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Information technology — Learning, education and training — Collaborative technology — Collaborative workplace —

Part 1: Collaborative workplace data model

Technologies de l'information — Apprentissage, éducation et formation — Technologies collaboratives — Lieu de travail collaboratif —

Partie 1: Modèle de données du lieu de travail collaboratif

Reference number
ISO/IEC 19778-1:2008(E)



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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 19778-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 36, *Information technology for learning, education and training*.

ISO/IEC 19778 consists of the following parts, under the general title *Information technology — Learning, education and training — Collaborative technology — Collaborative workplace*:

— *Part 1: Collaborative workplace data model*

— *Part 2: Collaborative environment data model*

— *Part 3: Collaborative group data model*

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Introduction

Many activities in the field of learning, education and training are collaborative in nature, involving turn-taking, statement-and-response or multi-thread discussions which, in turn, take place among *participants* over periods of time ranging from seconds to entire human generations. For example, a question posed via text messaging or email might receive a response in a matter of seconds, minutes or hours; commentary on a historically-significant text might take place months, years or even generations after it has been written. A typical collaborative event is initiated by one *participant*, is usually received by several other *participants*, refers to a previous collaborative event, and provides a response to it. *Collaborative activities* can be established in the widest imaginable range of circumstances, involving many different communicative forms and contents.

The International Standards on collaborative technology for learning, education and training focus on a particular subset of these *collaborative activities*. (Note that all terms specifically defined in these International Standards are italicized throughout all parts of ISO/IEC 19778.) This subset of activities is characterized by:

- information exchange in small or medium-sized *collaborative groups* of *participants* (typically above two and below a few dozen) who collaborate over relatively short periods of time (typically several days to several months);
- information exchange taking place through the use of communication technology, using either a single, well-defined *collaborative tool* supporting *collaborative functions*, or a set of *collaborative tools*, organized in a *collaborative environment*;
- short intervals in establishing feedback on messages or expressions (generally seconds to hours);
- the exchange of relatively small information chunks (generally comparable to a range between a single word and a small number of paragraphs);
- a relatively high level of responsiveness among active *collaborative group* members;
- information exchanged among *participants* (due to a number of the factors listed above) tends to be highly context-dependent or -sensitive;
- further, important contextual information is presented by the relationship between these *collaborative group* members and the *collaborative environment* (and its subcomponents), which all together form a *collaborative workplace*.

ISO/IEC 19778 consists of three parts:

Part 1: Collaborative workplace data model provides a representation format for *Data Model* specification, and specifies the *Data Model* structure and the *Data Model Elements* for the *collaborative workplace* in general.

Part 2: Collaborative environment data model specifies the *Data Model* structure and the *Data Model Elements* for the technical infrastucture of a *collaborative workplace*.

Part 3: Collaborative group data model specifies the *Data Model* structure and the *Data Model Elements* specifying and providing information for the membership of a *collaborative workplace*.

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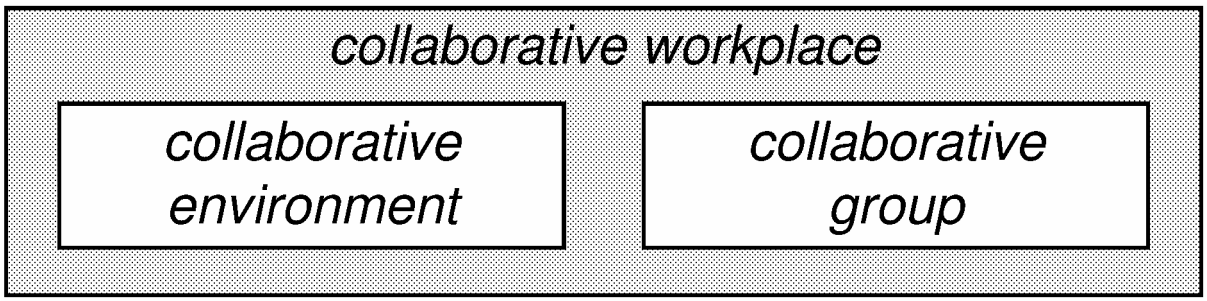

Figure 1 — Entities defined in ISO/IEC 19778

Figure 1 illustrates the relationships among the three physical entities involved. Any *collaborative workplace* represents the combination of a particular *collaborative environment* and a particular *collaborative group*. While the physical entity *collaborative workplace* contains its *collaborative environment* and its *collaborative group*, the *Data Model* instantiations for these physical entities (and the *Data Models* from which these instantiations are derived) are separate data entities.

The *Data Models* specified by ISO/IEC 19778 provide the structure and the concepts for information which

- supports the understanding of the application intentions of *collaborative workplaces* and their components;
- is qualified for supporting the set-up and managing of *collaborative workplaces*;
- enables the specification of relationships among *Data Model instantiations* derived from ISO/IEC 19778 or among their *Data Model Element instantiations*;
- enables the specification of relationships among anticipated, further *Data Models* or their *Data Model Elements* (or their instantiations), and the *Data Models* or their *Data Model Elements* of ISO/IEC 19778 (or their instantiations).

The interrelationship among a *collaborative workplace* and its *collaborative environment* and *collaborative group*, their associated *Data Model* instantiations, and the corresponding *Data Models* specified in ISO/IEC 19778 is illustrated in Figure 2.

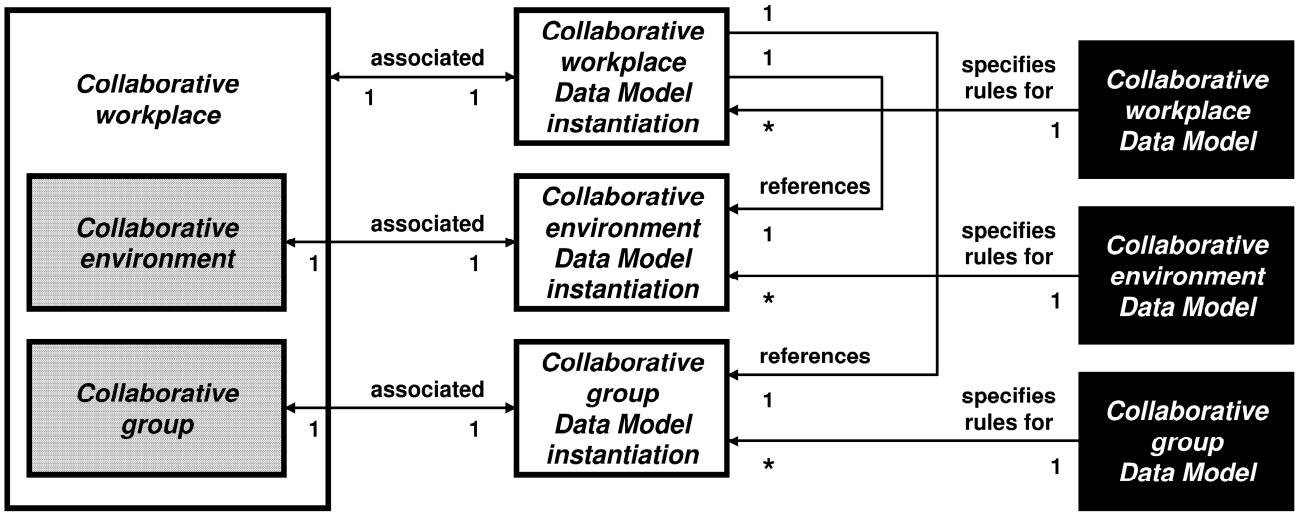

Figure 2 — The interrelationship among a *collaborative workplace* and its *collaborative environment* and *collaborative group*, their associated *Data Model* instantiations, and the *Data Models* specified in ISO/IEC 19778

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This part of ISO/IEC 19778 specifies a *Data Model* that provides general information on a *collaborative workplace* (in Figure 2, the outer frame to the left). A *collaborative workplace* comprises a technical infrastructure (Part 2, *collaborative environment*) and means of defining its membership (Part 3, *collaborative group*).

As illustrated in Figure 2, it is important to distinguish among (from left to right)

- the physical entities of a *collaborative workplace*, comprising its technical infrastructure and its members;
- the *Data Model instantiations* that are associated with these physical entities, and that are derived from their respective *Data Models* using any conforming binding;
- the *Data Models* provided by ISO/IEC 19778 and specifying the (binding-independent) rules for creating *Data Model instantiations*.

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Information technology — Learning, education and training — Collaborative technology — Collaborative workplace —

Part 1: Collaborative workplace data model

1 Scope

1.1 Statement of scope

1.1.1 ISO/IEC 19778

ISO/IEC 19778 is applicable to collaborative technologies used to support communication among learners, instructors and other *participants*. The implementation and communicative use of these technologies entails the creation of information related to *participant* groups, and to the *collaborative environments*, functions and tools that are set up for, and used by, these groups. This part of ISO/IEC 19778 – together with its subsequent parts – defines *Data Models* that enable the portability and reuse of this data in integrated form, and allow *Data Model instantiations* to be interchanged, stored, retrieved, reused or analysed by a variety of systems.

NOTE 1 A typical case of reusing a particular *collaborative workplace Data Model instantiation* (and its interlinked *collaborative environment and collaborative group Data Model instantiations*) is the automated set-up of new *collaborative workplaces* by using the specifications in the *Data Model instantiations* as templates.

NOTE 2 The reason for providing the specification for a *collaborative workplace* using several *Data Models* and their instantiations is to provide flexibility in the further development of these standards in future editions. By providing optional references to potential further specifications or standards, this approach goes far beyond the parts of ISO/IEC 19778 and the limited number of information elements provided by them.

1.1.2 This part of ISO/IEC 19778

This part of ISO/IEC 19778 specifies a table-based approach for defining *Data Models.* This *Data Model* specification is used for specifying the *collaborative workplace Data Model*. The same *Data Model* specification is also used in ISO/IEC 19778-2 and ISO/IEC 19778-3 to define the related components of the *collaborative environment* (ISO/IEC 19778-2) and the *collaborative group* (ISO/IEC 19778-3) in separate *Data Models*.

NOTE 1 This *Data Model* specification is also used in ISO/IEC 19780.

The *collaborative workplace Data Model* specifies the *Data Model Elements* and their interrelationships that enable the creation of *collaborative workplace Data Model instantiations*.

Any conforming *collaborative workplace Data Model instantiation* describes or specifies a particular *collaborative workplace* with which it is associated.

NOTE 2 How the association of a particular *collaborative workplace Data Model instantiation* and a particular *collaborative workplace* is implemented is outside the scope of this part of ISO/IEC 19778 (i.e. is dependent on the implementation of the used collaboration system).

