BS ISO/IEC 20944-1:2013

BSI Standards Publication

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

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

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National foreword

This British Standard is the UK implementation of ISO/IEC 20944-1:2013.

The UK participation in its preparation was entrusted to Technical Committee IST/40, Data management and interchange.

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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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3 Terms and definitions

For the purposes of this document, the following terms, abbreviations, and definitions apply.

3.1 Terms and definitions from ISO/IEC Guide 2

Definitions are taken verbatim from ISO/IEC Guide 2 unless otherwise stated in a following note.

3.1.1 Standardization

3.1.1.1
standardization
activity of establishing, with regard to actual or potential problems, provisions for common and repeated use, aimed at the achievement of the optimum degree of order in a given context

NOTE 1 In particular, the activity consists of the processes of formulating, issuing and implementing standards.

NOTE 2 Important benefits of standardization are improvement of the suitability of products, processes and services for their intended purposes, prevention of barriers to trade and facilitation of technological cooperation.

3.1.1.2
level of standardization
geographical, political or economic extent of involvement in standardization

3.1.1.3
consensus
general agreement, characterized by the absence of sustained opposition to substantial issues by any important part of the concerned interests and by a process that involves seeking to take into account the views of all parties concerned and to reconcile any conflicting arguments

3.1.2 Aims of standardization

3.1.2.1
fitness for purpose
ability of a product, process or service to serve a defined purpose under specific conditions

3.1.2.2
compatibility
suitability of products, processes or services for use together under specific conditions to fulfil relevant requirements without causing unacceptable interactions

3.1.2.3
interchangeability
ability of one product, process or service to be used in place of another to fulfil the same requirements

NOTE The functional aspect of interchangeability is called "functional interchangeability", and the dimensional aspect "dimensional interchangeability".

3.1.2.4
variety control
selection of the optimum number of sizes or types of products, processes or services to meet prevailing needs

NOTE Variety control is usually concerned with variety reduction.

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3.1.3 Normative documents

3.1.3.1
normative document
document that provides rules, guidelines or characteristics for activities or their results

NOTE 1 The term "normative document" is a generic term that covers such documents as standards, technical specifications, codes of practice and regulations.

NOTE 2 A "document" is to be understood as any medium with information recorded on or in it.

NOTE 3 The terms for different kinds of normative documents are defined considering the document and its content as a single entity.

3.1.3.2
standard
document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context

NOTE Standards should be based on the consolidated results of science, technology and experience, and aimed at the promotion of optimum community benefits.

3.1.3.3
international standard
standard that is adopted by an international standardizing/standards organization and made available to the public

3.1.3.4
regional standard
standard that is adopted by a regional standardizing/standards organization and made available to the public

3.1.3.5
national standard
standard that is adopted by a national standards body and made available to the public

3.1.3.6
provincial standard
standard that is adopted at the level of a territorial division of a country and made available to the public

3.1.3.7
prestandard
document that is adopted provisionally by a standardizing body and made available to the public in order that the necessary experience may be gained from its application on which to base a standard

3.1.3.8
technical specification
document that prescribes technical requirements to be fulfilled by a product, process or service

NOTE 1 A technical specification should indicate, whenever appropriate, the procedure(s) by means of which it may be determined whether the requirements given are fulfilled.

NOTE 2 A technical specification may be a standard, a part of a standard or independent of a standard.

3.1.3.9
regulation
document providing binding legislative rules, that is adopted by an authority

3.1.3.10
technical regulation
regulation that provides technical requirements, either directly or by referring to or incorporating the content of a standard, technical specification or code of practice

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NOTE A technical regulation may be supplemented by technical guidance that outlines some means of compliance with the requirements of the regulation, i.e. deemed-to-satisfy provision.

3.1.4 Harmonization of standards

3.1.4.1
harmonized standards
equivalent standards
standards on the same subject approved by different standardizing bodies, that establish interchangeability of products, processes and services, or mutual understanding of test results or information provided according to these standards

NOTE Within this definition, harmonized standards might have differences in presentation and even in substance, e.g. in explanatory notes, guidance on how to fulfil the requirements of the standard, preferences for alternatives and varieties.

