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# Conceptual Reference Model for Competencies and Related Objects —

| Warning |
|---|
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116 **Tables**
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119 **Foreword**

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127 The main task of technical committees is to prepare International Standards. Draft International Standards
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129 International Standard requires approval by at least 75 % of the member bodies casting a vote.

130 In exceptional circumstances, when a technical committee has collected data of a different kind from that which is
131 normally published as an International Standard ("state of the art", for example), it may decide by a simple
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133 in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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

136 ISO/IEC TR 24763 was prepared by Subcommittee SC 36, *Information Technology for Learning, Education, and*
137 *Training*.

138 ## 0   Introduction

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

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

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

158 This Technical Report provides a common model and format to clarify the logic of information types and
159 relationships that are used in LET information technology systems underlying the information systems related to
160 competencies that are used by LET organizations and their respective communities. It is important to note that the
161 Technical Report aims to clarify the logic of information types and relationships that are used in information
162 technology systems by LET organizations and their communities in order to manage, develop, describe, transfer
163 or assess competency information or other related objects. It is not intended as a normative specification.

164 IT systems managing competency information face many challenges, such as:

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

168 • IT systems may be designed, developed, and implemented with specific labels for competency information in
169 mind: according to the context in which it is used (see clause 9),

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

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

173 • Competency information is data about people that can be used to make decisions related to employment,
174 advancement, admission, accreditation, etc. Where competency information is linked to an identifiable
175 individual, the protection of the privacy of that identifiable individual is essential.

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

182 Each different LET Institution may be supported through the use of specific information systems that consist of
183 digital products and services selected to support the institutional mission.  The process of the delivery of digital
184 products from point(s) of origin (provider) to destination (stakeholder) to support learning, education and training
185 can be described as "Digital Services Supply Chains (ITLET)" (DSSC). There currently are several existing and
186 implemented models providing competency information related to learner knowledge, skills, capabilities,
187 qualifications, performance, learning objectives, and other related objects. These models are implemented in
188 various ways within different "Digital Services Supply Chains".  Thus, a challenge for competency information
189 standards is providing methods for taking advantage of existing information about competencies in current and
190 emerging IT systems that are used to manage, develop, describe, transfer or assess competency information or
191 other related objects.

192 **0.1 Introduction – An overview of the structure of this Technical Report**

193 The structure of this document includes 10 clauses, 1 normative annex, and 3 informative annexes.

194 The clauses are structured as follows:

195 • Clause 1 – scope;

196 • Clause 2 - normative references;,

197 • Clause 3 - terms and definitions;

198 • Clause 4 - provides symbols and abbreviations used in this Technical Report;

199 • Clause 5 - provides a graphical representation of the ITLET Conceptual Reference Model, which provides
200 information regarding the relationships between the classes and properties;

201 • Clauses 6 and 7 – provide more detailed Information regarding the ITLET Conceptual Reference Model
202 classes and properties;

203 • Clause 8 - provides an overview of how to use the ITLET Conceptual Reference Model, and introduces the
204 two topics of competency information objects and competency information records, and presents the
205 relationships to existing metadata used in ITLET;

206 • Clause 9 - discusses the representation of competency within Information Technology for Learning, Education,
207 and Training (ITLET), the nature of competency as it is considered within the context of ITLET and the
208 challenges inherent for competency information standards within the context of ITLET;

209 • Clause 10 briefly notes areas where further international standardization should be considered.

210 The annexes are provided as follows:

211 • Annex A (normative) - provides more detailed information regarding the development of an information model
212 from the ITLET Conceptual Reference Model. This normative annex is closely related to clauses 8 and 9,
213 which provide an abbreviated version of the process and several briefer examples;

214 • Annex B (informative) - provides a specific example of a use case;

215 • Annex C (informative) - provides an overview of the development of the ITLET Conceptual Reference Model
216 and explains the genesis of the model itself;

217 • Annex D (informative) - provides a table of brief descriptions of the use cases submitted by National Bodies
218 and a template used to support the development of this technical report.

219 **0.2 Introduction – Acknowledgement**

220 It must be noted that the main source of inspiration for this technical report is the CIDOC Conceptual Reference
221 Model produced by the ICOM/CIDOC Documentation Standards Group and continued by the CIDOC CRM
222 Special Interest Group (http://cidoc.ics.forth.gr/), published as ISO 21127:2006E[1]. While it is the main source of
223 inspiration for this document, it is not considered a normative reference for this TR.

---

[1] ISO 21127:2006 Information and documentation -- A reference ontology for the interchange of cultural heritage information. ISO 21127:2006 establishes guidelines for the exchange of information between cultural heritage institutions. It is developed and maintained by ISO TC46 „Information and Documentation, WG4, Technical interoperability".

224 # Conceptual Reference Model for Competencies and Related
225 # Objects —

226 ## 1 Scope

227 This Technical Report provides a Conceptual Reference Model that defines categories of objects, attributes and
228 relationships and may include concepts such as competency, knowledge, skills, capabilities, qualifications,
229 performance, learning objectives, and other related objects. This Technical Report pertains to the exchange and
230 integration of heterogeneous information relating to information technology systems that are used by learning,
231 education, and training organizations and their communities in order to manage, develop, describe, transfer or
232 assess competency information or other related objects. The scope is further elaborated to include:

233 • This Technical Report provides guidance regarding the level of detail and precision expected and required to
234 describe, in relation to the ITLET Conceptual Reference Model, information technology systems that are used
235 to manage, develop, describe, transfer or assess competency information or other related objects within the
236 Learning, Education, and Training (LET) fields.
237

238 • This Technical Report provides a definition of competency (ITLET) specific to competency as it is represented
239 within an IT system. This definition is not domain dependent and acknowledges the unique challenges of
240 representing competency information within IT systems (some of which are further elaborated in section 7.1 of
241 this Technical Report).
242

243 • This Technical Report is intended specifically to introduce requisite contextual information, i.e., the
244 environment, which may for example include information such as location description, duration, date and time,
245 etcetera.
246

247 • The exchange of relevant information from information technology systems among LET organizations and
248 their communities, and harmonization with their models, falls within the scope of this Technical Report.
249

250 • Guidelines are provided within this Technical Report regarding privacy needs related to information
251 technology systems that are used by LET organizations in order to manage, develop, describe, transfer or
252 assess competency information or other related objects.
253

254 • This Technical Report focuses on information about participants, related elements, and the respective
255 relationships included within information technology systems in LET that are used to manage, develop,
256 describe, transfer or assess competency information or other related objects.
257

258 ### 1.1 Scope – Primary role of this Technical Report

259 The primary role of this Technical Report is to enable the integration and interoperability of heterogeneous
260 sources of competency information. This Technical Report provides a toolkit comprising of the ITLET Conceptual
261 Reference Model, and processes needed to elaborate semantic definitions and clarifications to transform and
262 enable the exchange of information across disparate, localized information sources into a coherent global
263 resource. The ITLET Conceptual Reference Model may be used as a common reference point, and the process
264 described in this technical report may be used to assist human understanding of information technology system(s)
265 used within LET to manage, develop, describe, transfer or assess competency information or other related objects.

266 **1.2 Scope – Areas of applicability**

267 ISO/IEC 24763 applies to activities including:

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

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

274 • ITLET Conceptual Reference Model that comprises classes of entities and relationships, which include
275 concepts such as competency, actor, action, outcome, evaluation, assessment process, etc.;

276 • Procedure to gather information regarding individual use cases;

277 • Ability to describe the competency information within different systems and to derive system information
278 models; and,

279 • General information and a detailed example of the application of the ITLET Conceptual Reference Model
280 toolkit that allows for elaboration of information models, the determination of competency information
281 objects and competency information records.

282 c. The use of the ITLET Conceptual Reference Model that includes classes of entities and relationships, which
283 include concepts such as competency, actor, action, outcome, evaluation, assessment process, and other
284 related concepts or objects.

285 d. Guidance regarding a process to assist with the exchange of competency information between and amongst
286 information technology systems used by and developed for Learning, Education, and Training (LET)
287 communities.

288 e. A common model and format to identify common information contents that are in different data formats; in
289 particular to support the implementation of automatic data transformation algorithms from local to global data
290 structures without loss of meaning. These transformation algorithms are useful for data exchange, data
291 migration from legacy systems, data information integration, and mediation of heterogeneous sources.
292
293 f. Support for associative queries against integrated resources by providing a central model of the basic classes
294 and their associations to formulate such queries.
295
296 g. Guidance regarding good practice in conceptual modeling of competency information for information
297 technology systems.
298

299 **1.3 Scope – Aspects not currently addressed**

300 The 1st edition of this Technical Report does not yet address the following aspects:
301
302 a. Specific details related to the functions of the classes.
303
304 b. The creation of data models and complex data structures.
305
306 c. Guidelines related to the use of such data models, or to their bindings.
307
308 d. Application Program Interfaces (APIs) and associated bindings.

309
310  e.  Specific relationships to other ISO/IEC standards and detailed descriptions of related work by other
311      organizations.
312
313  f.  Multilingual support.
314
315  g.  Cultural adaptability.
316
317  h.  A detailed overview of privacy issues.  For more information related to privacy within ITLET systems, ISO/IEC
318      29187 Information Technology - Identification of Privacy Protection Requirements pertaining to Learning,
319      Education and Training (LET) should be consulted.
320
321  i.  Guidance regarding accessibility issues.  For more information related to accessibility with ITLET systems, the
322      ISO/IEC 24751 multipart standard should be consulted.
323
324  It is anticipated that some or all of these requirements will be addressed in future editions of ISO/IEC 24763, or in
325  companion standards or technical reports.

## 2   Normative References

327  There are no normative references for this Technical Report.  It is based on new work undertaken by
328  JTC1/SC36/WG3.  For documents consulted, see the Bibliography.

## 3   Terms and definitions

330  -------------------------

331  *Project Co-Editors Note:*

332  *As noted in Annex X if the alternative figure 1b is chosen, then the terms and definitions clause will need to be*
333  *updated accordingly.*

334  -------------------------

335  The ITLET Conceptual Reference Model is expressed as a series of interrelated concepts. Each of these
336  concepts has been assigned a unique label, a.k.a. "term".  The Oxford English Dictionary (OED) should be used
337  as a source for those words used in this Technical Report (e.g., action; actor; etcetera) that are not defined in
338  Clause 3.

339  This Technical Report *is not intended as a terminology standard* and does not set out to define the terms that are
340  used in their common sense meaning, or that are typically used as data in competency documentation.

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

342  **3.1**
343  **class**
344  category of items that share one or more common **properties**, which serve as criteria to identify items that belong
345  to the class.
346
347  NOTE 1  Within the ITLET Conceptual Reference Model for Competencies and Related Objects there are 9 classes:  Action;
348  Actor; Competency; Criteria and method; Environment; Evaluation, assessment process; LET institution; Outcome; and, Role.
349
350  NOTE 2  Class properties need not be explicitly formulated in logical terms, but may be described as a statement that refers to
351  a common conceptualization of domain experts. The sum of these properties is called the intension of the class. A class can

352 be the domain or range of none, one, or more properties formally defined in a model. The formally defined properties need not
353 be part of the intension of their domains or ranges: such properties are optional.

354 [Adapted from ISO/IEC 21127-1:2006 (3.1)]

355
356 **3.2**
357 **competency (ITLET)**
358 observable or measurable ability of an actor to perform necessary action(s) in given context(s) to achieve specific
359 outcome(s)

360
361 NOTE 1  See clause 9.

362
363 **3.3**
364 **competency information (ITLET)**
365 structured data about a competency that is communicated among individuals, organizations, and public
366 administrations

367
368 NOTE competency information comprises one or several competency information records and at least one
369 another type of information related to a person, an institution…

370
371 **3.4**
372 **competency information object (ITLET)**
373 set of competency information

374
375 **3.5**
376 **competency information record**
377 set of recorded information describing competency in any format

378
379 **3.6**
380 **digital services supply chain (ITLET)**
381 process of the delivery of digital products from point(s) of origin (provider) to destination (stakeholder) to support
382 learning, education and training

383
384 **3.7**
385 **environment (ITLET)**
386 context, surroundings or conditions in which a person lives or operates

387
388 NOTE  Environment (ITLET) is a class within the ITLET Conceptual Reference Model for Competencies and Related Objects.

389
390 **3.8**
391 **ITLET conceptual reference model**
392 definitions and a common structure for describing the implicit and explicit concepts and relationships within an IT
393 system for LET

394
395 **3.9**
396 **LET institution**
397 any institution delivering Learning, Education or Training (LET) services, whether they be formal or non-formal

398
399 EXAMPLE  A social or decision-making body, an organization, a government ministry, a community of learners, a professional
400 certifying body, a person, etc.

401
402 NOTE  LET institution is a class within the ITLET Conceptual Reference Model for Competencies and Related Objects.

403
404 **3.10**
405 **object**
406 any part of the perceivable or conceivable world object

407

408 NOTE: Objects may be material (e.g. resume, paper transcript, computer) or immaterial, (e.g., virtual environment, streaming
409 video), or imagined (e.g., a unicorn).

410

411 [Adapted from ISO 1087:2000 (3.1.1)]

412
413 **3.11**
414 **property**
415 characteristic of a **class** that states the specific relationship that exists between two **classes**

416
417 NOTE 1   A property is characterized by an intension, which is conveyed by a statement or a scope note.

418
419 NOTE 2 Within this Technical Report, Clause 7 identifies each of the distinct properties, i.e., characteristics of each member of
420 a "class", which are identified and defined in Clause 6.

421
422 [Adapted from ISO/IEC 21127-1:2006 (3.14)]

## 4   Symbols and abbreviations

424 The following symbols and abbreviations are defined for use within this Technical Report.

**Symbols**

| | |
|---|---|
| **[ ]** | Square brackets – denotes a class, subclass, or instance related to a class in clauses 6, 7, 8.2, 8.3, Annex A.5, Annex B |
| **{ }** | Curly brackets – used to denote examples of subclasses in clause 6. Used in clause 8.2 to help denote examples of sets and subsets of information that form competency information objects. |
| **( )** | Brackets or parentheses – used throughout the document to provide parenthetical or additional information.  Used in clause 7 to denote range-to-domain relationships.  Used in clause 8.2 to help denote examples of sets and subsets of information that form competency information objects. |
| $\cup$ | Union – This symbol represents a basic binary operation in set theory known as union.  The union of two sets is denoted as $A \cup B$, which indicates a set that includes all the sub-components that are included in at least one of A or B.  For example, the union of (1, 2) and (2, 3) is the set (1, 2, 3).  The use of this symbol in clause 8.2 is intended to provide support for queries, not necessarily to create data models but to create sets of information. |
| $\subset$ | Subset of – This symbol represents a subset.  For example, if set A = (1, 2, 3) and set B = (1, 2, 3, 4), then A is a subset of B.  In this Technical Report this is described using the notation $A \subset B$. Whereas, if set C = (1, 5), then it is not a subset of B.  This is provided as an illustrative example only; additional notational formats are described elsewhere in formal texts related to set theory. |

**Abbreviations**

| | |
|---|---|
| **API** | Application Program Interface |
| **CRM** | Conceptual Reference Model |

**Abbreviations
(Cont'd)**

| | |
|---|---|
| **CWA** | CEN Workshop Agreement |
| **DSSC** | Digital Services Supply Chain |
| **HRIS** | Human Resources Information System |
| **HR-XML** | Human Resources **XML** |
| **IEEE** | Institute of Electrical and Electronics Engineers, Inc. |
| **IMS** | IMS Global Learning Consortium, Inc. |
| **ICT literacy** | Information and Communication Technology literacy |
| | NOTE  This also may be referred to as **IT** literacy or as **IT** fluency. |
| **IT** | Information Technology |
| **ITLET** | Information Technology for Learning, Education, and Training |
| **LET** | Learning, Education, and Training |
| **SIS** | Student Information System |
| **XML** | eXtensible Markup Language |

425

**6**

## 5  Introduction to the ITLET Conceptual Reference Model for Competencies and Related Objects

The ITLET Conceptual Reference Model is the most abstract level of the standardization process. It provides definitions and a formal structure for describing implicit and explicit concepts and relationships within a system: it provides a model against which heterogeneous information models may be compared. It can be used to gain understanding of the types of information different organizations/institutions/government agencies encode, and facilitate interoperability by providing a framework for considering who, what, how, when, why, and where information is being encoded, thus enabling the leveraging of information within existing systems.

