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A Common assessment Results Model for ILE

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Abstract: Many Interactive Learning Environments (ILE) produce assessment results. Norms exist to define how these results can be used, obtained and manipulated within ILE. AICC, certainly the most known, defines how to communicate assessment results and more widely, datas from a Learning Object (LO) to a Learning Management System (LMS). However, AICC and the other norms don't define what an assessment result has to look like. Moreover, assessment results are often semantically poor and expressed in a ILE-specific formalism. A common results model would improve the interoperability between ILE but also, if it is rich enough, clarify the meaning of assessment results. In this paper, such a common results model is introduced. At first its conceptual model is exposed, then its information model is described.

Introduction

Historically, Interactive Learning Environments (ILE) used within the school or lifelong learning programs, have always integrated varied means of assessing users based on traditional methods, tools and techniques of assessment. But their way of expressing learners' results remains specific to each ILE, which can appear natural if one admits that a ILE generally relates to a particular discipline and is used most of the time only individually by the learner or the teacher.

However, the propagation of Learning Management Systems (LMS) gives a new context within assessments can be shared by other actors that the teacher and the learner. Assessment can also be used by other LMS services in particular administrative services. One of the important questions that the integration of ILE within LMS raises is that of their interoperability through the results which they produce. However, there is currently no standard results format. ILE standards such as AICC[1] treat only aspects relating to the interactions between LO and LMS but the format in which data will be stored and shared in the LMS and in particular the results is not standardized. To answer these problems, we are working on a results model called CRM for Common Results Model [1].

This model expresses assessment results by clarifying the used mechanisms of assessment and especially, thanks to its associated formalism, facilitating the interoperability of the services of the LMS.

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[1] Aviation Industry CBT (Computer Based Training) Committee, http://www.aicc.org/
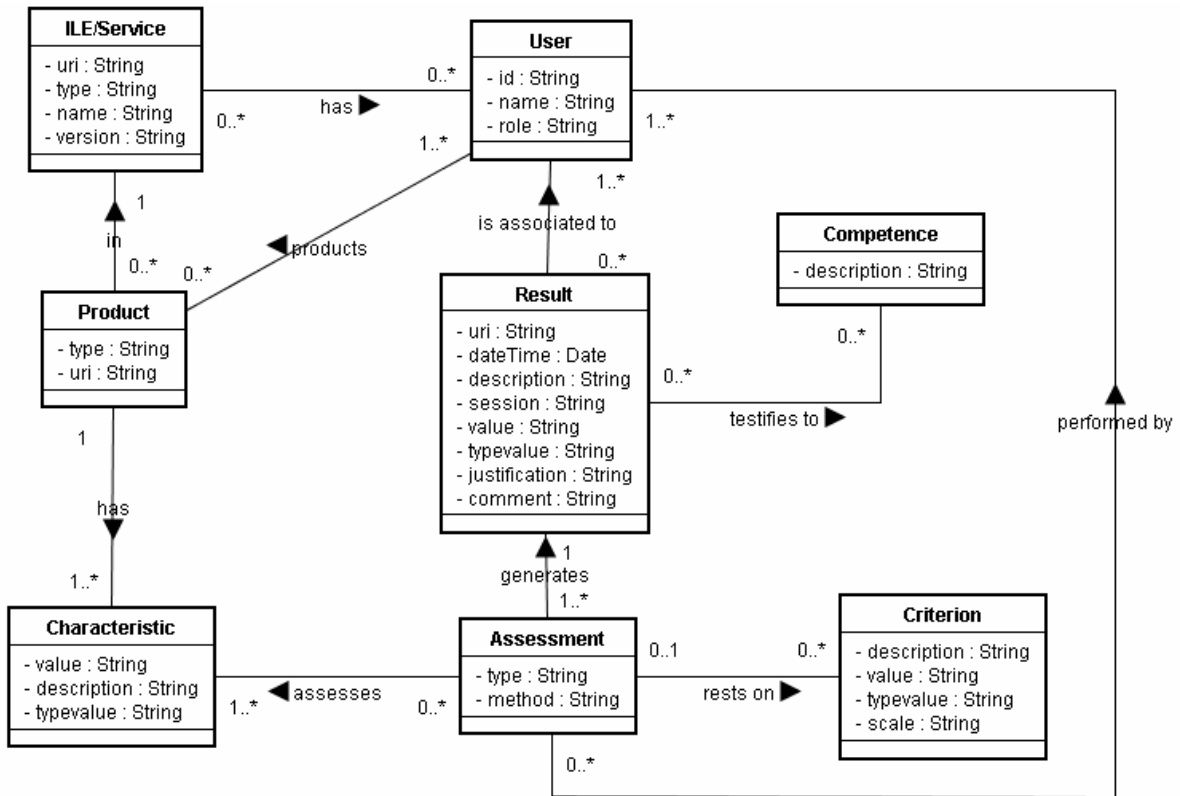
1. Conceptual Model