3.1.4.2
unified standards
harmonized standards that are identical in substance but not in presentation

3.1.4.3
identical standards
harmonized standards that are identical in both substance and presentation

NOTE 1 Identification of the standards may be different.

NOTE 2 If in different languages, the standards are accurate translations.

3.1.4.4
comparable standards
standards on the same products, processes or services, approved by different standardizing bodies, in which different requirements are based on the same characteristics and assessed by the same methods, thus permitting unambiguous comparison of differences in the requirements

NOTE Comparable standards are not harmonized (or equivalent) standards.

3.1.5 Content of normative documents

3.1.5.1
provision
expression of normative wording that takes the form of a statement, an instruction, a recommendation or a requirement

NOTE These types of provision are distinguished by the form of wording they employ; e.g. instructions are expressed in the imperative mood, recommendations by the use of the auxiliary "should" and requirements by the use of the auxiliary "shall".

3.1.5.2
statement
provision that conveys information

3.1.5.3
instruction
provision that conveys an action to be performed

3.1.5.4
recommendation
provision that conveys advice or guidance

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3.1.5.5
requirement
provision that conveys criteria to be fulfilled

3.1.5.6
exclusive requirement
mandatory requirement (deprecated)
requirement of a normative document that must necessarily be fulfilled in order to comply with that document

NOTE The term "mandatory requirement" should be used to mean only a requirement made compulsory by law or regulation.

3.1.5.7
optional requirement
requirement of a normative document that must be fulfilled in order to comply with a particular option permitted by that document

NOTE An optional requirement may be either: (1) one of two or more alternative requirements; or (2) an additional requirement that must be fulfilled only if applicable and that may otherwise be disregarded.

3.1.5.8
deemed-to-satisfy provision
provision that indicates one or more means of compliance with a requirement of a normative document

3.1.5.9
descriptive provision
provision for fitness for purpose that concerns the characteristics of a product, process or service

NOTE A descriptive provision usually conveys design, constructional details, etc. with dimensions and material composition.

3.1.5.10
performance provision
provision for fitness for purpose that concerns the behavior of a product, process or service in or related to use

3.1.6 Implementation of normative documents

3.1.6.1
adoption of an international standard (in a national normative document)
publication of a national normative document based on a relevant international standard, or endorsement of the international standard as having the same status as a national normative document, with any deviations from the international standard identified

NOTE ISO/IEC Guide 2 uses the term "taking over of an international standard (in a national normative document)". ISO/IEC Guide 2 explains that "taking over of ..." is equivalent to "adoption of ...".

3.1.6.2
application of a normative document
use of a normative document in production, trade, etc.

3.1.6.3
direct application of a normative document
application of an international standard irrespective of the taking over of that international standard in any other normative document

3.1.6.4
indirect application of a normative document
application of an international standard through the medium of another normative document in which it has been taken over

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3.1.7 References to standards

3.1.7.1
reference to standards (in regulations)
reference to one or more standards in place of detailed provisions within a regulation

NOTE 1 A reference to standards is either dated, undated or general, and at the same time either exclusive or indicative.

NOTE 2 A reference to standards may be linked to a more general legal provision referring to the state of the art or acknowledged rules of technology. Such a provision may also stand alone.

3.1.7.2
dated reference (to standards)
reference to standards that identifies one or more specific standards in such a way that later revisions of the standard or standards are not to be applied unless the reference is modified

NOTE The standard is usually identified by its number and either date or edition. The title may also be given.

3.1.7.3
undated reference (to standards)
reference to standards that identifies one or more specific standards in such a way that later revisions of the standard or standards are to be applied without the need to modify the reference

NOTE The standard is usually identified only by its number. The title may also be given.

