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**Information technology — Learning, education and training —
Collaborative technology — Collaborative workplace — Part 2:
Collaborative environment data model**

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Foreword

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This second/third/... edition cancels and replaces the first/second/... edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

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*
- *Part2: Collaborative environment data model*
- *Part3: Collaborative group data model*

Introduction

The multipart standard ISO/IEC JTC1 19778 Information technology - Learning, education and training - Collaborative Technology – Collaborative Workplace provides data models for specifying *collaborative workplaces* and their components. This standard, Part 2 of the multipart standard ISO/IEC 19778 Information technology - Learning, education and training - Collaborative technology - Collaborative workplace specifies the *collaborative environment* or the service aspects of the *collaborative workplace*.

The concept of a *collaborative workplace* is described in ISO/IEC 19778 Part 1, while aspects related to *participants* and *collaborative group* members of the *collaborative workplace* are specified in ISO/IEC 19778 Part 3.

The specification of the *collaborative workplace* as an entity and the definition of its two main components are provided in the first three Parts of the multipart standard ISO/IEC 19778 Information technology - Learning, education and training - Collaborative technology - Collaborative workplace:

Part 1: **Collaborative workplace data model:** specifies the *collaborative workplace* generally - being provided as a separate Part.

Part 2: **Collaborative environment data model:** describes the *collaborative services* of a *collaborative workplace* - this document.

Part 3: **Collaborative group data model:** specifies attributes for *participants* and members of a *collaborative workplace* - being provided as a separate Part.

Information technology — Learning, education and training — Collaborative technology — Collaborative workplace — Part 2: Collaborative environment data model

1 Scope

This document, Part 2 of ISO/IEC 19778 **Collaborative environment data model** - of the multipart standard ISO/IEC 19778 specifies the data model for a *collaborative environment*.

The purpose of this Standard is:

- to provide a standardized way of defining and instantiating, as an independent entity the service(s) and associated entities of a *collaborative workplace*. (This is done by associating these services and entities with a *collaborative environment* identifier unique within a particular domain or application context); and
- to specify the technical and infrastructural requirements of a *collaborative workplace* for the purpose of set-up, employment, management, administration, and evaluation of its *collaborative environment*.

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 11404 Information technology -- Programming languages, their environments and system software interfaces -- Language-independent datatypes.
- ISO/IEC 10646:2003 Information technology -- Universal Multiple-Octet Coded Character Set (UCS).
- ISO 8601:2004 Data elements and interchange formats – Information interchange – Representation of dates and times.
- RFC 3986 - Uniform Resource Identifiers (URI): Generic Syntax (see <http://www.ietf.org/rfc/rfc3986.txt>)

3 Terms and Definitions

NOTE The terms defined here are closely interrelated. When a term is utilized anywhere in this document as defined in this list, that term is *italicized*.

3.1 Collaborative effect

A particular intended result supportive or constitutive of learning that can be achieved through the use of a *collaborative service* or a *collaborative tool*.

3.2 Collaborative environment

One or more *collaborative service(s)* provided within a *collaborative workplace*, for the purposes of supporting the *collaborative activities* of a *collaborative group*.

3.3 Collaborative function

An elementary functionality or capability provided for members of a *collaborative workplace* 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 a voice communication function and a text-based chat function) which could also be provided individually, through separate *collaborative tools*.

3.4 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*.

3.5 Collaborative service

One or several *collaborative tools* provided in a *collaborative environment* and administered as a single, compound set.

NOTE *Collaborative services* are based on *collaborative tools* and additionally provide communicative functionalities for employing these tools in a *collaborative workplace*.

3.6 Collaborative tool

Hardware, and related software and data providing one or multiple *collaborative functions* for several or all members of a *collaborative workplace*.

3.7 Collaborative workplace

That which is instantiated as an independent entity, comprising the *collaborative activities* of a *collaborative group* defined in relationship 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*.

3.8 Participant

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

3.9 Role

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

3.10 Smallest Permitted Maximum (SPM)

A declaration regarding the upper limit of the size of a data element value, which has a variable size.

Typical data elements whose specifications define SPMs are character strings, records, arrays, bags, sets, and the kind.

Generally, this term designates different concepts depending on the application of the data element, such as:

- For data elements in data model instances, the SPM specifies the upper size limit for a permissible value (i.e. data element values conforming to the standard shall not exceed this size limit); or
- For applications using the value of a data element, the SPM specifies the lowest permissible size limit regarding the capability of the application (i.e. applications conforming to the standard shall be able to handle data element values up to this size limit, or larger).

In the context of this Standard, SPM values are solely used for data elements in data model instances.

4 Conformance

These conformance specifications are concerned solely with the conformance of data model instances themselves (in contrast to, e.g., conformance specifications regarding applications which may use such data model instances).

A conforming *collaborative environment* data instance shall be an instance of the data model as defined in section 5.

5 Data Model

5.1 Notation

The following tabular notation is used in the data model.