Figure 1 : The CRM conceptual model

To build the CRM conceptual model (Figure 1), we were based on the expression of assessment results produced by ILE. A selection of ILE softwares has been made. Each software has been selected according to the type of assessment which it illustrated. Thus, we were interested in ILE software proposing formative, normative, summative assessment, etc. From this step by step study a conceptual model of assessment results in ILE has been created.

1.1 Activity products and results

From the assessment in ILE point of view, a first distinction of results should be made. Considering a summative assessment which uses multiple-choice questionnaires, we can notice that two types of "results" are used:

- The learner's answer to the question which is asked to him/her;

- The score obtained by the learner answering the question.

The learner answer and the score are both "results", but different results. The learner answer is a learner's production, while the score is an assessment result of his/her production. Consequently, assessment results are particular results that are associated to the activity products. Figure 1 exposes clearly this concept; an assessment result is associated to the learner's product.

1.2. Characteristics of learner's activity products and assessment criteria

Learner's activity products are seldom the subject of a total and undifferentiated assessment. Only a few number of characteristics of these products are evaluated, and at a given moment.
For example, a mathematic teacher generally do not take into account spelling mistakes contained in the copies which he/she corrects, even if he/she is attentive with the quality of the expression of his/her learners. These mistakes, characteristics of some of these copies, do not take part of the criteria retained by the teacher to assess the copies. Conversely, the French teacher will be more attentive with these errors.

Assessing is a process during which the teacher selects, on the basis of set criterions, some characteristics of the product delivered by the learner/s and, by a method of his/her choice, grants a value to these characteristics. In other words the characteristics of a product are like many facets. Each facet can be selected or ignored by the teacher in order to evaluate it. In figure 1 we can see:

- Characteristics of the product selected by the teacher;
- Criteria of assessment of these characteristics;
- Assessment method implemented to grant a value to these characteristics;
- Assessment Result, i.e. the whole of the values granted to the product.

As illustration we should take the example of a ILE proposing to the learner a questionnaire. To evaluate each learner answer, and to produce a result, the ILE must hold additional information on the given question. It must obviously be able to check which the good answers are. The Learner product is the question which the learner answered. The evaluated characteristic is the given answer. This characteristic is evaluated by comparison with the good answer which is the assessment criterion. The assessment result is the learner score obtained with this question.

1.3. Result and competence

A score is rarely a sufficient information to clearly understand the learner's production. It is also necessary to be able to put this score in connection with a more or less extended control of the field, for example, so as to propose a strategy of remediation adapted to the learner's level. The result obtained by the learner indicates in this case a more or less great control of a competence. In the conceptual model (cf figure 1), 'Competences' and 'Results' are linked.