The ITLET Conceptual Reference Model formalizes the semantics necessary to express observed situations in the world of learning, education and training and cases in which "competencies" and other related objects are used in LET institutions within different sectors (e.g. academic, government, corporate). It may be used to describe and compare the internal semantics of disparate Digital Services Supply Chains.

This ITLET Conceptual Reference Model is designed to assist with identification of:
- Information model requirements, both in terms of records or digital documents that are relevant to the use of Competencies,
- Classes of attributes that will be needed for these records,
- Functionality that may be required for manipulation of these records and their attributes.
- Required authorization and control mechanisms for these records.

In many cases, existing standards, or standards being developed by ISO/IEC JTC1 SC36 may specify these records, attributes, or functionality and can be used as references. A basic assumption is that these records will be aggregates of many types of information. A goal of this ITLET Conceptual Reference Model is to identify methods where the structure and information in competency records may be used to determine or manipulate related records.

IT systems that support the management and exchange of competency information may exist in varying levels of complexity and capture, store, and exchange diverse types of information. The approach taken in this Technical Report has been inspired by the museum world in which an ISO/IEC standard can be used to help understand IT systems and to support interoperability by providing a flexible and consistent way of thinking about information models. The ITLET Conceptual Reference Model approach allows for the identification of groupings of information that represent a concept regardless of the label that has been placed upon the information in actual IT systems. It is recognized that not all concepts denoted in the ITLET Conceptual Reference Model are represented in all IT system information models. However, by referring to the ITLET Conceptual Reference Model it is possible to identify which concepts are present within an IT system information model and the relationships that may exist between those concepts within the IT system information models being studied.

At the heart of the ITLET Conceptual Reference Model for Competencies and Related Objects is the understanding that IT systems need to support human development. This means that IT systems need to be structured to do more than simply define learners in terms of their competencies; instead a more flexible approach is needed. The approach outlined in this Technical Report provides a useful toolkit that can help to identify where knowledge and skills meet specified criteria for example. It also provides flexibility to acknowledge that there are many factors that contribute to the competency measurement process, such as the criteria used, the assessment or evaluation methods that are employed. As well, the words that have been used in the ITLET Conceptual Reference Model itself have been carefully chosen so that they do not favour one specific learning theory.

-------------------------------------------------------------------

*Project Co-Editors Note:*

*Please see Annex X to review Figure 1b.  NBs need to decide whether to stay with the existing Figure 1a or move to Figure 1b if the rationale provided for making such a significant change is provided via P-member ballot comments. Should P-members decide to adopt alternative figure 1b as found in Annex X is accepted then, the terms and definitions in Clause 3, clauses 6 and 7 and several of the following figures in the document will need to*

476 *be updated. NBs who advocate this significant change in the adoption of new Figure 1b, instead of existing*
477 *Figure 1a, are requested to provide a clear rationale as to why such a change needs to be made as well as*
478 *needed suggested replacement or amended text for existing text in Clauses 3, 5, 6 and 7 as well as all the other*
479 *impacted figures in this document.*

480 The ITLET Conceptual Reference Model for Competencies and Related Objects includes 9 classes and 17
481 properties (or relationships between the different classes), which are described in greater detail below (Figure 1)
482 and in clauses 6 and 7 respectively.

483
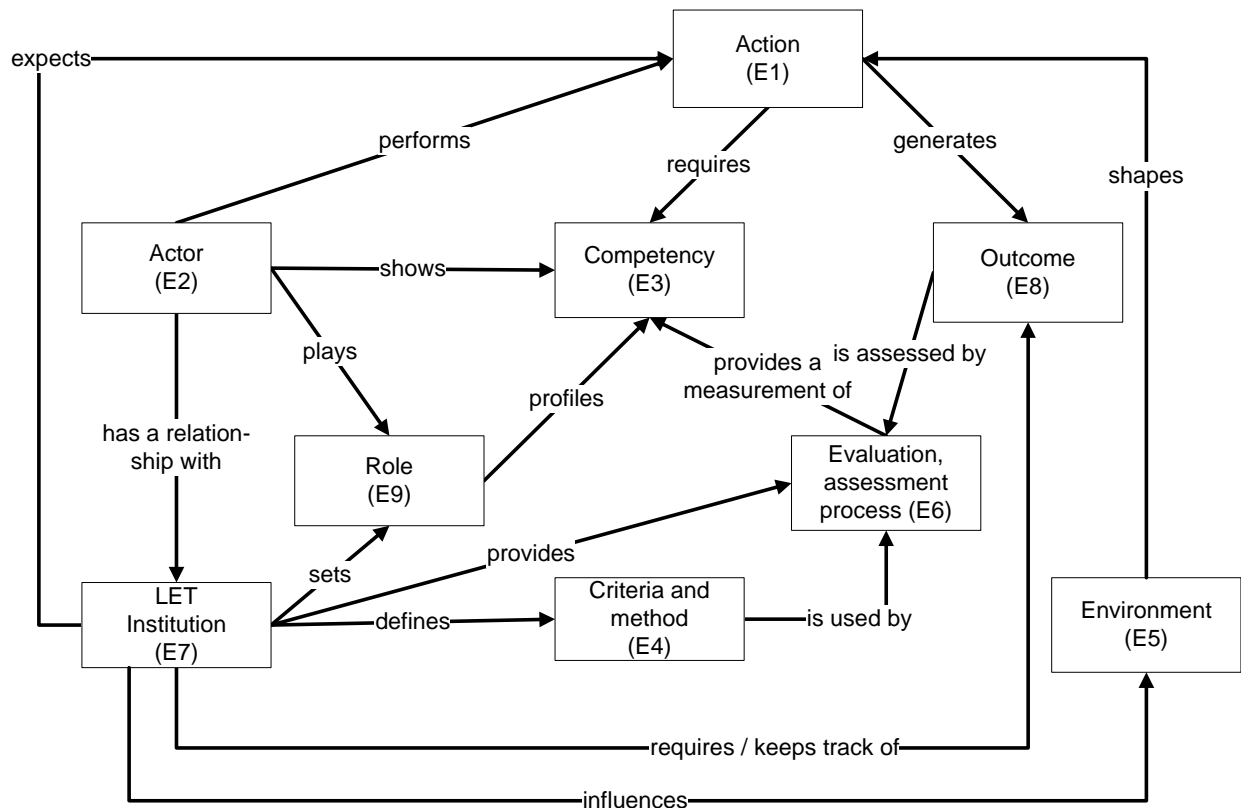
484 **Figure 1a — The ITLET Conceptual Reference Model for Competencies and Related Objects**

485

## 6 Classes of the ITLET Conceptual Reference Model for Competencies and Related
486 Objects
487

488 *Project Co-Editors Note: if the alternative figure 1b (see Annex X) is accepted, clauses 6 and 7 and several of the*
489 *following figures in the document would need to be updated consequently.*

### 6.1 Introduction and approach
490

491 The structure of the ITLET Conceptual Reference Model and Related Objects includes the classes and their
492 characteristics as described in clauses 6.1 and 6.2.

493 In the ITLET Conceptual Reference Model, classes are categories of "entities" that are found in the real world and
494 classes may be present or involved in competency-related events. The characteristics of a class are provided
495 below:
496

497　　　1)　A class consists of subclasses as noted in the lists in { } brackets in clause 6.2 below (e.g., university is a
498　　　　　 subclass of the class [LET institution]);
499
500　　　2)　Any entity belonging to a subclass of the classes noted in clause 6.2 inherits the properties of the class.
501
502　　　3)　Subclasses are an open list, i.e., non-exhaustive;
503
504　　　4)　Classes are associated with an open set of real-life instances that are an open list, i.e., non-exhaustive
505　　　　　 (e.g., XYZ University is an instance of the subclass university);
506
507　　　5)　Instances do not define class, in other words a class cannot be defined by enumerating its instances;
508
509　　　6)　A class plays the role of a noun either as a subject or object, in a modeling statement consisting of nouns
510　　　　　 (classes) and verbs (properties);
511
512　　　7)　Classes are or can be organized hierarchically to illustrate the relationship between them (e.g., sub and
513　　　　　 super classes).
514
515　For example, [Actor] is a class. An [Actor] can have the property of being a *member* or *employee* of a LET
516　institution, but this is not a necessary condition for being an [Actor] for the purposes of modeling. As noted in
517　Appendix A.4 in a specific use case, when an LET institution is modeling the process of elaborating a job profile,
518　then different subclasses such as a Job Expert and Research Engineer may be involved in the action of job profile
519　elaboration. Later on in the modeling process when competencies are being assessed, there may be another
520　subclass, such as Job Seeker, who is involved in the process being modeled. An instance of the Job Seeker
521　would be a physical individual who generates results from performing a computerized assessment test.

## 6.2 Identification of classes and their descriptions

523　The main classes of the ITLET Conceptual Reference Model for Competencies and Related Objects are provided
524　below. Examples of subclasses for each class are given in the form of {a list}.
525
526　E1: [Action] {action related to learning, action related to teaching / training, action related to HR management,
527　action related to HR administration, action related to LET administration…}
528
529　E2: [Actor] {person, group, automated agent…}
530
531　E3: [Competency] {simple competency, complex competency...}
532
533　E4: [Criteria and method] {performance criteria, method of measurement...}
534
535　E5: [Environment] {location description, duration, date and time, equipment…}
536
537　E6: [Evaluation, assessment process] {jury, exam, test…}
538
539　E7: [LET institution] {school, university, training department…}
540
541　E8: [Outcome] {observable result, measurable result…}
542
543　E9: [Role] {learner, tutor, teacher, trainer, support, administrator, staff…}

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　**9**

544 # 7    Properties of the classes within the ITLET Conceptual Reference Model for
545    Competencies and Related Objects

546 **7.1 Introduction and approach**

547 The structure of the ITLET Conceptual Reference Model and Related Objects includes the properties and their
548 characteristics as described in clauses 7.1 and 7.2.  A property plays a role analogous to a *verb* in the sense that
549 it needs to be defined with reference to both a domain and a range. Domain and range are analogous to the
550 *subject* and *object* in a phrase (unlike classes, which can be defined independently).

551 In the ITLET Conceptual Reference Model, properties describe the relationships between classes.   The
552 characteristics of properties are provided below:
553
554    1)   A property plays the role of a *verb*;
555
556    2)   A property is expressed in a modeling statement consisting of nouns (classes) and verbs (properties);
557
558    3)   Properties are expressed with reference to domain and range;
559
560    4)   A statement can be bidirectional.  In other words, a property can be interpreted in both directions, with two
561       distinct but related interpretations. This idea is further elaborated in clause 7.2.
562
563    5)   When using the ITLET Conceptual Reference Model all properties should be considered as optional and
564       repeatable, i.e., default quantifier for each of these properties is "many-to-many" or (0,n:0,n).  This should
565       not be interpreted in terms of implementation, where cardinality constraints may occur.
566
567    6)   When modelling there should be a minimum of 2 classes and 1 property or relationship between the 2
568       classes.
569
570    7)   Properties can also be *specialized* in the same manner as classes, resulting in *IsA* relationships between
571       subproperties and their superproperties.
572
573 For example, as noted in Appendix A.4 the ITLET Conceptual Reference Model can be used to identify
574 subclasses and the properties (or the relationships between the subclasses) during the information modeling
575 process.

| ITLET Conceptual Reference Model | Subclasses and properties identified in modeling example in clause A.4 |
|---|---|
| [Actor] performs [Action] | [Job Expert] performs [Job Profile Elaboration] [Research Engineer] performs [Job Profile Elaboration] [Job Seeker] performs [Computerized Assessment test] |
| [Actor] plays [Role] | [Job Expert] plays [Expert role] [Research Engineer] plays [Support role] [Job Seeker] plays [Candidate role] |
| [Actor] has relationship with [LET Institution] | [Job Expert] has relationship with [Research Center Henri Tudor] [Research Engineer] has relationship with [Research Center Henri Tudor] [Job Seeker] has relationship with [ADEM] |

**10**

## 7.2 Identification of properties and their descriptions

The relations between the properties between the classes of the ITLET Conceptual Reference Model for Competencies and Related Objects are provided below.

Each property is expressed using two forms: domain-to-range and (range-to-domain), the latter being given between parentheses (). Sometimes, the property is symmetrical, i.e., the domain-to-range and the (range-to-domain) phrasing is the same. In that case, the parenthetical form of the property description is not necessary (e.g., [Actor] has a relationship with [LET institution]).  In other examples, such as P1: [Actor] shows [Competency] could be noted as (range-to-domain) as the following: ([Competency] is shown by [Actor]).

P1: [Actor] shows (is shown by) [Competency]

P2: [Actor] performs (is performed by) [Action]

P3: [Actor] plays (is played by) [Role]

P4: [Actor] has a relationship with [LET institution]

P5: [Action] generates (is generated by) [Outcome]

P6: [Action] requires (is required by) [Competency]

P7: [Criteria and method] is used by (uses) [Evaluation, assessment process]

P8: [Environment] shapes (is shaped by) [Action]

P9: [Evaluation, assessment process] provides a measurement of (is measured by) [Competency]

P10: [LET institution] expects (is expected by) [Action]

P11: [LET institution] influences (is influenced by) [Environment]

P12: [LET institution] sets (is set by) [Role]

P13: [LET institution] provides (is provided by) [Evaluation, assessment process]

P14: [LET institution] defines (is defined by) [Criteria and method]

P15: [LET institution] requires/keeps track of (is required by/is tracked by) [Outcome]

P16: [Outcome] is assessed by (assesses) [Evaluation, assessment process]

P17: [Role] profiles (is profiled by) [Competency]

## 8   How to use the Conceptual Model Reference Model

A brief overview of how the ITLET Conceptual Reference Model may be used is provided below.  More detailed information regarding the process that may be used to gather information from disparate resources, and to use the ITLET Conceptual Reference Model to compare the information from different source IT systems is described in Annex A.

624 **8.1 Developing an information model from the ITLET Conceptual Reference Model**

625 This section provides information to assist with the development of use cases to determine the relationships
626 between different actors, actions, competencies, etc. More detailed information regarding how this information
627 may be gathered using a template is provided in Annex A. Once the detailed information has been gathered, the
628 CRM diagram is used to derive an information model according to the structure noted in Figure 2 below. It should
629 be noted that the information that is present in the information model will depend upon the classes that are
630 present in the real world example that is being analyzed. More detailed examples of information models derived
631 from the CRM are provided in Annex A.