Table 1 — The Tabular notation for the data model

No.	Name	Explanation	Presence Type	Multi	Datatype	Example

For each data element that has a value domain (i.e. that is not simply an aggregate or container for other, subordinate elements), the following information is provided:

No.: An alpha-numerical value associated with the data element. An element may be composed of sub-elements, and this numbering scheme reflects these relationships.

Name: A title for the element.

Explanation: A definition of the element. An asterisk (*) indicates that the explanation has been adapted from Dublin Core (ISO 15836) data element definitions.

Presence Type: Indicates, for conformance purposes, the conditions under which an element is to be provided:

- M = Mandatory Element. Must be provided in a conformant data instance or record.
- CM = Conditional Mandatory. Elements which must be provided only under certain conditions (e.g. a parent element must be provided when a sub-element is populated).
- O = Optional Element. Elements which can be included in an instance, but are not mandatory.

Multi: Multiplicity of the element:

- Number = the number of times the data element can occur (i.e. its “cardinality”).
- [Number1 .. Number2] = specifies a range for the cardinality of the data element (i.e. from Number1 up to Number2). Note that “*” is used in the context of this notation to indicate “unbounded.”

e.g.,

- [1..10] one to 10 instances of the element are acceptable
- [0..10] 0 to 10 instances of the element are acceptable
- [0..*] 0 to an unlimited number of instances of the element are acceptable

Multiplicity of an element implies that all sub-elements repeat with the parent element.

Datatype: A property of distinct values, indicating common features of those values. Where possible, these datatypes are taken from ISO/IEC 11404:

- Char - characterstring(ISO/IEC 10646:2003) (ISO/IEC 11404)
- T/D - Time Interval (ISO 8601:2004)

NOTE “Agg” designates an aggregate data element, having no value, value space or datatype, but having one or more leaf elements subsumed hierarchically underneath it.

Example: Possible value for the given element.

5.2 Collaborative environment data model

5.2.1 Relational description

Figure 1 (below), shows the *collaborative environment* data model (bounded by a dashed line) as specified in this Standard. This diagram also indicates specifications or standards which are as of yet unidentified and out of scope for this standard, but which may play a significant role in its implementation.

The following graphical conventions are used in this diagram:

- boxes with a solid outline are data elements as defined in this Standard
- boxes with a dashed outline are standards or specifications

Lines or arrows (and the notation appearing next to them) describe the relationships among elements, and between elements and specifications or standards:

- An arrow joining two boxes indicates that they are related hierarchically, as parent (super-ordinate) and child (sub-ordinate) entities:

- The box at the arrow's origin is the parent (super-ordinate) data element, standard or specification.
- The box to which the arrow points is the child (sub-ordinate) data element, standard or specification.
- The notation appearing next to the origin or end of the arrow indicates the multiplicity of the adjacent data element, standard or specification:
 - "1" next to the origin of the arrow indicates that any of possibly multiple relations applies to a single instance of (possibly multiple) parent (super-ordinate) data elements. The notation next the end of the arrow applies to any of such (possibly multiple) relations.
 - "1" next to the end of the arrow indicates that exactly one instance of the corresponding element, standard or specification is related to any parent (super-ordinate) data element.
 - "0..1" is used only in conjunction with data elements, indicating that the data element is optional, and that if it is used, only a single instance shall exist.
 - "1..*" is also used only in conjunction with data elements, and indicates that the data element is mandatory, and that one or more instance(s) of that element may exist.