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Any conforming *collaborative workplace Data Model instantiation*

- references *Data Model instantiations* for both a particular *collaborative environment* and a particular *collaborative group*;
- provides its particular identifier that allows this *Data Model instantiation* to be referenced from other *Data Model instantiations*;

  NOTE 3 The ISO/IEC 19778 *Data Models* and *Data Model* or *Data Model Element instantiations* are referenced by ISO/IEC 19780, which provides storage formats for captured communicative contributions, along with contextual data (relationship to other contributions, time sent, authorship, etc.).

- provides the life-span dates-and-times for the associated *collaborative workplace*;
- may provide a name and a textual description for its associated *collaborative workplace*, particularly for the purpose of full-text seach for *collaborative workplace Data Model instantiations*.

1.2 Subjects and aspects not currently addressed in ISO/IEC 19778

Further parts or future new editions of the existing parts of ISO/IEC 19778 are anticipated. They include the following.

- Internationalization (e.g. national alternatives for the values of textual, descriptive *Data Elements*).
- Bindings for the *Data Models* of Parts 1, 2, and 3 will be provided by additional parts.
- Best practice guides for the use of Parts 1, 2, and 3 will be provided by additional parts.
- Enabling the concurrent use of several international languages in Parts 1, 2, and 3 will be reflected by future editions.
- Any lessons learnt from practicing Parts 1, 2, and 3 will be reflected by future editions of these parts.

1.3 Excluded subjects and aspects in ISO/IEC 19778

Beyond the scope of ISO/IEC 19778, communities of practice or standardization bodies may provide further specifications or standards which are not yet identified. These anticipated specifications or standards may either make use of ISO/IEC 19778, or may – where this is prepared for – specify value domains for *Data Elements* of the *Data Models* of ISO/IEC 19778, or may represent extensions of ISO/IEC 19778 by providing and referencing *Data Models* with supplementing information.

Subjects and aspects not provided by ISO/IEC 19778, but anticipated to be provided by further specifications or standards, include:

- the specification of *roles* that *collaborative group* members may play, including the obligations and permissions associated with these *roles*;
- the specification of *collaborative tools* and their *collaborative functions*, including their technical capabilities and constraints;
- the specification of models for collaborative applications, including the modelling of tasks, activities and objectives of such activities.

1.4 Subjects and aspects addressed in related standards

ISO/IEC 19778 is closely related to ISO/IEC 19780-1. This related International Standard enables the recording, portability and reuse of the communicative contents, the messages or expressions generated in the course of *collaborative activity*. The way this communicative data is recorded and captured makes use of *collaborative workplace*, *collaborative group* and *collaborative environment Data Model Elements*.

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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 8601:2004, *Data elements and interchange formats — Information interchange — Representation of dates and times*

ISO/IEC 10646:2003, *Information technology — Universal Multiple-Octet Coded Character Set (UCS)*

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

3 Terms and definitions

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

NOTE 1 The terms defined here are closely interrelated. Terms defined in this clause are italicized elsewhere in this part of ISO/IEC 19778 when used as defined. Where these terms are not italicized in the document, they are used with their self-explanatory or common meanings. One exception to this rule is presented by the use of these defined terms in clause and subclause titles, headings, or term listings, where italicization is dropped for purposes of formatting consistency.

NOTE 2 An alphabetical list of all of the terms defined in 3.1 and 3.2 is provided in Annex A.

3.1 Terms and definitions used to specify a representation of a Data Model

NOTE This subclause defines terms used to specify the way the *Data Model* is represented in ISO/IEC 19778.

3.1.1
Aggregating Element
AE
DME which is neither a *Root Element* nor a leaf element in a *Data Model* tree structure, represented as a unit of data for which an *identifier*, *designation*, *definition*, *obligation status*, and *a multiplicity value* are all specified as *DME attributes*

NOTE *AEs* provide an important means of structuring the *Data Model*, and also provide important semantic information.

3.1.2
Collaborative Technology standards
CT standards
International Standards family in the domain of “Information technology — Learning, education and training — Collaborative technology”

NOTE Many of the standards in this domain are closely interrelated, implying the need for particular cross-standard harmonization.

3.1.3
conditionally mandatory
required under certain specified conditions

NOTE 1 This is one of four permissible *DME obligation status* values. See also *conditionally optional*, *mandatory* and *optional*.

NOTE 2 Where this *DME obligation status* value is assigned, the specification of the “conditions” under which the *DME's* provision is *mandatory* is required.

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3.1.4
conditionally optional
permitted under certain specified conditions only, but not required

NOTE 1 This is one of four permissible *DME obligation status* values. See also *conditionally mandatory*, *mandatory* and *optional*.

NOTE 2 Where this *DME obligation status* value is assigned, the specification of the "conditions" under which the *DME's* provision is *optional* is required.

NOTE 3 Adapted from ISO/IEC 11179-3:2003, definition 3.2.9.

3.1.5
Data Element
DE
DME which is a leaf element in a *Data Model* tree structure, represented as a unit of data for which an *identifier*, *designation*, *definition*, *obligation status*, a *DME multiplicity*, the representation and permissible values of the *Data Element*, and optionally value examples for the *Data Element* are all specified as *DME attributes*

NOTE 1 In *Data Model instantiations* in any appropriate binding, the representation of a *Data Element* instantiation requires (at least) the provision of its *DME identifier* and its value. The format used to achieve this is binding-specific.

NOTE 2 In *CT standards*, both the representation and permissible values of a *Data Element* are indicated through the *DE datatype*. Additional constraints for the set of permissible values may be imposed by a referenced external specification or standard.

NOTE 3 Adapted from ISO/IEC 11179-3:2003, definition 3.3.36.

3.1.6
Data Element datatype
DE datatype
specification of a set of distinct values for a *DE*, characterized by properties of those values and by possible operations on those values

NOTE 1 The set of distinct values specified by the value of a *DME datatype* may be restricted to a subset, based on a specification or standard which is external to the *Data Model*. The reference to this external specification or standard is provided as the value of an appropriate *Data Element* in the *Data Model*. Which *Data Element* provides the reference to this external specification or standard is indicated at the same place where the respective *DE datatype* is specified.

NOTE 2 Adapted from ISO/IEC 11404:2007, definition 3.12.

3.1.7
Data Model
DM
graphical and/or lexical representation of data, specifying their properties, structures and interrelationships

[ISO/IEC 11179-3:2003, definition 3.2.11]

3.1.8
Data Model Element
DME
Aggregating Element or *Data Element*

3.1.9
Data Model Element attribute
DME attribute
particular characteristic of a *DME*

NOTE Adapted from ISO/IEC 11179-3:2003, definition 3.1.3.

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3.1.10
Data Model Element definition
DME definition
representation of the concept of a *DME* through a descriptive statement which serves to differentiate it from related concepts

NOTE Adapted from ISO 1087-1:2000, definition 3.3.1.

3.1.11
Data Model Element designation
DME designation
label for a *DME*, designating it in a manner which is unambiguous in the context of the *Data Model*

NOTE 1 *DME designations* are used in the wording of *CT standards* in order to refer to particular *DMEs*, as opposed to the linguistically neutral *DME identifiers*, which serve a mnemonic function.

NOTE 2 Adapted from ISO 1087-1:2000, definition 3.4.1.

3.1.12
Data Model Element identifier
DME identifier
sequence of numerical branch indices, which specify the path from the general *Root Element* of the *Data Model* to the specific *DME*, and thus identify it uniquely within the context of the *Data Model*

NOTE Adapted from ISO/IEC 11179-3:2003, definition 3.1.8.

3.1.13
Data Model Element instantiation
DME instantiation
data object in a *Data Model instantiation*, representing a *Data Model Element*

3.1.14
Data Model Element multiplicity
DME multiplicity
specification of the interval between the required minimum and the permitted maximum of *DME instantiation* occurrences in a conforming *Data Model instantiation*

NOTE 1 Where a *DME* is not provided at all in a *Data Model instantiation* (as permitted by the value of the *DME obligation status*), its *DME multiplicity* value does not apply.

NOTE 2 In cases where the two values (required minimum and permitted maximum occurrence) coincide, only a single value is specified.

3.1.15
Data Model Element obligation status
DME obligation status
specification of whether, or under which condition(s), a *DME* is permitted or required in a conforming *Data Model instantiation*

NOTE 1 The possible values for this attribute are *mandatory*, *optional, conditionally mandatory* and *conditionally optional*.

NOTE 2 Adapted from ISO/IEC 11179-3:2003, definitions 3.2.9, 3.2.17, and 3.2.28.

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3.1.16
Data Model instantiation
DM instantiation
data object derived from a *Data Model*, providing values for its *Data Elements*, and generally making use of a particular binding specification (RDF, XML, etc.)

NOTE The precise forms of the *DM instantiations* are dependent on the specific binding used.

3.1.17
mandatory
always required

NOTE 1 One of four permissible *DME obligation status* values. See also *conditionally optional*, *conditionally mandatory*, and *optional*.

NOTE 2 Adapted from ISO/IEC 11179-3:2003, definition 3.2.17.

3.1.18
optional
permitted but not required

NOTE 1 One of four permissible *DME obligation status* values. See also *conditionally optional*, *conditionally mandatory*, and *mandatory*.

NOTE 2 Adapted from ISO/IEC 11179-3:2003, definition 3.2.28.

3.1.19
Root Element
RE
root or top-most element in the tree structure of a *Data Model*

NOTE The *Root Element* represents the entire *Data Model* and is neither quoted in the table representation of the *Data Model* nor included in the concept *Data Model Element*.

3.2 Terms and definitions for the Data Model Elements of this and related standards

NOTE This subclause defines terms used to specify the *Data Model Elements* of the *Data Model* in ISO/IEC 19778.

3.2.1
collaborative activity
pursuit of intended results through the efforts of several or all members of a *collaborative group* in a *collaborative workplace*

3.2.2
collaborative effect
particular intended result, supportive or constitutive of learning, that can be achieved through the use of a *collaborative service*

3.2.3
collaborative environment
single or combination of *collaborative service(s)* provided within a *collaborative workplace* for the purposes of supporting the *collaborative activities* of a *collaborative group*

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3.2.4
collaborative function
elementary functionality or capability provided for *collaborative group* members and enabling particular *collaborative effects* and *collaborative activities* that cannot be further decomposed without loss of this functionality

NOTE A single *collaborative tool* frequently provides multiple *collaborative functions* (e.g. the combination of an application broadcasting function and a text-based chat function), which could also be provided individually through separate *collaborative tools*.

3.2.5
collaborative group
two or more *participants*, in their capacity as members of the same *collaborative workplace* and through their involvement in the same *collaborative environment*

NOTE Accommodating on-the-fly changes in membership or in participation status (e.g. on-line vs. off-line) of *participants* or *role holders* is considered outside of the scope of ISO/IEC 19778. For example, whisper (a subset of a larger group being temporarily created for the purposes of confidential communication) is a function not directly accommodated by ISO/IEC 19778.