3.1.7.4
general reference (to standards)
reference to standards that designates all standards of a specified body and/or in a particular field without identifying them individually

3.1.7.5
mandatory standard
standard the application of which is made compulsory by virtue of a general law or exclusive reference in a regulation

3.1.8 Conformity in general

3.1.8.1
conformity
fulfillment by a product, process, or service of specified requirements

3.1.8.2
conformity assessment
any activity concerned with determining directly or indirectly that relevant requirements are fulfilled

NOTE Typical examples of conformity assessment activities are sampling, testing and Inspection; evaluation, verification and assurance of conformity (supplier's declaration, certification); registration, accreditation and approval as well as their combinations.

3.2 Terms and definitions from ISO/IEC Directives, Part 2

Definitions are taken verbatim from ISO/IEC Directives, Part 2 unless otherwise stated in a following note.

3.2.1 Fundamental terms

3.2.1.1
International Standard
international standard where the international standards organization is ISO or IEC

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3.3 Terms and definitions from ISO/IEC JTC 1 Directives

Definitions are taken verbatim from the ISO/IEC JTC 1 Directives unless otherwise stated in a following note.

3.3.1 Fundamental terms

3.3.1.1
API
application programming interface
boundary across which application software uses facilities of programming languages to invoke services

[JTC 1 Directives, 5th edition, Annex J; and ISO/IEC 13886]

3.4 Terms and definitions from ISO 704

Definitions are taken verbatim from ISO 704 unless otherwise stated in a following note.

3.4.1 Basic concepts

3.4.1.1
object
<terminology> anything that may be perceived or conceived

3.4.1.2
symbol
designation that is non-linguistic

[adapted[7] from ISO 704]

3.4.1.3
sign
term, appellation, or symbol

[adapted[8] from ISO 704 and ISO 1087-1]

3.5 Terms and definitions from ISO 1087-1

Definitions are taken verbatim from ISO 1087-1 unless otherwise stated in a following note.

3.5.1 Basic concepts

3.5.1.1
definition
representation of a concept by a descriptive statement which serves to differentiate it from related concepts

3.5.1.2
designation
representation of a concept by a sign which denotes it

EXAMPLES Budget Amount (a term, according to ISO 704), New York City (an appellation, according to ISO 704), AHRS1 (a symbol, according to ISO 704).

NOTE A designation may be human readable (e.g., Budget Amount, grand_total) or not (e.g., AHRS1, 1.3.60.1234).

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[7] The definition is adapted from the text in ISO 704:2000, subclause 7.5.

[8] The definition of *sign* is adapted from ISO 704:2000, subclause 7.5 on the definition of *symbol*, and from the definitions of *designation*, *term*, and *appellation* in ISO 1087-1.

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3.6 Terms and definitions from ISO/IEC 2382-1, fundamental terms

Definitions are taken verbatim from ISO/IEC 2382-1 unless otherwise stated in a following note.

3.6.1 General terms

3.6.1.1
text
data in the form of characters, symbols, words, phrases, paragraphs, sentences, tables, or other character arrangements, intended to convey a meaning, and whose interpretation is essentially based upon the reader's knowledge of some natural language or artificial language

EXAMPLES A business letter printed on paper or displayed on a screen.

3.6.1.2
to access
to obtain the use of a resource

3.6.1.3
information processing
systematic performance of operations upon information, that includes data processing and may include operations such as data communication and office automation

NOTE The term information processing is not a synonym for data processing. Information processing includes data communication (e.g., computer networks) and office automation (e.g., satisfying the business needs of an entity), whereas data processing does not include data communication and office automation.

3.6.1.4
data processing
DP
automatic data processing
ADP
systematic performance of operations upon data

EXAMPLE Arithmetic or logic operations upon data, merging or sorting of data, assembling or compiling of programs, or operations on text, such as editing, sorting, merging, storing, retrieving, displaying, or printing.

NOTE The term data processing is not a synonym for information processing. Information processing includes data communication (e.g., computer networks) and office automation (e.g., satisfying the business needs of an entity), whereas data processing does not include data communication and office automation.