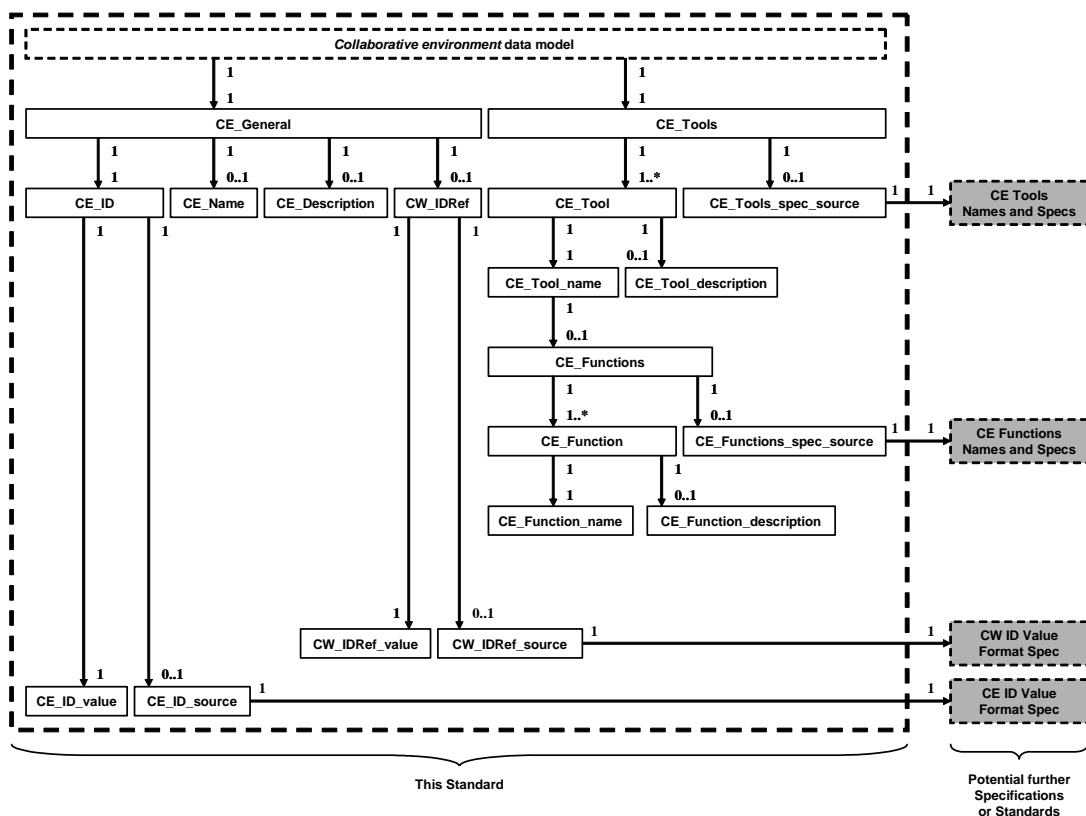


Figure 1 — Collaborative environment data model and external specifications

As indicated above, all of the data elements and interrelationships that comprise the collaborative environment data model are indicated within the framed area on the left of Figure 1. At the highest level, the collaborative environment data model is divided into two sub-structures:

- The sub-structure specifying the collaborative environment as a whole (sub-structure CE_General); and

- the sub-structure specifying the components of the *collaborative environment*: the *collaborative tools* and the *collaborative functions* (sub-structure CE_Tools).

The "potential" specifications and standards provided on the far right of the diagram are those which have either not yet been fully developed, or which are not yet widely recognized in the use of Information and Communication Technologies (ICTs) in learning, education and training. Their development is seen as dependent on experience and practices that are only gradually emerging through the widespread use of ICTs in collaborative and other forms of learning. These potential specifications or standards could serve as sources or namespaces that provide values for specific *collaborative environment* data model elements. Should these kinds of specifications or standards eventually be developed or identified, the degree to which data model instances conforming to the this Standard could be reused would be substantially increased.

In the case of ISO/IEC 19778 Part 2, these "potential specifications or standards" are seen as addressing two issue in this data model (a further issue of this kind, regarding **roles**, is addressed in the Part 3 of this multipart standard ISO/IEC 19778):

- The value domains (designations and particularly definitions) for tool names and for function names (see CE_Tool_name and CE_Function_name, respectively), including the specification of the associated *collaborative tools* and *collaborative functions*.

Achieving international agreement on a harmonized list or taxonomy of kinds of *collaborative tools* and types of *collaborative functions* in ICT-supported LET is likely to be difficult, and cannot be undertaken without drawing from a broad range of experience and practice – extending well beyond the scope of collaborative learning. One of the goals of this Standard is to facilitate the acquisition of such experience in the context of structured and standardized systems. This, in turn, should allow for further systematization and harmonization of typologies, functionalities and their effects.

- Identifiers and identifier references.

Globally unique identifiers are already in use in many fields of technical application. The standardized creation and management of such identifiers for ICT-supported learning, education, and training (LET) has been gradually emerging. However, this use has yet to become a matter of formalized consensus.

5.2.2 Tabular description

Table 2 — *Collaborative environment* data model

No	Name	Explanation	Presence Type	Multi	Datatype	Example
E1	CE_General	Information describing the <i>collaborative environment</i> as a whole	M	1	Agg	-/-
E1.1	CE_Name	A title or name by which the <i>collaborative environment</i> is generally known.	O	1	Char SPM: 100	Computer Graphics Exercises

E1.2	CE_Description	An account of the <i>collaborative environment</i>	O	1	Char SPM: 4000	Environment for collaborative work on Computer Graphics exercises
E1.3	CE_ID	An identifier for the <i>Collaborative environment</i>	M	1	Agg	-/-
E1.3.1	CE_ID_source	The name or URI of the identification scheme used to generate the value of the <i>collaborative environment</i> identifier. A namespace scheme.	O	1	Identifier_type	http://www.gris.informatik.tu-darmstadt.de/idformats/identifier_type.pdf
E1.3.2	CE_ID_value	Value of the <i>collaborative environment</i> identifier	M	1	Identifier_type	de_tu-darmstadt_informatik_gris_20060707_13582578
E1.4	CW_IDRef	<i>Collaborative workplace</i> identifier reference	O	1	Agg	-/-
E1.4.1	CW_IDRef_source	The name or URI of the identification scheme used to generate the value of the <i>collaborative workplace</i> identifier reference. A namespace scheme.	O	1	Identifier_type	http://www.gris.informatik.tu-darmstadt.de/idformats/identifier_type.pdf
E1.4.2	CW_IDRef_value	Value of the <i>collaborative workplace</i> identifier reference	CM	1	Identifier_type	de_tu-darmstadt_informatik_gris_20060910_10141733
E2	CE_Tools	Specification of the <i>collaborative tools</i> of the <i>collaborative environment</i>	M	1	Agg	-/-