3.2.6
collaborative service
service providing *collaborative tools* and *collaborative functions* to *collaborative environments*

NOTE *Collaborative service* itself is not defined in ISO/IEC 19778, because a CE *DM instantiation* may choose some or all of *collaborative tools* from a *collaborative service* or it may combine different *collaborative tools* or *collaborative functions* from multiple *collaborative services* into a CE. For this reason, only *collaborative tools* and *collaborative functions* appear in CE specifications. The definition of *collaborative service*, e.g. how it may define *collaborative tools* and *collaborative functions* within it, is outside of scope of ISO/IEC 19778.

3.2.7
collaborative tool
hardware and related software and data providing one or multiple *collaborative functions* for several or all *collaborative group* members

NOTE Several *collaborative tools* may be integrated in a *collaborative service*.

3.2.8
collaborative workplace
instantiation of an entity, comprising the *collaborative activities* of a *collaborative group* defined in relation to a *collaborative environment*

NOTE A *collaborative workplace* is usually established with the intention of facilitating *collaborative activities* among the members of the *collaborative group* to achieve one or more *collaborative effects*.

3.2.9
participant
interactive entity such as a human being, artifact such as an interactive computer process (enabled by appropriate software, data and interfaces), or set of such entities and/or artifacts acting and reacting as a single entity

3.2.10
role
profile or listing of rights and responsibilities specified for a potential or actual member of a *collaborative group*

NOTE By assigning a single *role* or several *roles* to a *collaborative group* member, the aggregate rights and responsibilities associated with the *role(s)* are transferred to this *participant*.

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4 Abbreviations and acronyms

NOTE Some of the abbreviations or acronyms in this clause represent terms defined in Clause 3.

AE Aggregating Element (see 3.1.1)

CE Collaborative Environment (see 3.2.3)

CG Collaborative Group (see 3.2.5)

CT Collaborative Technology (see 3.1.2)

CW Collaborative Workplace (see 3.2.8)

DE Data Element (see 3.1.5)

DM Data Model (see 3.1.7)

DME Data Model Element (see 3.1.8)

ID Identifier

HTML HyperText Markup Language

RE Root Element (see 3.1.19)

Ref Reference

URI Uniform Resource Identifier

URL Uniform Resource Locator (world wide web address)

XML eXtensible Markup Language

XSD XML Schema Definition

5 Collaborative workplace Data Model

5.1 Data Model representation

The *Data Models* specified in *CT standards* can be represented as tree structures, where a tree structure is a particular variant of an undirected graph and represents a hierarchical structure of *Data Model Elements* (*DMEs*).

Corresponding to the common terminology of tree structures, we use the terms "child", "descendant", "parent", "ancestor", "root" and "leaf". "Sibling" *DMEs* are child *DMEs* of the same parent *DME*.

In a tree structure of a *Data Model*, the top-most element is referred to as the *Root Element*, representing the entire *Data Model* and being neither quoted in the table representation of the *Data Model* nor included in the concept *Data Model Element*. *DMEs* which are leaf elements are referred to as *Data Elements* (*DEs*), as they feature the *DME attribute* "*Data Element datatype*" (that specifies their respective data value space). *DEs* may exhibit data value examples. All other *DMEs* are referred to as *Aggregating Elements* (*AEs*) and shall neither feature the *DME attribute* "*DE datatype"*, nor exhibit data value examples.

A graphical representation of a *Data Model* tree structure is not well suited for specifying the diverse associated *DME attributes*. Consequently, the *Data Models* specified in *CT standards* are provided in a lexical, tabular representation.

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Where appropriate in *CT Standards*, a (typically simplified) graphical diagram representation of the *Data Model* is provided in form of a tree structure in a separate Subclause. This graphical representation is provided for the sole purpose of illustrating the relationships among the *DMEs* and explicating the structure implied in the *Data Model* table. In all *CT standards*, the table representation is to be taken as the authoritative representation of the respective *Data Model*.

The correspondence of the tree diagram and the table of any given *Data Model* is indicated by the *DME identifiers*. Any *DME identifier* specifies the path from the *Root Element* of the *Data Model* down a particular *DME*, by providing the sequence of numerical branch indices along this particular path, the indices separated by dot (".") characters. Every index sequence starts with the index of the branch leading from the *Root Element* down towards the particular *DME*, and ends with the index of the branch directly leading to this particular *DME*. Figure 3 illustrates this approach.

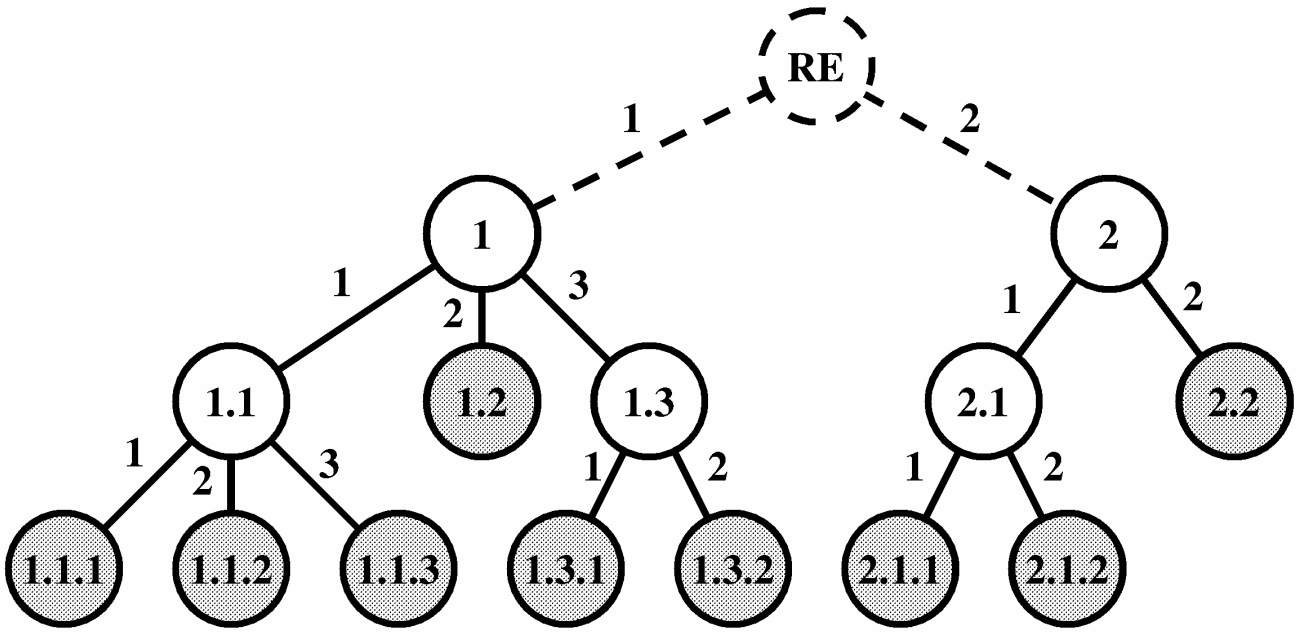

Figure 3 — Tree structure representation of a *Data Model* (branch indices and *DME identifiers* noted only)

In Figure 3, the *Root Element*, designated "RE", is the root of the tree structure of the *Data Model.* The *Root Element* and its indexed branches downwards are dashed in order to denote that the *Root Element* is not included in the tabular representation of the *Data Model*. The unshaded *DMEs*, designated by their *DME identifiers*, are *Aggregating Elements* (*AEs*). The shaded *DMEs*, also designated by their *DME identifiers*, are *Data Elements* (*DEs*).

The relationships branching from any one *DME* to its child *DMEs* are numbered from left to right, although the particular order of child *DMEs* in the tree structure is generally arbitrary (this, of course, does not exclude other strategies of ordering the *DMEs* according to other rationale).

In the tabular representation of a *Data Model*, any row of the table (except the header row) specifies a single *DME* by providing its various *DME attribute* values. The header row of the table denotes the assignment of the *DME attributes* to the columns of the table.

The mapping between the *Data Model* tree structure and the corresponding *Data Model* table (i.e. the sequence of rows in the table) generally reflects a top-to-bottom, left-to-right traversal of the tree structure. In the *Data Model* table, any *AE* is directly followed by its child element with branch index 1.

The table that results from this "traversal" of the tree structure of the *Data Model* example in Figure 3 is shown in Figure 4.

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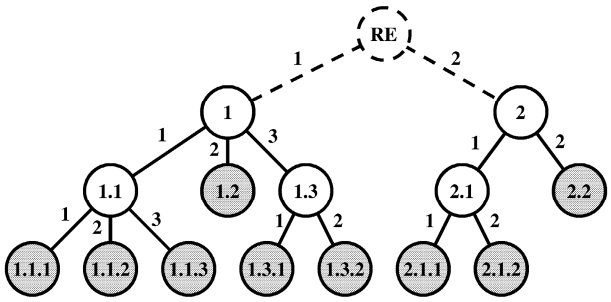

ID	...	...
1		
1.1		
1.1.1		
1.1.2		
1.1.3		
1.2		
1.3		
1.3.1		
1.3.2		
2		
2.1		
2.1.1		
2.1.2		
2.2		

Figure 4 — Mapping of a tree structure representation of a *Data Model* to a table representation (branch indices and *DME identifiers* noted only)

The *DME attributes* for *Data Models* specified in *CT standards* and the corresponding columns of the *Data Model* table are listed and explained below:

a) Identifier

Specifying the *DME identifier* (see term 3.1.12).

In *CT standards*, *DME identifiers* are sequences of branch indices, represented by decimal natural numbers and separated by delimiting characters ".".

Where *DMEs* are referenced or identified in a *Data Model* specified in another *CT standard* (cross-standard referencing), a concatenated character string "<standard designation>", ", " "<*DME identifier*>" shall be used, where the partial string in the middle contains a "comma" character followed by a "space" character.

EXAMPLE Referencing the *DME* with *DME identifier* 1.3.2 of this part of ISO/IEC 19778 (the CW_ID_value) in another *CT standard* would be done by using the reference "ISO/IEC 19778-1:2008, 1.3.2".

b) Designation

Specifying the *DME designation* (see term 3.1.11).

DME designations are used in the wording of *CT standards* in order to refer to particular *DMEs*. In contrast to the linguistically neutral *DME identifiers*, they have mnemonic value; but at the same time, they are language-specific and may be subject to internationalization.

c) Definition

Specifying the *DME definition* (see term 3.1.10).

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As the definitions provided in the *Data Model* table are kept as concise as possible, supplementing information on the *DMEs* is provided in a separate Subclause of the standards for explanatory purposes only. In all *CT standards*, the *DME definition* provided in the cells of table column 3 is the authoritative definition of the *DME*.

d) Obligation

Specifying the *DME obligation status* (see term 3.1.15).

