

Strict parallelism of implementation and governance is the essence of this standard.

8.1.4. Requirements for Modularity

8.1.4.1. Each Conformance class tests a complete requirements class

REQUIREMENT 6

IDENTIFIER /req/core/no-optional-tests

A A conformance class SHALL not contain any optional conformance tests.

This requirement stops conformance classes from containing optional requirements and tests, and, at least as far as the standard is concerned, makes all certificates of conformance mean that

exactly the same tests have been conducted. Standards documents may use recommendations for such options, but the conformance test classes do not test recommendations.

Table 11

PER007	<code>/per/core/conf-class-parameterized</code> A Conformance class <i>MAY</i> be parameterized.
--------	---

This means that the class's tests depend on some parameter that must be defined before the tests can be executed. This can be thought of as an "if-then-else" decision tree.

For example, if a conformance class needs to apply tests against a specific data format, such as GML or KML, then XYZ(GML) is XYZ using GML, and XYZ(KML) is XYZ using KML. Because the parameters choose which requirements will be tested, two conformance classes with distinct parameters should be considered as distinct conformance classes.

The most common parameters are the identities of indirect dependencies. For example, if a service uses or produces feature data, the format of that data may be a parameter, such as GML, KML or GeoJSON. When reading a certificate of conformance, the values of such parameters are very important.

REQUIREMENT 7

IDENTIFIER `/req/core/all-parameters-expressed`

A A certificate of conformance **SHALL** specify all parameter values used to pass the tests in its conformance test class.

Conformance to a particular conformance class means exactly the same thing everywhere.

REQUIREMENT 8

IDENTIFIER `/req/core/conf-class-single-req-class`

A A Conformance class **SHALL** explicitly test only requirements from a single requirements class.

This means that there is a strict correspondence between the requirements classes and the conformance test classes in the test suite. Recall that a conformance test class may specify dependencies causing other conformance test classes to be used, but this is a result of an explicit requirement in the "home" requirements class.

REQUIREMENT 9

IDENTIFIER `/req/core/con-class-dependencies`

REQUIREMENT 9

A	A Conformance class SHALL specify any other conformance class upon which it is dependent and that other conformance class shall be used to test the specified dependency.
---	---

Such referenced conformance classes may be in the same standard or may be a conformance class of another standard.

Example — Indirect dependency on schema: If a service specifies that a particular output is required to be conformant to a conformance test class in a specific standard (say a normatively referenced XML schema), then the conformance class of that normative reference will be used to test that output. For example, if an OGC Web Feature Service (WFS) implementation instance specifies that its feature collection output is compliant to a particular profile of GML, then that profile of GML will be used to validate that output. This means that the service is indirectly tested using the GML standard. In other words, GML is an indirect dependency of the original service.

Requirements classes may be optional as a whole, but not piecemeal. This means that every implementation that passed a particular conformance class satisfies exactly the same requirements and passes exactly the same conformance tests. Differences between implementations will be determined by which conformance test classes are passed, not by listing of which options within a class were tested. If a standard's authors wish to make a particular requirement optional, [req-9] forces them to include it in a separate requirements class (and therefore in a separate conformance test class) which can be left untested.

NOTE: Standards developed outside the OGC may not follow a strict parallelism between requirement specification and testing, so for use within a standard compliant to the ModSpec, special care must be taken in importing conformance test classes from other standards.

REQUIREMENT 10

IDENTIFIER /req/core/imported-requirements-class

A	If a requirements class is imported from another standard for use within a standard conformant to the ModSpec, and if any imported requirement is "optional," then that requirement SHALL be factored out as a separate requirements class in the profile of that imported standard used in the conformant standard.
B	Each such used requirements class SHALL be a conformance class of the source standard or a combination of conformance classes of the source standard or standards.

The tracking of the parallelism between requirements and tests should be easy if the standards document is non-ambiguous. To insure this, by utilizing the names of the two types of classes the following requirement places a default mapping between the two.

REQUIREMENT 11

IDENTIFIER /req/core/all-classes-explicitly-named

- A** For the sake of consistency and readability, all requirements classes and all conformance test classes SHALL be explicitly named, with corresponding requirements classes and conformance test classes having similar names.

Logically, a requirements class (set of requirements) and a conformance class (set of tests) are not comparable. This can be remedied by noting that both have a consistent relation to a set of requirements. A requirements class is a set of requirements. A conformance class tests a set of requirements. Therefore a requirements class corresponds precisely to a conformance class if they both are related (as described) to the same set of requirements.

8.1.5. Requirements classes contain all requirements tested by a conformance test case

REQUIREMENT 12

IDENTIFIER /req/core/req-in-only-one-req-class

- A** Each requirement in the standard SHALL be contained in one and only one requirements class.
- B** Inclusion of any requirement in a requirements class by a conformance class SHALL imply inclusion of all requirements in its class (as a dependency).

Unless a requirement is referenced in a conformance test and thus in a conformance class, it cannot be considered a requirement since no test has been defined for it.

Table 12

	/rec/core/parallel-structure
REC002	If possible, the structure of the normative clauses of the standard <i>SHOULD</i> parallel the structure of the conformance classes in the conformance clause.

The above requirement in conjunction with [req-9] means that all requirements in a conformant standard will be tested in some conformance class. In the best example, a requirement should be contained explicitly in one and only one requirements class and tested in one and only one conformance class. This is not really a requirement here, since a single requirement can be stated twice in different requirements classes.

REQUIREMENT 13

IDENTIFIER /req/core/co-dependent-requirements

- | | |
|---|---|
| A | If any two requirements are co-dependent (each dependent on the other) then they shall be in the same requirements class. |
| B | If any two requirements classes are co-dependent, they shall be merged into a single class. |

Normally, circular dependencies between implementation components are signs of a poor design, but they often cannot be avoided because of other considerations (code ownership for example).

Table 13

REC003

/rec/core/circular-dependencies

Circular dependencies of all types *SHOULD* be avoided whenever possible.

REQUIREMENT 14

IDENTIFIER /req/core/structure-requirements-classes

- | | |
|---|---|
| A | There SHALL be a natural structure to the requirements classes so that each may be implemented on top of any implementations of its dependencies and independent of its extensions. |
|---|---|

NOTE: The only certain manner to test this requirement maybe to create a reference implementation.