E2.1	CE_Tools_spec_source	URI of the specification of permissible <i>collaborative tools'</i> names and specifications. A namespace scheme.	O	1	Identifier_type	http://www.gris.informatik.tu-darmstadt.de/tools.pdf
E2.2	CE_Tool	<i>Collaborative tool</i> specification	M	[1...]	Agg	
E2.2.1	CE_Tool_name	Name of the <i>collaborative tool</i>	M	1	Char SPM: 100	Chat
E2.2.2	CE_Tool_description	Description of the <i>collaborative tool</i>	O	1	Char SPM: 4000	Proprietary tool
E2.2.3	CE_Functions	Specification of the <i>collaborative function(s)</i> of the <i>collaborative tool</i>	O	1	Agg	
E2.2.3.1	CE_Functions_spec_source	URI of the specification of permissible <i>collaborative functions'</i> names and specifications. A namespace scheme.	O	1	Identifier_type	http://www.gris.informatik.tu-darmstadt.de/functions.pdf
E2.2.3.2	CE_Function	<i>Collaborative function</i> specification	CM	[1...]	Agg	
E2.2.3.2.1	CE_Function_name	Name of the <i>collaborative function</i>	CM	1	Char SPM: 100	Upload
E2.2.3.2.2	CE_Function_description	Description of the <i>collaborative function</i>	O	1	Char SPM: 4000	File upload function

5.2.3 Textual description

5.2.3.1 Data element CE_General

This sub-structure groups the general information that describes this *collaborative environment* as a whole.

5.2.3.2 Data element CE_Name

Name given to the *collaborative environment*.

NOTE This name is solely intended for human use.

5.2.3.3 Data element CE_Description

Description of the *collaborative environment*.

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

5.2.3.4 Data element CE_ID

The *collaborative environment* identifier serves as a lable for a *collaborative environment* data model instance (for allowing the reference from the associated *collaborative workplace* data model instance, or from external objects).

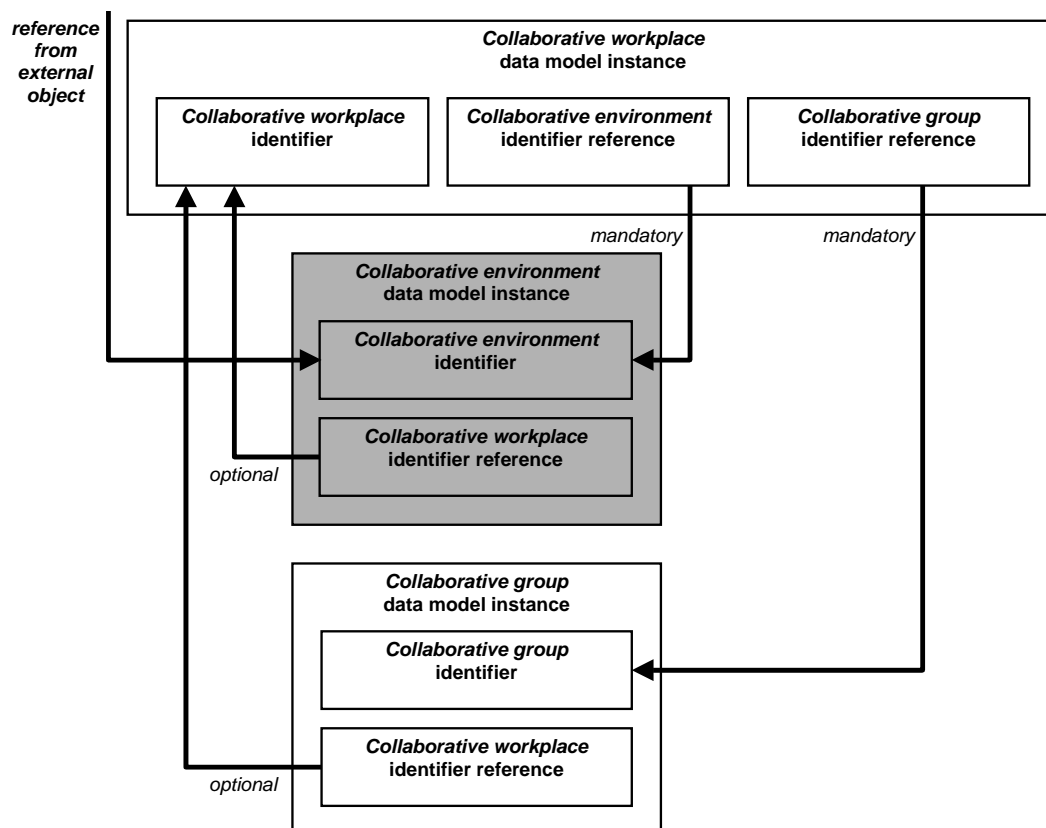


Figure 2 — Linkages between the *collaborative environment*, the associated *collaborative workplace*, and the associated *collaborative group*

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

5.2.3.5 Data element CE_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 environment* 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 uniqueness of the used *collaborative environment* 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 instances only) restrict the SPM value for the number of characters of the character string, etc.