1.4. Actors of assessment

In the case of ILE such as OASYS [2] which proposes mutual assessments, also named peer assessment, learner's computer programs are assessed by other learners taking into consideration criteria fixed beforehand by the teacher. Most of the time, the actors who produce, are different from those who evaluate (teacher/learner). More rarely, and especially in the case of peer assessment, the actors who produce and evaluate are in a symmetrical relation. So we can conclude that a production is thus associated to one or more actors. These productions are evaluated by one or more actors who can be different or identical (cf figure 1).

2. Information Model

To be able to re-use an assessment in a different context, for example in another ILE or LMS, it is necessary to be able to describe explicitly these methods of construction. With the conceptual Model, we have seen that only some characteristics are evaluated according to a method and many criteria of assessment. This assessment is carried out by actors who can be different or not from the authors of the evaluated products. This assessment generates results which can be significant of one or several author's competences. From the conceptual model, an information model or formalism has been designed (cf figure 2).
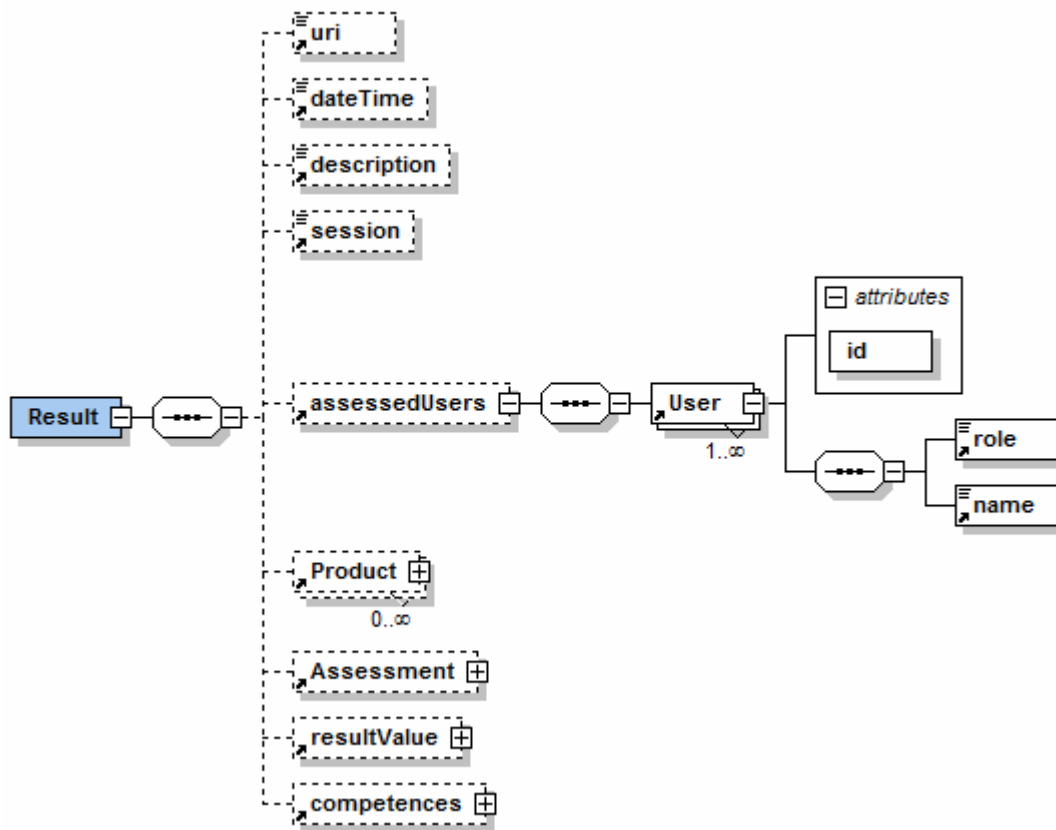