In cases of deriving *Data Model instantiations* from a *Data Model*, the applicability of the *DME obligation status* of any *DME* shall be subject to the employment of its ancestor *DMEs*. For the *Data Model*, this implies that *DMEs* with *DME obligation status* "*optional*" may well have descendant *DMEs* with *DME obligation status* "*mandatory*". Also, where any *DME* with *DME obligation status* "*mandatory*" has solely child *DMEs* with *DME obligation status* "*optional*", any instantiation of this *Data Model* shall provide one or more descendant *DE* instantiations of this *DME*.

Compare the definitions of the four permissible *DME obligation status* values *conditionally mandatory*, *conditionally optional*, *mandatory*, and *optional*.

e) Multiplicity

Specifying the *DME multiplicity* (see term 3.1.14).

Values for *DME multiplicity* (in some other sources also identified as "element repeatability") specify how frequently an instantiation of a *DME* shall and may occur in a conforming *Data Model instantiation*. Multiplicity for a *DME* means that multiple instantiations of the same *DME* shall or may occur in a given *Data Model instantiation*.

In *Data Models instantiations*, multiple *DE* instantiations are usually arranged adjacent to each other, while instantiations of multiple *AEs* (aggregating substructures) result in these substructure instantiations being represented in an adjacent or serial manner. By default, the particular *order* in which multiple *DME instantiations* are placed or listed shall be of no relevance. The only exception to this is if some notation for indicating order as being significant is provided in this cell of the *DME* table row.

In cases where the *DME obligation status* of a *DME* has the value *mandatory*, the required minimum *DME instantiation* occurrence shall be assumed greater than zero, even if specified to be zero.

In cases where the two values (required minimum and permitted maximum occurrence) differ, the interval is specified as a concatenated character string "<required minimum>", "..", "<permitted maximum>", where the values for <required minimum> and <permitted maximum> are represented by nonnegative integers.

An unlimited permitted value for <permitted maximum> is specified using the asterisk character "*".

In cases where the two values (required minimum and permitted maximum occurrence) coincide, this single value is specified only.

f) Datatype

Specifying the *DE datatype* (see term 3.1.6).

In *CT standards*, this specifies the set of distinct values for a given *DME,* as the value of a *DE datatype*. This may be restricted to a particular subset of values, based on a specification or standard which is external to the *Data Model*. The reference to this external specification or standard shall be provided as the value of an appropriate *DE* in the *Data Model*. The *Data*

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Models defined in *CT standards* provide *DEs* and *DME* structures specifically for the purpose of including such references.

Where such references are used, the specific *Data Element* enabling such references shall be indicated in the Datatype column.

g) Examples

May provide one or more illustrations of possible *DE* values.

5.2 Collaborative workplace Data Model diagram

Figure 5 provides a relational overview for the *collaborative workplace Data Model* as specified in this part of ISO/IEC 19778. This diagram also indicates specifications or standards which are as of yet unidentified and out of scope for this part of ISO/IEC 19778, but which may play a significant role in its implementation.

The *Data Model* is outlined inside the large dashed box. The *Root Element* on top represents the basis for this *Data Model* and is not represented in the table representation. The indices of the branches are denoted.

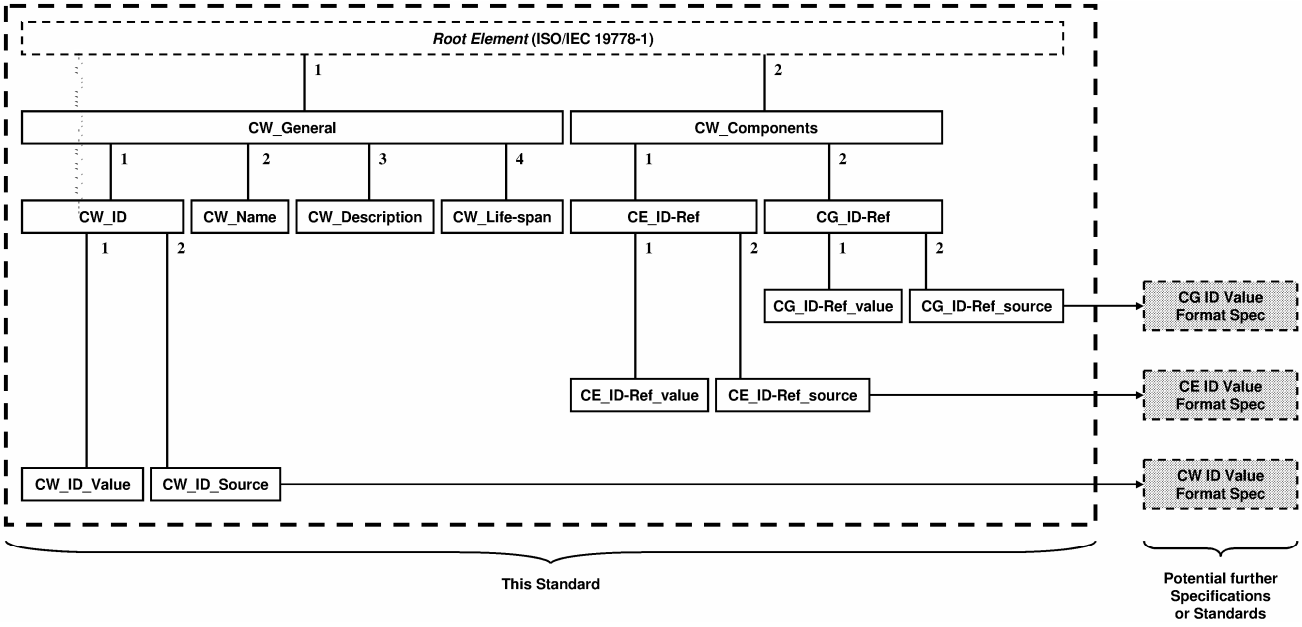

Figure 5 — *Collaborative workplace Data Model* and external specifications or standards

Three potential further specifications or standards are denoted as grey boxes outside the large dashed box to the right. The arrows from the *DMEs* to these boxes represent references from this *Data Model* to such specifications or standards. Where such specifications or standards are referenced, they impose regulations on the "value" *DMEs* that are adjacent to the "source" *DMEs*.

5.3 Collaborative workplace Data Model specification

The following specification of the *Data Model* uses the tabular representation specified in Subclause 5.1.

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Table 1 — *Collaborative Workplace Data Model*

Identifier	Designation	Definition	Obligation	Multiplicity	Datatype	Examples
1	CW_General	Information on the *collaborative workplace* as a whole	*mandatory*	1		
1.1	CW_Name	Name of the *collaborative workplace*	*optional*	1	ISO/IEC 11404:2007, 10.1.5 "Character string (ISO/IEC 10646:2003)" Supported Length = 100 characters	"Computer Graphics Exercises"
1.2	CW_Description	Description of the *collaborative workplace*	*optional*	1	ISO/IEC 11404:2007, 10.1.5 "Character string (ISO/IEC 10646:2003)" Supported Length = 4000 characters	"Workplace for collaborative work on Computer Graphics exercises"
1.3	CW_ID	*Collaborative workplace* identifier	*mandatory*	1		
1.3.1	CW_ID_source	The name or URI of the identification scheme used to generate the value of the *collaborative workplace* identifier. A namespace scheme.	*optional*	1	ISO/IEC 11404:2007, 10.1.5 "Character string (ISO/IEC 10646:2003)" Supported Length = 250 characters	http://www.gris.informatik.tu-darmstadt.de/idformats/identifier_type.pdf

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Identifier	Designation	Definition	Obligation	Multiplicity	Datatype	Examples
1.3.2	CW_ID_value	Value of the *collaborative workplace* identifier	*mandatory*	1	ISO/IEC 11404:2007, 10.1.5 "Character string (ISO/IEC 10646:2003)" Supported Length = 250 characters Permissible values shall comply with any specification or standard identified by the reference value in *DE* 1.3.1 (if provided).	de_tu-darmstadt_informatik_gris_20060906_14545134
1.4	CW_Life-span	Time period of the existence of the *collaborative workplace*	*mandatory*	1	ISO 8601:2004(E), 4.4 "Time interval", expressed by two separated ISO 8601:2004(E), 4.3 "Date and time of day" values for start and end.	2006-10-01T12:00:00+02:00/2007-06-01T12:00:00+02:00 A "/" character is used in the above *DE* value example to separate the two "Date and time of day" values.
2	CW_Components	Identification of the components of the *collaborative workplace*	*mandatory*	1		
2.1	CE_ID-Ref	*Collaborative environment* identifier reference	*mandatory*	1		
2.1.1	CE_ID-Ref_source	The name or URI of the identification scheme used to generate the value of the *collaborative environment* identifier reference. A namespace scheme.	*optional*	1	ISO/IEC 11404:2007, 10.1.5 "Character string (ISO/IEC 10646:2003)" Supported Length = 250 characters	http://www.gris.informatik.tu-darmstadt.de/idformats/identifier_type.pdf

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Identifier	Designation	Definition	Obligation	Multiplicity	Datatype	Examples
2.1.2	CE_ID-Ref_value	Value of the *collaborative environment* identifier reference; the corresponding *collaborative environment* identifier is specified in *Data Element* "ISO/IEC 19778-2:2008, 1.3.2".	*mandatory*	1	ISO/IEC 11404:2007, 10.1.5 "Character string (ISO/IEC 10646:2003)" Supported Length = 250 characters Permissible values shall comply with any specification or standard identified by the reference value in *DE* 2.1.1 (if provided).	de_tu-darmstadt_informatik_gris_20060907_13582578
2.2	CG_ID-Ref	*Collaborative group* identifier reference	*mandatory*	1		
2.2.1	CG_ID-Ref_source	The name or URI of the identification scheme used to generate the value of the *collaborative group* identifier reference. A namespace scheme.	*optional*	1	ISO/IEC 11404:2007, 10.1.5 "Character string (ISO/IEC 10646:2003)" Supported Length = 250 characters	http://www.gris.informatik.tu-darmstadt.de/idformats/identifier_type.pdf

Identifier	Designation	Definition	Obligation	Multiplicity	Datatype	Examples
2.2.2	CG_ID-Ref_value	Value of the *collaborative group* identifier reference; the corresponding *collaborative group* identifier is specified in *Data Element* "ISO/IEC 19778-3:2008, 1.3.2".	*mandatory*	1	ISO/IEC 11404:2007, 10.1.5 "Character string (ISO/IEC 10646:2003)" Supported Length = 250 characters Permissible values shall comply with any specification or standard identified by the reference value in *DE* 2.2.1 (if provided).	de_tu-darmstadt_informatik_gris_20060907_14033718

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5.4 Supplementing information for DMEs of the CW DM

5.4.1 AE CW_General

This *Aggregating Element* groups the general information that describes this *collaborative workplace* as a whole.

5.4.2 DE CW_Name

Name given to the *collaborative workplace.*

NOTE This name is solely intended for human use.