632 To derive this information model, it is assumed that
633     1) Each entity of the real world composing the CRM can be represented or described in an Information
634        System by a specific set of information, and
635     2) The properties of the CRM are preserved as relations between the different sets of information.
636
637 NOTE The quantifiers of the relations should be revised as appropriate according to the specific use-case(s)
638 being analyzed.
639
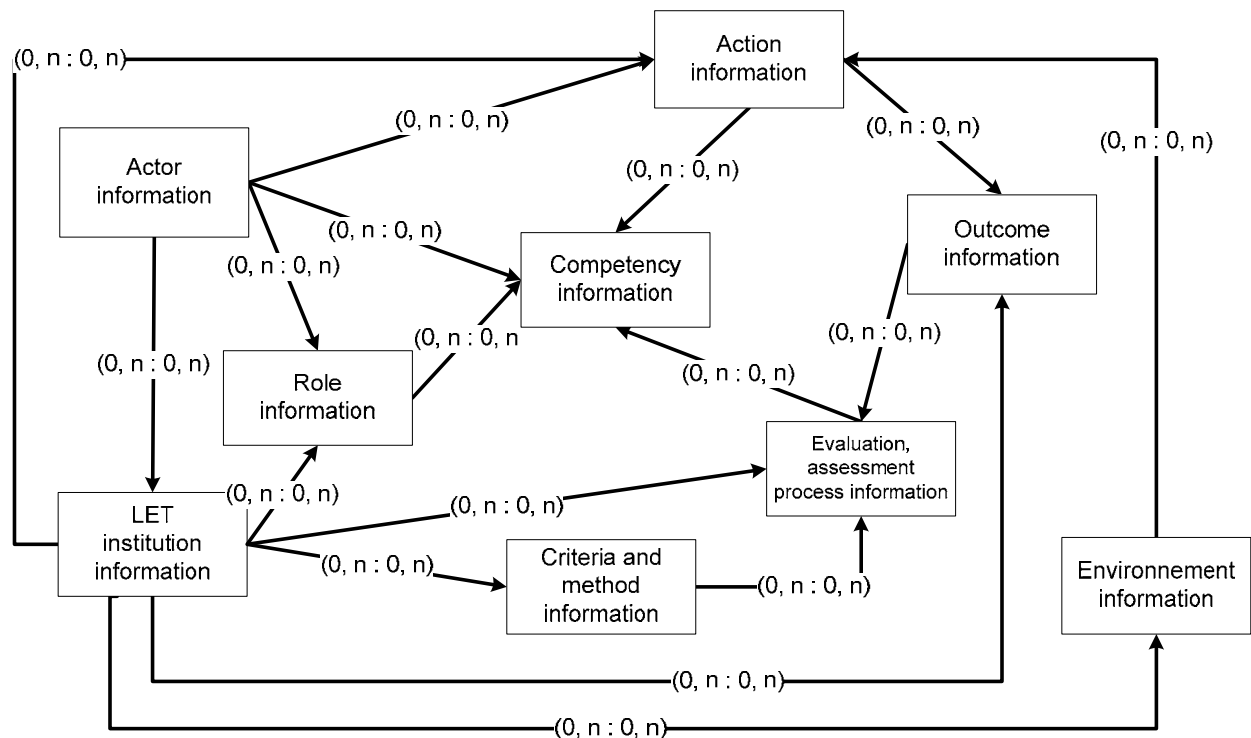


640
641 **Figure 2 — An information model structure based on the CRM for Competencies and Related Objects**
642

643 **8.2 Competency Information Objects**

644 A competency information object is set of information that is collected to facilitate human exchanges about
645 competency. The competency information object may include information from different parts of an IT system. For
646 example, a curriculum vitae generally comprises 4 parts:
647     1) personal information
648     2) work experience information
649     3) education and training information
650     4) competency information

    

651 In order to collect the set of information recorded in a curriculum vitae there may be different subsets of
652 information that are used to make a composite competency information object that is then managed or transferred.
653
654 The curriculum vitae may collect information that is located in different parts of an IT system or of a Digital
655 Services Supply Chain that is described by an information model.  For example:

- 656 • Part 1 could include a subset of [Actor information], that may comprise biographical and geographical
657 information. This could be represented as: $\subset$ [Actor information].
- 658 • Part 2 could include a subset of the union of information from [LET institution information], [Environment
659 information], [Role information] comprising information about the work entity (name, sector, size… from
660 [LET institution information]), information about its localization (address, telephone…) and information
661 about the time spent within the institution (from [Environment information]), information about the position
662 and responsibilities (from [Role information]). This could be represented as: $\subset$ {[LET institution
663 information] $\cup$ [Environment information] $\cup$ [Role information]}.
- 664 • Part 3 could include a subset of the union of information comprising the awarding organization (name,
665 type…from [LET institution information]), information about its localization and the date of the qualification
666 (from [Environment information]), information about the obtainment of the award (from [Action
667 information]) and information about the results (from [Output information]). This could be represented as:
668 $\subset$ {[LET institution information] $\cup$ [Environment information] $\cup$ [Action information] $\cup$ [Outcome
669 information]}.
- 670 • Part 4 could include a subset of the union of [Competency information] that comprises the description of
671 the competencies formally recognized, resulting from an [Evaluation process information]) as well as
672 those informally accepted as profiled by [Role information]. This could be represented as: $\subset$
673 {[Competency Information] $\cup$ [Evaluation process information] $\cup$ [Role information].

674
675 If each part of the information model is defined, the resulting set of information can be obtained by a query
676 gathering the relevant data into a single data structure.
677
678 Other notation examples of competency information objects can be described easily using an information model
679 that is based on the ITLET Conceptual Reference Model and the curriculum vitae example above include:

- 680 - A resume could be composed of a subset of part 1 and part 4 of the CV, i.e., a subset of [Actor information]
681 and [Competency information]. This could be represented as: resume competency information object $\subset$
682 {[Actor information] $\cup$ [Competency information]}.
- 683 - A portfolio could be composed of a complete CV and of some evidences of competencies, which are usually
684 a subset of {[Outcome information]}. This could be represented as:  portfolio competency information object $\subset$
685 [Outcome information].
- 686 - A job ad could be composed of a subset of the union of [LET institution information], [Environment
687 information], [Role information], [Competency information]. This could be represented as: job ad competency
688 information object $\subset$ {[LET institution information] $\cup$ [Environment information] $\cup$ [Role information] $\cup$
689 [Competency information]}.
- 690 - A job profile could be composed of a subset of the union of [Role information], [Competency information].
691 This could be represented as: job profile competency information object $\subset$ {[Role information] $\cup$ [Competency
692 information]}.
- 693 - A transcript could include information that includes a subset of the union of [Actor information], [LET
694 institution information], [Evaluation process information], [Action information], [Outcome information],
695 [Environment information], [Competency information]. This could be represented as: transcript competency
696 information object $\subset$ {[Actor information] $\cup$ [LET institution information] $\cup$ [Evaluation process information] $\cup$
697 [Action information] $\cup$ [Outcome information] $\cup$ [Environment information] $\cup$ [Competency information]}.

698

699 **8.3 Competency Information Records**

700 In complex information structures such as competency information objects described above, the main purpose is
701 to identify the specific information components that are to be exchanged.  However, it is recognized that not all
702 items in an information model are targeted for exchange. Thus, the term competency information record is

703    intended to capture the set of recorded information describing competency in any format. The relationship
704    between the term competency information record and competency information object is provided in Figure 3 and
705    Figure 4 below.
706
707    There are sets of recorded information related to competency that may be contained within an IT system within
708    LET Institution A and LET Institution B for example. The competency information records may be structured
709    differently. Using the Conceptual Reference Model, the desired competency information records may be identified
710    within different institutional IT systems or Digital Services Supply Chains. The competency information object
711    contains information that has been formatted in an agreed upon manner to facilitate the exchange of competency
712    information. There are many possible scenarios to describe how LET Institutions may exchange information. For
713    example, as noted in Figure 4, it is possible that there could be a broker LET Institution D that provides a
714    competency thesaurus that helps to validate items in a competency information record from LET Institution C to
715    be included in a competency information object, such as an ePortfolio.  The key differentiating factor between a
716    competency information record and a competency information object is that the competency information object
717    includes information that has been structured specifically to support the human exchange of competency
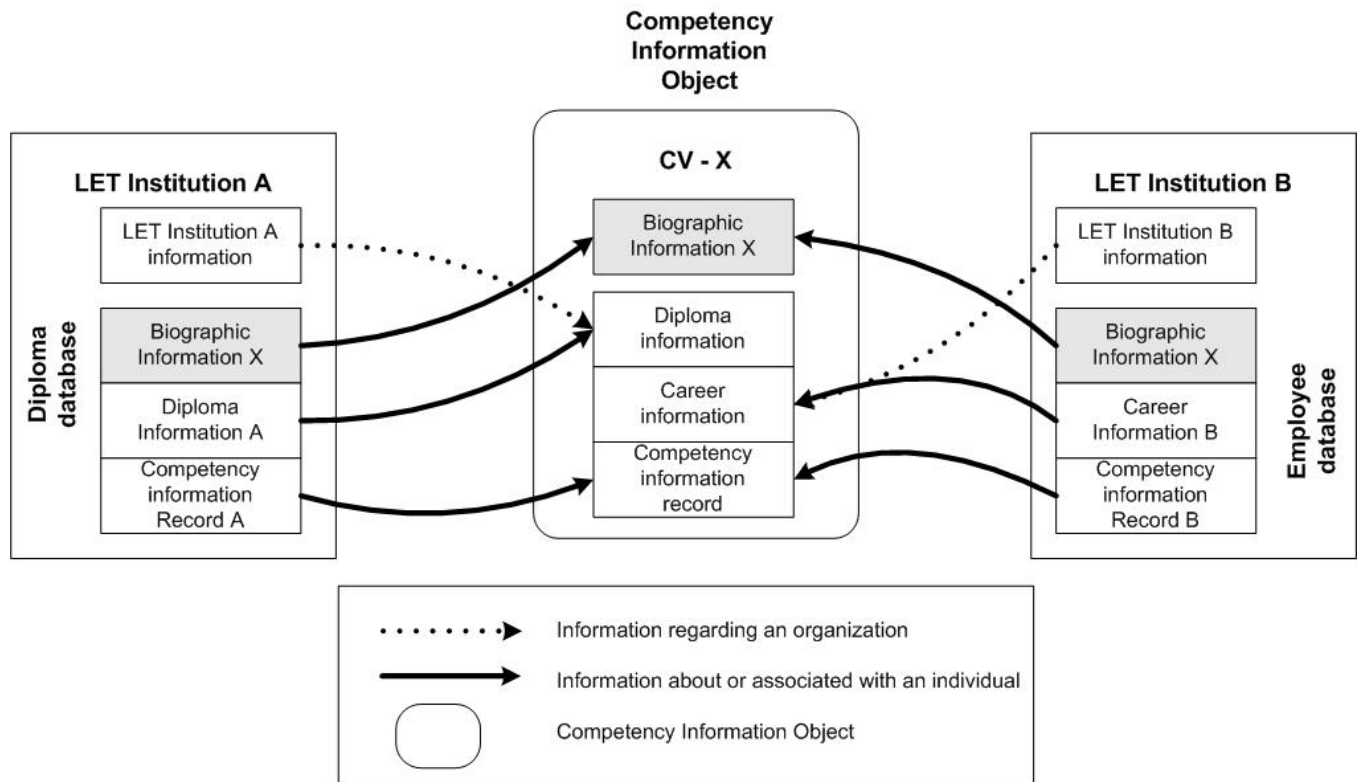718    information.



719
720    **Figure 3 - An example of relationships between competency information records and a competency**
721    **information object**

722

     **14**

723
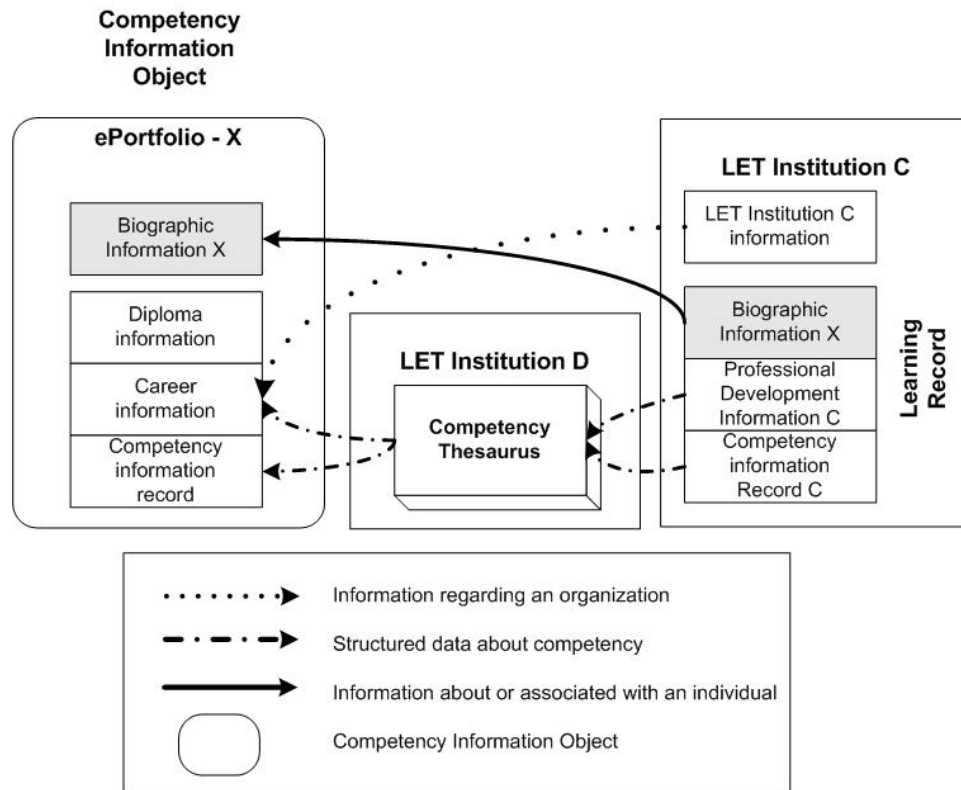
724    **Figure 4 — An example of relationships between a competency information object, a competency**
725    **thesaurus and a learning record**
726

## 8.4 Using metadata to build Competency Information Objects

728    Instances of the CRM classes are included as competency-related metadata in learning objects. The following list
729    of entity classes indicate where related standards refine these classes as a first step toward a taxonomy or
730    complete class hierarchy for each of the entities. Related standards also specify appropriate attributes to be
731    associated with these entities, as described here.
732

733    **Action:** Action is included as an entity in the TEN Competence Domain, which identifies attributes for actions.
734    The IMS GLC Inc. QTI includes an extensive set of options for actions as responses to tests.
735

736    **Actor:** The MLR (ISO/IEC 19788), the IEEE LOM, the TEN Competence Domain, the DCMI Educational
737    Application Profile, the HR-XML competencies schemas, and the IMS GLC Inc. QTI all specify that one or more
738    actors should be identified in the metadata for a learning object. If more than one actor is specified, then the
739    actors are distinguished by their roles.
740