This requirement is more important and may be more difficult than it seems. It states simply that conformance classes and their associated requirements classes can be put in a one-to-one correspondence to a fully modular implementation of the complete standard (at least against a single standardization target). Implementors who wish to sacrifice modularity for some other benefit can still do what they want; the requirement here only states that if the software requirements classes are properly separated, they can be implemented in a “plug’n’play” fashion.

REQUIREMENT 15

IDENTIFIER /req/core/requirements-and-dependencies

- | | |
|---|--|
| A | No requirements class SHALL redefine the requirements of its dependencies, unless that redefinition is for an entity derived from but not contained in those dependencies. |
|---|--|

This means, for example, that a UML classifier cannot be redefined in a new extension. If a new version of the classifier is needed it has to be a valid subtype of the original.

In terms of generalization, subclassing, extension and restriction (into a new class or type) are all acceptable, redefinition (of an old class or type) is not.

Clause 8.1.2 makes some pointed suggestion as to how to organize the conformance classes and normative clauses in parallel to make this requirement easier to verify.

Most standards include examples, which are useful for illustrative or pedagogical purposes. However, it is not possible to write a standard “by example” that leads to conformance tests. Examples are therefore non-normative, by definition.

8.1.6. Profiles are defined as sets of conformance classes

All the conformance classes created in a standard form a base (an upper bound of all conformance classes) for defining profiles as defined in ISO/IEC 10000 (see ISO/IEC DIR 2). The base for creating a profile can be defined as the union of all requirements classes.

REQUIREMENT 16

IDENTIFIER /req/core/profile-conformance

A

The conformance tests for a profile of a standard SHALL be defined as the union of a list of conformance classes that are to be satisfied by that profile’s standardization targets.

8.1.7. There is a Defined Core

REQUIREMENT 17

IDENTIFIER /req/core/core-requirements-separate

A

Every standard SHALL define and identify a core set of requirements as a separate conformance class.

REQUIREMENT 18

IDENTIFIER /req/core/requirements-and-dependencies-2

A

All general recommendations SHALL be in the core.

REQUIREMENT 19

IDENTIFIER /req/core/requirements-and-dependencies-3

- | | |
|----------|--|
| A | Every other requirements class in a standard SHALL have a standardization target type which is a subtype of that of the core |
| B | And every requirement class SHALL have the core as a direct dependency. |

Table 14

REC004	/rec/core/simple-core The core <i>SHOULD</i> be as simple as possible.
---------------	--

Table 15

PER008	/per/core/core-type The core <i>MAY</i> be partially or totally abstract.
---------------	---

Table 16

PER009	/per/core/req-class-another-standard The core requirements class <i>MAY</i> be a conformance class in another standard.
---------------	---

Table 17

REC005	/rec/core/optional-tests If a requirements class is from another standard, the current standard <i>SHOULD</i> identify any optional tests in that conformance class that are required by the current standard's core requirements class. See [req-13].
---------------	--

Since the core requirements class is contained (as a direct dependency) in each other requirements class with a similar standardization target type, the general recommendations are thus universal to all requirements classes.

Table 18

PER010	/per/core/core-maybe-recommendations Since the basic concept of some standards is mechanism not implementation, the core <i>MAY</i> contain only recommendations, and include no requirements.
---------------	--

NOTE: In most cases, if someone feels the need to define a “simple” version of the standard, it is probably a good approximation of the best core. For example, the core of a refactored

GML might be the equivalent of the “GML for Simple Features” profile. The core for any SQL version of feature geometry is probably “Simple Features.”

8.1.8. Extensions are requirements classes

A common mechanism to extend the functionality of a standard is to define extensions, which may be either local or encompass other standards.

Standards should use extensions as required and feasible, but should never hinder them.

REQUIREMENT 20

IDENTIFIER /req/core/core-and-extensions

A Each standard conformant to the ModSpec SHALL consist of the core and some number of requirements classes defined as extensions to that core.

REQUIREMENT 21

IDENTIFIER /req/core/extensions-conformant-to-the-modspec

A A standard conformant to the ModSpec SHALL require all conformant extensions to be conformant to the ModSpec.

Since software is evolutionary at its best, it would not be wise to restrict that evolutionary tendency by restricting the specification of extensions. A good standard will thus list the things a standardization target has to do, but will never list things that a standardization target might want to do above and beyond the current design requirements.

REQUIREMENT 22

IDENTIFIER /req/core/restriction-of-extensions

A A standard conformant to the ModSpec SHALL never restrict in any manner future, logically valid extensions of its standardization targets

The above requirement should not be interpreted as a restriction on quality control. Any efforts by a standard to enforce a level of quality on its standardization targets, when well and properly formed, do not interfere with the proper extension of those targets. So, the standard may require its standardization targets to behave in a certain manner when presented with a logical inconsistency, but that inconsistency must be fundamental to the internal logic of the model, and not a possible extension. Thus, a standard may require a standardization target to accept GML as a feature specification language, but cannot require a standardization target to not

accept an alternative, such as KML, or GeoJSON, as long as that alternative can carry viable information consistent with the fundamental intent of the standard.

8.1.9. Optional requirements are organized as requirements classes

REQUIREMENT 23

IDENTIFIER /req/core/optional-requirements

A The only conditional requirements acceptable in a standard conformant with the ModSpec SHALL be expressible as a list of conformance classes to be passed.

NOTE: Standards and implementations are restricted by this, but not instances of schemas. For example, a XML schema standard can specify an optional element, which data instances may use or not. However schema-aware processors claiming conformance to the standard should be able to handle all elements defined in the schema, whether they are required by the schema or not.

Requirements of the form “if the implementation does this, it must do it this way” are considered to be options and should be in a separate requirements class.

8.1.10. Requirements classes intersect overlap only by reference

REQUIREMENT 24

IDENTIFIER /req/core/req-class-overlap-by-reference

A The common portion of any two requirements classes SHALL consist only of references to other requirements classes.

This implies that each requirement is directly in exactly one requirements class and all references to that requirement from another requirements class must include its complete “home” requirements class. This means that requirements for dependencies will often result in conformance test cases which require the execution of the dependency conformance class. See for example [annex-A-2-1].