5.4.3 DE CW_Description

Description of the *collaborative workplace.*

NOTE This description is solely intended for human reading and understanding.

5.4.4 AE CW_ID

The *collaborative workplace* identifier serves as a lable for a *collaborative workplace Data Model instantiation* (for allowing references from its associated *collaborative environment* and *collaborative group Data Model instantiations*, or from external objects).

In order to support more than a single identifier format, a "source-value" approach has been applied in this *Aggregating Element*. Accordingly, the value of the child element "source" specifies a Uniform Resource Identifier (URI), that can be used for establishing the range of uniqueness for the *collaborative workplace* identifier value; it could also represent a URI that procures access to a data object that specifies the identifier format. The child element "value" serves as a lable for the associated *collaborative workplace*.

5.4.5 DE CW_ID_source

The value of this *Data Element* specifies the URI of the source where the regulations are provided that are associated with the used *collaborative workplace* ID value. The purpose of this value is manifold.

- The URI (in its capacity of being a globally unique identifier) unambiguously identifies a particular community that is responsible for the unambiguousness of the used *collaborative workplace* ID values within this community.

- The URI provides access to the regulations regarding the format of the admissible *collaborative environment* ID values. These regulations generally specify, how such identifiers are constructed (within the limits of their datatype). Typically, such a specification may restrict the permitted character set, may specify particular characters with special meaning (e.g. separators between distinct fields of the character string), may (for *Data Model instantiations* only) restrict the maximum supported number of characters of the character string, etc.

NOTE 1 The format of such regulations is not specified in this part of ISO/IEC 19778. Particularly, it is left open whether such regulations are appropriate for automated use or just for human reading, understanding, and observance.

NOTE 2 This *Data Element* is *optional* in order to allow simple applications of this *Data Model*, where the practicing community takes care that within the range of their visibility the *collaborative workplace* identifier values are unambiguous.

NOTE 3 At the time of the publication of this part of ISO/IEC 19778, direct or indirect reference to RFC 3986 - Uniform Resource Identifiers (URI): Generic Syntax {http://www.ietf.org/rfc/rfc3986.txt} was recommended.

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5.4.6 DE CW_ID_value

This *Data Element* represents the identifier of this *collaborative workplace Data Model instantiation*. This identifier shall be unique at least within the application range of this *Data Model instantiation*.

5.4.7 DE CW_Life-span

Time period of the existance of the *collaborative workplace*.

5.4.8 AE CW_Components

An *Aggregating Element* that aggregates two child *Aggregating Elements* that provide identifier references to the *Data Model instantiations* of the *collaborative environment* and the *collaborative group* which are associated with this *collaborative workplace*.

5.4.9 AE CE_ID-Ref

A reference to the *Data Model instantiation* of the *collaborative environment* which is associated with this *collaborative workplace*. This reference is specified by providing the identifier of the *Data Model instantiation* of the *collaborative environment.*

5.4.10 DE CE_ID-Ref_source

The value of this *Data Element* specifies the URI of the source where the regulations are provided that are associated with the used *collaborative environment* ID value. The purpose of the *Data Element* value (in combination with the *collaborative environment* identifier reference value) is the linkage of (and thus allowing access to) the *Data Model instantiation* which specifies the associated *collaborative environment*.

NOTE 1 This *Data Element* is *optional* in order to allow simple applications of this *Data Model*, where the practicing community takes care that within the range of their visibility the *collaborative environment* identifier values are unambiguous.

NOTE 2 At the time of the publication of this part of ISO/IEC 19778, direct or indirect reference to RFC 3986 - Uniform Resource Identifiers (URI): Generic Syntax {http://www.ietf.org/rfc/rfc3986.txt} was recommended.

5.4.11 DE CE_ID-Ref_value

This *Data Element* provides the reference to the *Data Model instantiation* specifying the *collaborative environment* that is associated with the *collaborative workplace*. The purpose of the *Data Element* value (possibly in combination with the *collaborative environment* identifier reference source) is the linkage of (and thus allowing access to) the *Data Model instantiation* which specifies the associated *collaborative environment*.

5.4.12 AE CG_ID-Ref

A reference to the *Data Model instantiation* of the *collaborative group* which is associated with this *collaborative workplace*. This reference is done by providing the identifier of the *Data Model instantiation* of the *collaborative group.*

5.4.13 DE CG_ID-Ref_source

The value of this *Data Element* specifies the URI of the source where the regulations are provided that are associated with the used *collaborative group* ID value. The purpose of the *Data Element* value (in combination with the *collaborative group* identifier reference value) is the linkage of (and thus allowing access to) the *Data Model instantiation* which specifies the associated *collaborative group*.

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NOTE 1 This *Data Element* is *optional* in order to allow simple applications of this *Data Model*, where the practicing community takes care that within the range of their visibility the *collaborative group* identifier values are unambiguous.

NOTE 2 At the time of the publication of this part of ISO/IEC 19778, direct or indirect reference to RFC 3986 - Uniform Resource Identifiers (URI): Generic Syntax {http://www.ietf.org/rfc/rfc3986.txt} was recommended.

5.4.14 DE CG_ID-Ref_value

This *Data Element* provides the reference to the *Data Model instantiation* specifying the *collaborative group* that is associated with the *collaborative workplace*. The purpose of the *Data Element* value (possibly in combination with the *collaborative group* identifier reference source) is the linkage of (and thus allowing access to) the *Data Model instantiation* which specifies the associated *collaborative group*.

6 Conformance

These conformance specifications regard solely the conformance of *Data Model instantiations* (in contrast to, e.g. conformance specifications regarding applications which may use such *Data Model instantiations*).

For any *Data Model instantiation* that conforms to this part of ISO/IEC 19778 the following requirements shall be met.

- The *Data Model instantiation* shall at least provide one or more *Data Model Element instantiations* of any *Data Element* in the *Data Model* where any of its ancestor *Data Model Elements* has either the *Data Model Element obligation status* value "*mandatory*" or "*conditionally mandatory*" with the respective condition met. Where more than one *Data Model Element instantiation* is provided for a *Data Element*, this multiple occurrence shall correspond to the specified *Data Model Element multiplicity* attribute for this *Data Element*.

  NOTE 1 This rule specifies which *DEs* must appear in a *DM instantiation*.

- The *Data Model instantiation* shall not contain any instantiation of a *Data Element* where the *Data Model Element obligation status* value is "*conditionally optional*" with the respective condition not met.

  NOTE 2 This rule specifies which *DEs* of the *DM* are not allowed in a *DM instantiation*.

- The *Data Model instantiation* shall not contain any instantiated *Data Element* which does not correspond to any of the *Data Elements* and their attribute values of the *Data Model* specified in this part of ISO/IEC 19778.

  NOTE 3 This rule forbids any instantiations of *DEs* that do not conform to the *DM* (being not specified at all, or exceeding multiplicity ranges). At the same time, this rule allows the instantiation of all the "effectively" (subject to instantiated or implied ancestor *AEs*, and the *DME obligation status* value of the respective *DE*) *optional DEs*.

- For any instantiation of a *Data Element* in a *Data Model instantiation*, both the *Data Model Element identifier* and the value for this *Data Element* shall be provided, where the value of the instantiation of the *Data Element* shall correspond to the specified *Data Model Element datatype* attribute for this *Data Element*.

  NOTE 4 This rule specifies that the *DME identifier* and a correct *DE* value are required for any instantiated *DE*.

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- For any instantiation of an *Aggregating Element* in a *Data Model instantiation*, the *Data Model Element identifier* shall be provided.

  NOTE 5 This rule specifies that the *DME identifier* is required for every instantiated A*E*. No values exist for instantiated *AEs*.

- The *Data Model instantiation* shall allow the complete and unambiguous reconstruction of a tree structure for this instantiation that corresponds to the *Data Model* specified in this part of ISO/IEC 19778.

  NOTE 6 This rule specifies the requirement of being able to assign the correct tree structure location to any instantiated *DME*. This rule implies also the instantiation of *AEs* with multiple occurence. *AEs* with single occurrence can be reconstructed based on the instantiations of their descendant *DMEs*.

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Annex A
(informative)

Alphabetical list of terms

Term	Defined in
AE	3.1.1
Aggregating Element	3.1.1
collaborative activity	3.2.1
collaborative effect	3.2.2
collaborative environment	3.2.3
collaborative function	3.2.4
collaborative group	3.2.5
collaborative service	3.2.6
Collaborative Technology standards	3.1.2
collaborative tool	3.2.7
collaborative workplace	3.2.8
conditionally mandatory	3.1.3
conditionally optional	3.1.4
CT standards	3.1.2
Data Element	3.1.5
Data Element datatype	3.1.6
Data Model	3.1.7
Data Model Element	3.1.8
Data Model Element attribute	3.1.9
Data Model Element definition	3.1.10
Data Model Element designation	3.1.11
Data Model Element identifier	3.1.12
Data Model Element instantiation	3.1.13
Data Model Element multiplicity	3.1.14
Data Model Element obligation status	3.1.15
Data Model instantiation	3.1.16
DE	3.1.5
DE datatype	3.1.6
DM	3.1.7
DM instantiation	3.1.16
DME	3.1.8

Term	Defined in
DME attribute	3.1.9
DME definition	3.1.10
DME designation	3.1.11
DME identifier	3.1.12
DME instantiation	3.1.13
DME multiplicity	3.1.14
DME obligation status	3.1.15
mandatory	3.1.17
optional	3.1.18
participant	3.2.9
RE	3.1.19
role	3.2.10
Root Element	3.1.19

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Annex B
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A minimalistic use case

B.1 Scope and purpose of the minimalistic use case

This use case demonstrates the reuse of a set of ISO/IEC 19778 *Data Model (DM) instantiations* in an exemplifying HTML binding for supporting the semi-automated set up of new *collaborative workplaces*. On the first glance, it is the system administrator who profits from this support. On the long run, however (and particularly for *collaborative workplaces* with large, structured groups and with complex technical environments), all users of *collaborative workplaces* will profit from the adoption of the specifications of *collaborative workplaces* that have well proved themselves in practice.

The minimalistic use case uses of a set of *DM instantiations* (for the three parts of ISO/IEC 19778) that solely instantiate those *Data Model Elements* (*DMEs*) which are indispensable for the *DM instantiations*. This minimalistic approach illustrates the applicability of even such minimalistic *DE* instantiations (at the same time justifying the *DME obligation status* values for the *DMEs* of the *Data Models* of ISO/IEC 19778).

While explaining this use case, some advantages of additionally providing *optional DMEs* and multiple occurances of DMEs are just outlined, while those *DEs* that provide references to "potential further specifications or standards" (see Figure 5) are listed, but not taken into account here.

B.2 An exemplifying binding for the Data Models

Data Model instantiations are derived from respective *DMs* by

- selecting the *DMEs* which are required to specify (or describe) the intended physical entity (the *collaborative workplace* with its components *collaborative environment* and *collaborative group*); and
- applying a binding to it.