741    **Competency:** Competency definitions are not easily specified by a single metadata attribute, so most standards
742    provide flexible ways of specifying the competency. Some metadata standards also include learning objectives,
743    which in some cases are defined as achieving a competency. The MLR (ISO/IEC 19788), the IMS GLC Inc.
744    RCDEO, the IEEE RCD, and the IEEE LOM allow competency to be decomposed into a combination of
745    knowledge, skills, and aptitudes. The IEEE RCD and the IEEE LOM have been used to describe competency in
746    terms of tasks to be performed, conditions under which the tasks are performed, and standards for the outcomes
747    of performing those tasks.
748

    

749 **Criteria:** The IMS QTI metadata extends the IEEE LOM learning resource type with additional details about
750 assessment criteria. The TEN Competence Domain defines additional entities and connecting properties for
751 criteria and methods.
752
753 **Environment:** The ISO MLR describes the environment in terms of geographical and cultural contexts. The MLR
754 (ISO/IEC 19788), the IEEE LOM, and the IMS GLC Inc. QTI include metadata identifying the linguistic context or
755 environment of competence evaluation resources.
756
757 **Evaluation, assessment process:** The IEEE LOM includes assessment methods as possible values for a
758 learning resource type. The IMS QTI metadata extends the IEEE LOM with extensive detailed descriptions of
759 assessment processes. The TEN Competence Domain defines additional entities and connecting properties for
760 evaluation methods. The DCMI Educational Application Profile includes attributes for labelling learning resources
761 as being used for assessment.
762
763 **LET institution:** The MLR (ISO/IEC 19788) characterizes the LET institution through its description of the
764 institutional context. The IEEE LOM includes institutional affiliations as attributes of actors, which is a way of
765 capturing the competency CRM property: [LET Institution] *sets* [Role].
766
767 **Outcome:** Result is included as an entity in the TEN Competence Domain, which provides subordinate entities
768 for result logs and results linked to the assessment of those results. The IMS GLC Inc. QTI includes an extensive
769 set of options for outcomes. The DCMI Educational Application Profile includes attributes for associating learning
770 resources with educational outcomes.
771
772 **Role:** The MLR (ISO/IEC 19788), the IEEE LOM, the TEN Competence Domain, the DCMI Educational
773 Application Profile, and the IMS GLC Inc. QTI all provide definitions of multiple categories of roles.
774
775 The properties in the competency CRM define relationships between the entities. These properties impose
776 requirements on information models derived from the CRM. A database that implements a competency model
777 consistent with the CRM must provide tables or queries that link appropriate instances of the two entities
778 associated with each property. A refinement of the CRM entity class hierarchies should also define class
779 hierarchies for the properties that specify sub-properties in terms of their domains and ranges as sub-classes of
780 the entities. This filtering supports gap analyses in terms of the assessment processes that an organization
781 provides and allows learners to find available ITLET options for improving competency.
782
783 For example, the **Outcome** entity class can be divided into three subclasses: **Knowledge Acquired**, **Skills
784 Obtained**, and **Attitude** about the use of those skills. Similarly, the **Assessment Process** entity class can be
785 divided into multiple subclasses including **Multiple Choice Tests**, **Procedural Performance Exam**, **Job History**,
786 and **360 Organizational Reviews**. The competency CRM requires that **Outcome** entities are linked to
787 **Assessment Process** entities via the *is assessed by* property. Subclasses of the *is assessed by* property can
788 be defined that would associate **Knowledge Acquired** entities with **Multiple Choice Tests**, **Skills Obtained**
789 entities with **Procedural Performance Exams**, and **Attitude** entities with **Job Histories** and **360 Organizational
790 Reviews**.
791
792 Note that these property subclass definitions inherit the restrictions of the parent domain and range entity classes.
793 The consistency and completeness of these property subclass definitions is an important form of compliance with
794 the CRM.
795

## 9 Representation of competency within information technology systems used for learning, education, and training

798 In ITLET systems, information about Competency can describe various levels (simple competency, complex
799 competency…) using different formats. Some of these formats are described using specifications and related
800 methods such as the following:

801 • CWA 14590 Description of Language Capabilities

802  • HR-XML vocabularies

803  • IEEE P1484-20.1 Reusable Competency Definition

804  • IMS-Learner Information Package

805  • IMS-Reusable Definition of Competencies and Educational Objectives

806

807  In section 9.1 some challenges regarding competency information standards within the context of ITLET are
808  provided.  Following this, section 9.2 discusses the nature of competency considered within the context of ITLET
809  and how competency may be represented or designated within information models. In many cases, information
810  about competency is described in proprietary format, with no indication of level, under various labels, which
811  makes the exchange of such information quite difficult. This clause provides indications about the landmarks
812  which can facilitate the identification of "competency information records", regardless of their data structure.

813  **9.1 Challenges of standardization for competency information within the context of ITLET**

814  Competency information standards have to face the following challenges:

815

816  • There is no one definition of competency that is accepted by all.  Instead it has been suggested that
817  competency is an unobservable entity that IT systems can be used to make observable and measurable.

818

819  • Competency depends on a variety of factors such as context.

820

821  • Competency may improve or deteriorate over the course of time depending on opportunities for practice and
822  application.

823

824  • There may be other factors (such as ICT literacy) that impact on learner performance within an ITLET system.

825

826  EXAMPLE  A learner may not realize that she/he needs to ensure that popup blockers need to be turned off for an online
827  test using specific software, and the learner may be unable to complete the online test.

828

829  • ITLET systems need to interoperate and integrate well with other IT systems.

830

831  EXAMPLE 1  Online testing may be impacted in unpredictable ways by new browser software and by hardware
832  configurations in computer labs or on home computers.

833

834  EXAMPLE 2  An ITLET system such as a course management system may be integrated with other IT systems (such as
835  HRIS and SIS) and the successful integration of an ITLET system with these other systems may impact on the
836  performance of the ITLET system and on the performance of participants within the ITLET system.

837

838  • ITLET systems need to support the description of competencies at multiple levels of abstraction and in
839  various formats.  For example, ITLET systems need to be able to provide competency information in
840  aggregate form to provide an indication of learning levels and for more detailed individualized competency
841  information to provide personalized adaptive learning environments.  Therefore, ITLET systems need to
842  support the competency information requirements of LET stakeholders.

843

844  • There is a lot of information about competencies that has already been developed. A challenge for
845  competency information standards is the provision of methods for taking advantage of existing information
846  about competencies.

847

848  • An evidence of a competency comes in a very broad variety of forms. Thus, another challenge for
849  competency information standards is related to the provision of methods for accurately associating
850  competency requirements with appropriate evidence.

851

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

853

854 • IT systems may be designed, developed, and implemented with specific labels for competency information in
855 mind.
856

857 • Competency information is data about people that can be used to make decisions related to employment,
858 advancement, admission, accreditation, etcetera. Where competency information is linked to an identifiable
859 individual, the protection of the privacy of that identifiable individual is essential. ISO standards should allow
860 flexible and secure methods for sharing competency information while respecting the rights of the individual to
861 privacy.
862

863 **9.2 The nature of competency considered within the context of ITLET and the labels of**
864 **competency information**

865 This section identifies the nature of competency as it is considered within the context of ITLET and labels which
866 are commonly used in order to facilitate the identification of where competency information lies in ITLET
867 information models, i.e., the "competency information records", and therefore meet some of the challenges
868 presented in the previous section.

869 In the context of ITLET, competencies might be considered according to several dimensions, depending on the
870 situation.
871

872 In a situation in which competency is measured, evaluated or assessed, competency shown by an actor is
873 considered in its "*actual*" dimension and may be expressed by different words or labels.
874

875 In other situations related to competency acquisition, such as searching for a course, prescribing a course, setting
876 a learning plan, competency is considered in its "*desired*" dimension. In such a case, competency to acquire can
877 be expressed by other words, and competency information can be labelled using words such as "training goals",
878 "learning objectives", "educational objectives", "abilities" or "capabilities", etc.
879

880 In a third category of situations, related to instruction design, such as designing a curriculum or a course,
881 competency is considered in its "*required*" dimension. In such situations, competency information can be labelled
882 using the same words as above: as "training goals", "learning objectives", "educational objectives", "abilities" or
883 "capabilities", etc. Furthermore, if the competency is fairly general, competency information can be found under
884 the label "aptitude".
885

886 As noted above, each different LET Institution may be supported through the use of specific information systems
887 that consist of digital products and services selected to support the institutional mission. These different
888 information systems are designed to meet the requirements of their own LET communities and may provide
889 structured competency information in a variety of different forms using diverse labels, making it challenging to
890 share competency information across different systems, domains, and jurisdictions. Some examples of how
891 competency information may be structured in different systems are provided in Figure 5 below. A program of
892 study in a higher education institution (LET Institution A) may describe the learning outcomes for courses
893 (required and elective) that must be completed over the program of study in order for a student to receive a
894 particular degree or diploma. A National Body (LET Institution B) may provide a taxonomic structure of
895 occupation competency lists that are provided in a structured hierarchy that allows for the discovery of skills that
896 may be common to several occupations for example. A professional association (LET Institution C) may develop
897 a competency ontology that indicates the required competencies for professionals in a particular field. The
898 Conceptual Reference Model for Competencies and Related Objects can be used to assist with understanding
899 the nature of the structured competency information and identifying the location of target competency records.

900 By using the Conceptual Reference Model for Competencies and Related Objects, competency information may
901 be identified and leveraged for potential use to support different activities such as to:

902 • Validate competency acquisition across different domains and various jurisdictions;

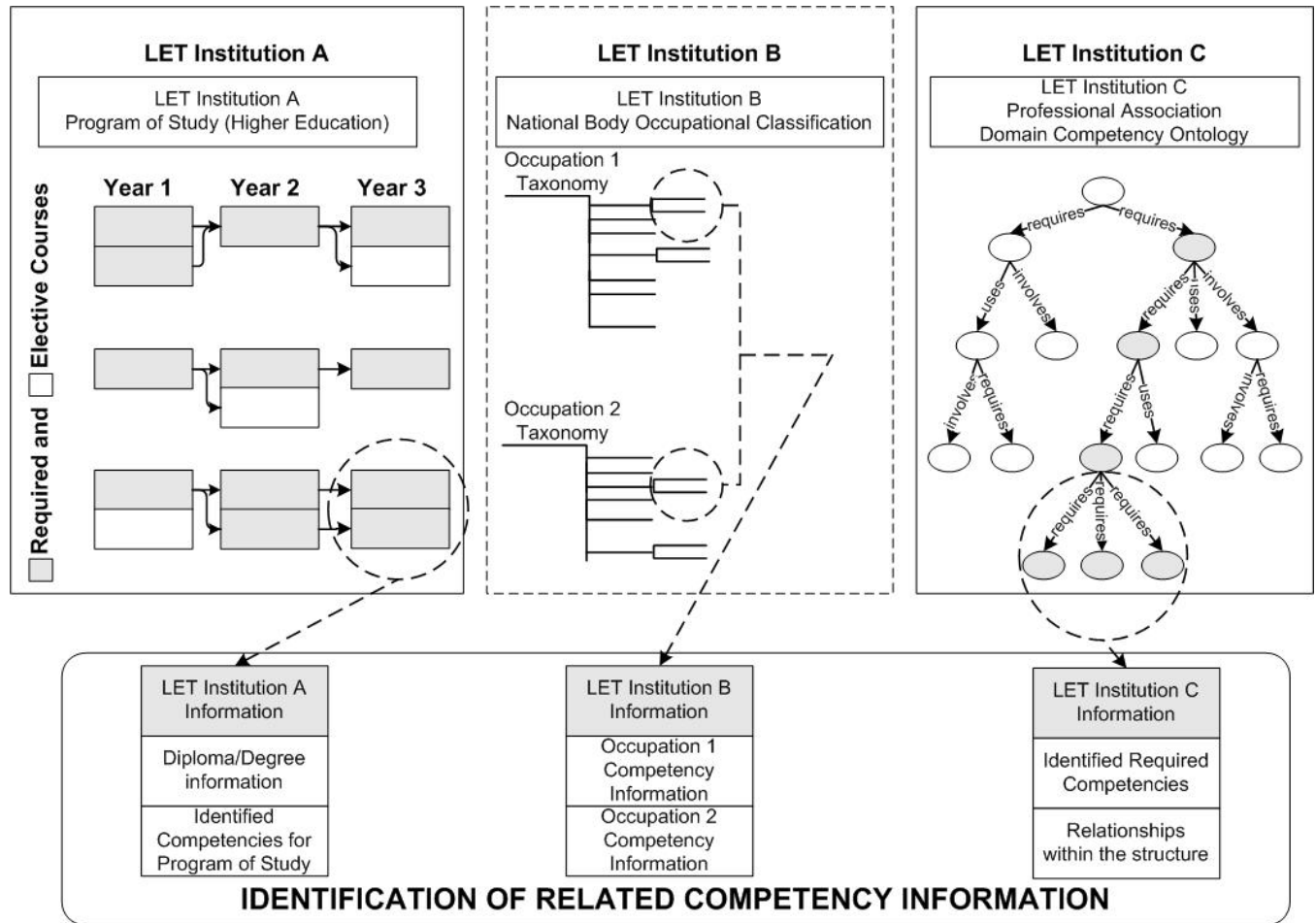903 • Consolidate competency information to support a job application;

**18**

904

905 **Figure 5 — Examples of identification of competency information that is used and expressed by many**
906 **stakeholders in diverse ways**

907

908 • Determine training required by an organization

909 • Create an individual plan to support personal learning and development in a new field of study

910 • Gather information to support the development of a new higher education program of study.

911 There is a need for common indexing information to associate shared data when competency information is
912 assembled from multiple databases (as shown in Figure 5). In some cases, this assembly requires exact matches
913 (e.g., the use of personal identifiers to collect competency information about a person). In some cases, less exact
914 matches may be appropriate (e.g., a search to find all the people in a company who have required competencies).
915 The class hierarchies of the Competency CRM (particularly those of the **Competency** and **Outcomes** entities)
916 can help to find common denominators that can be used for associating the data and therefore improve the
917 interoperability of the databases used to create the assembled competency information.

918 There is a need for common measurements, when the competency information from two individuals is compared.
919 For example, different combinations of work experience and formal education diplomas may be possible to meet
920 some competency requirements. Again, the class hierarchies of the Competency CRM (particularly those of the
921 **Criteria and Methods**, **Evaluation and Assessment Process**, **Outcomes**, and **Environment** entities) can be

922 used to characterize acceptable combinations of experience and diplomas for achieving the required competency
923 data and therefore improve the interoperability of the databases providing the information about the individuals.

924 When the competency evidence about two individuals is compared, part of this comparison is often a judgement
925 about the reliability and bias of the evidence.   This judgement may be based on the source of the evidence and
926 the manner in which the evidence was collected.   The CRM characterizes the evidence in terms of **Outcomes**,
927 identifies **Roles**, **Actors**, and **LET Institutions,** and **Environment** involved in creating the evidence, and
928 specifies the **Criteria and Methods**, **Evaluation and Assessment Process**, used to create the evidence and
929 therefore can improve the interoperability of the databases providing the information about the individuals.

