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INTERNATIONAL STANDARD

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# Information technology — Metadata Registries Interoperability and Bindings (MDR-IB) —

## Part 1: Framework, common vocabulary, and common provisions for conformance

*Technologies de l'information — Interopérabilité et liaisons des registres de métadonnées (MDR-IB) —*

*Partie 1: Cadre d'applications, vocabulaire commun et dispositions communes de conformité*

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# Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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

ISO/IEC 20944-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 32, *Data management and interchange*.

ISO/IEC 20944 consists of the following parts, under the general title *Information technology — Metadata Registries Interoperability and Bindings (MDR-IB)*:

— *Part 1: Framework, common vocabulary, and common provisions for conformance*

— *Part 2: Coding bindings*

— *Part 3: API bindings*

— *Part 4: Protocol bindings*

— *Part 5: Profiles*


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# Introduction

ISO/IEC 20944 provides the bindings and their interoperability for metadata registries, such as those specified in ISO/IEC 11179.

This part of ISO/IEC 20944 contains an overview, framework, common vocabulary, and common provisions for conformance for ISO/IEC 20944. In the context of increasing metadata and data interoperability harmonization, four methodologies have been employed to simplify the tasks and to reduce risk.

The first methodology employed is the treating of data (and metadata) interoperability as a series of layered technical specifications (e.g., standards), from application-independent layers to application-specific layer(s).

The second methodology employed is the simplification of interoperability specializations, also known as bindings. Rather than independently developing each separate method of representation and access [codings, application programming interfaces (APIs), protocols], a common, harmonized approach is taken where each binding is derived in a consistent two-step process:

— Step #1 is choosing from the categories of coding, API, protocol (or combination), which themselves are derived from a common data model and navigation method.

— Step #2 is to derive the specific binding from its general binding, e.g., the XML coding binding (ISO/IEC 20944-2:2012, Clause 12) and other (specific) coding bindings are derived from the generic coding binding (ISO/IEC 20944-2:2012, Clauses 1-10); the C API binding (ISO/IEC 20944-3:2012, Clause 11), the Java API binding (ISO/IEC 20944-3:2012, Clause 12), and the other API bindings are derived from the generic API binding (ISO/IEC 20944-3:2012, Clauses 1-10). Because these bindings have a well-defined derivation, the bindings are harmonized, i.e., there is commonality in meaning and interpretation across the bindings. Thus, the complexity of adding and harmonizing a new (coding, API, protocol) binding is greatly simplified.

The third methodology employed is the use of rule-based bindings to simplify the normative wording of the standards. A rule-based binding is a binding that is specified by a general set of rules (in contrast to application-specific normative wording). For example, the XML coding binding is based upon a set of transformation rules (in contrast to specifying a specific DTD or XML schema).

The fourth methodology involves the harmonization of bindings within a category. For example, the XML coding binding is intended to be harmonized with the ASN.1 coding binding; the C API binding is intended to be harmonized with the Java API binding, etc.

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# Information technology — Metadata Registries Interoperability and Bindings (MDR-IB) —

# Part 1: Framework, common vocabulary, and common provisions for conformance

## 1 Scope

### 1.1 General

ISO/IEC 20944 is a series of International Standards that describe codings, APIs, and protocols for interacting with an ISO/IEC 11179 metadata registry (MDR).

This part of ISO/IEC 20944 provides the overview, framework, common vocabulary, and common provisions for conformance for ISO/IEC 20944. It addresses the following data interoperability features[1]:

— a common framework for variety control: harmonized concepts for conforming implementations and strictly conforming implementations;

— harmonized provisions, such as mandatory requirements[2] and optional requirements[3], and their consistent application across all bindings of ISO/IEC 20944;

— harmonized and consistent treatment of data elements with varying data obligation attributes (e.g., mandatory, conditional, optional, extended) and varying data longevity attributes (e.g., in-use, obsolete, reserved, etc.).

This part of ISO/IEC 20944 also includes a rationale that guided its development. The rationale also discusses the harmonized use of profiles (e.g., subsets, supersets, changes, etc.) of the data structure and data elements.

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[1] The concept of *data interoperability* applies to metadata when metadata is treated as data, e.g., metadata item attributes (as specified by ISO/IEC 11179-3) that are transferred or exchanged. The concept of data interoperability is different from *metadata interoperability* (agreement upon the meaning of descriptive data), which is outside the scope of ISO/IEC 20944.

[2] In the context of this part of ISO/IEC 20944, the term *mandatory requirement* is defined as in ISO/IEC Guide 2:2004, subclause 7.5.1: *a requirement of a normative document that must necessarily be fulfilled in order to comply with that document*. There is *no implication* that the aforementioned requirement is compulsory by law or regulation. This kind of *mandatory requirement* is also known as an *exclusive requirement*.

[3] ISO/IEC Guide 2:2004, subclause 7.5.2 defines the term *optional requirement*, which includes the following note: *An optional requirement may be either: a) one of two or more alternative requirements; or b) an additional requirement that must be fulfilled only if applicable and that may otherwise be disregarded*.