NOTE: All general recommendations are in the core requirements class. The core conformance test class contains tests that all other conformance classes must pass.



9

MAPPING THE MODSPEC TO TYPES OF MODELS

MAPPING THE MODSPEC TO TYPES OF MODELS

9.1. Semantics

The previous section defines requirements for conformance to the ModSpec. However, testing for that conformance may depend on how the various forms and parts of a conformant standard are viewed. Additional Parts to the ModSpec Standard specify how those views are to be defined. Standards that take an alternative mechanism to the ones defined in the additional Parts must be tested solely on the structure of their conformance test suite until such times as an extension to the ModSpec is defined for that alternate mechanism.

Standards are often structured about some form of modeling language, or implementation paradigm. Additional Parts to the ModSpec define a mechanism to map parts of the model (language, schema, etc.) to the conformance classes used as the model from Clause 6.1.

As suggested in Clause [req-22], the structure of the normative clauses in a standard should parallel the structure of the conformance test classes in that standard. The structure of the normative clauses in a well written standard will follow the structure of its model. This means that all three are parallel.

9.2. A Note on Data Models

If a data model is to be used to define the parameters of operational interfaces, then that model should belong in the core since it can be considered as part of a common reference model and vocabulary.

If a data model is to be used to create “data transfer” elements, the issue is more complex. In the use of parameter names and types in the operational model above, the definition of a common vocabulary in the core is justifiable. In the case where data transfer elements are being defined, it may be that some types and elements are a defining separator between conformance classes and have to exist independently of such data elements defined for non-dependent classes. For these reasons, care should be taken in creating separable data transfer schemas across requirements. Dependencies in the schemas will have to parallel the dependencies in the requirements classes. The mechanism for enforcing this is dependent on the schema language.



ANNEX A (NORMATIVE) ABSTRACT CONFORMANCE TEST SUITE

A

ANNEX A (NORMATIVE) ABSTRACT CONFORMANCE TEST SUITE

A.1. Conformance Test Class: The Core

A.1.1. Requirements are atomic and tests cover all the parts of each of the requirement

All the parts of a requirement, a requirement module, or requirements class shall be tested. Failure to meet any part of any requirement shall be a failure to pass the associated conformance test class.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: Table 2
4. Test Type: Conformance.

A.1.2. All components have an assigned URI

Each component of the standard, including requirements, requirements modules, requirements classes, conformance test cases, conformance modules and conformance classes shall be assigned a URI as specified by the OGC Naming Authority or its equivalent.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: Table 3
4. Test Type: Conformance.

A.1.3. Requirements on vocabulary are appropriately placed

Requirements on the use and interpretation of vocabulary shall be in the requirements class where that use or interpretation is used.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: Table 7
4. Test Type: Conformance.

A.1.4. Requirements have a single target

Each requirement in a conformant standard shall have a single standardization target type.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-4]
4. Test Type: Conformance.

A.1.5. Conformance test classes have a single target

All conformance tests in a single conformance test class in a conformant standard shall have the same standardization target.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-5]
4. Test Type: Conformance.

A.1.6. Requirements are organized by clauses

The requirements shall be grouped together in clauses (numbered sections) of the document in a strictly hierarchical manner, consistent with requirements modules and requirements classes.

1. Test Purpose: Verify that this requirement is satisfied.

2. Test Method: Inspect the document to verify the above.
3. Reference: Clause 6.4, [req-6]
4. Test Type: Conformance.

A.1.7. Conformance test classes are consistent with requirements classes

The requirements structure of the document shall be in a logical correspondence to the test suite structure.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: Clause 6.4, [req-7]
4. Test Type: Conformance.

A.1.8. Requirement classes and the Conformance Test classes in correspondence

The requirements classes shall be in a one-to-one correspondence to the conformance test classes, and thus to the various certificate of conformance types possible for a candidate implementation.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-8]
4. Test Type: Conformance.

A.1.9. No Optional Elements in Requirements classes

A Conformance class shall not contain any optional conformance tests.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-9]
4. Test Type: Conformance.

A.1.10. Certificate of conformance specifies all parameters used

A certificate of conformance shall specify all parameter values used to pass the tests in its conformance test class.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-10]
4. Test Type: Conformance.

A.1.11. Conformance class tests only one requirements class

A Conformance class shall explicitly test only requirements from a single requirements class.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-11]
4. Test Type: Conformance.

A.1.12. Conformance class specifies all dependencies

A Conformance class shall specify any other conformance class upon which it is dependent and that other conformance class shall be used to test the specified dependency.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-12]
4. Test Type: Conformance.

A.1.13. Imported Conformance class tests are consistent with the specification

If a requirements class is imported from another standard for use within a standard conformant to this standard, and if any imported requirement is “optional,” then that requirement shall be factored out as a separate requirements class in the profile of that imported standard used in

the conformant standard. Each such used requirements class shall be a conformance class of the source standard or a combination of conformance classes of the source standard or standards.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-13]
4. Test Type: Conformance.

A.1.14. Naming consistency

For the sake of consistency and readability, all requirements classes and all conformance test classes shall be explicitly named, with corresponding requirements classes and conformance test classes having similar names.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-14]
4. Test Type: Conformance.

A.1.15. Requirements in one and only one requirements class

Each requirement in the standard shall be contained in one and only one requirements class. Inclusion of any requirement in a requirements class by a conformance class shall imply inclusion of all requirements in its class (as a dependency).

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-15]
4. Test Type: Conformance.

A.1.16. Co-dependent Requirements are in the same requirements class

If any two requirements or two requirements modules are co-dependent (each dependent on the other) then they shall be in the same requirements class. If any two requirements classes are co-dependent, they shall be merged into a single class.

1. Test Purpose: Verify that this requirement is satisfied.

2. Test Method: Inspect the document to verify the above.
3. Reference: [req-16]
4. Test Type: Conformance.

A.1.17. Modularity in implementation is possible

There shall be a natural structure on the requirements classes so that each may be implemented on top of any implementations of its dependencies and independent of its extensions.

All general recommendations shall be in the core.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-17]
4. Test Type: Conformance.