3.6.1.5
software
all or part of the programs, procedures, rules, and associated documentation of an information processing system

NOTE Software is an intellectual creation that is independent of the medium on which it is recorded.

3.6.1.6
storage
<device> functional unit into which data can be placed, in which they can be retained, and from which they can be retrieved

3.6.1.7
data processing system
computer system
computing system
one or more computers, peripheral equipment, and software that perform data processing

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3.6.1.8
information processing system
one or more data processing systems and devices, such as office and communication equipment, that perform information processing

3.6.1.9
information system
information processing system, together with associated organizational resources such as human, technical, and financial resources, that provides and distributes information

3.6.1.10
process (1)
predetermined course of events defined by its purpose or by its effect, achieved under given conditions

3.6.1.11
process (2)
<data processing> predetermined course of events that occur during the execution of all or part of a program

3.6.1.12
configuration
manner in which the resources of an information processing system are organized and interconnected

3.6.1.13
synchronous
pertaining to two or more processes that depend upon the occurrence of specific events such as common timing signals

3.6.1.14
asynchronous
pertaining to two or more processes that do not depend upon the occurrence of specific events such as common timing signals

3.6.1.15
input (1), noun
<data> data entered into an information processing system or any of its parts for storage or processing

3.6.1.16
input (2), verb
<process> process of entering data into an information processing system or any of its parts for storage or processing

3.6.1.17
input (3), adj.
pertaining to a device, process, or input-output channel involved in an input process, or to the associated data or states

NOTE The word "input" may be used in place of "input data", "input signal", or "input process" when such a usage is clear in a given context.

3.6.1.18
output (1), noun
<data> data that an information processing system, or any of its parts, transfers outside of that system or part

3.6.1.19
output (2), verb
<process> process by which an information processing system, or any of its parts, transfers data outside of that system or part

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3.6.1.20
output (3), adj.
pertaining to a device, process, or input-output channel involved in an output process, or to the associated data or states

NOTE The word "output" may be used in place of "output data", "output signal", or "output process" when such a usage is clear in a given context.

3.6.1.21
interface
shared boundary between two functional units, defined by various characteristics pertaining to the functions, physical interconnections, signal exchanges, and other characteristics, as appropriate

3.6.1.22
data communication
transfer of data among functional units according to sets of rules governing data transmission and the coordination of the exchange

3.6.1.23
functional unit
entity capable of accomplishing a specified purpose

EXAMPLES A hardware subsystem, a software component, both, a human operator, all three (hardware, software, operator).

3.6.1.24
interoperability
capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units

3.6.1.25
virtual
pertaining to a functional unit that appears to be real, but whose functions are accomplished by other means

3.6.1.26
virtual machine
VM
virtual data processing system that appears to be at the exclusive disposal of a particular user, but whose functions are accomplished by sharing the resources of a real data processing system

3.6.1.27
data medium
material in or on which data can be recorded and from which data can be retrieved

3.6.1.28
to log on
to log in
to initiate a session

3.6.1.29
to log off
to log out
to end a session

3.6.2 Information representation

3.6.2.1
numeric
numerical
pertaining to data that consist of numerals as well as to processes and functional units that use those data

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3.6.2.2
alphanumeric
pertaining to data that consist of letters, digits, and usually other characters, such as punctuation marks, as well as to processes and functional units that use those data

3.6.2.3
bit
binary digit
either of the digits 0 or 1 when used in the binary numeration system

3.6.2.4
byte
string that consists of a number of bits, treated as a unit, and usually representing a character or a part of a character

NOTE 1 The number of bits in a byte is fixed for a given data processing system.

NOTE 2 The number of bits in a byte is usually 8.