Figure 2: A global view of the information model

All the components described by the conceptual model have been encapsulated in the element "Result" and are optional. That is justified in particular by the fact that in many cases the services of the LMS do not evaluate the products of learning. But it is always necessary to express products in the formalism in order to evaluate them later. In the formalism, an assessment result is single, it is identified and located by its URI (Uniform Resource Identifier). An assessment result is produced at a precise moment (dateTime). Each result owns a description. A result is obtained from the assessment of one or more products. An assessment result is associated to actors or users who are evaluated (assessedUsers). A user has a single identifier. Very often, this identifier in a LMS is his/her "login". Each user has a name and plays a particular part in the development of the product. A result has a value (resultValue) which can for example be a score, an appreciation, a rank, according to the type of assessment which is carried out. An assessment result is associated to competences. We have chosen to re-use the formalism IMS-RDCEO [3] to express these

competences. In the following the elements Product, Assessment, resultValue and competences are quickly described.
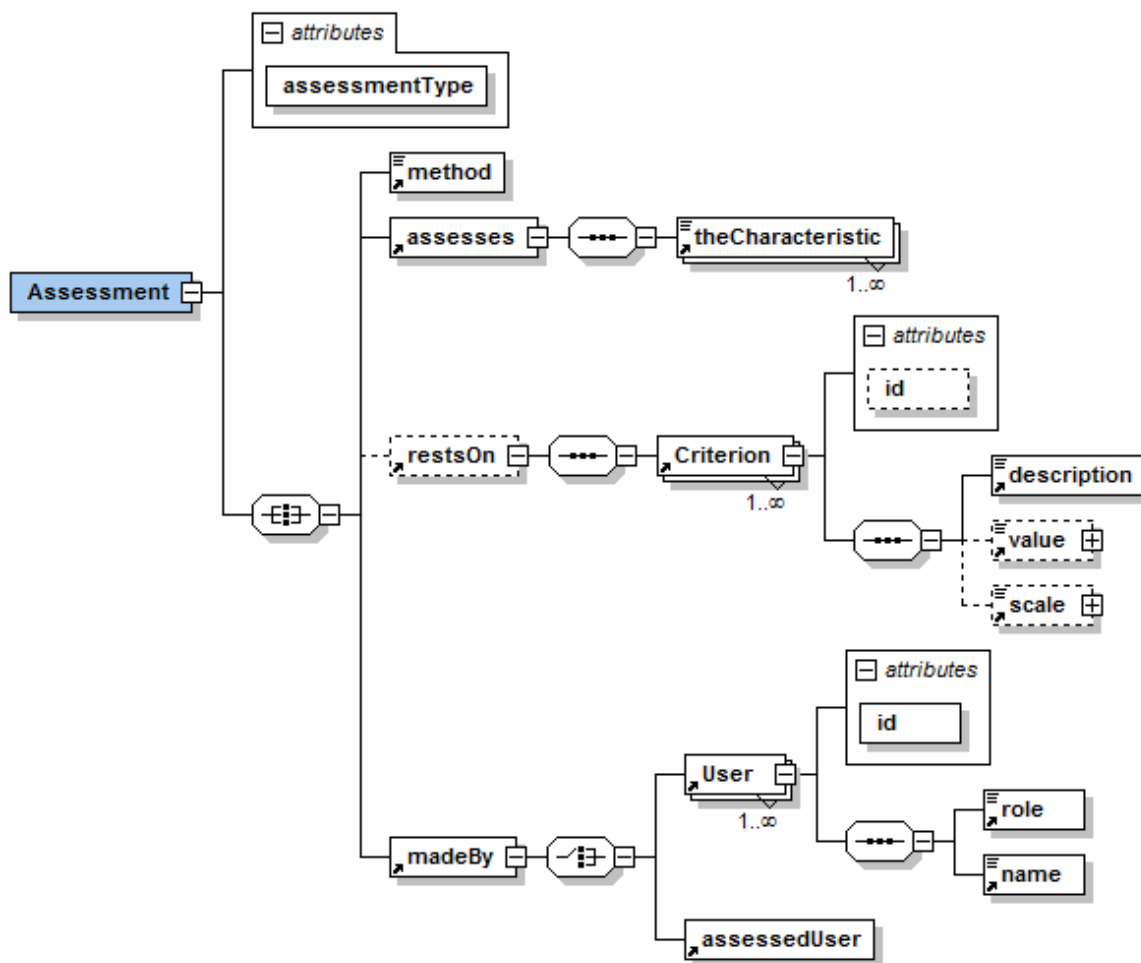