930 In a supply chain, there is often a need to conduct gap analyses comparing the requirements of the consumer
931 with the capabilities of the supplier.   The class hierarchies of the Competency CRM (particularly those of the
932 **Competency**, **Outcomes**, and **Environment** entities) can help to find common denominators that can be used for
933 determining gaps and therefore improve the interoperability of the databases used in the gap analysis, as well as
934 suggesting methods for filling those gaps.
935
936 To summarize, competency representations can be found under the following labels in "competency information
937 records" or in "competency information objects", (e.g., CV, job profile) (see also clauses 8.2 and 8.3):

938        1)  "Competency"
939        2)  "Training goals", "Learning Objectives", "Educational Objectives", "Abilities", "Capabilities"
940        3)  "Aptitude"
941
942 Sometimes, competency information is embedded within "competency information records" or "competency
943 information objects" (see also clauses 8.2 and 8.3 in this document).
944
945 Therefore, to identify the target competency items in a given system, it is necessary to

946     1)  describe the system using the CRM,
947     2)  derive the system information model from the system description using the CRM.
948
949 Within the IT system of an institution there can be many different instances of competency information records.
950 When the institution must share this competency information with another institution, then information from the
951 competency information record is formatted into an agreed upon format and structure into a competency
952 information object that can be transferred from one institution to another.  First, competency information records in
953 each system must be identified using the steps described in clause 8.2, together with the format used to represent
954 competencies in each competency information record.  For schools or University records, the target competency
955 information records are likely to be identified from competency information objects like transcripts of diplomas or
956 of certifications. For work records, the competency information records may be more explicitly designated. Then,
957 once all competency information records are identified, together with their format, information contained in each
958 competency information record can be "harvested" and translated (if needed).

959 More detailed examples of how the CRM can be used are provided in Annex A and Annex B.  Annex A describes
960 how the CRM toolkit can be used to assist with understanding a use case.  A detailed example involving the
961 Luxemburg use case is provided in Annex B of this document.  The process described in Annex A.2 and A.3 was
962 used to compare the Luxemburg use case with the ITLET CRM.  Figures 11, 12, and 13 are the result of following
963 the process described in A.2 and A.3 and provide diagrammatic representations of lexical statements that
964 describe the Luxemburg use case. The final products are noted in each of the figures, - for example, the
965 competency information record 1 in the case of Figure 11 includes job profile information, which could comprise a
966 list of required competencies.

967 ## 10 Areas for further international standardization

968 There is much work that is ongoing regarding competency in different regions of the world.  Given this current
969 work it is suggested that the following areas for further international standardization should be considered:

970    •    Basic information about participants and associated competency information that should be included
971          within an IT system;

972    •    Clearer and more detailed semantic information that may be used to better understand and access
973          competency and related information within an IT system;

974    •    Standardized service interface components that can be used to more easily exchange and manage
975          competency information (e.g., profiles, job information, level, assessments, learning results, learning logs,
976          evidence information);

977    •    A standardized mechanism or method to aggregate, package, and transfer competency and related
978          information; and,

979    •    Other areas that may require standardization (some of which have been noted in clause 1.3 of this
980          document.

      

982
983
984

# Annex A
## (normative)

# Development of models from the ITLET Conceptual Reference Model


985 ## A.1  General

986 The ITLET Conceptual Reference Model together with the instructions and examples below provide a mechanism
987 or CRM toolkit to capture the processes that occur within a specific IT system that is used for LET in order to
988 manage, develop, describe, transfer or assess competency information or other related objects. This CRM toolkit
989 provides a process for the development of diagrammatical representations of lexical statements, the identification
990 of competency information objects that are the products of these processes, and competency information records
991 that contain constituent competency information components within the IT system being examined.  This CRM
992 toolkit may be used to compare competency information from heterogeneous sources to assist with the exchange
993 of competency information in a manner that supports IT system interoperability. A description of how to develop a
994 specific use case using the ITLET Conceptual Reference Model is provided in clause A.2 below.  Following this,
995 clause A.3 contains a Use case template that can be employed to gather information related to the use case.  A.4
996 provides a set of models that have been developed from a specific use case that was submitted by a National
997 Body.  A.5 describes the next steps that one would follow in order to clearly outline the information models as
998 distinct information records and competency-related objects.

999 ## A.2  How to develop a specific use case using the ITLET Conceptual Reference Model

1000 In order to develop a specific use case that can be used to determine the relationships between different actors,
1001 actions, competencies, etc., one would:

1002 ### A.2.1  Gather representative diagrams and information structures

1003 First gather any representative diagrams (for example, diagrams that have been created by the organization that
1004 developed or is using an IT system to manage, develop, describe, transfer or assess competency information or
1005 other related objects).  These diagrams may represent logical process, architectural structure, or relationships of
1006 different IT systems.
1007

1008 ### A.2.2  Develop use case description(s)

1009 In addition to any existing diagrams or if no diagrams exist, a completed use case description would be developed
1010 that is based on the Use case template document developed by SC36 WG3 (refer to clause A.3).
1011

1012 ### A.2.3  Determine aspects of IT system that will be analyzed using the CRM

1013 Next one would determine the aspects of the IT system that is being used to manage, develop, describe, transfer
1014 or assess competency information or other related objects that will be analyzed vis-à-vis the ITLET Conceptual
1015 Reference Model for Competencies and Related Objects.
1016

1017 ### A.2.4  Prepare new or review existing lexical statement representations

1018 The next step would be to use the prepared lexical statement representations developed or to develop lexical
1019 representations of the use case that clearly indicate the ITLET Conceptual Reference Model for Competencies
1020 and Related Objects elements that are involved.  Please note that if prepared lexical statement representations
1021 that have already been developed are being used, it may be necessary at this stage to more closely analyze the

1022 statements to determine the ITLET Conceptual Reference Model for Competencies and Related Objects elements
1023 that are specific to the particular use case.
1024

### A.2.5 Create diagram representations for each lexical statement

1026 Following this, using the CRM toolkit, a diagram representation is created for each lexical statement that clearly
1027 labels the relevant ITLET Conceptual Reference Model for Competencies and Related Objects elements that are
1028 in use for the IT system in question.
1029

### A.2.6 Assemble diagram representations or component diagram representations

1031 Then all diagram representations or component diagram representations that are relevant to the particular use
1032 case may be assembled to create a diagram that is specific to the use case in question and the aspect of the IT
1033 system that is to be analyzed.
1034

### A.2.7 Compare diagrams with CRM

1036 Finally, either the assembled diagram or the component diagrams may be compared to the ITLET Conceptual
1037 Reference Model for Competencies and Related objects itself or to other diagrams that have been developed
1038 from the ITLET Conceptual Reference Model to describe different information technology systems. Again, it
1039 should be noted that these diagrams may represent logical process, architectural structure, or relationships of
1040 different IT systems that are used to manage, develop, describe, transfer or assess competency information or
1041 other related objects.

## A.3 Use case template

1043 Below is a use case template that is based on the use case template developed by JTC1 SC36 WG3 (as JTC1
1044 SC36 WG3 N186) in order to gather information regarding different ITLET systems used to manage, develop,
1045 describe, transfer or assess competency information or other related objects. The use case template can assist in
1046 documenting the relevant information that needs to be analyzed and compared with the CRM.

# "Use case template"

### A.3.1 Background information components

1049 The following background information components should be considered:

1050 • Name of the Organization
1051 • Address
1052 • Website
1053 • Primary function or activities or business (For example, tertiary educational institution, government
1054 department, corporation.)
1055 • Date founded/created
1056 • Mission of the organization
1057 • Primary clients, customers, or stakeholders
1058 • Size of the organization
1059 • Contact Person (Name and E-Mail)
1060
1061

### A.3.2 Use case components

1063 The following use case information components should be considered:

- **Name of the use case:**

- **Scope:** (Details regarding scope may include whether the use case is applicable to a city, a province/state, a country, a group of countries, and whether it is specific to education, business, government, or other.)

- **Description:** (Briefly describe the use case (e.g., business context, scope, and goals of the actors). Describe typical transaction patterns and any special quality of service, security, or other information that is key to understanding the scenario. Please keep it to a paragraph or two as a short, human readable description.)  Please provide more detailed information under A.3.3.

- **Level of participant(s) addressed:** (For example, are the participants at the primary, secondary, tertiary, adult, or other level?)

- **Description or list of the technologies used:**

- **Scenario Sequence** (Briefly walk through the scenario step-by-step. Optionally, provide a corresponding UML activity or sequence diagram to illustrate.

  Step 1

  Step 2

  Sub Step 2.1

  Step 3

  etc.)

- **Primary Actor(s) and Role(s):** (Who are the actors within the scenario? What roles do they play in the scenario? Provide names and brief description of role.

  Actor 1 / Role

  Actor 2 / Role

  　　Etc.)


- **Competencies:** (How is competency defined, described, and represented in this use case?)

- **Trigger(s) / Pre-condition(s)** (Identify events, "triggers," or other preconditions. Which actor initiates the scenario?

  Trigger/Precondition 1

  Trigger/Precondition 2

  　　Etc.)

- **Post-condition – Success / Error Cases** (Describe the state or post-condition upon success.  If significant in understanding the scenario, briefly describe common error cases.

  Success case 1

  Error case 1

  Etc.)

- **Variations** (Use this section to document variations of the scenario outlined above. Repeat the whole template for alternatives that require significant description.

  Step 1

  Step 2

  Sub Step 2.1

  Step 3

  etc.)

- **Related objects:**               (What related objects are included in this use case (e.g., learning objectives, performance data)?)

- **Other elements:**               (What other elements are represented in this use case (e.g., environment, context, outcomes, criteria)?  How are these elements represented?)

- **Who is using what is described in this use case?**

1064

### A.3.3  Additional information component – Information relevant to understanding the use case

1066  A section regarding additional background information components should be considered to gather additional
1067  information relevant to the use case.  Wording that could be used for this section is provided below.

1068  Please use this section to provide additional information that will help to understand this use case.  For example,
1069  please provide additional website links, conceptual diagrams, vocabulary lists, elements, relationship diagrams,
1070  expanded description, and other documentation in use within the organization.
1071

1072　　　　　　　　　　　　　　　　**Annex B**

1073　　　　　　　　　　　　　　　　**(informative)**

1074

1075　　　　　**Specific example based on a use case submitted**


1076　This informative annex provides a detailed solution to the representation of the "Luxembourg use case" which was
1077　submitted in response to the call. It comprises two sections: the first one presents the ITLET Conceptual
1078　Reference Model instantiated with the case; the second presents the information model derived from it.　The
1079　diagram representations regarding the processes are compared with the CRM, and based on further analysis
1080　information models are generated that depict distinct information records.　During the process competency
1081　information records and competency information objects may be identified as well.

## B.1　Luxembourg use case

1083　Below is a detailed representation of the use case that is the result of following the steps from clause A.2.　The
1084　detailed representations have been created from an analysis of lexical statements and additional information
1085　provided by the Luxembourg National Body in response to the call for use cases.　The template call for use cases
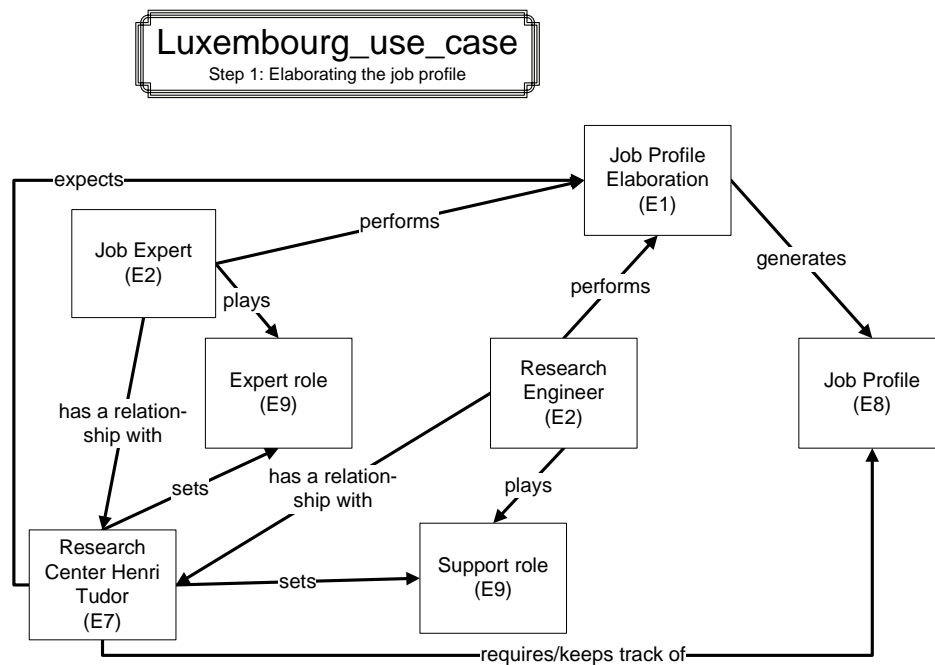1086　document provided in D.2 was used to gather this information.



1088　　　　　**Figure 6 — Luxembourg use case – Step 1:  Elaborating the job profile**

　　　　　　　　　　　　　　　　　　　　　　　　　**26**

1089  Figures 7 and 8 below document the next steps that have been elaborated using the CRM to describe the process
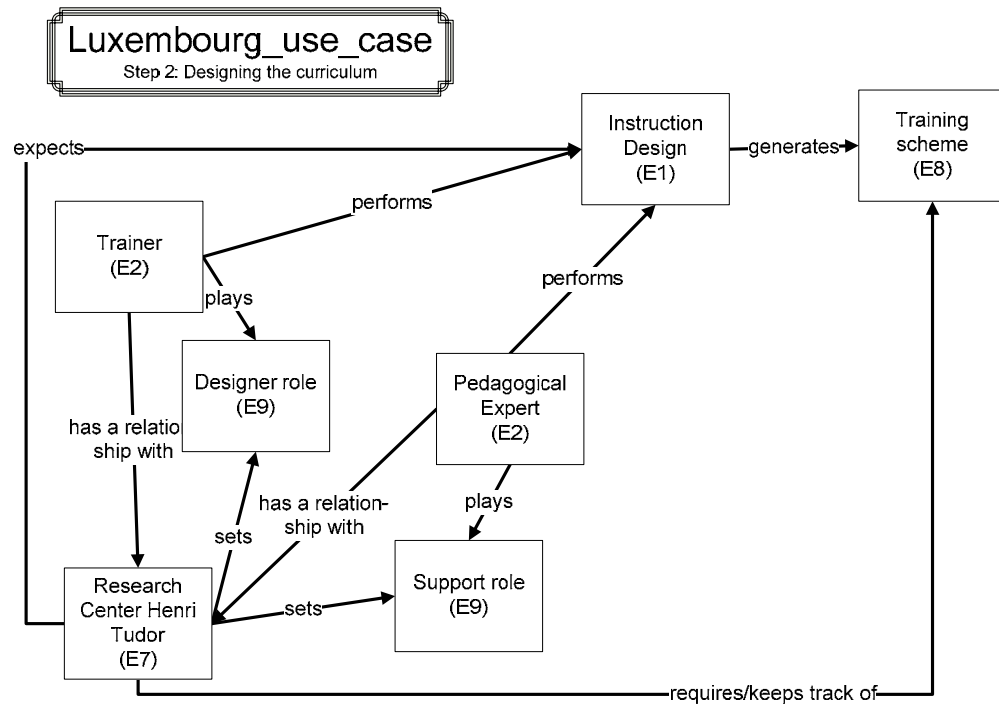1090  for the Luxembourg use case example.
1091