As for the *Data Models* of ISO/IEC 19778 no binding has been specified yet, an exemplifying binding is provided here for solely illustrative purposes. The HTML binding chosen here is obviously no candidate for standardization (however serves the requirements of this use case description).

- Any *Data Model instantiation* (*DM instantiation*) in this HTML binding is represented as an ordered list with two list elements.
  - Representation of the *Data Model* and binding specification section:

    The first list element contains an ordered list that may provide, however does not require a list header element containing the concatenated character strings "*Data Model* Standard Identification // URI of the Binding Specification"; the ordered list contains two list elements:

    - The first list element represents the identification of the Standard which specifies the *Data Model* (*DM*), this *DM instantiation* is derived from;
    - The second list element represents an URI that allows to locate the specification of this HTML binding;

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- Representation of the *DME* section:

  The second list element contains an unordered list that may provide, however does not require a list header element containing the character string "Data Model section"; the unordered list contains one ore more list elements:

  - one or more *Data Element* (*DE*) instantiations; and/or
  - one or more *Aggregating Element* (*AE*) instantiations and their descendant *AE* or *Data Element* (*DE*) instantiations.

- Representation of *AE* instantiations:

  Any *AE* instantiation in this HTML binding is represented by an unordered list that may provide, however does not require a list header element containing the concatenated character string "<*DME identifier*>", "<separator>", "<*DME designation*>"; a separator string " // " is recommended; the unordered list contains one ore more list elements:

  - one or more *Data Element* (*DE*) instantiations; and/or
  - one or more *Aggregating Element* (*AE*) instantiations and their descendant *AE* or *Data Element* (*DE*) instantiations.

- Representation of *DE* instantiations:

  Any *DE* instantiation in this HTML binding is represented as an ordered list that may provide, however does not require a list header element containing the character string "<*DE designation*>"; the ordered list contains two list elements:

  - The first list element contains the character string of the attribute value "<*DME identifier*>" of the *DE* this *DME instantiation* is derived from;
  - The second list element contains the data value of the *DE* instantiation in a character string representation;

- Simplification rule:

  The following rule may, however is not required to be applied for further simplification of a *DM instantiation* in this HTML binding:

  - Any represented unordered list which solely contains either a single *AE* instantiation or a single *DE* instantiation is replaced by its contained list element.

In this use case description, the *DM instantiations* are presented as printouts of the HTML instantiations. In order to ease their understanding, all list headers are provided, and the simplification rule of the HTML binding is not applied.

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B.3 The minimalistic Data Model instantiations

The Figures B.1, B.2, and B.3 show minimalistic *DM instantiations* for the three *DMs* specified by ISO/IEC 19778.

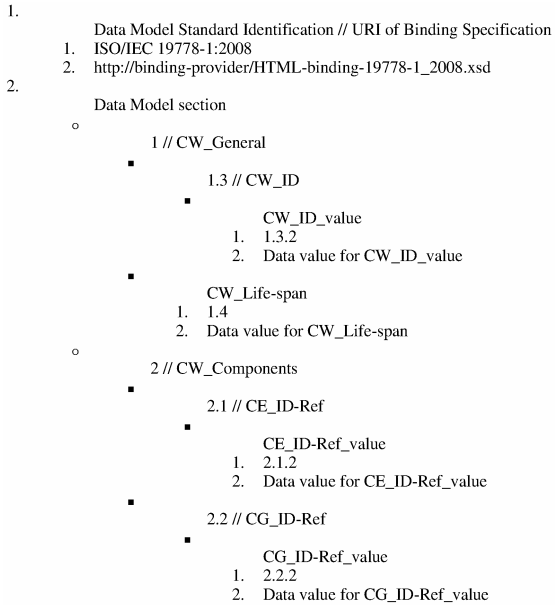

Figure B.1 — Minimalistic *collaborative workplace Data Model instantiation*

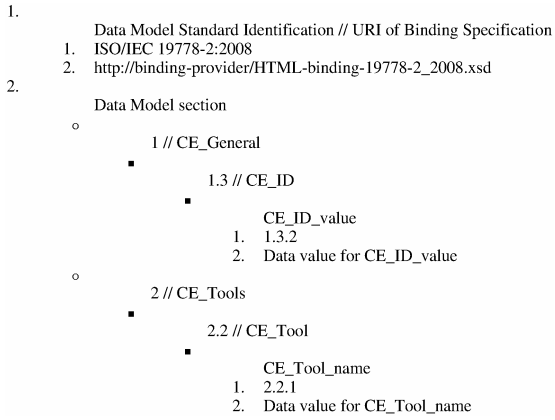

Figure B.2 — Minimalistic *collaborative environment Data Model instantiation*

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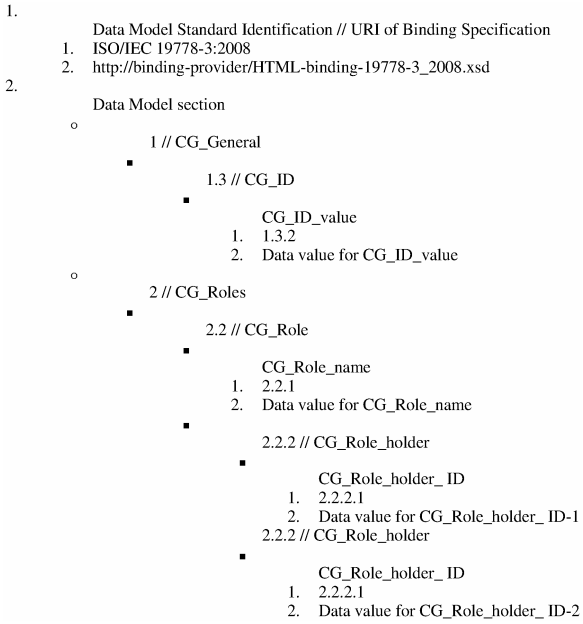

Figure B.3 — Minimalistic *collaborative group Data Model instantiation*

In these *DM instantiations*, the values for *DEs* are represented symbolically ("Data value for <*DME designation*>-<any multiplicity index>").

The following *DE* value correspondences exist for the minimalistic *DM instantiations* of a *collaborative workplace*:

- Value for CE_ID_value (ISO/IEC 19778-2:2008, *DE* 1.3.2), and value for CE_ID-Ref_value (ISO/IEC 19778-1:2008, *DE* 2.1.2)

- Value for CG_ID_value (ISO/IEC 19778-3:2008, *DE* 1.3.2), and value for CG_ID-Ref_value (ISO/IEC 19778-1:2008, *DE* 2.2.2)

The *collaborative group DM instantiation* does not provide references to the *participants* being associated with the *role* holders. This means that this *DM instantiation* is not associated with an active *collaborative workplace* (i.e. the present time is outside the CW_Life-span). This kind of *DM instantiation* may have been derived from an active *collaborative group DM instantiation* by anonymizing it for the purpose of reuse, or may be provided beforehand as a template for planned *collaborative group DM instantiations*.

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B.4 Creation of Data Model instantiations for a new collaborative workplace

Creating a new set of *DM instantiations* for a new *collaborative workplace* (reuse of a given set of *DM instantiations*) is done by the following actions.

- Replacing the value for CW_ID_value (ISO/IEC 19778-1:2008, *DE* 1.3.2) by an identifier value that is unique within the application range of this *DM instantiation*.

- Replacing both, the values for CE_ID_value (ISO/IEC 19778-2:2008, *DE* 1.3.2) and CE_ID-Ref_value (ISO/IEC 19778-1:2008, *DE* 2.1.2) by an identifier value that is unique within the application range of the new *collaborative workplace*.

- Replacing both, the values for CG_ID_value (ISO/IEC 19778-3:2008, *DE* 1.3.2) and CG_ID-Ref_value (ISO/IEC 19778-1:2008, *DE* 2.2.2) by an identifier value that is unique within the application range of the new *collaborative workplace*.

- Replacing the value for the CW_Life-span (ISO/IEC 19778-1:2008, *DE* 1.4) *DE* instantiation appropriately.

- Replacing all values for CG_Participant_ID-Ref (multiple ISO/IEC 19778-3:2008, *DEs* 2.2.2.2).

B.5 Additional options of the minimalistic use case

The minimalistic *DM instantiations* contain indispensable *DE* instantiations only. Further *DEs* may be instantiated for any of the three *Data Models* (the diverse "reference sources" are not listed here, but in B.6).

In both the *collaborative environment Data Model* and the *collaborative group Data Model*, *optional* identifier references to the associated *collaborative workplace* are provided (*AE* 1.4 and their descendant *DEs* in both *Data Models*). Where needed, these identifier references could simplify locating the *collaborative workplace DM instantiation* which is associated with a given *collaborative environment* or *collaborative group DM instantiation*.

For any of the three *Data Models*, *optional Data Elements* Name (*DE* 1.1) and Description (*DE* 1.2) are available, where Name may serve as a mnemonic association help for the system administrator, while Description could provide detailed, general information and might be also appropriate for full-text search purposes.

Optional Data Elements Name and Description are also provided for every included *collaborative tool* (*DE* 2.2.1 and *DE* 2.2.2) and for every included *collaborative function* (*DE* 2.2.3.2.1 and *DE* 2.2.3.2.2) of the *collaborative environment DM*, serving human association support and full-text search purposes.

Making use of the *AEs* CE_Functions (*AEs* 2.2.3 and their descendant *DMEs* in the *collaborative environment DM*) supports the adoption of *collaborative environment* specifications even across different systems providing different sets of *collaborative tools*. As for the users of the *collaborative workplaces* the available *collaborative functions* (representing, what can be done) have priority over the *collaborative tools* (representing the implementation of the *collaborative functions*), the specification of the *collaborative functions* will supports the substitution of *collaborative tools* being not available by available *collaborative tools* with appropriate *collaborative functions*.

In the *collaborative group DM*, for every provided CG_Role_holder *AE* (*AEs* 2.2.2) the *optional Data Elements* CG_Participant_ID-Ref (*DE* 2.2.2.2) and CG_Role_holder_nickname (*DE* 2.2.2.3) are available, where CG_Participant_ID-Ref is required for every active *collaborative workplace* (associating physical *participants* with virtual *role* holders), while CG_Role_holder_nickname allows a more intimate adressing of the *participants* in the *collaborative group*.

Making use of the permitted multiplicities for *collaborative tools*, *collaborative functions*, *roles*, and *role* holders allows to specify quite complex *collaborative workplaces*.