3.6.2.5
octet
8-bit byte
byte that consists of eight bits

3.6.3 Software

3.6.3.1
application software
application program
software or a program that is specific to the solution of an application problem

EXAMPLE A spreadsheet program

3.6.3.2
system software
application-independent software that supports the running of application software

EXAMPLE An operating system

3.6.3.3
support software
support program
software or a program that aids in the development, maintenance, or use of other software or provides general application-independent capability

EXAMPLE A compiler, a database management system

3.6.3.4
system documentation
collection of documents that describe the requirements, capabilities, limitations, design, operation, and maintenance of an information processing system

3.6.3.5
application documentation
collection of documents that describe the requirements, capabilities, limitations, design, operation, and maintenance of application software or an application program

EXAMPLE User and installation documentation for a program

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3.6.3.6
portability (of a program or of data)
capability to be interpreted, understood, or executed on various types of data processing systems without conversion and with little or no modification

3.6.3.7
operating system
OS
software that controls the execution of programs and that may provide services such as resource allocation, scheduling, input-output control, and data management

3.6.4 Programming

3.6.4.1
program
computer program
syntactic unit that conforms to the rules of a particular programming language and that is composed of declarations and statements or instructions needed to solve a certain function, task, or problem

3.6.4.2
programming
designing, writing, modifying, and testing of programs

3.6.4.3
artificial language
language whose rules are explicitly established prior to its use

3.6.4.4
programming language
artificial language for expressing programs

3.6.5 Computer security

3.6.5.1
data protection
implementation of appropriate administrative, technical or physical means to guard against unauthorized intentional or accidental disclosure, modification, or destruction of data

3.6.6 Data management

3.6.6.1
information management
functions of controlling the acquisition, analysis, retention, retrieval, and distribution of information all within an information processing system

3.6.6.2
data management
functions that provide access to data, performs or monitors the storage of data, and controls input-output operations all within a data processing system

3.6.6.3
access method
technique to obtain the use of data, the use of storage in order to read or write data, or the use of an input-output method to transfer data

EXAMPLE 1 Random access method, indexed access method, sequential access method

EXAMPLE 2 In object-oriented design, any class method that sends or receives data

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3.6.6.4
database
collection of data organized according to a conceptual structure describing the characteristics of these data and the relationships among their corresponding entities, supporting one or more application areas

3.6.6.5
file
labeled set of records treated as a unit

3.7 Terms and definitions from ISO/IEC 2382-4, organization of data

Definitions are taken verbatim from ISO/IEC 2382-4 unless otherwise stated in a following note.

3.7.1 Character sets

3.7.1.1
character
member of a set of elements that is used for the representation, organization, or control of data

NOTE Characters may be categorized as follows:

- character
  - graphic character
    - digit
    - letter
    - ideogram
    - special character
  - control character
    - transmission control character
    - format effector
    - code extension character
    - device control character

EXAMPLE The international reference version of the character set of ISO/IEC 10646

3.7.1.2
character set
finite set of characters that is complete for a given purpose

EXAMPLE The international reference version of the character set of ISO/IEC 10646

3.7.1.3
alphabetic character set
character set that contains letters and may contain special characters, but not digits

EXAMPLE The international reference version of the character set of ISO/IEC 10646

3.7.1.4
numeric character set
character set that contains digits and may contain special characters, but usually not letters

3.7.1.5
alphanumeric character set
character set that contains both letters and digits and may contain special characters

3.7.1.6
binary character set
character set that consists of two characters

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3.7.2 Codes

3.7.2.1
code, noun
coding scheme
collection of rules that maps the elements of a first set onto the elements of a second set

NOTE 1 The elements of either set may be characters or character strings.

NOTE 2 The first set is called coded set and the second set is called code set.

NOTE 3 Each element of the code set may be related to more than one element of the coded set but the reverse is not true.