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

NOTE This data element is optional (and not mandatory) in order to allow simple applications of this data model, where the practicing community takes care that the *collaborative group* identifier values are unambiguous.

5.2.3.6 Data element CE_ID_value

This data element represents both:

- The identifier of this *collaborative environment* instance; and
- The identifier-based reference to the *collaborative workplace* which is associated with this *collaborative environment* instance.

This identifier shall be unique at least within the application range of this data model instance.

5.2.3.7 Data element CW_IDRef

A reference to the data model instance of the *collaborative workplace* the *collaborative environment* is associated with. This reference is specified by providing the identifier of the data model instance of the *collaborative workplace*. This data element directly links the *collaborative environment* with its associated *collaborative workplace*, and indirectly (via the *collaborative workplace* link) links the *collaborative environment* with its associated *collaborative group* (see Figure 2).

This identifier reference is optional, as in diverse use cases, this reference might not be required.

5.2.3.8 Data element CW_IDRef_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; and
- The URI provides access to the regulations regarding the format of the admissible *collaborative workplace* 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 instances only) restrict the SPM value for the number of characters of the character string, etc.

NOTE This data element is optional (and not mandatory) 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.

5.2.3.9 Data element CW_IDRef_value

This data element represents the identifier of the associated *collaborative workplace* data model instance. This identifier shall be unique at least within the application range of this data model instance.

5.2.3.10 Data element CE_Tools

This sub-structure specifies the composition of the *collaborative environment* regarding its *collaborative tools* and their provided *collaborative functions*. It does this by firstly specifying the *tools* and secondary describing the *functions* provided by those.

NOTE This "tools-first" approach is taken in order to make it easy to use this Standard without much further community harmonization activities. In a given system, the available tools are usually well known and named, while the achievement of a harmonized set of non-overlapping functions requires quite a lot of experience and time.

5.2.3.11 Data element CE_Tools_spec_source

The value of this data element specifies the URI of the source where the specification of *collaborative tool* names and specifications is provided. 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 uniqueness of the used *collaborative tool* names within this community; and
- The URI provides access to the value domain of the admissible *collaborative tool* names and the specification of the *collaborative tools* associated with these names.

NOTE The format of such value domain and specification is not specified in this Standard. Particularly, it is left open whether such regulations are appropriate for automated use or just for human reading, understanding, and observance.

5.2.3.12 Data element CE_Tool

The designation of a particular *collaborative tool*.

5.2.3.13 Data element CE_Tool_name

The designation of a particular *collaborative tool*.

NOTE 1 The specification of the *collaborative tool* which is associated with this name is provided at the *collaborative tools spec source* URI.

NOTE 2 Any desirable standardization of *collaborative tool* names and specifications requires the evaluation of a sufficient amount of experiencing in practice.

5.2.3.14 Data element CE_Tool_description

The description of the *collaborative tool*

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

5.2.3.15 Data element CE_Functions

This sub-structure specifies the equipment of a *collaborative tool* regarding its provided *collaborative functions*.

5.2.3.16 Data element CE_Functions_spec_source

The value of this data element specifies the URI of the source where the specification of *collaborative function* names and specifications is provided. 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 uniqueness of the used *collaborative function* names within this community; and
- The URI provides access to the the value domain of the admissible *collaborative function* names and the specification of the *collaborative functions* associated with these names.

NOTE The format of such value domain and specification is not specified in this Standard. Particularly, it is left open whether such regulations are appropriate for automated use or just for human reading, understanding, and observance.

5.2.3.17 Data element CE_Function

The designation of a particular *collaborative function*. Annex A provides a list of examples for what could such functions look like. Though being well-considered, it also shows, that the value space for *collaborative functions* is not at all a trivial issue.

5.2.3.18 Data element CE_Function_name

The designation of a particular *collaborative function*.

NOTE 1 The specification of the *collaborative function* which is associated with this name is provided at the *collaborative functions* spec source URI.

NOTE 2 Any desirable standardization of *collaborative function* names and specifications requires the evaluation of a sufficient amount of experiencing in practice.

5.2.3.19 Data element CE_Function_description

The description of the *collaborative function*.

6 Auxiliary data types

6.1 Identifier_type

Values of datatype *identifier_type* are based on datatype *characterstring(iso-10646-1)* with an SPM of 250 characters.