A.1.18. Requirements follow rules of inheritance

No requirements class shall redefine the requirements of its dependencies, unless that redefinition is for an entity derived from but not contained in those dependencies.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-18]
4. Test Type: Conformance.

A.1.19. Profiles are expressed as sets of conformance classes

The conformance tests for a profile of a standard shall be defined as the union of a list of conformance classes that are to be satisfied by that profile's standardization targets.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-19]
4. Test Type: Conformance.

A.1.20. There is a named Core requirements class

Every standard shall define and identify a core set of requirements as a separate conformance class.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-20]
4. Test Type: Conformance.

A.1.21. General conditions are in the core

Every other requirements class in a standard shall have a standardization target type which is a subtype of that of the core and shall have the core as a direct dependency.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-22]
4. Test Type: Conformance.

A.1.22. Every extension has a consistent target type

Every other requirements class in a standard shall have a standardization target type which is a subtype of that of the core and shall have the core as a direct dependency.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-22]
4. Test Type: Conformance.

A.1.23. A standard is a core plus some number of extensions

Each standard conformant to the ModSpec shall consist of the core and some number of requirements classes defined as extensions to that core.

1. Test Purpose: Verify that this requirement is satisfied.

2. Test Method: Inspect the document to verify the above.
3. Reference: [req-23]
4. Test Type: Conformance.

A.1.24. Conformance to this ModSpec is required for any extensions

A standard conformant to the ModSpec shall require all conformant extensions to itself to be conformant to the ModSpec.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-24]
4. Test Type: Conformance.

A.1.25. Future extensions cannot be restricted

A standard conformant to the ModSpec shall never restrict in any manner future, logically-valid extensions of its standardization targets.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-25]
4. Test Type: Conformance.

A.1.26. Optional requirements are organized as requirements classes

The only optional requirements acceptable in a standard conformant to this standard shall be expressible as a list of conformance classes to be passed.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-26]
4. Test Type: Conformance.

A.1.27. Requirements classes intersect overlap only by reference

The common portion of any two requirements classes shall consist only of references to other requirements classes.

1. Test Purpose: Verify that this requirement is satisfied.
2. Test Method: Inspect the document to verify the above.
3. Reference: [req-27]
4. Test Type: Conformance.



B

ANNEX B (NORMATIVE) OGC ONLY: CHANGES REQUIRED IN THE OGC STANDARDS



B

ANNEX B

(NORMATIVE)

OGC ONLY: CHANGES REQUIRED IN THE OGC STANDARDS

NOTE: The following is for OGC Standards and Abstract Specifications only: No changes are required to existing OGC Standards

B.1. New OGC standards and revisions to existing OGC standards

Any new standard or major revision of an existing standard *SHALL* comply with the ModSpec in the structure of its internal models and its conformance tests.

Failure to conform by a candidate standard to the ModSpec should be specifically noted and reasons given for such non-compliance in the conformance clauses of any new or new version of such candidate standards.

The adoption of such documents not compliant with the ModSpec *SHALL* be considered as an authorized exception to the requirements of the ModSpec by the appropriate authority, such as the OGC or ISO. An exception to the rules of the authority such as the OGC and will require a two-thirds (2/3) majority ("Robert's Rules") or as specified in the authorities Policy and Procedures for an exception to procedure. In the OGC, a similar vote is required within the Executive Planning Committee or as specified in any Policy and Procedure document used by this committee.



ANNEX C (INFORMATIVE) MODSPEC UML MODEL, SEMANTICS, AND DEFINITIONS

ANNEX C

(INFORMATIVE)

MODSPEC UML MODEL, SEMANTICS, AND DEFINITIONS

C.1. Semantically ordered definitions

Clause 4 formally defines the terms used in the conformance tests in alphabetical order. It may be easier to understand the more significant terms in the following less formal definitions arranged in a bottom-up order:

1. a *standardization target type* (Clause 4.27) is a type of entity about which a standard is written. An instance of a *standardization target type* (Clause 4.27) is a *standardization target* (Clause 4.26). A standard may address multiple targets in separate *conformance classes*.
2. a *requirement* (Clause 4.21) is a statement of a condition to be satisfied by a single *standardization target type* (Clause 4.27), and it must be stated in “normative” language.
3. a *conformance test* (Clause 4.3) checks if a set of *requirements* (Clause 4.21) are met (**pass**) or not met (**fail**) by a *standardization target* (Clause 4.26). The relationship between *conformance tests* (Clause 4.3) and *requirements* (Clause 4.21) is many-to-many.
4. all *conformance tests* (Clause 4.3) are graded as **pass** or **fail** against each instance of the *standardization target* (Clause 4.26).
5. a *requirement* (Clause 4.21) is associated to one *conformance test* (Clause 4.3).
6. a *recommendation* (Clause 4.20) is a suggestion and is not associated to any *conformance test* (Clause 4.3).
7. a *requirements class* (Clause 4.22) is a set of one or more *requirements* (Clause 4.21) all with the same *standardization target type* (Clause 4.27).
8. a *conformance (test) class* (Clause 4.6) is a collection of *conformance tests* (Clause 4.3) that are associated to and only to the requirements in a corresponding *requirements class* (Clause 4.22).

9. a *conformance (test) module* (Clause 4.5) is also collection of **term conformance test classes not resolved via ID conformance-test-classes** that group *conformance tests* (Clause 4.3) on a single *standardization target type* (Clause 4.27).
10. a **conformant implementation** is a *standardization target type* (Clause 4.27) that has successfully passed all tests in a specified *conformance (test) class* (Clause 4.6) and received a *certificate of conformance* (Clause 4.2)
11. the *core requirements class* (Clause 4.8) of a standard is the minimal set of *requirements* (Clause 4.21) which must be supported by all **conformant implementations**. If a standard addresses multiple *standardization target types* (Clause 4.27), it may have a **core** for each **target type**.
12. an **extension** of a *requirements class* (Clause 4.22) is an additional *requirements class* (Clause 4.22) (the extension) that adds additional *requirements* (Clause 4.21) to the first *requirements class* (Clause 4.22) (the **base requirements class** being extended). The extension is said to be dependent on the **base**. Any *conformance test class* (Clause 4.6) must identify all its dependencies during the execution of conformance tests against a candidate *standardization target* (Clause 4.26).