2.1. Product
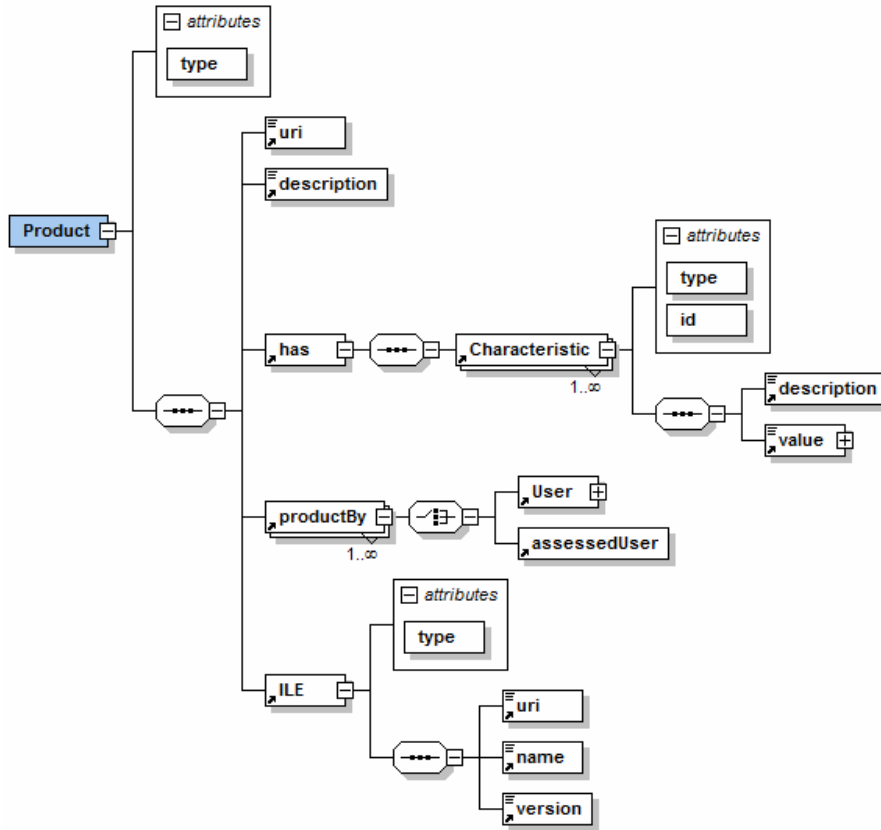
Figure 3: A product in the information model

Each product owns a type. A type is the nature of the produced document; an image, one text, a video, etc. To define this type, we use MIME (Multipurpose Internet Email Extensions) typology. For example, with MIME a JPEG image will be expressed by "image/JPEG". However MIME Typology is not sufficient to give meaning to the products. Each product is thus described (description) to give him a meaning and thus to raise ambiguities on its nature. Many products have characteristics. For example, an essay (description) of type "msword application" (type) has various intrinsic characteristics, such as the number of words, its language, its plan, its subject, its title, etc. It has also external characteristics, such as its realization duration, creation date, etc. It is necessary to define the characteristics of the product because future assessment will use some of them. The assessed characteristics will be selected according to the needs of the teacher.

A product is the fruit of the work of one or more actors. These actors can be those evaluated or not. If the actor who carries out the product is also the assessed actor (assessedUser), it is not necessary to redefine him/her here. If an actor who carries out a product is not evaluated, it is necessary to define him/her (User). This case is met in group assessment such as the assessment of a learner participation in a discussion. The discussion is the product of several learners, but only one of these learners is evaluated.