This data type is provided for identifiers that identify a single object and possibly one or more exact equivalents. These identifiers shall be unique within the context in which such objects are utilized. The character string shall conform to the syntax for Uniform Resource Identifiers (URIs) as defined by RFC 3986.

Annex A (informative)

Examples for collaborative functions

NOTE This listing is based on the document SC36 WG2 N0077, "Abstract Collaborative Workplace Conceptual Architecture Contribution," submitted by a "US Expert," 2004-08-20.

A.1 Instant messaging

Instant Messaging (IM) is a mechanism to alert users when other users are on line and allows them to communicate with each other in real time through private online chat areas. With IM, a user or facilitator creates a list of users with whom communication is desired. When a user on the list is on line and makes a request, other users are alerted and communication is immediately established with the requesting user. Businesses and learning institutions both are starting to employ IM to increase collaboration efficiency and make expertise more readily available to groups of users. Although primarily considered a synchronous mode of collaboration, IM transactions can be stored for later review by other users, enabling an asynchronous use for IM. When used in an asynchronous mode, IM transactions may serve as a basis for a discussion thread.

A.2 Presence awareness

Presence Awareness is the ability of a user to determine who is on line at a given instant in time. Presence Awareness is inherent part of IM and the various forms of Chat in synchronous modes. Some Collaborative Workplace implementations of Presence Awareness use a list of available on-line participant users known as a "buddy list" to determine who is online at any given moment. Through the use of Presence Awareness, a user can identify other users who are on-line.

A.3 Chat

Chat is an abbreviation for conversational hypertext access technology. It is a form of synchronous interactive online typewritten communication allowing users to engage in text-message conferencing. This implies real-time computer networking over designated communications facilities known as "chat rooms". When using Chat, a user message is instantaneously relayed to all other users logged into the chat room. User replies are also instantaneously relayed to the originator and all other users. Chat is also used for private communications between a subset of participants, for example communications between 2 of 20 participants.

A.3.1 Persistent chat

Persistent Chat is a variation of Chat. Like Chat, Persistent Chat is a form of synchronous interactive online typewritten communication allowing users to engage in text-message conferencing. This implies real-time computer networking over designated communications facilities known as "chat rooms". When using Persistent Chat, a user message is instantaneously relayed to all other users logged into the chat room. User replies are also instantaneously relayed to the originator and all other users. However, Persistent Chat messages posted by collaboration participants remain visible, or at least retrievable, indefinitely. In this context, Persistent Chat is an asynchronous form of Chat. In some Collaborative Workplace implementations, Persistent Chat serves as a basis for threaded discussions.

A.3.2 Multi-chat

Multi-Chat is a variant of Chat. Like Chat, Multi-Chat is a form of synchronous interactive online typewritten communication that allows users to engage in text-message conferencing. Multi-Chat allows a user to

participate in multiple simultaneous Chat sessions using a single interface. It provides a way to monitor and collaborate with many users in multiple Chat rooms. Like Persistent Chat, some Multi-Chat implementations allow for persistence of messages, where messages are displayed or can be retrieved for an indefinite period of time.

A.3.3 Broadcast chat

Broadcast Chat is a variant of chat. Like Chat, it is a form of synchronous interactive online typewritten communication that allows users to engage in sending text-messages. Broadcast Chat is one-way communication intended to send a chat message to multiple chat sessions simultaneously. It is generally used for announcements or alerts that apply to most or all users. In most implementations, a dedicated user or facilitator can send the chat message to all of the chat sessions, but users of those sessions are typically not able to respond.

A.3.4 Ticker

A Ticker is another variant of Chat. This is another special case of Chat similar to Broadcast Chat in that it gives privileged users the ability to post messages that are visible to all logged-in users. It differs from Broadcast Chat in that the messages posted are usually displayed outside of the currently used chat tool itself. Ticker is also a one-way means of communication. There is no way for receiving users to interact with the Ticker application or the sender of the message.

A.4 Polling/surveying

Polling / Surveying is intended to provide the ability for a user to request a vote from other collaboration participants. In some implementations, a collaboration session leader or a key decision maker will post a question to participants in a collaboration session. Participants will be presented with a list of possible reactions (usually 'yes' or 'no'). Upon answering, individual user selections may be visible to all, to a privileged few, or the overall result may be displayed. This can be done in synchronous or asynchronous modes.

A.4.1 Emoticons

Emoticons are considered a special case of Polling or Surveying. Emoticons are intended to enable users in synchronous collaborative sessions to select or type specific icons that depict typical human actions, such as hand raising, applauding, frowning, laughing, etc. that can be displayed to other collaboration users. Typical implementations of emoticons are used to convey sentiment or emotion in a collaborative environment where modes to express body language and voice inflections are not available. It provides users a non-interruptive way to participate and register their reactions to subjects or discussions in real time. Emoticons can be simple keyboard characters such as :>), or special characters or icons created for a specific implementation.