C.2. UML Model

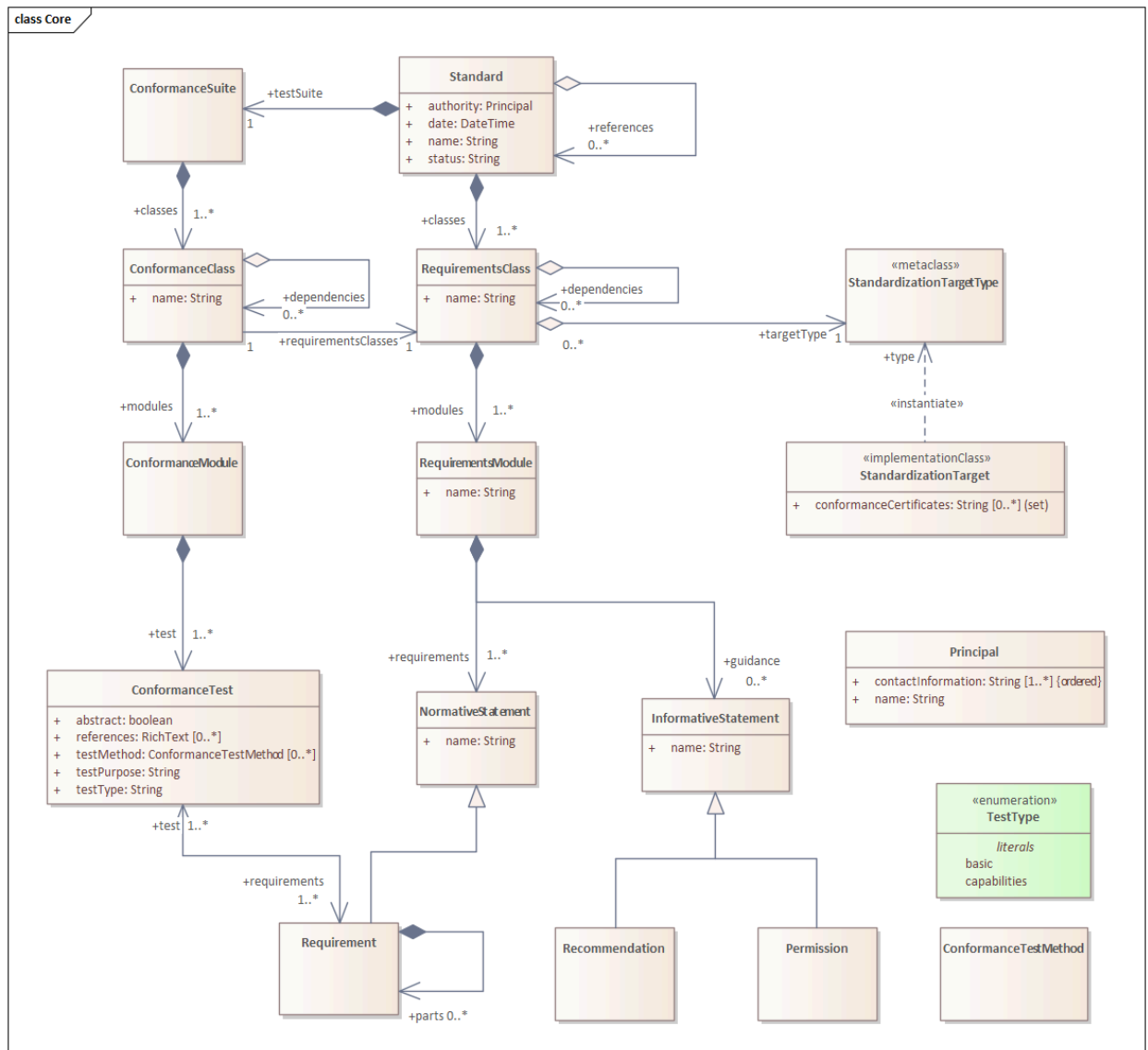


Figure C.1

Figure 1 represents a UML model consistent with the model described in Clause 8 of this document. The following subclauses describe the classes shown in this UML class diagram.

C.3. Core Data Dictionary

C.3.1. ConformanceClass

set of conformance tests that must be passed to receive a single certificate of conformance (Clause 4.2) NOTE:: When no ambiguity is possible, the word test may be left out, so conformance test class may be called a conformance class.

In the ModSpec, the set of requirements tested by the conformance tests within a conformance class is a requirements class and its dependencies. Optional requirements will be in a separate requirements class with other requirements that are part of the same option. Each requirements class corresponds to a separate conformance class

Each requirements class will be in a 1 to 1 correspondence to a similarly named conformance class that tests all of the requirements class's requirements.

All requirements in a conformance class will have the same standardization target type.

Table C.1

ROLE NAME	TARGET CLASS	MUL	DEFINITION
	ConformanceClass	[1]	
dependencies	ConformanceClass	[0..*]	Conformance classes that this conformance class depends on. These dependent conformance classes must be passed if this one is to be passed.
classes	ConformanceClass	[1..*]	Conformance classes that this conformance suite contains.
	ConformanceSuite	[1]	
	ConformanceClass	[1]	
requirements Class	RequirementsClass	[1]	The requirements class that this conformance class aims to test against.
ATTRIBUTE	VALUE TYPE	MUL	DEFINITION
name	String		Name of the conformance class

C.3.2. ConformanceModule

a set of related tests, all within a single conformance test class

NOTE When there is no ambiguity, the word test may be omitted, i.e. conformance test module is the same as conformance module. Conformance modules may be nested in a hierarchical way. This term and those associated with it are included here for consistency with ISO 19105.

Table C.2

ROLE NAME	TARGET CLASS	MUL ¹ DEFINITION
modules	ConformanceModule	[1..*]
	ConformanceClass	[1]
ATTRIBUTE	VALUE TYPE	MUL ¹ DEFINITION

C.3.3. ConformanceSuite

set of conformance classes that define tests for all requirements of a standard or abstract specification

NOTE The conformance suite is the union of all conformance classes. It is by definition the conformance class of the entire specification.