1092



1093  **Figure 7 — Luxembourg use case – Step 2:  Designing the curriculum**

1094
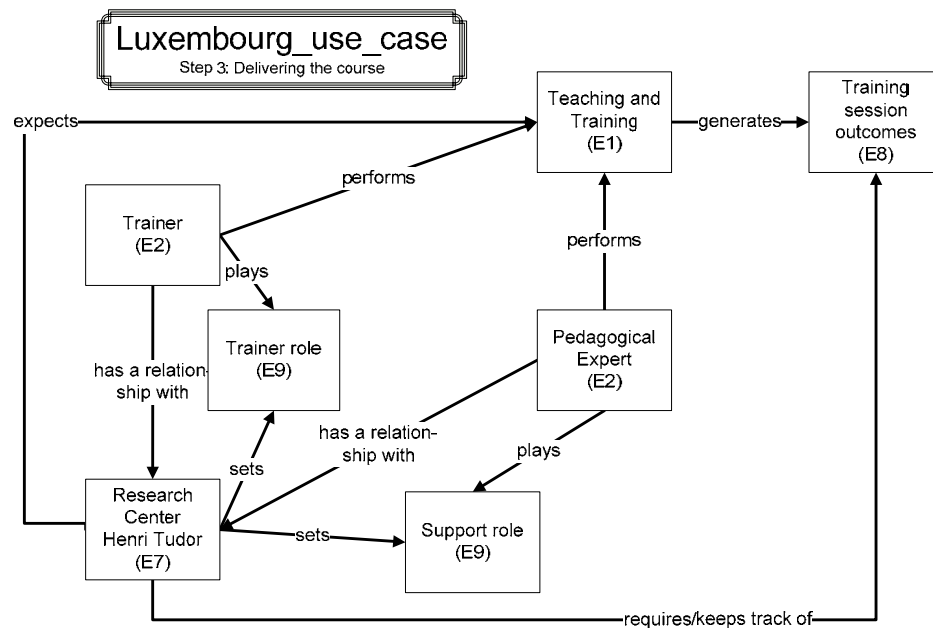1095

1096



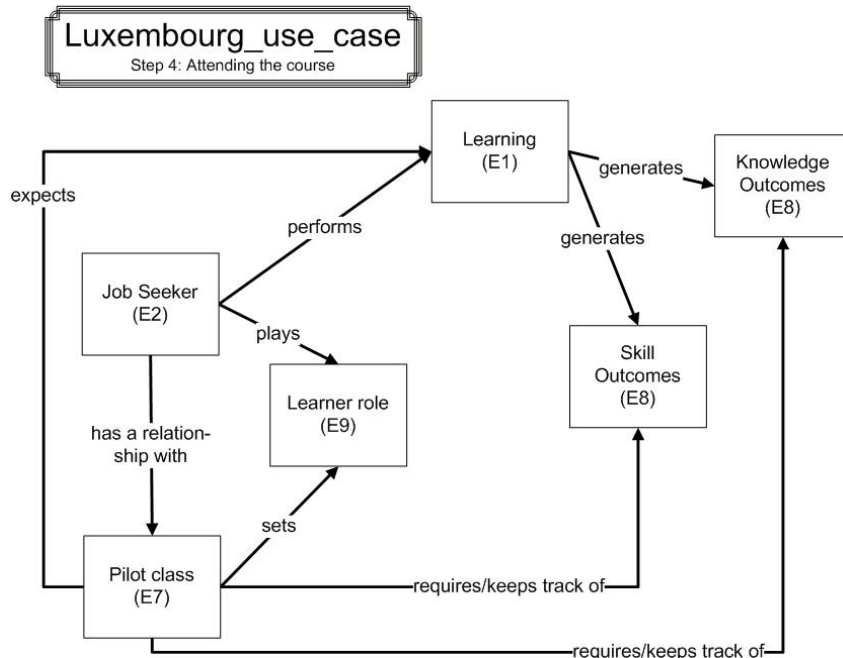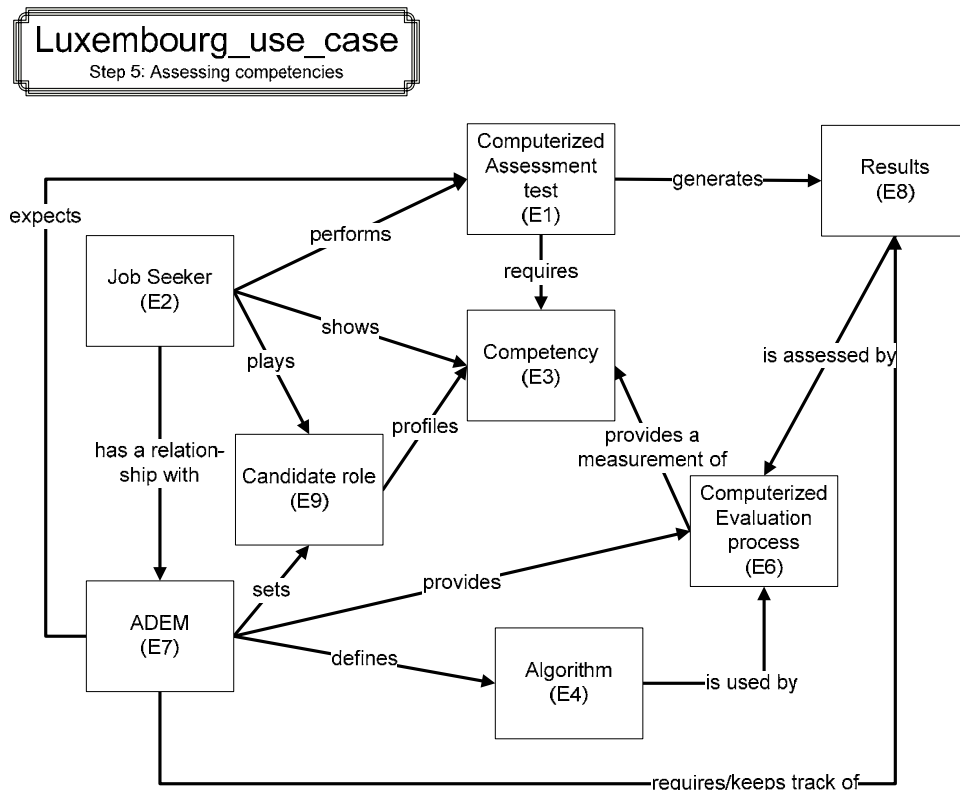1097  **Figure 8 — Luxembourg use case – Step 3:  Delivering the course**

**27**

1098    Elaborations of the next steps in the Luxembourg use case using the CRM are provided in Figures 9 and 10
1099    below.

1100

1101                    **Figure 9 — Luxembourg use case – Step 4:  Attending the course**

1102

1103

1104                    **Figure 10 — Luxembourg use case – Step 5:  Assessing competencies**

1105 ## B.2 The Luxembourg information models
1106

1107 To develop an information model from Step 1 of the Luxembourg use case (noted in Figure 6 in B.1), the related
1108 information model would be reviewed to discover the information records that are present during this step in the
1109 process. In the Luxembourg use case – Step 1: Elaborating the job profile, provided in B.1, the outcome of the
1110 action [job profile elaboration] is a [job profile]. The job profile information resides as a competency information
1111 record in the institution's IT system and contains information about the competencies required by the job in the
1112 form of a list of required competencies for example (see competency information record 1 in Figure 11 below).
1113 When the institution decides to share this competency information with another institution, then information from
1114 the competency information record is formatted into an agreed upon format and structure into a competency
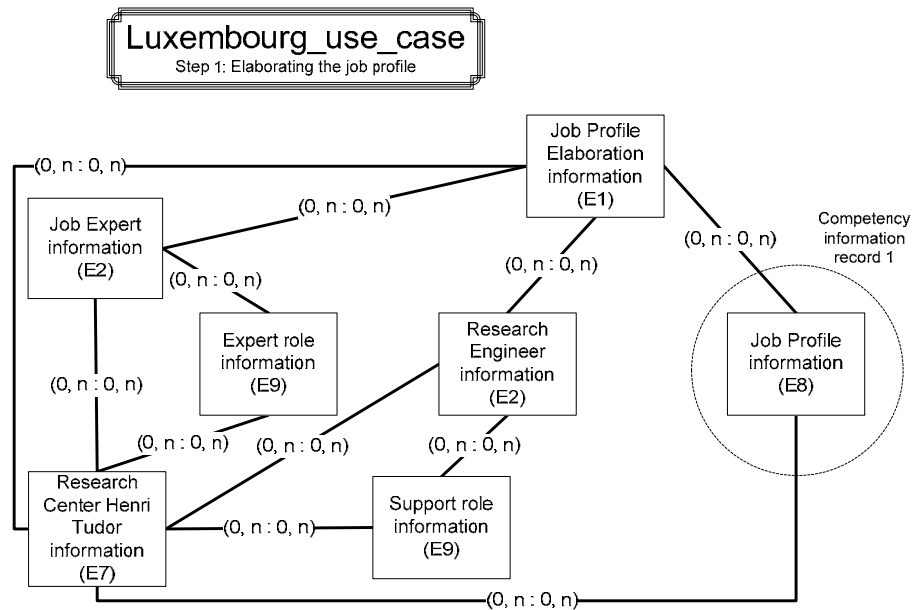1115 information object that can be transferred from one institution to another.



1116

1117 **Figure 11 — Competency information record 1**

1118

1119    To then develop an information model from Step 2 of the Luxembourg use case (noted in Figure 7 of B.1), the
1120    related information model would be reviewed to discover the information records that are present during this next
1121    step in the process.   In the Luxembourg use case – Step 2:   Designing the curriculum, provided in B.1, the
1122    outcome of the action [instruction design] is a [training scheme]. The description of the training scheme contains a
1123    list of learning objectives, which is a list of competencies required from the participants at the end of the training
1124    session (competency information record 2). If we want to determine the relevance of the training scheme to the
1125    job profile, we will compare the lists of required competencies for the job (competency information record 1 in
1126    Figure 11 above) to the list of learning objectives (competency information record 2 in Figure 12 below).

1127
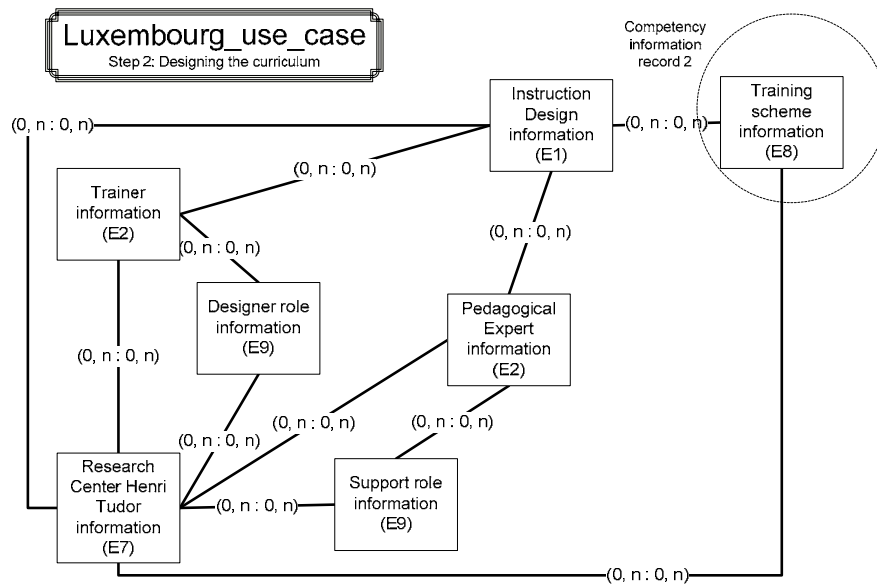


1128                                  **Figure 12 — Competency information record 2**

1129    Based on the application of the CRM toolkit, the Luxemburg use case indicates that:

1130    Competency information record 1 = list of required competencies from a job profile.

1131    Competency information record 2 = list of learning objectives, which is a list of competencies required from the
1132    participants at the end of the training session.

1133    Through a comparison of competency information record 1, and competency information record 2, it is possible to
1134    determine if the training is relevant to the job profile to which the training is targeted.

1135 It is possible to develop an information model from Step 5 of the Luxembourg use case (noted in Figure 10 of B.1),
1136 by reviewing the related information model. In the Luxembourg use case – Step 5:  Assessing competencies
1137 provided in B.1, the [computerized evaluation process] will provide a measurement of the actual [competency] of
1138 the job seeker, before the training session (competency information record 3a) and after the training session
1139 (competency information record 3b). The generic competency information record for this step is represented in
1140 Figure 13 below.

1141 It is expected that, after the training session, the actual competencies measured (competency information record
1142 3b) would be similar to competencies required by the job (competency information record 1).

1143 If the two competency information records use the same structure, the comparison is easily possible. If not, the
1144 structures are to be compared using an appropriate translator.

1145
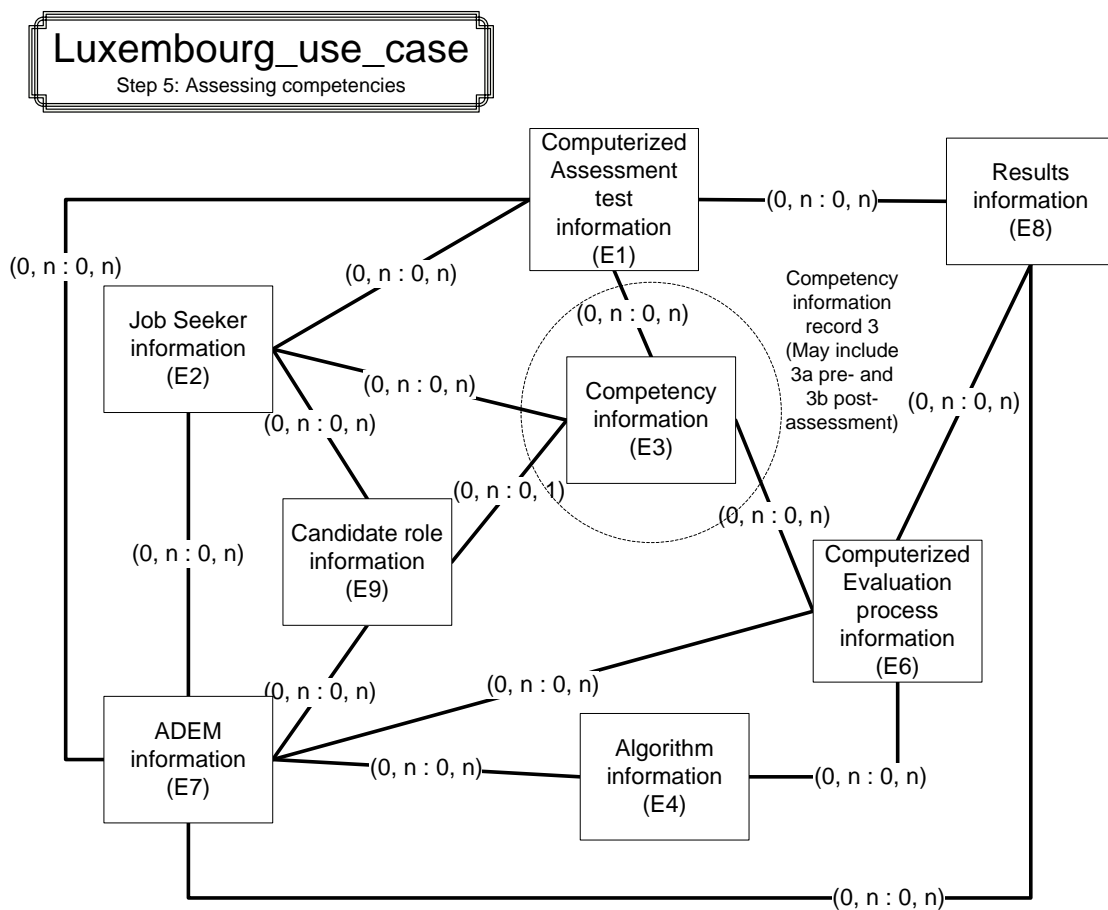


1146

1147 **Figure 13 — Competency information record 3**

1148 In this use case, 3 competency information records have been identified, each having a different label.  These
1149 identified competency information records include:  job profile (as noted in Figure 11), training scheme (as noted
1150 in Figure 12), and competency (as noted in Figure 13, and potentially measured before and after training). The
1151 structure of the information contained within these records can be different for many reasons.