3.7.2.2
coded set
set of elements that is mapped onto another set according to a code

EXAMPLE A list of the names of airports that is mapped onto a corresponding set of three-letter abbreviations

3.7.2.3
code value
code element
code (deprecated)
result of applying a code to an element of a coded set

EXAMPLES "CDG" representing Paris Charles-De-Gaulle in the code for three-letter representation of airport names; the hexadecimal number 0041 representing "Latin capital letter A" in ISO/IEC 10646

3.7.2.4
code set
code element set
code (deprecated)
result of applying a code to all elements of a coded set

EXAMPLES All the three-letter representations of airport names

3.7.2.5
alphabetic code
code whose application results in an alphabetic code set

3.7.2.6
numeric code
code whose application results in a numeric code set

3.7.2.7
alphanumeric code
code whose application results in an alphanumeric code set

3.7.2.8
binary code
code whose application results in a binary code set

3.7.2.9
alphabetic code set
alphabetic code element set
code set whose elements are taken from an alphabetic character set

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3.7.2.10
numeric code set
numeric code element set
code set whose elements are constructed from a numeric character set

3.7.2.11
alphanumeric code set
alphanumeric code element set
code set whose elements are constructed from an alphanumeric character set

3.7.2.12
binary code set
binary code element set
code set whose elements are constructed from a binary character set

3.7.3 Graphic characters

3.7.3.1
graphic character
character, other than a control character, that has a visual representation and is normally produced by writing, printing, or displaying on a screen

NOTE A graphic character may be used to represent a control character in text.

3.7.3.2
letter
alphabetic character
graphic character that, when appearing alone or combined with others, represents one or more concepts of a written language, or one or more sound elements of a spoken language

NOTE Diacritical marks used alone and punctuation marks are not considered to be letters.

3.7.3.3
alphabet
character set in which the order of its elements has been agreed upon

EXAMPLE The 128 ASCII characters

3.7.3.4
ideogram
ideographic character
graphic character, in a natural language, that represents an object or a concept and associated sound elements

EXAMPLES A Chinese ideogram or a Japanese Kanji

3.7.3.5
digit
numeric character
character that represents a natural number

EXAMPLES One of the characters 0 through 9 in the decimal system; these digits plus the characters A through F used in the hexadecimal system

NOTE 1 The mathematical term “natural number” denotes all non-negative integers.

NOTE 2 This is a modified version of the definition in ISO/IEC 2382-1.

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3.7.3.6
alphanumeric character
character of an alphanumeric character set

3.7.3.7
decimal digit
digit used in the decimal system

EXAMPLE The Arabic digits 0 through 9

3.7.3.8
hexadecimal digit
digit used in the hexadecimal system

EXAMPLE The graphic characters 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F

3.7.3.9
bit
binary digit
either of the digits 0 or 1 when used in the binary system

3.7.3.10
binary character
either character of a binary character set

EXAMPLES T (true) or F (false), Y (yes) or N (no)

3.7.3.11
blank
blank character
character that represents an empty position in a graphic character string

NOTE 1 A blank is conceptually different from a space character but may not be differentiated in a particular character set. For example, some character sets include a blank as a "nonbreaking space" that may be used between two graphic characters without being treated as a delimiter.

NOTE 2 Blank is not included in ISO/IEC 10646.

3.7.3.12
special character
graphic character that is neither a letter, digit, nor blank, and usually not an ideogram

EXAMPLES A punctuation mark, a percent sign, a mathematical symbol

3.7.4 Control characters

3.7.4.1
control character
character whose purpose is to effect format, to control data transmission, or to perform other control functions

NOTE A control character, although it is not a graphic character, may have a graphic representation.

3.7.4.2
transmission control character
control character used to control or facilitate data transmission between data terminal equipment

NOTE Transmission control characters are described in ISO/IEC 10646 and ISO 6429.

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3.7.4.3
space character
character that causes the print or display position to advance one position along the line without producing any graphic character

NOTE The space character is described in ISO/IEC 10646, ISO 4873 and ISO 6937-1.

3.7.4.4
format effector
control character used to position printed, displayed, or recorded data

NOTE Format effectors are described in ISO/IEC 10646 and ISO 6429.

EXAMPLES Space character, horizontal-tab character, carriage-return character, line-feed character, and form-feed character

3.7.4.5
code extension character
control character used to indicate that one or more of the succeeding code values are to be interpreted according to a different code

NOTE Code extension characters are described in ISO/IEC 10646 and ISO 2022.