In this standard, each requirement is mandatory within its conformance class and each requirement is tested in at least one conformance test.

Table C.3

ROLE NAME	TARGET CLASS	MUL ¹ DEFINITION
testSuite	ConformanceSuite	[1]
	Standard	[]

ATTRIBUTE	VALUE TYPE	MULTI DEFINITION
-----------	------------	------------------

C.3.4. ConformanceTest

test, abstract or real, of one or more requirements contained within a standard, or set of standards

Table C.4

ROLE NAME	TARGET CLASS	MULTI DEFINITION
test	ConformanceTest	[1..*]
	ConformanceModule	[]
tests	ConformanceTest	[1..*] Conformance tests that when passed confirm the satisfaction of this requirement. NOTE: If this requirement is a requirement part, it may or may not have a corresponding conformance test.
	Requirement	[1]
ATTRIBUTE	VALUE TYPE	MULTI DEFINITION
abstract	boolean	Whether this test is abstract or concrete. An abstract conformance test is commonly called an abstract test.
references	RichText	[0..*] References to the specification(s) or the conformance test
testMethod	ConformanceTest Method	[0..*] Method to perform this conformance test. A method is considered a “part” of the test if there are multiple of them.
testPurpose	String	Purpose of the conformance test
testType	TestType	Type of the conformance test

C.3.5. ConformanceTestCase

test for a particular requirement or a set of related requirements

NOTE	When there is no ambiguity, the word case may be omitted. i.e. conformance test is the same as conformance test case.
------	---

Table C.5

ROLE NAME	TARGET CLASS	MULTI DEFINITION
ATTRIBUTE	VALUE TYPE	MULTI DEFINITION

C.3.6. ConformanceTestMethod

Table C.6

ROLE NAME	TARGET CLASS	MULTI DEFINITION
ATTRIBUTE	VALUE TYPE	MULTI DEFINITION

C.3.7. CoreRequirementsClass

Original

unique requirements class that must be satisfied by any conformant standardization targets associated to the specification

NOTE	The core requirements class is unique because if it was possible to have more than one, then each core would have to be implemented to pass any conformance test class, and thus would have to be contained in any other core. The core may be empty, or all or part of another standard or related set of standards.
------	---

The core can refer to this requirements class, its associated conformance test class or the software module that implements that requirements class.

Table C.7

ROLE NAME	TARGET CLASS	MULTI DEFINITION
-----------	--------------	------------------

ATTRIBUTE	VALUE TYPE	MULTI DEFINITION
-----------	------------	------------------

C.3.8. GeneralRecommendation

Original

recommendation applying to all entities in a specification model

Table C.8

ROLE NAME	TARGET CLASS	MULTI DEFINITION
ATTRIBUTE	VALUE TYPE	MULTI DEFINITION

C.3.9. InformativeStatement

expression in a document conveying information

NOTE: Includes all statements in a document not part of the normative requirements, recommendations, or conformance tests. Included for completeness.

Table C.9

ROLE NAME	TARGET CLASS	MULTI DEFINITION
guidance	InformativeStatement	[0..*]
	RequirementsModule	[]
ATTRIBUTE	VALUE TYPE	MULTI DEFINITION
name	String	

C.3.10. NormativeStatement

expression in a document conveying information

NOTE: Includes all statements in a document not part of the normative requirements, recommendations, or conformance tests. Included for completeness.

Table C.10

ROLE NAME	TARGET CLASS	MUL	DEFINITION
requirements	NormativeStatement	[1..*]	Requirements classes, recommendations, and permissions that this requirements module contains.
	RequirementsModule	[]	
ATTRIBUTE	VALUE TYPE	MUL	DEFINITION
name	String		Name of the normative statement

C.3.11. Permission

uses “may” and is used to prevent a requirement from being “over interpreted” and as such is considered to be more of a “statement of fact” than a “normative” condition.

Table C.11

ROLE NAME	TARGET CLASS	MUL	DEFINITION
ATTRIBUTE	VALUE TYPE	MUL	DEFINITION

C.3.12. Principal

Table C.12

ROLE NAME	TARGET CLASS	MULTI DEFINITION
ATTRIBUTE	VALUE TYPE	MULTI DEFINITION
contact Information	String	[1. .*]
name	String	

C.3.13. Recommendation

expression in the content of a standard conveying that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required, or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited

NOTE Although using normative language, a recommendation is not a requirement. The usual form replaces the shall (imperative or command) of a requirement with a should (suggestive or conditional).

Table C.13

ROLE NAME	TARGET CLASS	MULTI DEFINITION
ATTRIBUTE	VALUE TYPE	MULTI DEFINITION

C.3.14. Requirement

expression in the content of a standard conveying criteria to be fulfilled if compliance with the standard is to be claimed and from which no deviation is permitted

NOTE Each requirement is a normative criterion for a single standardization target type. In this standard, requirements will be associated to conformance tests that can be used to prove compliance to the underlying criteria by the standardization target.

The implementation of a requirement is dependent on the type of specification being written. A data specification requires data structures, but a procedural specification requires software

implementations. The view of a standard in terms of a set of testable requirements allows us to use set descriptions of both the standard and its implementations.

The specification of a requirement is usually expressed in terms of a model of the standardization target type, such as a UML model, or an XML or SQL schema. Anything without a defined test is a priori not testable and thus would be better expressed as a recommendation.