1152 Each of the three competency information models is essential to understanding the process that is being used to
1153 manage competency information for this use case.  In Figure 11, a detailed job profile (competency information

1154 record) is one of the end products of this step in the process. The competency information record for this figure
1155 includes a listing of the job requirements (competency information record 1) for the job profile.

1156 Next in the process, in Figure 12, a training plan is developed that includes specific training scheme information
1157 such as the intended learning outcomes. It may also include the activities that will be employed to foster learning,
1158 and the measurement methods that will be used to determine if the learning outcomes have been met.

1159 Finally, in the last phase of the process depicted in Figure 13, which involves implementation, a pre-assessment
1160 may be used to determine the current level of the learner with regard to the specific job requirements. Following
1161 the learning activity, the subsequent level of the learner may be measured using the measurement method that
1162 was determined during the development of the training plan. The resulting competency information record 3
1163 would include the actual competencies measured both prior to and subsequent to the intervention. Translators
1164 that include job profiles that are used for competency information objects for exchange with other institutions and
1165 include specific job requirements may be used to compare the results of the post-assessment and the pre-
1166 assessment to determine if the learner has made gains in terms of the job requirements with respect to an
1167 external competency framework. In addition, it may be possible to determine the effectiveness of specific learning
1168 activities for individual learners based on aggregated data that is compared across different systems and to tailor
1169 the learning activities based on specific individual results.

1170 Based on the application of the CRM toolkit, the Luxemburg use case indicates that if:

1171 Competency information record 3a = measurement of the actual competency of the job seeker BEFORE the
1172 training session

1173 Competency information record 3b = measurement of the actual competency of the job seeker AFTER the training
1174 session

1175 Then,

1176 • A comparison of competency information records 3a, 3b, and 2 may help with evaluating the effectiveness of
1177 the training that was provided;

1178 • If competency information records 3b and 1 are compared, it is possible to determine if the competencies
1179 measured following the training are now closer to the job profile requirements that have been listed for the
1180 specific job.

1181 **Annex C**
1182 **(informative)**
1183

1184 **Background information related to the development of the CRM**

1185 The initial set of classes for this ITLET Conceptual Reference Model was extracted from the definition of
1186 competency:
1187 • [competency]
1188 • [actor]
1189 • [outcome]
1190 • [action]
1191

1192 The following properties were noted between these classes and included in the CRM:
1193 • [actor] shows [competency]
1194 • [actor] performs [action]
1195 • [action] generates [outcome]
1196 • [action] requires [competency]
1197

1198 The classes and the relationships between the classes that are based on the definition of competency are
1199 represented in Figure 14 below. It should be noted that extensive discussions took place within WG3 regarding
1200 the choice of words used to describe the relationships between the classes. In particularly the terms "expresses",
1201 "executes", "demonstrates" and others were discussed to describe the relationship between actor and
1202 competency. Finally, the word "shows" was chosen as the concern was to ensure that the class and property
1203 labels do not favour one learning theory over another. Initially, the agreement at the WG3 meetings was to use
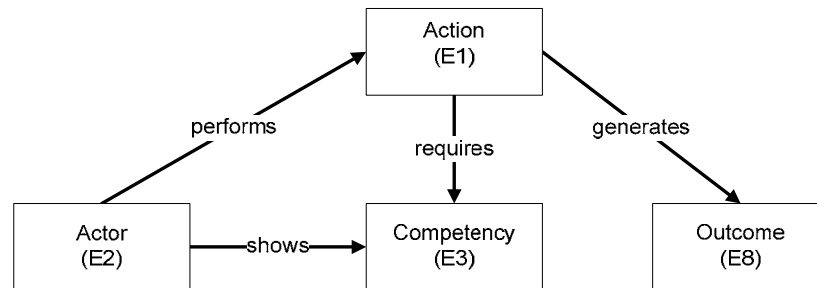1204 the word "expresses". However, the simpler and straightforward word "shows" finally was chosen.
1205



1206
1207 **Figure 14 — Initial set of classes in the ITLET Conceptual Reference Model based on JTC1 SC36 definition**
1208 **of competency**

1209
1210 However, the development of use cases focused on the communication of competency information between
1211 various LET institutions and the [Actors] possessing the [Competencies]. Therefore, [LET institution] was added
1212 to the CRM. Examples of [LET institution] include educational institutions, corporations, governments, and other
1213 organizations.
1214
1215 The use cases also described collaborative activities in which multiple [Actors] participate in various [Roles]. For
1216 example, a student is an [Actor] who desires to acquire and demonstrate certain [Competencies]. This student
1217 may enroll in an educational institution (which is a [LET institution]) and collaborate with teachers (who are
1218 [Actors] with specific [Roles]) and examiners (who also are [Actors] with specific [Roles]). Therefore, [Role] was
1219 added to the CRM. Since a [Role] is a community understanding rather than a unilateral understanding, the
1220 property that [LET institution] assign [Roles] to [Actors] was included in the CRM.
1221

1222 The use cases pointed out the need to include in the CRM descriptions of how [Competencies] are evaluated as
1223 well as how [Competencies] are acquired.  Therefore, the classes [Evaluation, assessment Process] and [Criteria
1224 and method] were added to the CRM.  An example of [Evaluation, assessment Process] is an exam, where the
1225 [Criteria and method] is the minimal score needed to pass the exam and how it is calculated (weight of items for
1226 example).

1227

1228 Since the [Criteria and method] is a community understanding rather than a unilateral understanding, the property
1229 that [LET institution] determines [Criteria and method] was included in the CRM.  Similarly, the properties [Criteria
1230 and method] is used by [Evaluation, assessment Process] and [Evaluation, assessment Process] measures
1231 [Competency] are also included in the CRM.

1232

1233 This then led to the further development of the ITLET Conceptual Reference Model to include classes that may be
1234 used if needed to represent information technology systems where there are external bodies such as educational
1235 institutions, corporations, governments, and other organizations (e.g., accreditation organizations) that are
1236 involved in the competency assessment process.  Thus, the next set of classes for this ITLET Conceptual
1237 Reference Model that was extracted from the use cases include:
1238    • [criteria and method]
1239    • [evaluation, assessment process]
1240    • [LET institution]
1241    • [role]

1242

1243 The following properties were noted between these entities and the initial set of entities and are included in the
1244 second version of the CRM:
1245    • [actor] has a relationship with [LET institution]
1246    • [actor] plays [role]
1247    • [LET institution] sets [role]
1248    • [LET institution] expects [action]
1249    • [LET institution] provides [evaluation, assessment process]
1250    • [LET institution] defines [criteria and method]
1251    • [LET institution] requires/keeps track of [outcome]
1252    • [role] profiles [competency]
1253    • [criteria and method] are used by [evaluation, assessment process]
1254    • [outcome] is assessed by [evaluation, assessment process]
1255    • [evaluation, assessment process] provides a measurement of [competency]

1256

1257 The first revision of the classes and the properties that were developed based on use cases that were submitted
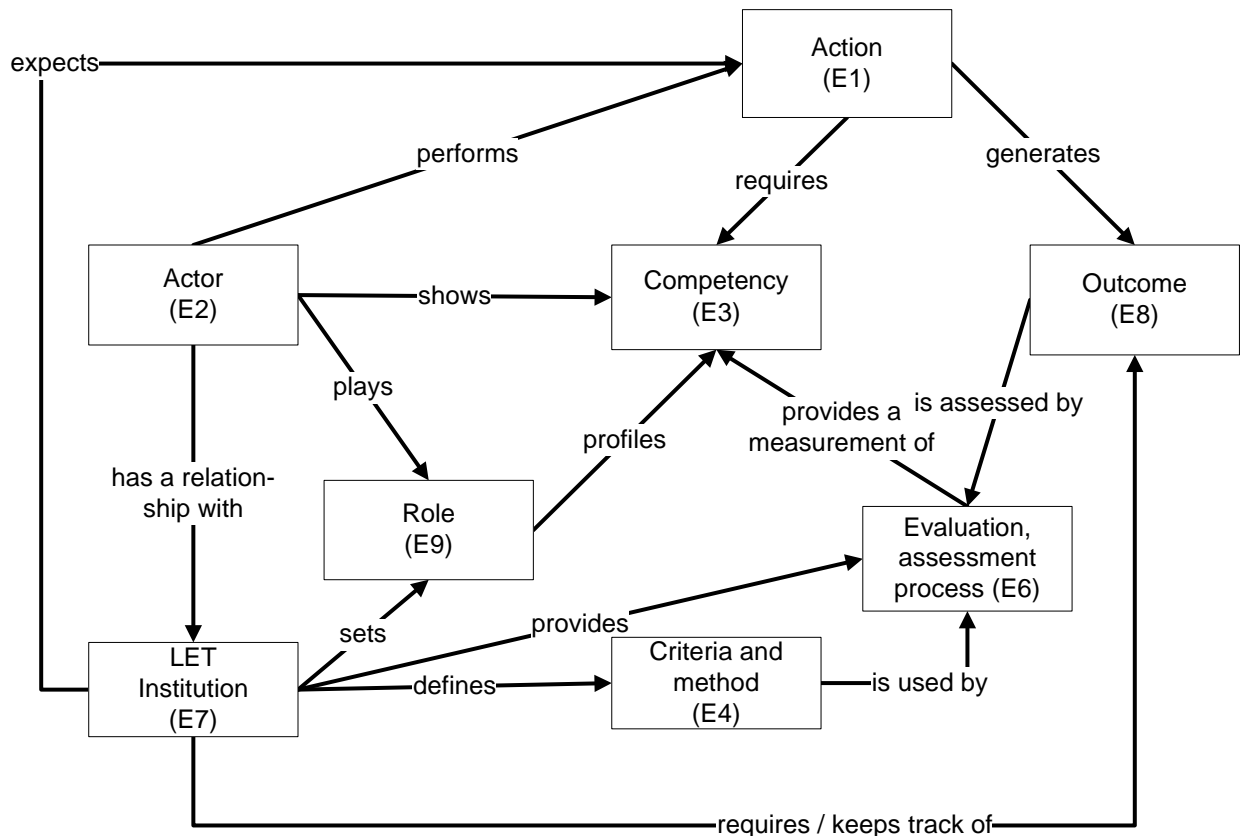1258 are represented in Figure 15 below.

1259

1260 **Figure 15 — First revision of classes and properties in developing the ITLET Conceptual Reference Model**
1261 **for Competencies and Related Objects based on use case analyses**

1262

1263 It became evident from discussions regarding the use cases that LET institutions exist within different
1264 environments and these environments (physical and virtual) may impact on the actions of those involved in
1265 competency activities. Additionally, part of the function of Learning, Education, and Training institutions is to
1266 provide environments for acquiring and demonstrating competencies that are safer and more effective than
1267 naturally occurring contexts. For example, using simulations to allow nuclear engineering students to manipulate
1268 experimental conditions may be safer than allowing them to perform experiments in a laboratory setting. Training
1269 doctors in medical colleges that certify their competency is safer for patients than letting anyone treat patients and
1270 using their public reputation define their competency. Therefore, the class [environment] was added to the CRM to
1271 capture information such as location description, duration, date and time, etc. that may be gathered and stored in
1272 information technology systems.

1273

1274 Thus, the following class was added to the ITLET Conceptual Reference Model:
1275 • [environment]

1276

1277 The following properties were noted between this class and the other classes within the revised CRM:
1278 • [LET institution] influences [environment]
1279 • [environment] shapes [action]

1280

1281 The addition of this class and its properties in the ITLET Conceptual Reference Model are represented in Figure
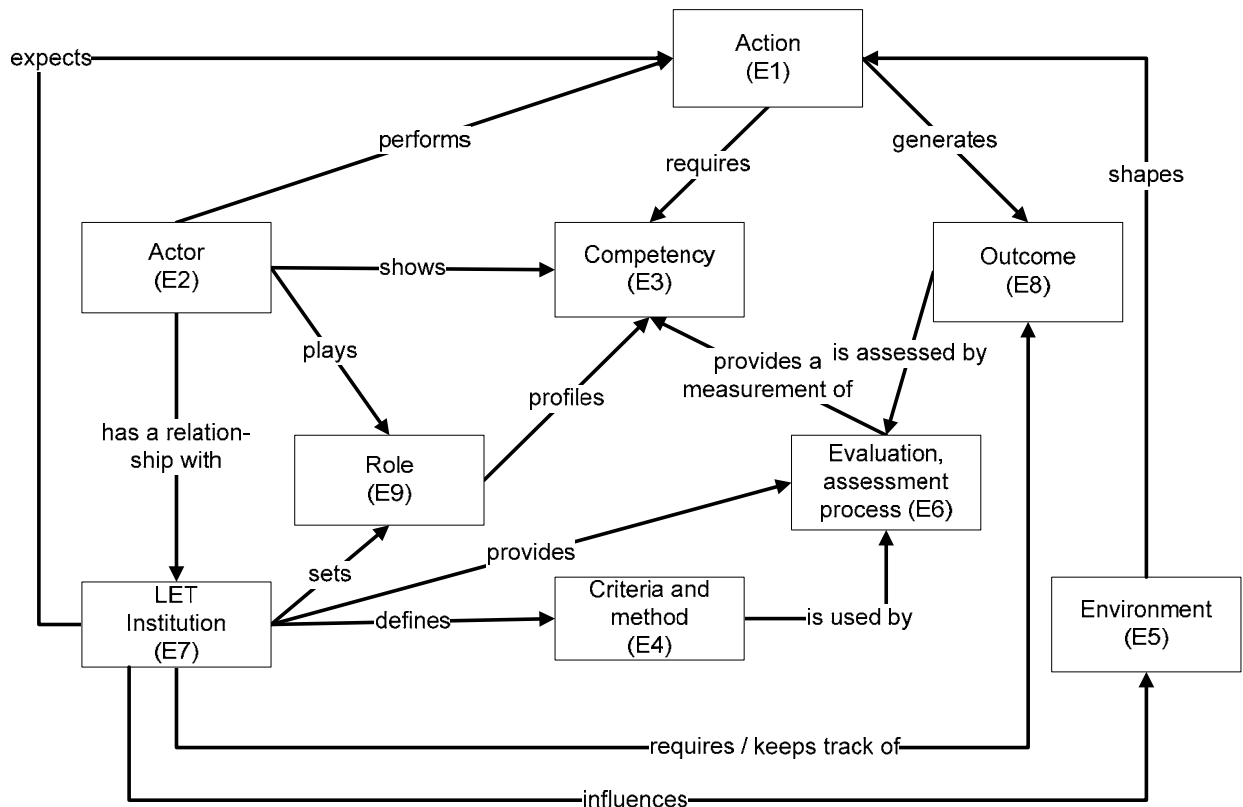1282 16 below.