A.5 Whiteboard

Whiteboards are normally a synchronous communications device that displays graphics, as well as text, in a window on all user computer screens in a collaborative environment. It's like sharing a window from a paint program, but far more efficient, as it usually includes specific options customized for interactive communication. Typically, users can type, draw or cut and paste onto the whiteboard, and all of the other participants can see it. In several Collaborative Workplace implementations, whiteboards are a principal component of teleconferencing applications because they enable visual as well as audio communication. Normally, Whiteboards exist synchronously for a real-time collaboration session. A Whiteboard usually has a way to save the contents displayed.

A.5.1 Persistent whiteboard

Persistent Whiteboard is a special case of Whiteboard. Like a Whiteboard, a Persistent Whiteboard is normally a communications device that displays graphics, as well as text, in a window on all user computer

screens in a collaborative environment. However a Persistent Whiteboard remains available for an indefinite period and constantly reflects the latest changes made to it by a user. Some Collaborative Workplace implementations utilize Persistent Whiteboards in an asynchronous manner to allow users to add to or update the contents as need be over time. It allows individual users to participate in specifically designed group activities without the entire group being present. As with Whiteboards, a Persistent Whiteboard normally has a way to save the contents displayed.

A.5.2 Geo-registered whiteboarding

Geo-Registered Whiteboarding is a special case of Whiteboard. Like a Whiteboard, a Geo-Registered Whiteboard is normally a communications device that displays graphics, as well as text, in a window on all user computer screens in a collaborative environment. However, a Geo-Registered Whiteboard also provides the ability to import or paste in graphical data that includes geographical information (e.g., Lat./Long.). In some implementations of Collaborative Workplace, Geo-Registered Whiteboards are used to pinpoint the geo-location of participants. Other implementations use Geo-Registered Whiteboards to pinpoint a geographical area of study.

A.6 Application sharing

Application Sharing allows a host user or facilitator to select one or more of the applications resident on the host user computer and make it available to other participants. All participants may then manipulate or control the shared application as if it were executing on their own computers. The application however, remains running on the host user's computer. It is just the graphical output, and potentially the other participant users input, that is made available to others. Several Collaborative Workplace implementations use Application Sharing to allow multiple users to update a single document interactively. Other Collaborative Workplace implementations use Application Sharing to allow a user having trouble with an application (even their OS) to allow another remote user to have control, normally for troubleshooting application problems, correcting application or OS problems, or just for educating users on an application.

A.6.1 Application following

Application Following is a special case of the Application Sharing. It allows a host user to select one or more of the applications resident on the host user computer and make it available to other user participants in a collaborative space. However Application Following does not allow other the other participants to control the host user's application. Application following is normally used in conjunction with other collaborative elements to provide real-time feedback. Most Collaborative Workplace implementations use Application Following when the host user is presenting information to other user participants, a PowerPoint briefing for example.

A.6.2 Application broadcasting

Application Broadcasting is another special case of Application Sharing. Application broadcasting allows a host user to select one or more of the applications resident on the host user computer and make it available to other user participants in a collaborative space. Like Application Following, Application Broadcasting does not allow other the other participants to control the host user's application. However, Application Broadcasting is one-way. No collaborative elements are used to provide real-time feedback. Most Collaborative Workplace implementations use Application Broadcasting when the host user is presenting information to other collaborative participants on a large scale numbering in the hundreds or thousands.

A.7 Desktop sharing

Desktop sharing is intended to allow remote access to a host computer by all users in a collaborative environment. Although similar to Application Sharing, Desktop Sharing allows access to most if not all of the resources found on the host computer. This includes all of the applications, data and processing power of the host computer. All participants have the ability to launch, manipulate and control an application on the host computer; access, use and or store data on the host computer; and use a host computer's processor to run

applications from other computers. Desktop Sharing also allows all participants to simultaneously view the interactions involved with Desktop Sharing.

A.8 File sharing

File Sharing is the sharing of computer data or space on a network. File sharing allows multiple users or related collaborative applications to use the same file by being able to read, modify, copy and/or print it. Files to be shared may reside on a server, or a user's computer. Several Collaborative Workplace implementations use collaborative applications that include the ability to upload, download, share files and use these files in applications to share a particular view of the file contents. Other Collaborative Workplace implementations use whiteboard applications that have the ability to open and use files, and save the files used with modifications made.

A.9 Shared storage

Shared Storage provides multiple collaborative users with a common place for the placement, access and management of data objects. This is perhaps one of the most common and basic of all collaboration elements. A common place to upload and download files is a necessity for any Collaborative Workplace. It provides the basis for the exchange of documents, images, video, collaborative logs and the applications necessary to instantiate a Collaborative Workplace e-environment. Most Collaborative Workplace implementations of Shared Storage use network servers as the common place to upload, store and download files accessed by portals, portlets or related collaborative applications.

