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Information technology — Learning, education and training — Conceptual Reference Model for Competency Information and Related Objects

Technologies de l'information — Apprentissage, éducation et formation — Modèle de référence conceptuel pour compétences et objets liés

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Contents

Page

LIST OF FIGURES

LIST OF TABLES

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.

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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.

In exceptional circumstances, when the joint technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may propose the publication of a Technical Report. A Technical Report is entirely informative in nature and shall be subject to review every five years in the same manner as an International Standard.

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 TR 24763 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 36, *Information technology for learning, education and training*.

0 Introduction

0.1 General

There are currently several existing and implemented models providing competency information related to learner knowledge, skills, capabilities, qualifications, performance, learning objectives, and other related objects. Some of these models do not interoperate because of lack of clarity or consistency of the semantics. The primary purpose of this Technical Report is to provide an information technology for learning, education and training (ITLET) Conceptual Reference Model (CRM) that will support consistency and enhance understanding and interoperability of various existing competency information models across learning, education and training (LET) communities.

This Technical Report provides both the ITLET Conceptual Reference Model and a process that may be used to compare and enable exchange of data between heterogeneous information models across LET communities. The ITLET Conceptual Reference Model is a common reference point against which divergent and incompatible sources of information can be compared and, ultimately, harmonized. It may also be used as a basis for the assembly of new models and related standardization work.

The standardization concept is that the ITLET Conceptual Reference Model can be used as a “fundamental level” of modelling to complement the currently accepted levels of 1) semantic model or meta-model, 2) information model, 3) data model. It defines a framework for building potential information models related to competencies as represented in LET information technology systems by providing classes and properties that are common across multiple use cases and mappings of existing metadata onto these classes. These classes and properties provide reference points for attributes and information structures included in the information models. The information models in turn can be used to develop frameworks that may be used to develop bindings to specific data structures and formats.

This Technical Report provides a common model and format to clarify the logic of information types and relationships that are used in LET information technology systems underlying the information systems related to competencies that are used by LET organizations and their respective communities. It is important to note that this Technical Report aims to clarify the logic of information types and relationships that are used in information technology systems by LET organizations and their communities in order to manage, develop, describe, transfer or assess competency information or other related objects. This Technical Report is primarily informative in content.

Challenges that have been identified include (but are not limited to) the need for competency standards to:

- accommodate complex competency information structures,
- provide adequate linkages to competency information that resides within different IT systems,
- provide support for comparisons of competency information, across diverse communities and contexts, and
- allow for the monitoring and updating of competency information related to individual learners.

IT systems managing competency information face many challenges, such as the following.

- There is no single definition of competency that is accepted by all. Instead, there are many definitions, using different structures and vocabularies, describing different levels of competency.
- It has even been suggested that competency is an unobservable entity, and therefore that it cannot be traced, measured or recorded.

- IT systems may be designed, developed, and implemented with specific labels for competency information in mind, according to the context in which it is used (see Clause 8).

- IT systems need to provide cost-effective support for the description of competencies at multiple levels of abstraction and in various formats.

- IT systems may need to comply with international, national and regional legislative requirements.

- Competency information may be associated with identifiable individuals, and could be used to make decisions related to employment, advancement, admission, accreditation, etc. When competency information is related to an identifiable individual, then privacy protection of this individual is essential.

Therefore, competency information standards should protect the privacy and integrity of that information. They should allow flexible methods for sharing that information under the control of the person or people described by that information. There is also a need to aggregate and normalize information about the competency of multiple individuals to support decision-making by organizations. Therefore, competency standards should support the description of competencies at multiple levels of abstraction. Many stakeholders have an interest in competency information, all with different views of the information and different terminologies about competency information.