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B.6 Limitations of the minimalistic use case

It is evident that the benefits associated with this minimalistic use case are very limited, even in cases where the additional options explained in B.5 are used. These limitations are generally implied by not making use of references to "potential further specifications or standards" (see Figure 5). Some of these limitations will be qualified as soon as such "potential further specifications or standards" exist and are observed silently (without specifying this in the respective reference elements of the *DM instantiations*).

a) The uniqueness of all identifer values is questionable. This limits the reuse of the *DM instantiations* in cases, where these are searched in a larger range than anticipated during their creation. During such searches, multiple matches may occur and may provide *DM instantiations* that actually are not intended to be associated. Using references to the regulations for such identifiers will overcome this problem. This applies to the following DMEs:

   - CW_ID_source (ISO/IEC 19778-1:2008, *DE* 1.3.1)
   - CE_ID-Ref_source (ISO/IEC 19778-1:2008, *DE* 2.1.1)
   - CG_ID-Ref_source (ISO/IEC 19778-1:2008, *DE* 2.2.1)
   - CE_ID_source (ISO/IEC 19778-2:2008, *DE* 1.3.1)
   - CW_ID-Ref_source (ISO/IEC 19778-2:2008, *DE* 1.4.1)
   - CG_ID_source (ISO/IEC 19778-3:2008, *DE* 1.3.1)
   - CW_ID-Ref_source (ISO/IEC 19778-3:2008, *DE* 1.4.1)

b) Using names for *collaborative tools* and *collaborative functions* without specifying which tools and functions are associated with these names, and how these tools and functions are specified, limits any reuse across environments where these associations and specifications are silently known. Actually, these names used in the *DM instantiations* have the effect of references to the specifications of the associated physical entities (the physical tools and the provided functions). This applies to the following *DMEs*:

   - CE_Tools_spec_source (ISO/IEC 19778-2:2008, *DE* 2.1)
   - CE_Functions_spec_source (ISO/IEC 19778-2:2008, *DE* 2.2.3.1)

c) Using names for *roles* without specifying which capabilities, obligations, permissions, and limitations are associated with these *roles*, limits any reuse across environments where these conventions are silently known and agreed to. Actually, *role* names used in the *DM instantiations* have the effect of references to whatever specifications exist for these *roles*. This applies to the following *DME*:

   - CG_Roles_spec_source (ISO/IEC 19778-3:2008, *DE* 2.1)

It is evident that this minimalistic use case is profitable where *collaborative workplaces* of corresponding configuration need to be set up frequently. At the same time, reusing such *DM instantiations* is a very helpful first step towards richer use cases.

First trials of "potential further specifications or standards" (see Figure 5) can be implemented and experienced. Across diverse communities of practice, such implementations can be exchanged. This will be valuable for as well cross-checking as for increasing the benefits of using ISO/IEC 19778. Feedback from such experience will be the basis for providing such "potential further specifications or standards" and for preparing the next edition of ISO/IEC 19778.

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Annex C
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A rich use case

C.1 Scope and purpose of the rich use case

This use case demonstrates the reuse of a set of ISO/IEC 19778 *Data Model (DM) instantiations*, and particularly addresses the use of the "potential further specifications or standards". In doing so, this rich use case includes the aims and benefits of the minimalistic use case (see Annex B) and exceeds it by also exceeding the scope of ISO/IEC 19778.

Again, the exemplifying HTML binding introduced in Annex B is used for creating the *DM instantiations*. These *DM instantiations* include instantiations of all *optional DMEs*. They are still not really large, as in cases of permissible *DME multiplicity*, just two *AEs* and their descendant *DMEs* are provided (as this is sufficient to show the overall structures of the *DM instantiations*).

This use case description focusses particularly on the employment of the "source-value" approach for integrating and using "potential further specifications or standards".

C.2 The rich Data Model instantiations

The Figures C.1, C.2, and C.3 show rich *DM instantiations* for the three *DMs* specified by ISO/IEC 19778. "Rich" means here providing all *DMEs* and using *DME multiplicity* values of two in all cases where multiplicity is permissible.

In practice, such *DM instantiations* will be much larger, particularly due to provided description text for the *DM instantiations* themselves (*DEs* 1.2 in the *DM instantiations* of all ISO/IEC 19778 Parts), and for *collaborative tools* and *collaborative functions* (multiple *DEs* 2.2.2 and *DEs* 2.2.3.2.2 in the *collaborative environment DM instantiation*), and larger multiplicity values for *collaborative tools*, *collaborative functions*, *roles*, and *role holders*.

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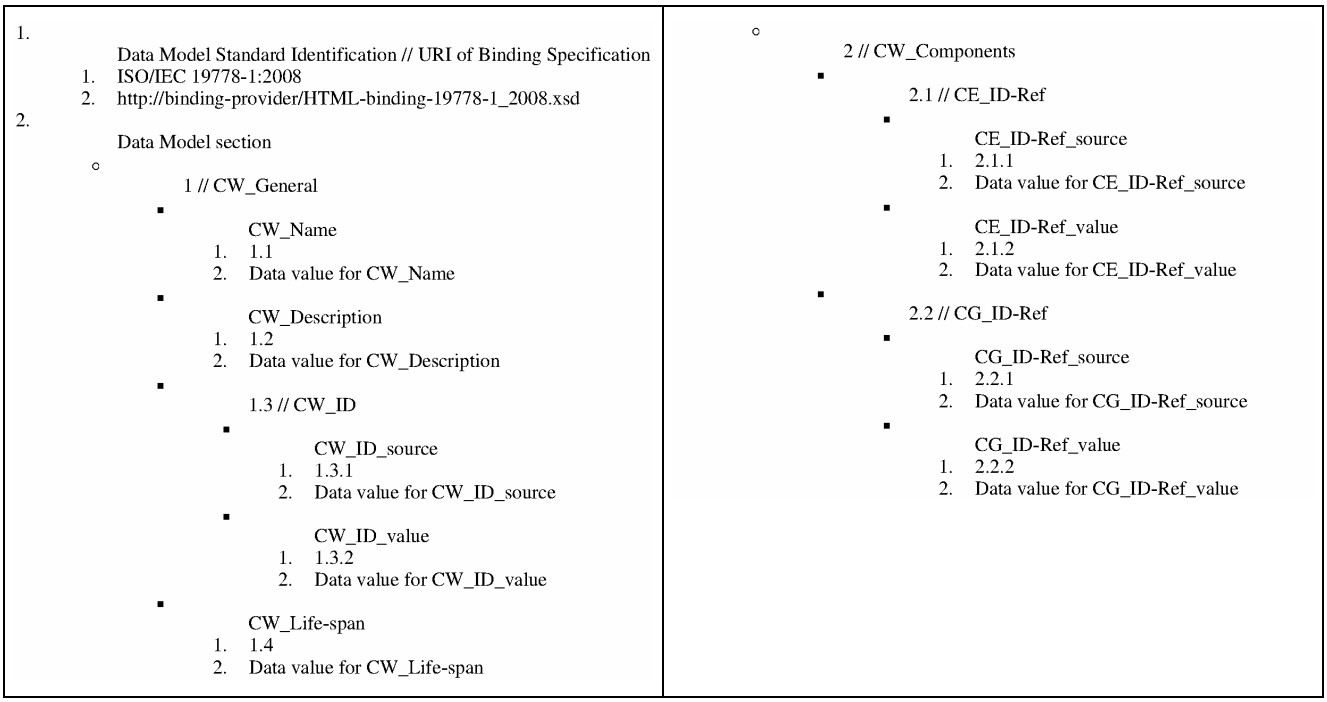

Figure C.1 — Rich *collaborative workplace Data Model instantiation*

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1.

Data Model Standard Identification // URI of Binding Specification

1. ISO/IEC 19778-2:2008
2. http://binding-provider/HTML-binding-19778-2_2008.xsd

2.

Data Model section

- 1 // CE_General
  - CE_Name
    1. 1.1
    2. Data value for CE_Name
  - CE_Description
    1. 1.2
    2. Data value for CE_Description
  - 1.3 // CE_ID
    - CE_ID_source
      1. 1.3.1
      2. Data value for CE_ID_source
    - CE_ID_value
      1. 1.3.2
      2. Data value for CE_ID_value
  - 1.4 // CW_ID-Ref
    - CW_ID-Ref_source
      1. 1.4.1
      2. Data value for CW_ID-Ref_source
    - CW_ID-Ref_value
      1. 1.4.2
      2. Data value for CW_ID-Ref_value
- 2 // CE_Tools
  - CE_Tools_spec_source
    1. 2.1
    2. Data value for CE_Tools_spec_source
  - 2.2 // CE_Tool
    - CE_Tool_name
      1. 2.2.1
      2. Data value for CE_Tool_name-1
    - CE_Tool_description
      1. 2.2.2
      2. Data value for CE_Tool_description-1
    - 2.2.3 // CE_Functions
      - CE_Functions_spec_source
        1. 2.2.3.1
        2. Data value for CE_Functions_spec_source-1
      - 2.2.3.2 // Function
        - CE_Function_name
          1. 2.2.3.2.1
          2. Data value for CE_Function_name-1-1
        - CE_Function_description
          1. 2.2.3.2.2
          2. Data value for CE_Function_description-1-1
      - 2.2.3.2 // Function
        - CE_Function_name
          1. 2.2.3.2.1
          2. Data value for CE_Function_name-1-2
        - CE_Function_description
          1. 2.2.3.2.2
          2. Data value for CE_Function_description-1-2
  - 2.2 // CE_Tool
    - CE_Tool_name
      1. 2.2.1
      2. Data value for CE_Tool_name
    - CE_Tool_description
      1. 2.2.2
      2. Data value for CE_Tool_description-2
    - 2.2.3 // CE_Functions
      - CE_Functions_spec_source
        1. 2.2.3.1
        2. Data value for CE_Functions_spec_source-2
      - 2.2.3.2 // Function
        - CE_Function_name
          1. 2.2.3.2.1
          2. Data value for CE_Function_name-2-1
        - CE_Function_description
          1. 2.2.3.2.2
          2. Data value for CE_Function_description-2-1
      - 2.2.3.2 // Function
        - CE_Function_name
          1. 2.2.3.2.1
          2. Data value for CE_Function_name-2-2
        - CE_Function_description
          1. 2.2.3.2.2
          2. Data value for CE_Function_description-2-2