Requirements use normative language and in particular are commands and use the imperative shall or similar imperative constructs. Statements in standards which are not requirements and need to be either conditional or future tense normally use will and should not be confused with requirements that use shall imperatively

Table C.14

ROLE NAME	TARGET CLASS	MUL	DEFINITION
requirements	Requirement	[1..*]	Corresponding requirement of requirement part that this conformance test is supposed to test against.
	ConformanceTest	[1]	
parts	Requirement	[0..*]	Collection of requirements that are parts to this requirement. Satisfaction of all requirement parts are necessary for this requirement to be satisfied.
	Requirement	[]	
ATTRIBUTE	VALUE TYPE	MUL	DEFINITION

C.3.15. RequirementsClass

aggregate of all requirements (Clause 4.21) that must all be satisfied to satisfy a conformance test Class

NOTE	There is some confusion possible here, since the testing of indirect dependencies seems to violate this definition. But the existence of an indirect dependency implies that the test is actually a test of the existence of the relationship from the original target to something that has a property (satisfies a condition or requirement from another requirements class).
------	---

Table C.15

--

ROLE NAME	TARGET CLASS	MULTIPLICITY	DEFINITION
classes	RequirementsClass	[1..*]	
	Standard	[]	
dependencies	RequirementsClass	[0..*]	Requirements classes that this requirements class depends on. These dependent requirements classes must be satisfied for this requirements class to be satisfied.
	RequirementsClass	[]	
ATTRIBUTE	VALUE TYPE	MULTIPLICITY	DEFINITION
name	String		Name of the requirements class

C.3.16. RequirementsModule

a set of related requirements (Clause 4.22), recommendations (Clause 4.20) and permissions (Clause 4.18) all with a single requirements class (Clause 4.26)

NOTE This term is included to be consistent with the use of modules in ISO 19105.

Table C.16

ROLE NAME	TARGET CLASS	MULTIPLICITY	DEFINITION
modules	RequirementsModule	[1..*]	A set of one or more requirements classes, recommendations, and permissions with the same standardization target.
	RequirementsClass	[]	
ATTRIBUTE	VALUE TYPE	MULTIPLICITY	DEFINITION
name	String		Name of the requirements module

C.3.17. Specification

document containing recommendations, requirements and conformance tests for those requirements

NOTE This definition is included for completeness. See Clause 5.3. This does not restrict what else a specification may contain, as long as it does contain the three types of element cited.

Table C.17

ROLE NAME	TARGET CLASS	MULTI DEFINITION
ATTRIBUTE	VALUE TYPE	MULTI DEFINITION

C.3.18. Standard

document containing recommendations (Clause 4.20), requirements (Clause 4.21) and conformance tests (Clause 4.6) that has been approved by a legitimate Standards Body

(original) specification that has been approved by a legitimate Standards Body

NOTE This definition is included for completeness. Standard and specification can apply to the same document. While specification is always valid, standard only applies after the adoption of the document by a legitimate standards organization. The legitimate Standards Bodies for OGC consist of OGC, ISO and any of the other standards bodies accepted and used as a source of normative references by OGC or ISO in their standards. In the normal meaning of the word standard, there are other conditions that may be required, but this standard has chosen to ignore them in the process of abstraction.

Table C.18

ROLE NAME	TARGET CLASS	MULTI DEFINITION
references	Standard	[0. .*]
	Standard	[]

ATTRIBUTE	VALUE TYPE	MUL' DEFINITION
authority	Principal	Standards body or author of this standard
date	DateTime	Publication date of the standard
name	String	Name of the standard
status	String	Publication status of this standard

C.3.19. StandardizationTarget

entity to which some requirements of a standard apply NOTE The standardization target is the entity which may receive a certificate of conformance for a requirements class.

Table C.19

ROLE NAME	TARGET CLASS	MUL' DEFINITION
ATTRIBUTE	VALUE TYPE	MUL' DEFINITION
conformance Certificates	String	[0. .*] Conformance classes passed by this target

C.3.20. StandardizationTargetType

type of entity or set of entities to which the requirement (Clause 4.21) of a standard (Clause 4.25) apply

NOTE	The standardization target types give the standardization targets a typing system similar to the UML classifiers. In general, the types inherit from one another in the same way that UML classes do. The same class/metaclass semantics apply, and two targets can be considered to have the same type (in a particular situation) if their instantiation types share the appropriate supertype, as is the case in UML. In OGC for example, all service types that must pass the OWS (Open Web Services) Common specification are some extension of the Open Web Service standardization target type. This makes OWS Common a default global core for all OGC Services.
------	--

In some cases, the standardization target type may be another specification. A GML application schema is a standardization target for the GML standard, but is in turn a specification of instances of that application schema.

Table C.20

ROLE NAME	TARGET CLASS	MUL	DEFINITION
Type	StandardizationTarget Type	[]	Type of the standardization target type
	StandardizationTarget	[]	
targetType	StandardizationTarget Type	[1]	Type of standardization target
	RequirementsClass	[0. .*]	
ATTRIBUTE	VALUE TYPE	MUL	DEFINITION

C.3.21. Statement

Original

expression in a document conveying information

NOTE Includes all statements in a document not part of the normative requirements, recommendations or conformance tests. Included for completeness.

Table C.21

ROLE NAME	TARGET CLASS	MUL	DEFINITION
ATTRIBUTE	VALUE TYPE	MUL	DEFINITION

C.3.22. TestType

Table C.22

ROLE NAME	TARGET CLASS	MUL' DEFINITION
ATTRIBUTE	VALUE TYPE	MUL' DEFINITION
basic «enum»	<←section,>>	
capabilities «enum»	<←section,>>	

C.4. Concepts Data Dictionary

C.4.1. CertificateOfConformance

evidence of conformance to all or part of a standard, awarded for passing one or more of the conformance test classes specified in that standard

NOTE	Certificates do not have to be instantiated documents; having proof of passing the conformance test class is sufficient. For example, the OGC currently keeps an online list of conformant applications at http://www.opengeospatial.org/resource/products . Each certificate of conformance is awarded to a standardization target.
------	--

Table C.23

ROLE NAME	TARGET CLASS	MUL' DEFINITION
ATTRIBUTE	VALUE TYPE	MUL' DEFINITION

C.4.2. DirectDependency

Original

NOTE	Explanatory text associated to normative language often repeats or rephrases the requirement to aid in the discussion and understanding of the official version of the normative language. Since such restatements are often less formal than the original source and potentially subject to alternate interpretation, it is important to know the location of the home official version of the language. These alternative statements use non-normative language and are statements using the definitions of the ISO Directives Part 2.
------	--

Table C.26

ROLE NAME	TARGET CLASS	MUL DEFINITION
ATTRIBUTE	VALUE TYPE	MUL DEFINITION

C.4.5. IndirectDependency

Original

requirements class with a different standardization target which is used, produced or associated to by the implementation of this requirements class

NOTE	In this instance, as opposed to the direct dependency, the test against the consumable or product used or produced by the requirements class does not directly test the requirements class, but tests only its side effects. Hence, a particular type of feature service could be required to produce valid XML documents, but the test of validity for the XML document is not directly testing the service, but only indirectly testing
------	---

the validity of its output. Direct dependencies test the same standardization target, but indirect dependencies test related but different standardization targets. The standardization target of the indirect dependency is different from the target of —this requirements class|| but it may be of the same or related standardization target type. For example, if one service is related to another second service, then a service requirement may be placed against the second associated service to assure that the first service has access to its functionality. For example, if a DRM-enabled service is required to have an association to a licensing service, then the requirements of a licensing service are indirect requirements for the DRM-enabled service. Such a requirement may be stated as the associated licensing service has a certificate of conformance of a particular kind.