A.9.1 Distributed product management

Distributed Product Management is similar to shared storage except that users are provided a mechanism that can automatically track changes to and provide versions of documents, code or other collaboratively developed artifacts. Distributed Product Management could also provide the capability for participants or facilitators to split documents into smaller pieces which could be separately tracked and controlled, with the capability to collate into a single product at upon request. Distributed Product Management facilitates the control of large, complex documents, or code.

A.10 File transfer

File Transfer is the process of using communications to send a file from one computer to another. This is another common and basic of all collaboration elements. In Collaborative Workplace e-environments, a protocol, FTP or HTTP for example, must be agreed upon by sending and receiving computers before a file transfer can occur. File Transfer can move files from one storage medium location to another, from a storage medium to a program, or a program to a storage medium. Several Collaborative Workplace implementations use File Transfer to send files from one participant to another participant or set of participants. Several implementations also use File Transfer to retrieve relevant subject matter files from the Internet and share these files with other users.

A.11 Shared calendars

Shared Calendars provides a group of participants a common calendar that all may directly interact with. Shared Calendars usually provides a common schedule that all users can view and possibly manipulate. In Collaborative Workplace implementations, Shared Calendars are used to record the meetings and deadlines of a group of users that relate to the needs and goals of the collaborative efforts. Shared Calendars also make it possible to quickly set meetings according to each participant's availability. Some Collaborative Workplace implementations allow users to query the availability of other users and/or resources at given dates and times.

A.12 Real-time multipoint audio

Real-Time Multipoint Audio provides users the ability to participate in audio conferences with multiple participants in a duplex mode. Real-Time Multipoint Audio is essentially the same as a Teleconference, except that participants are able to use their computers instead of their telephones. The use of streaming technologies is paramount in the implementations of Real-Time Multipoint Audio. Some Collaborative Workplace implementations use Real-Time Multipoint Audio in the context of Chat, where groups of participants collaborate in virtual “audio” Chat rooms using audio instead of text. Other Collaborative Workplace implementations couple Whiteboard applications with Real-Time Multipoint Audio.

A.13 Real-time multipoint video

Real-Time Multipoint video is similar to Real-Time Multipoint Audio, except it provides users the ability to participate in video conferences with multiple participants. It also allows users to simultaneously utilize the thousands of Web Cameras transmissions freely available on the internet. As with Real-Time Multipoint Audio, the use of streaming technologies is paramount in the implementations of Real-Time Multipoint Video. Some Collaborative Workplace implementations use an individual camera connected to a user’s computer to transmit video imagery. Some Collaborative Workplace implementations also use Real-Time Multipoint Audio in conjunction with Real-Time Multipoint Video.

A.14 Audio broadcast

Audio Broadcast provides a participant user or facilitator the ability to send audio to many or all other participants, but does not allow the other participants responses to be heard by the sending user or facilitator. Although Audio Broadcast messages are delivered in a synchronous collaborative environment, the Audio Broadcast message could be a file to be played at a later time to those users not on-line when the message is played. Audio Broadcast messages could also be a file that is transmitted at certain points or time during a collaboration event. Several Collaborative Workplace implementations use Audio Broadcast for making announcements. Other implementations use Audio Broadcast to conduct informational briefings. Some implementation use Video Broadcast in conjunction with Audio Broadcast.

A.15 Video broadcast

Video Broadcast is similar to Audio Broadcast service but provides for video instead of audio. Video Broadcast may include standard participant video from their computer, but may also include any one of the thousands of available Internet surveillance cameras. Although Video Broadcast streams are delivered in a synchronous collaborative environment, the Video Broadcast could be a file to be played at a later time to those participants not on-line when the broadcast is made. A Video Broadcast could also be a file that is transmitted at certain points or time during a collaboration event. Some Collaborative Workplace implementations use Audio Broadcast in conjunction with Video Broadcast.

A.16 Discussion board

A Discussion Board is a communication tool, which allows users and facilitators to post messages, which can be read and replied to by other users and facilitators. Discussion Boards are designed for asynchronous use, where users and facilitators are not present at the same time. Messages posted to a Discussion Board are commonly grouped into threads, containing a main posting and all related replies. Typically, messages are logged and organized into threads, that contain a main posting, defined by the Course Instructor, and all related replies.

A.17 E-mail

e-mail is short for electronic mail. Basically it is the transmission of messages over communications networks. The messages can be notes entered from the keyboard or electronic files stored on disk. Most mainframes, minicomputers, and computer networks have an e-mail system. Some electronic-mail systems are confined to a single network, but others have gateways to other computer systems, enabling users to send electronic mail anywhere in the world.

A.18 Audio to text/text to audio

Audio to Text is considered a translation service translating audio into text in real-time for display. Text to Audio is also considered a translation service translating text into audio in real-time for broadcast. This combination provides users in bandwidth-constrained environments, or users without audio equipment including those with accessibility issues, the ability to “see” audio collaboration and to respond interactively.