Each different LET institution may be supported through the use of specific information systems that consist of digital products and services selected to support the institutional mission. The process of the delivery of digital products from point(s) of origin (provider) to destination (stakeholder) to support LET can be described using a Digital Services Supply Chain (DSSC) approach. There currently are several existing and implemented models providing competency information related to learner knowledge, skills, capabilities, qualifications, performance, learning objectives, and other related objects. These models are implemented in various ways, and the relationships inherent within the models may be made explicit by applying a DSSC approach to real-world implementations of competency information models. Thus, a challenge for competency information standards is to provide methods for taking advantage of existing information about competencies in current and emerging IT systems that are used to manage, develop, describe, transfer or assess competency information or other related objects.

0.2 Areas of applicability

This Technical Report applies to activities including:

a. Assistance with understanding competency as it is measured and observed within an IT system and the description and process by which the ITLET Conceptual Reference Model may be used as a common reference point to facilitate the exchange and management of information for IT systems that support the management, development, description, transfer or assessment of competency information or other related objects.

b. The use of an ITLET Conceptual Reference Model toolkit that includes:

   - the ITLET Conceptual Reference Model that comprises classes of entities and relationships, which include concepts such as competency, actor, action, outcome, evaluation, assessment process, and other related concepts or objects;

   - procedure to gather information regarding individual use cases;

   - process to describe the competency information within different systems and to derive system information models;

   - general information and a detailed example of the application of the ITLET Conceptual Reference Model toolkit that allows for elaboration of information models, the determination of competency information objects and competency information records.

c. Guidance regarding a process to assist with the exchange of competency information between and amongst IT systems used by and developed for LET communities.

d. A common model and format to identify common information contents that are in different data formats; in particular to support the implementation of automatic data transformation algorithms from local to global data structures without loss of meaning. These transformation algorithms are useful for data exchange, data migration from legacy systems, data information integration, and mediation of heterogeneous sources.

e. Support for associative queries against integrated resources by providing a central model of the basic classes and their associations to formulate such queries.

0.3 Overview of the structure of this Technical Report

The structure of this Technical Report includes nine clauses and four informative annexes.

- Clause 1 describes the scope.
- Clause 2 provides terms and definitions used in this Technical Report.
- Clause 3 provides symbols and abbreviations used in this Technical Report.
- Clause 4 provides a graphical representation of the ITLET Conceptual Reference Model, which provides an introduction to the relationships between the classes and properties.
- Clauses 5 and 6 provide more detailed information regarding the ITLET Conceptual Reference Model classes and properties.
- Clause 7 provides an overview of how to use the ITLET Conceptual Reference Model, and introduces the topics of sharing and aggregating competency information (7.2, 7.3), deriving query requirements and information model structures (7.4), supporting interoperability requirements (7.5), and using metadata to build competency information objects (7.6).
- Clause 8 discusses the representation of competency within ITLET, the nature of competency as it is considered within the context of ITLET, and the challenges inherent for competency information standards within the context of ITLET.
- Clause 9 briefly notes potential areas where further international standardization may need to be considered.
- Annex A (informative) provides more detailed information regarding the development of an information model from the ITLET Conceptual Reference Model. This informative annex is closely related to Clauses 7 and 8, which provide an abbreviated version of the process and several briefer examples.
- Annex B (informative) provides a specific example of a use case.
- Annex C (informative) provides an overview of the development of the ITLET Conceptual Reference Model and explains the genesis of the model itself.
- Annex D (informative) provides a table of brief descriptions of the use cases submitted by National Bodies and a template used to support the development of this Technical Report.

0.4 Acknowledgement

The main source of inspiration for this Technical Report is the CIDOC Conceptual Reference Model produced by the ICOM/CIDOC Documentation Standards Group and continued by the CIDOC CRM Special Interest Group (http://cidoc.ics.forth.gr/), published as ISO 21127:2006[1)]. Although it is the main source of inspiration for this Technical Report, it is not a normative reference for it.

1) See Bibliography. ISO 21127:2006 establishes guidelines for the exchange of information between cultural heritage institutions. It is developed and maintained by ISO/TC 46, *Information and documentation*, SC 4, *Technical interoperability*.