Figure C.2 — Rich *collaborative environment Data Model instantiation*

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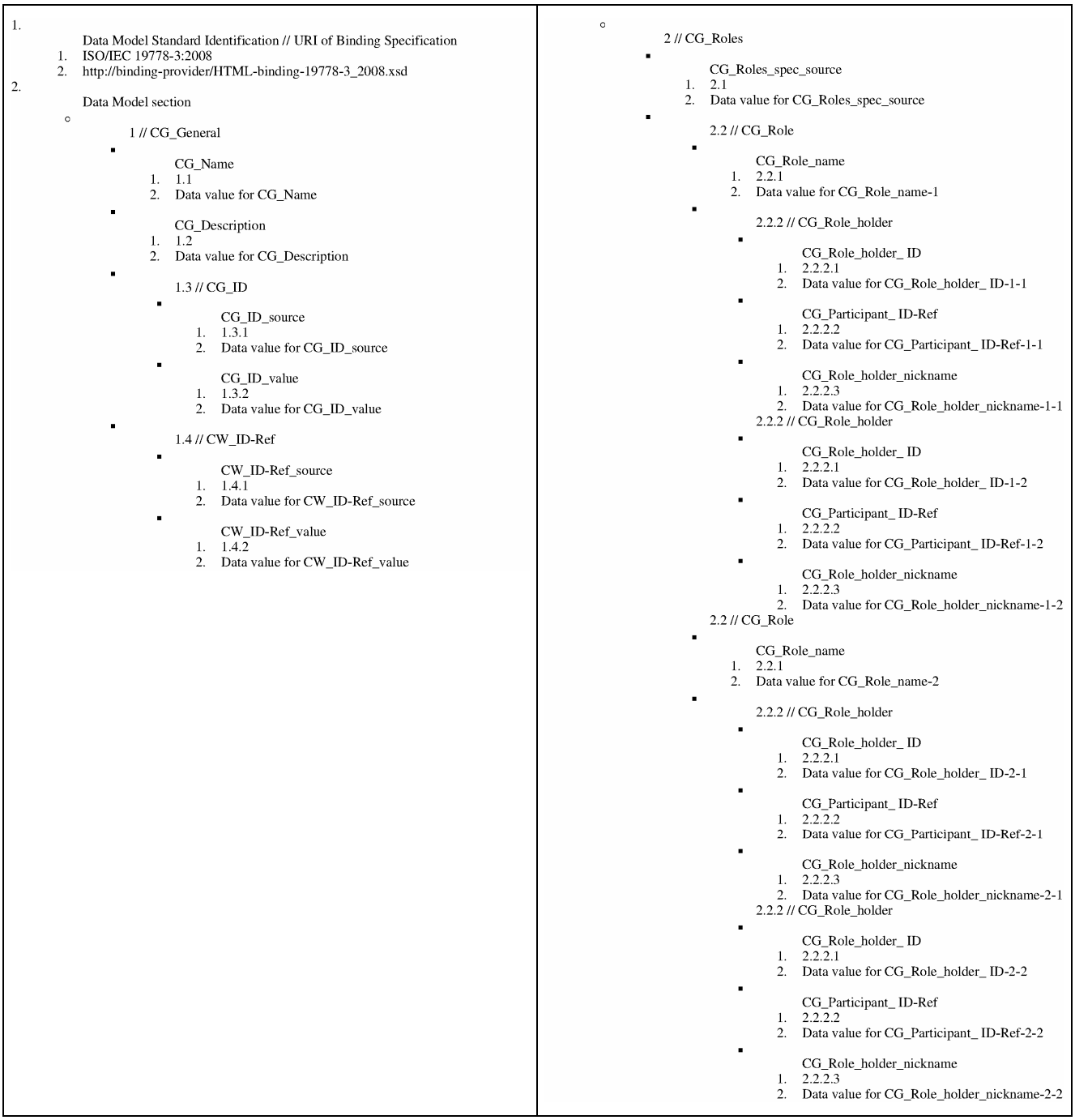

Figure C.3 — Rich *collaborative group Data Model instantiation*

As already practiced in the minimalistic use case (Annex B), in these *DM instantiations*, all values for *DEs* are represented symbolically ("Data value for <*DME designation*>-<any multiplicity index/index pair>").

The following *DE* value correspondences exist for the rich *DM instantiations* of a *collaborative workplace*:

- Value for CW_ID_source (ISO/IEC 19778-1:2008, *DE* 1.3.1), and values for CW_ID-Ref_source (ISO/IEC 19778-2:2008, *DE* 1.4.1 and ISO/IEC 19778-3:2008, *DE* 1.4.1)

- Value for CW_ID_value (ISO/IEC 19778-1:2008, *DE* 1.3.2), and values for CW_ID-Ref_value (ISO/IEC 19778-2:2008, *DE* 1.4.2 and ISO/IEC 19778-3:2008, *DE* 1.4.2)

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- Value for CE_ID_source (ISO/IEC 19778-2:2008, *DE* 1.3.1), and value for CE_ID-Ref_source (ISO/IEC 19778-1:2008, *DE* 2.1.1)

- Value for CE_ID_value (ISO/IEC 19778-2:2008, *DE* 1.3.2), and value for CE_ID-Ref_value (ISO/IEC 19778-1:2008, *DE* 2.1.2)

- Value for CG_ID_source (ISO/IEC 19778-3:2008, *DE* 1.3.1), and value for CG_ID-Ref_source (ISO/IEC 19778-1:2008, *DE* 2.2.1)

- Value for CG_ID_value (ISO/IEC 19778-3:2008, *DE* 1.3.2), and value for CG_ID-Ref_value (ISO/IEC 19778-1:2008, *DE* 2.2.2)

The first two correspondence groups are actually redundant and are provided just for easing the locating of the associated *collaborative workplace DM instantiation*, starting from *collaborative environment* or *collaborative group DM instantiations*.

The following four of these correspondences constitute the association between the *DM instantiation* for the *collaborative workplace* and the *DM instantiations* for the *collaborative environment* and the *collaborative group*, and by doing so combine the two components to form the *collaborative workplace*.

The "rich" *collaborative group DM instantiation* provides references to *participants* that are associated with particular *role* holders (i.e. the *collaborative group DM instantiation* is not anonymized).

C.3 Creation of Data Model instantiations for a new collaborative workplace

C.3.1 Replacing DM instantiation identifiers, identifier references, and identifier sources

The ID_Source values and the corresponding ID-Ref_Source values of the reused *DM instantiations* may be either adopted and respected, or appropriately replaced. These values are URLs that support the location and provision of data objects in the world wide web, which specify rules for the identifier values and references to them. Such data objects may be provided as documents for human reading and understanding (like the RFC 3986 document - see RFC 3986 in the Bibliography), or in a machine usable way (e.g. as XML data objects with an associated XSD data object).

NOTE By providing an ID_Source value, the set of distinct values for the associated identifier is restricted. At the same time, information may be provided regarding the use of identifier reference values for supporting the location and provision of the referenced data objects.

EXAMPLE An identifier value might be a character string, built from delimited identifier fragments, where the first fraction might be the URL of a correlation table that assignes data object locators to identifier values.

The ID values and the corresponding ID-Ref values of the reused *DM instantiations* must be replaced by new values that are unique within the application range of this *DM instantiations*.

- Adopting or replacing the value for CW_ID_source (ISO/IEC 19778-1:2008, *DE* 1.3.1) and the corresponding values for CW_ID-Ref_source (ISO/IEC 19778-2:2008, *DE* 1.4.1 and ISO/IEC 19778-3:2008, *DE* 1.4.1).

  Replacing the value for CW_ID_value (ISO/IEC 19778-1:2008, *DE* 1.3.2) and the corresponding CW_ID-Ref_values (ISO/IEC 19778-2:2008, *DE* 1.4.2 and ISO/IEC 19778-3:2008, *DE* 1.4.2).

- Adopting or replacing the value for CE_ID_source (ISO/IEC 19778-2:2008, *DE* 1.3.1) and the corresponding values for CE_ID-Ref_source (ISO/IEC 19778-1:2008, *DE* 2.1.1).

  Replacing the value for CE_ID_value (ISO/IEC 19778-2:2008, *DE* 1.3.2) and the corresponding CE_ID-Ref_value (ISO/IEC 19778-1:2008, *DE* 2.1.2).

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- Adopting or replacing the value for CG_ID_source (ISO/IEC 19778-3:2008, *DE* 1.3.1) and the corresponding value for CG_ID-Ref_source (ISO/IEC 19778-1:2008, *DE* 2.2.1).

  Replacing the value for CG_ID_value (ISO/IEC 19778-3:2008, *DE* 1.3.2) and the corresponding CG_ID-Ref_value (ISO/IEC 19778-1:2008, *DE* 2.2.2).

C.3.2 Specifying the life-span of the collaborative workplace

- Replacing the value for the CW_Life-span (ISO/IEC 19778-1:2008, *DE* 1.4) *DE* instantiation appropriately.

C.3.3 Assigning participants to the collaborative group

- Selecting appropriate *participants* for the specified *roles*.

- Accordingly replacing all values for CG_Participant_ID-Ref (multiple ISO/IEC 19778-3:2008, *DEs* 2.2.2.2).

  NOTE If it is the intention to assign the same *collaborative group* to a collaborative task of corresponding application type, the values for CG_Participant_ID-Ref could be adopted instead of replaced; however, this does only work within the same application range where the reused *DM instantiations* had been defined.

- Assigning appropriate permissions to the *participants*.

- Possible further actions, like informing the *participants* regarding their obligations and permissions, initializing any used workflow monitoring system, etc.

C.3.4 Assigning collaborative tools and collaborative functions to the collaborative environment

In general, this means adapting the *collaborative environment* specification (found in the reused *collaborative environment DM instantiation*) to the locally available technical infrastructure and to what is appropriate for and preferred by the *participants* in order to enable them to perform their obligations.

It should be noted that *participant* identifiers and names for *roles*, *collaborative tools*, and *collaborative functions* are expected to constitute references to associated instantiations of *Data Models* based on further specifications or standards. Where such specifications are not available, these references point into the (hopefully consistent) mindset of the community using the *collaborative workplace*.

The required actions for reusing a set of *collaborative workplace DM instantiations* address a wide field of standardization and specification, that is far beyond the scope of ISO/IEC 19778, however significantly contribute to the potential of using ISO/IEC 19778. Actually, these actions constitute a "best fit" and fuzzy optimization task for combining *participants* with *roles*, *collaborative tools* and *collaborative functions* in the context of a collaborative task.

For such an optimization task, a basis could be a specified application model and a harmonized *role* typology, that in combination would allow to specify the intended collaborative task. This specification might be performed in an implementation neutral way (e.g. based on *collaborative effects*, which abstract from *collaborative functions* and *collaborative tools*).

Another specification or standard might be available, that provides alternatives and options for implementing *collaborative effects*, based on *collaborative functions*. These options may assign effectivity values to such mappings between *collaborative effects* and (combinations of) *collaborative functions*.

The specification of *collaborative tools* might include information, which *collaborative functions* (with which support effectiveness values) are provided, and which usage requirements exist.

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In *participant* information specifications or standards, stated capabilities and requirements of *participants* might be included, and instantiated for *participants* as *DM instantiations*.

It is evident, that such an optimization task is really complicated and requires significant harmonization across rather interdisciplinary domains. Currently, optimizations as outlined above are done by humans (e.g. the administrators of learning management systems, supported, e.g. by the responsible educators). Any automated support for these responsible humans will help them in performing better. On the long run, an effective automated support would improve the performance of *collaborative groups* and the overall collaborative learning processes.

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