Table C.27

ROLE NAME	TARGET CLASS	MUL DEFINITION
-----------	--------------	----------------

ATTRIBUTE	VALUE TYPE	MULTI DEFINITION
-----------	------------	------------------

C.4.6. LeafPackage

Original

UML model package that does not contain any subpackages, but contains classifiers

Table C.28

ROLE NAME	TARGET CLASS	MULTI DEFINITION
ATTRIBUTE	VALUE TYPE	MULTI DEFINITION

C.4.7. Model

Original

theoretical construct that represents something, with a set of variables and a set of logical and quantitative relationships between them.

NOTE Derived from Wikipedia

The “theoretical construct” is essentially a conceptual metaphor with the target of the metaphor as the thing being modeled, and the source of the metaphor as the model. The terms are almost interchangeable, with model being preferred when the source is a constructed entity, and metaphor being preferred when the source already exists, and the emphasis is the mapping between it and the target.

The definition in ISO 19101, Clause 4.4 is conceptual model – model that defines concepts of a universe of discourse. While adequate in the context of a –universe of discourse|| as the something addressed by a standard, a model need not have any –universality|| property at all. Most often models are representative of only a relatively small portion of a larger universe, and part of the process of modeling is to factor out the properties and things to which no interest is directed within the present standard It also fails to define –model|| which is in fact the central issue within this discussion. The abstract or conceptual is actually redundant and will often be dropped in the text. Models are by their very nature not the same as what they are describing, and thus must contain a conceptual metaphor to describe their relationship to the target (the thing being described) of the model. This inherently makes them abstractions.

Table C.29

ROLE NAME	TARGET CLASS	MULTI DEFINITION
ATTRIBUTE	VALUE TYPE	MULTI DEFINITION

C.4.8. Profile

Original

specification or standard consisting of a set of references to one or more base standards and/or other profiles, and the identification of any chosen conformance test classes, conforming subsets, options and parameters of those base standards, or profiles necessary to accomplish a particular function.

NOTE	This definition has been adopted from ISO 10000: Part 1. The wording has been changed to accommodate the shared vocabulary of OGC and ISO TC 211 and for editorial reasons. The original text is —A set of one or more base standards and/or ISPs, and, where applicable, the identification of chosen classes, conforming subsets, options and parameters of those base standards, or ISPs necessary to accomplish a particular function. In the usage of this standard, a profile will be a set of requirements classes or conformance classes (either preexisting or locally defined) of the base standards. This means that a standardization target being conformant to a profile implies that the same target is conformant to the standards referenced in the profile.
------	---

Table C.30

ROLE NAME	TARGET CLASS	MULTI DEFINITION
ATTRIBUTE	VALUE TYPE	MULTI DEFINITION

C.5. Types Data Dictionary

C.5.1. DateTime

Table C.31

ROLE NAME	TARGET CLASS	MULTI DEFINITION
ATTRIBUTE	VALUE TYPE	MULTI DEFINITION

C.5.2. RichText

Table C.32

ROLE NAME	TARGET CLASS	MULTI DEFINITION
ATTRIBUTE	VALUE TYPE	MULTI DEFINITION

C.5.3. String

Table C.33

ROLE NAME	TARGET CLASS	MULTI DEFINITION
ATTRIBUTE	VALUE TYPE	MULTI DEFINITION



ANNEX D (NORMATIVE) ACKNOWLEDGEMENTS



ANNEX D (NORMATIVE) ACKNOWLEDGEMENTS

The following OGC Members were key contributors to Version 1 of the ModSpec

PERSON	ORGANIZATION REPRESENTED
Simon Cox	CSIRO
David Danko	Esri
James Greenwood	SeiCorp, Inc.
John R. Herring	Oracle USA
Andreas Matheus	University of the Bundeswehr – ITS
Richard Pearsall	US National Geospatial-Intelligence Agency (NGA)
Clemens Portele	interactive instruments GmbH
Barry Reff	US Department of Homeland Security (DHS)
Paul Scarponcini	Bentley Systems, Inc.
Arliss Whiteside	BAE Systems – C3I Systems



BIBLIOGRAPHY





BIBLIOGRAPHY

To preserve a unique numeric identifier for all documents listed as references in this standard, the numbering of references in this annex is continued from the list of normative reference in Clause 3.

- [1] ISO/IEC: ISO/IEC 9075:2003, *ISO/IEC JTC 1, ISO/IEC 9075:2003 – Information Technology – Database Languages – SQL..* ISO, IEC (2003).
- [2] ISO/IEC: ISO/IEC TR 10000, *ISO/IEC TR 10000: Information Technology – Framework and taxonomy of International Standardized Profiles.* ISO, IEC
- [3] ISO/IEC: ISO/IEC 13249-3:2006, *Information technology – Database languages – SQL multimedia and application packages – Part 3: Spatial.* International Organization for Standardization, International Electrotechnical Commission, Geneva (2006). <https://www.iso.org/standard/38651.html>.
- [4] W3C: W3C xmlschema11-1, *W3C XML Schema Definition Language (XSD) 1.1 Part 1: Structures.* World Wide Web Consortium <http://www.w3.org/TR/xmlschema11-1/>.
- [5] W3C: W3C xmlschema11-2, *W3C XML Schema Definition Language (XSD) 1.1 Part 2: Datatypes.* World Wide Web Consortium <http://www.w3.org/TR/xmlschema11-2/>.