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## 1.2 Overview of concepts

### 1.2.1 Metadata vs. data

Metadata is descriptive data about objects[4]. The *essential characteristics* of metadata include: it is *descriptive data*, and that it is *descriptive about something*. For example, if ***P*** is data and ***P***→***Q*** represents the descriptive relationship such that ***P*** describes ***Q***, then ***P*** is metadata about ***Q***. If there is no relationship from ***P*** to ***Q***, then ***P*** is no longer metadata (i.e., ***P*** is merely data) because metadata is always relative to the object of description. Or stated differently, ***P*** only becomes metadata once its descriptive relationship to ***Q*** is established. Thus, it is *impossible to determine, independent of context and relationships*, that any piece of data is actually also metadata. The implications are: (1) because metadata is data, it can be exchanged like other data, but (2) to remain metadata, the exchange must include the associated context and relationships. ISO/IEC 20944 simply treats everything as data — whether it is *used as metadata* is outside the scope of ISO/IEC 20944. Although metadata is just data, ISO/IEC 20944 also provides reification[5] and navigation of these contexts and relationships that are particular to metadata (and atypical for common data sets).

NOTE ISO/IEC 20944-5 provides a mapping and a profile such that ISO/IEC 20944 bindings may be used to interchange metadata contained in ISO/IEC 11179 metadata registries, e.g., an application may connect to, access, read, and use metadata from an ISO/IEC 11179 metadata registry.

### 1.2.2 Metadata and data interoperability

The successful interchange of data is dependent upon mutual agreement of interchange participants. Some key requirements for successful data interchange include (from lower implementation details to higher level abstractions):

— The *syntax* determines how data is coded (structured) and encoded (represented). Codings include specifications for organizing data structures (e.g., *How are records represented? Is tagging embedded or implied?*). Encodings include specifications for representation of datatypes (e.g., are numbers represented as a string of characters or a string of bits?).

EXAMPLE 1 In XML, *"the temperature is 17°"* might be *coded* as a tagged element "<temp>17</temp>" that is *encoded* as 15 UTF-8 characters, the encoding would be the ordering of the bits within the octet, e.g., little endian vs. big endian.

EXAMPLE 2 In the programming language C, *"the temperature is 17°"* might be *coded* as a single binary octet { uint8_t temp = 17; }, and *encoded* as a two's complement big-endian 16-bit integer.

— The *semantics* define the meaning of the data. Several kinds of descriptive techniques are possible, such as using ISO/IEC 11179-3 for describing data. Additional technical specifications, such as standards, may be used in conjunction with the ISO/IEC 11179-3 description of data.

EXAMPLE 3 The statement *"the temperature is 17°"* might not be descriptive enough because (1) it does not convey units of measure, e.g., Celsius or Fahrenheit; and (2) it does not convey what is being measured, e.g., temperature sensor #289. Both these features are part of the semantic description that comprises an ISO/IEC 11179-3 Data Element.

— Application-specific behavior is determined by the context of the data.

EXAMPLE 4 The statement *"temperature is 17°C at sensor #289"* may have different meanings depending upon the application. In a telemetry application, the statement *"temperature is 17°C at sensor #289"* might represent data to be recorded and analyzed, such as updating low, average, and high values in a set of time-series data. In contrast, in a heating, ventilation, and air conditioning (HVAC) application, the statement *"temperature is 17°C at sensor #289"* might represent a signal that causes heating units to turn on automatically.

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4 For example, metadata may be descriptive data about other data.

5 Reification is to transform into data, e.g., a relationship between datums is transformed into data itself.

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Of the three issues above, ISO/IEC 20944 concerns itself with the syntax, i.e., the bindings (codings, APIs, and protocols) for data interchange.

Regarding the semantics, the ISO/IEC 11179 series is a primary tool for specifying semantics, via descriptive data, for data interchange.[6] This descriptive data is known as metadata. The descriptive data (metadata) may also be interchanged via the ISO/IEC 20944 series. However, in this case the ISO/IEC 20944 series is being used for a different purpose: descriptive data interchange (i.e., metadata interchange) rather than data interchange. It is possible to have separate data and metadata interchanges, and to use the ISO/IEC 20944 series independently for each interchange.

Neither ISO/IEC 20944 nor ISO/IEC 11179 specify application-specific requirements and functionality.

### 1.2.3 Achieving metadata and data interoperability and harmonization

Interoperability with a metadata registry can be achieved in various ways. ISO/IEC 20944 provides a framework within which several approaches can be standardized. All interoperability requires some kind of interface, and associated bindings, between two or more participating functional units. A binding provides a concrete mapping of a functional unit to an interface. Three categories of bindings are supported by ISO/IEC 20944:

— codings, which deal with the formalized representation of information;

— APIs, which specify a binding in programming terms;

— protocols, which specify formalized communications.

## 2 Normative references

The following referenced documents are indispensable for the application 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 Guide 2, *Standardization and related activities — General vocabulary*

ISO/IEC JTC1 Directives, 5th edition

ISO/IEC 704:2000, *Terminology work — Principles and methods*

ISO/IEC 1087-1:2000, *Terminology work — Vocabulary — Part 1: Theory and application*

ISO/IEC 2382 (all parts), *Information technology — Vocabulary*

ISO/IEC TR 10000-1, *Information technology — Framework and taxonomy of International Standardized Profiles — Part 1: General principles and documentation framework*

ISO/IEC 10241:1992, *International terminology standards — Preparation and layout*

ISO/IEC 11179 (all parts), *Information technology — Metadata registries (MDR)*

ISO/IEC 11404:2007, *Information technology — General-Purpose Datatypes (GPD)*

ISO/IEC 13886:1996, *Information technology — Language-Independent Procedure Calling (LIPC)*

ISO/IEC 14977:1996, *Information technology — Syntactic metalanguage — Extended BNF*

ISO/IEC 19501:2005, *Information technology — Open Distributed Processing — Unified Modeling Language (UML) Version 1.4.2*

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[6] Additional semantics may be described by or supplanted with unstructured descriptive text and/or layering of additional standards and specifications.

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