3.7.4.6
device control character
control character used to specify a control function for peripheral equipment associated with a data processing system

NOTE Device control characters are described in ISO/IEC 10646 and ISO 6429.

3.7.5 Strings

3.7.5.1
string
sequence of elements of the same nature, such as characters or bits, considered as a whole

NOTE A string may be empty or contain only one element.

3.7.5.2
character string
string consisting solely of characters

3.7.5.3
alphabetic string
string consisting solely of letters from the same alphabet

3.7.5.4
bit string
string consisting solely of bits

3.7.5.5
null string
string that contains no elements

3.7.5.6
position
location of an element in a string

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3.7.5.7
n-bit byte
byte with an explicit specification of the number of its bits

EXAMPLE 7-bit byte

3.7.6 Words

3.7.6.1
word
character string or a bit string treated as a unit for a given purpose

NOTE The length of a computer word is defined by the computer architecture, while the words in text processing are delimited by special characters or control characters.

3.7.6.2
alphabetic word
word that consists of characters from the same alphabetic character set

3.7.6.3
numeric word
word that consists of digits and possibly space characters and special characters

EXAMPLE The string "33 (1) 41 62 80 00" as written for the AFNOR telephone number

3.7.6.4
alphanumeric word
word that consists of characters from the same alphanumeric character set

3.7.6.5
computer word
machine word
word, usually treated as a unit, that is suitable for processing by a given computer

3.7.6.6
word length
word size
number of characters or bits in a word

3.7.7 Structuring of data

3.7.7.1
data element
<organization of data> unit of data that is considered, in context, to be indivisible

EXAMPLE 1 The data element “age of a person” with values consisting of all combinations of 3 decimal digits

EXAMPLE 2 A personnel record that includes the data elements "name" and "address". In the context of the personnel record, "name" and "address" function as an indivisible unit, e.g., the data element "name" and the data element "address" each can be stored and retrieved as an indivisible unit. However, in a *different* context, "address" itself may be considered a record that contains its own data elements "street address", "city", "postal code", "country"

3.7.7.2
record
<organization of data> set of data elements treated as a unit

3.7.7.3
table
arrangement of data in which each item may be referenced by means of arguments or keys

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3.7.8 Delimiters and identifiers

3.7.8.1
internal label
label that is recorded on a data medium and that provides information about data recorded on the data medium

3.7.9 Trees

3.7.9.1
node
<organization of data> point from which subordinate items originate within a data structure

NOTE A node may have no subordinate items and is then called a terminal node.

3.7.9.2
tree
rooted tree
data structure containing nodes that are linked together hierarchically with at most one parent node for each node, and with only one root node

3.7.9.3
subtree
node within a tree with all its connected descendent nodes

3.7.9.4
ordered tree
tree in which the order of the subtrees of each node is significant

3.8 Terms and definitions from ISO/IEC 2382-5, representation of data

Definitions are taken verbatim from ISO/IEC 2382-5 unless otherwise stated in a following note.

3.8.1 Types of data representation

3.8.1.1
predefined
built-in
intrinsic
pertaining to a language construct that is declared by the definition of the artificial language

EXAMPLE The construct **sizeof()** is built-in to the C programming language

3.9 Terms and definitions from ISO/IEC 2382-6, preparation and handling of data

Definitions are taken verbatim from ISO/IEC 2382-6 unless otherwise stated in a following note.

3.9.1 General terms

3.9.1.1
to read
to obtain data from a storage device, from a data medium, or from another source

3.9.1.2
to write
to make a permanent or transient recording of data in a storage device or on a data medium

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NOTE The phrases "to read to" and "to read from" are often distinguished from the phrases "to write to" and "to write from" only by the viewpoint of the description. For example, the transfer of a block of data from internal storage to external storage may be called "writing to the external storage" or "reading from the internal storage", or both.