1283

1284

1285  **Figure 16 — Second revision to include new classes and properties in developing the ITLET Conceptual**
1286  **Reference Model for Competencies and Related Objects based on use case analyses**

1287

1288  The ITLET Conceptual Reference Model provides a model against which information models may be compared.
1289  It can be used to gain understanding of the types of information different organizations/institutions/government
1290  agencies encode, and facilitate interoperability by providing a framework for considering who, what, how, when,
1291  and where information is being encoded, thus enabling the leveraging of information within existing systems.
1292  Please refer to clauses 8.2, 8.3 and 8.4 and Annex B above, which provide more detailed examples regarding
1293  how information models, competency information records, and competency information objects may be
1294  represented using the ITLET Conceptual Reference Model for Competencies and Related Objects.

| 1295 | **Annex D** |
| 1296 | **(informative)** |
| 1297 | |
| 1298 | **Use cases submitted by National Bodies** |

1299 **D.1 Use cases submitted by National Bodies**
1300

1301 A total of 6 use cases have been submitted in response to SC36 Plenary Resolution #20 (London 2007) in
1302 36N1499 to assist WG3 in evaluating and refining the ITLET Conceptual Reference Model for Competencies and
1303 Related Objects Technical Report 24763 including: Canada (2), Japan (1), Luxembourg (1), and United Kingdom
1304 (2).

1305 **Table 1 — Use cases submitted by National Bodies**

| Use Case # | Submitted by | Description | Target Group | Technologies |
|---|---|---|---|---|
| 1 | Canada | This use case is applicable to the education sector; it involves the processing of applications for 18 universities and the Ontario College of Art & Design in the province of Ontario in Canada. Applications may be received from within Ontario, elsewhere in Canada or internationally. | Participants are at the tertiary and adult/other level. | EDI ANSI ASC X12 version 4010 – Electronic Data Interchange (EDI) standard that has been developed for: <br>• elementary/secondary schools <br>• postsecondary schools <br>• state and federal education agencies <br>• student data providers and other third parties <br>• commercial software vendors <br>SPEEDE/express Transaction sets such as: <br>• EDI-Formatted Transcript <br> ○ TS130(00) = Original |
| 2 | Canada | One of the key components of the e-Learning Ontario strategy is the Ontario Educational Resource Bank (OERB). The OERB is a learning object repository (LOR) that allows teachers to contribute and tag resources that they have created and share them on a province-wide | Teachers, students and parents of students in Kindergarten – Grade 12. All 72 provincial district school boards have signed on to participate in the provincial | 1. Contributor's Gateway (CG) – a locally developed interface application that permits the uploading and tagging of resources (PHP, MySQL) <br>2. Vendor licensed learning object repository <br>3. Standards used include: SCORM for object wrapping, and an application profile derived from CanCore for the metadata. The metadata standard has been customized and demonstrates |

**37**

| Use Case # | Submitted by | Description | Target Group | Technologies |
|---|---|---|---|---|
| | | scale with other teachers and students. The OERB is searchable via a basic search. It can also be browsed using provincial curriculum details. (http://www.edu.gov.on.ca/eng/educationFacts.html) | strategy. | flexibility and extensibility in its approach. |
| 3 | Japan | SSI-ITSS is a tool of skills inventory based on ITSS for IT professionals. It makes individual career paths visible for individuals and organization, and supports skill-analysis, skill-evaluation and skill-development for not only entry level engineers but advanced IT professionals. SSI-ITSS has a skill gap analysis, which provides one viewpoints for individuals comparing current individual skill status with ideal status for business strategy, and provides another viewpoints for organization comparing current organizational capability status with ideal status for business strategy. | Adults, who are employees or job applicants and university students, are the target group for this use case. | ASP Service, Oracle Database, Search Engine |
| 4 | Luxembourg | The use case is a research project the Research Centre Henri Tudor is realizing in partnership with the Luxembourg Employment Administration (ADEM). The aim is to design, implement and assess | The participants are adults who are unemployed. | TAO: French acronym for **T**esting **A**ssisté par **O**rdinateur (Computer-Based Testing), it is an open source computer-based assessment platform. |

| Use Case # | Submitted by | Description | Target Group | Technologies |
|---|---|---|---|---|
|  |  | new approaches in training and against unemployment. Training for unemployed persons has been designed, following a precise process, and job competencies are assessed before and after the training, in order to measure how efficient the training was in the participants' competencies evolution. |  |  |
| 5 | United Kingdom | This submission provides information regarding the first release of the TENCompetence Domain model. It is expressed as an UML class diagram and a vocabulary defining each concept (class) in the model. | The target group for this use case is lifelong learners who require that IT systems support the attainment of learning goals. | UML diagrams<br><br>Vocabulary including class names and descriptions<br><br>May involve integration of different technologies such as RSS, wikis, blogs, etc. (more information is listed within current submission) |
| 6 | United Kingdom | This use case describes some experiences in creating vocabularies to express curriculum information and to provide valid controlled values for metadata schemas. It suggests one way that vocabularies can be managed based upon real uses and proven technologies. | The curriculum authority created a set of keywords for the whole of the 5-16 year old curriculum in schools. | Based on LOM, utilizes Zthes specification,<br><br>Vocabulary editor (Studio), vocabulary server (Vocabulary Bank), web service |

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1312 **D.2 SC36 WG3 Use case template**

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1314 Below is the template from SC36 WG3 N186, which was used to gather use case information for this Technical
1315 Report.

1316

# 1317 <u>"Call for use cases"</u>

1318 *Please provide your documentation based on the following framework*

## 1319 D.2.1 Background Information

1320 Please complete the following table regarding the organization described in the use case:

| | |
|---|---|
| **Name of the Organization:** | |
| **Address:** | |
| **Website:** | |
| **Primary function or activities or business:** | (For example, tertiary educational institution, government department, corporation.) |
| **Date founded/created:** | |
| **Mission of the organization:** | |
| **Primary clients, customers, or stakeholders:** | |
| **Size of the organization:** | |
| **Contact Person (Name and E-Mail):** | |

1321

## 1322 D.2.2 Use case

| | |
|---|---|
| **Name of the use case:** | |
| **Scope:** | (Details regarding scope may include whether the use case is applicable to a city, a province/state, a country, a group of countries, and whether it is specific to education, business, government, or other.) |
| **Description:** | (Briefly describe the use case (e.g., business context, scope, and goals of the actors). Describe typical transaction patterns |

| | |
|---|---|
| | and any special quality of service, security, or other information that is key to understanding the scenario. Please keep it to a paragraph or two as a short, human readable description.) |
| **Level of participant(s) addressed:** | (For example, are the participants at the primary, secondary, tertiary, adult, or other level?) |
| **Description or list of the technologies used:** | |
| **Scenario Sequence** | (Briefly walk through the scenario step-by-step. Optionally, provide a corresponding UML activity or sequence diagram to illustrate.<br><br>   1. Step 1<br>   2. Step 2<br>       o Sub Step 2.1<br>   3. Step 3<br>   4. etc.) |
| **Primary Actor(s) and Role(s):** | (Who are the actors within the scenario? What roles do they play in the scenario? Provide names and brief description of role.<br><br>   • Actor 1 / Role<br>   • Actor 2 / Role<br>     Etc.) |
| **Competencies:** | (How is competency defined, described, and represented in this use case?) |
| **Trigger(s) / Pre-condition(s)** | (Identify events, "triggers," or other preconditions. Which actor initiates the scenario?<br><br>   • Trigger/Precondition 1<br>   • Trigger/Precondition 2<br>     Etc.) |
| **Post-condition – Success / Error Cases** | (Describe the state or post-condition upon success. If significant in understanding the scenario, briefly describe common error cases.<br><br>   • Success case 1<br>   • Error case 1<br>   • Etc.) |
| **Variations** | (Use this section to document variations of the scenario outlined above. Repeat the whole template for alternatives that require significant description.<br><br>   1. Step 1<br>   2. Step 2<br>       o Sub Step 2.1<br>   3. Step 3<br>   4. etc.) |
| **Related objects:** | (What related objects are included in this use case (e.g., learning objectives, performance data)?) |
| **Other elements:** | (What other elements are represented in this use case (e.g., environment, context, outcomes, criteria)? How are these |

| | elements represented?) |
|---|---|
| **Who is using what is described in this use case?** | |

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### D.2.3 Additional information relevant to understanding the use case

1325 Please use this section to provide additional information that will help to understand this use case.  For example,
1326 please provide additional website links, conceptual diagrams, vocabulary lists, elements, relationship diagrams,
1327 and other documentation in use within the organization.

1328    **Annex X**
1329    **(Replacement figure and text for NB consideration)**

1330    *Project Co-Editors Note:*

1331    *NBs need to decide whether*

1332        *1) to stay with the existing Figure 1a and existing text for ISO/IEC DTR 24673, and complete the first edition*
1333            *of this project accordingly based on ballot comments received; or,*

1334        *2)  change the whole approach as indicated in Figure 1b below, i.e.  if the rationale provided for making such*
1335            *a significant change is provided via P-member ballot comments.*

1336    *Should P-members decide to adopt alternative figure 1b as found in Annex X is accepted  then, the terms and*
1337    *definitions in Clause 3, clauses 6 and 7 and all the following figures in the document will need to be updated.*

1338    *NBs who advocate this significant change through the adoption of new Figure 1b, instead of existing Figure 1a,*
1339    *are requested to provide a clear rationale as to why such a change needs to be made as well as needed*
1340    *suggested replacement or amended text for existing text in Clauses 3 5, 6 and 7 as well as all the other impacted*
1341    *figures in this document.*

1342

1343    Figure 1b is based on a presentation from the German NB (WG3 N279 -
1344    http://isotc.iso.org/livelink/livelink/fetch/2000/2122/327993/806742/4920601/4920602/7545627/German_contributi
1345    on_for_discussion_in_Umea.pdf?nodeid=8380486&vernum=0) to the study period on the managing and
1346    exchanging participant information.

1347    **3  Terms and definitions**
1348    **3.2**
1349    **competency**
1350    definition required

1351    **3.3**
1352    **competency-in-action**
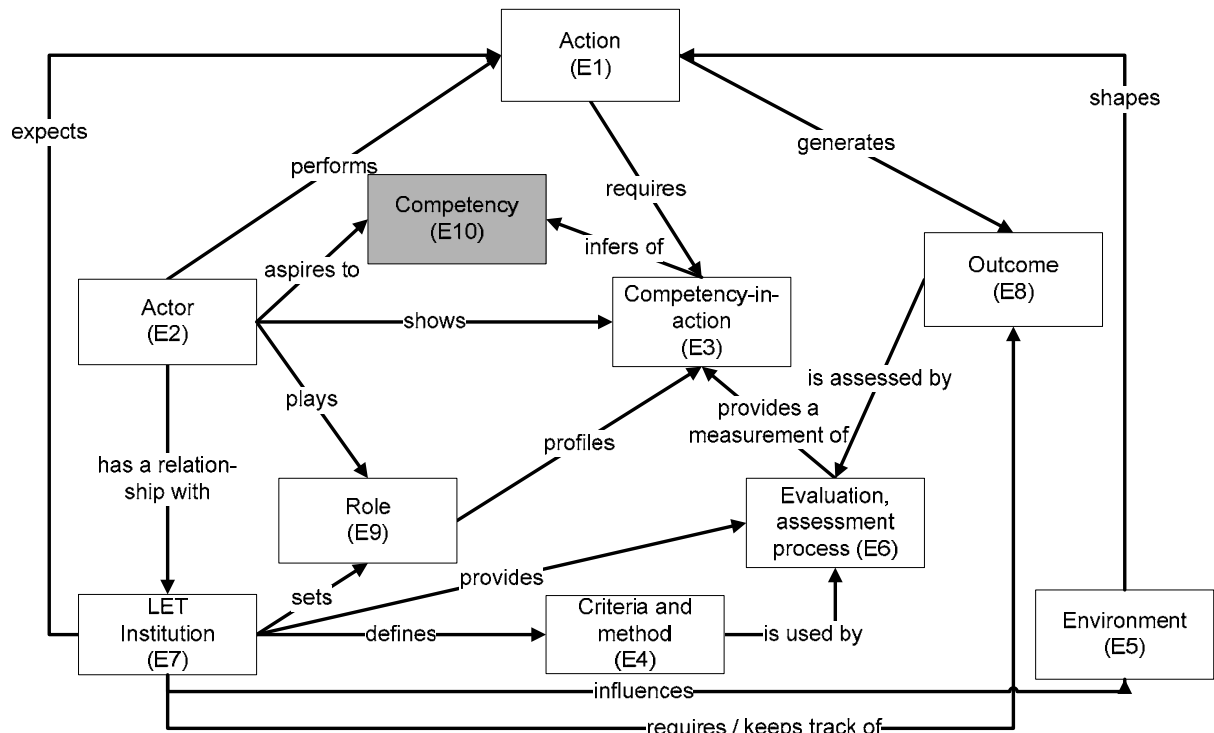1353    definition required

**43**

**Figure 1b — Alternative figure for the ITLET Conceptual Reference Model for Competencies and Related Objects**

*Concluding Project Co-Editors Note on Figure 1B and impact on ISO/IEC TR 24763:*

*If the rationale for  the alternative figure 1b is accepted, by SC36/WG3, then the key existing concepts and definition of "competency" will need to be changed, a new concept of "competency-in action" defined and many of the existing definitions of concept as found in Clause 3 need to be changed. In addition existing text in clauses 6 and 7 and all the following figures in the document would need to be updated consequently.*

***This will only be done if such agreed upon amended or replacement text for Clause 3, 5, 6, 7 and Annex C is provided as part of P-member ballot comments.***

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6.2  Identification of classes and their descriptions (if figure 1b is accepted):

E3: [Competency-in-Action] {simple competency, complex competency…}

E10: [Competency]

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7.2  Identification of properties and their descriptions (if figure 1b is accepted):

P1: [Actor] shows (is shown by) [Competency-in Action]

P6: [Action] requires (is required by) [Competency-in-Action]

P9: [Evaluation, assessment process] provides a measurement of (is measured by) [Competency-in-Action]

1381 P17: [Role] profiles (is profiled by) [Competency-in-Action]
1382
1383 Note: the following 2 properties would be added if figure 1b is accepted
1384
1385 P18: [Actor] aspires (is aspired by) [Competency]
1386
1387 P19: [Competency-in-Action] infers (is inferred by) [Competency]
1388
1389 ----------------------
1390
1391 Figures to be updated if figure 1b is accepted include:  figure 2, figure 10, figure 13,

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