3.9.1.3
to copy
to read data from a source data medium, leaving the source data unchanged, and to write the same data on a destination data medium that may differ from that of the source

EXAMPLE To copy a file from a magnetic tape onto a magnetic disk

3.9.1.4
to duplicate
to copy from a source data medium to a destination data medium that has the same physical form

EXAMPLE To copy a file from a magnetic tape to another magnetic tape

3.9.2 Transfer and conversion

3.9.2.1
to transfer
to move
to send data from one storage location to another

3.9.2.2
to transform
to change the form of data according to specified rules, without fundamentally changing the meaning of the data

3.9.2.3
to translate
to change the form of data from one artificial language into artificial language or into some other representation suitable for processing

3.9.2.4
to convert
to change the representation of data from one form to another, without changing the information conveyed

EXAMPLE Code conversion; radix conversion; analog to digital conversion, media conversion

3.9.2.5
to transliterate
to convert data character by character

3.9.2.6
to encode
to code
to convert data by the use of a code in such a manner that reconversion to the original form is possible

3.9.2.7
to decode
to convert data by reversing the effect of some previous encoding

3.9.2.8
to transcribe
to copy data from one data medium to another, converting them as necessary for acceptance by the receiving medium

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3.9.2.9
to pack
to convert data to a compact form in a storage medium by taking advantage of known characteristics of the data and of the storage medium, in such a way that the original form of the data can be recovered

EXAMPLE To make use of bit or byte locations that would otherwise remain unused

3.9.2.10
packing
operation performed when data are packed

3.9.2.11
to unpack
to recover the original form of the data from packed data

3.9.2.12
to compress
to compact
to reduce the space taken on a data medium by encoding or removing repetitive characters

3.9.2.13
to expand
to return compressed data to their original form

3.9.3 Searches

3.9.3.1
search
examination of one or more data elements of a set to find those elements that have a given property

3.9.3.2
search key
key used for data retrieval

3.9.3.3
scanning
systematic examination of data

3.9.4 Ordering, sorting, and collating

3.9.4.1
to order
to place items in an arrangement in accordance with specified rules

3.9.4.2
order
specified arrangement resulting from ordering

NOTE In contrast to a sequence, an order need not be linear, for example the ordering of a hierarchy of items.

3.9.4.3
to sequence
to place items in an arrangement in accordance with the order of the natural numbers

NOTE Methods or procedures may be specified for mapping other natural linear orders onto the natural numbers; then, by extension, sequencing may be, for example, alphabetic or chronological.

3.9.4.4
sequence
series of items that have been sequenced

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3.9.4.5
index
list of the contents of a file or of a document, together with keys or references for locating the contents

3.9.5 Preparation of data

3.9.5.1
to edit
to prepare data for a later operation

NOTE Editing may include the rearrangement, the addition or modification of data, the deletion of unwanted data, format control, code conversion, and the application of standard processes such as zero suppression.

3.9.5.2
to extract
to select and remove from a group of items those which meet specific criteria

3.9.5.3
to clear
to cause one or more storage locations to be set in a prescribed state, usually that corresponding to zero or that corresponding to the space character

3.10 Terms and definitions from ISO/IEC 2382-7, computer programming

Definitions are taken verbatim from ISO/IEC 2382-7 unless otherwise stated in a following note.

3.10.1 Kinds of languages

3.10.1.1
expression language
programming language in which assignments can be made in the context of an expression

EXAMPLE C

NOTE The expression "if (x = y < 0) ..." is legal in C, but would be illegal in Ada.

3.10.1.2
markup language
text-formatting language designed to transform raw text into structured documents, by inserting procedural and descriptive markup into the raw text

3.10.1.3
pseudocode
combination of language constructs from a programming language with those of natural language that is not necessarily computer-processible, but intended to make the design of a program manifest to human readers

EXAMPLE

```
IF the data arrive faster than expected,
        THEN reject every third input.
        ELSE process all data received.
ENDIF
```

3.10.2 Program preparation

3.10.2.1
to parse
to determine the syntactic structure of a language construct by decomposing it into lexical tokens and establishing the relationships among them

EXAMPLE To parse blocks into statements, statements into expressions, expressions into operators and operands

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