The product is created within a ILE. In the results formalism, a ILE has a type (exerciser, communication tool, etc). The ILE is identified and located by a URI. The other elements of a ILE are its name and its version.

2.2. Assessment

Figure 4: Assessment in the information model

An assessment belongs to a family of assessment (assessmentType). It can be prognostic, diagnostic, formative, summative, normative, etc. It evaluates certain characteristics of the products. Each assessed characteristic (theCharacteristic) is associated to a characteristic (by its identifier) defined inside the product element.

An assessment can be "criteried". It means that the assessment is based on assessment criteria which allow to evaluate several characteristics of the products. A criterion is described textually. It can have a value. For example, an assessment criterion of the learner response to a question should be the good answer. This good answer has a value. The respect or not of this criterion by the learner product is associated to a value which is specified by a scale. For example, to give the good answer (value) is worth six points (scale).

An assessment is carried out by actors who may be the assessed actors (case of the formative assessment) or not. These actors (or others) apply a method taking into consideration assessment criterion and characteristics. A method should be a function allowing to calculate a score, a comparison between assessed characteristics and criteria of evaluation, or the calculation of a rank or an average.
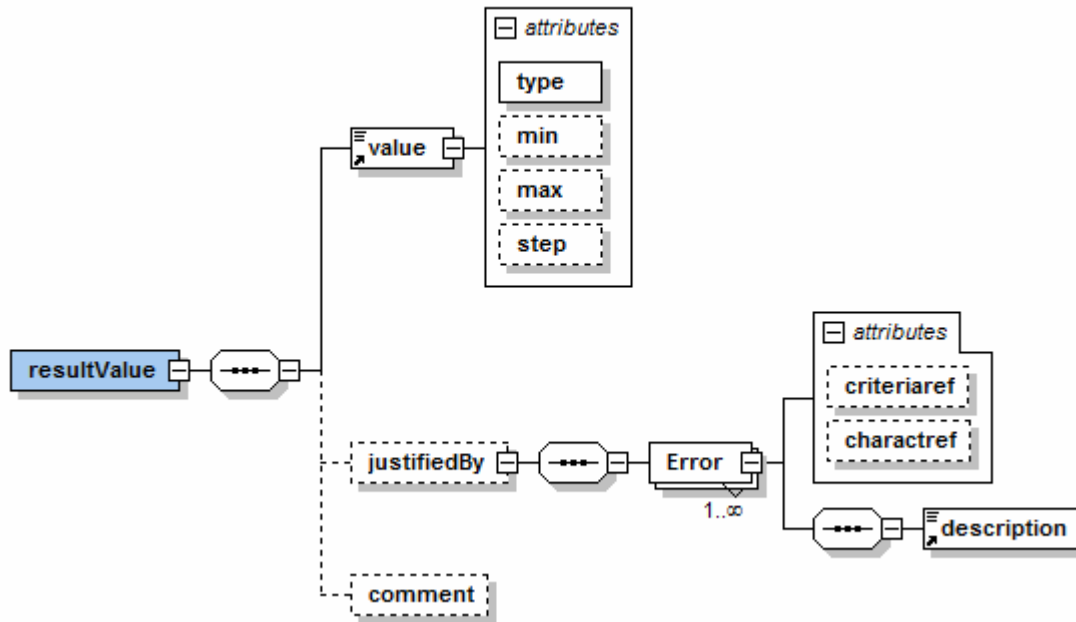
2.3. Result value

Figure 5: A result value in the information model

The assessment result value (resultValue) is not a simple value (a text, a number, table, classification, etc). This value has a meaning given by the other elements of the information model formalism (Product, Assessment, etc.) but also by a justification. The justification is a synthesis of the learner errors which have influenced the result value. Each error is described and associated to a characteristic and a criterion of assessment. The justification allows to detail the assessment which was carried out and to provide a correction to the learner. This justification improves the assessment transparency for learners and the teachers. The result value can also be commented in order to express the teacher appreciations.
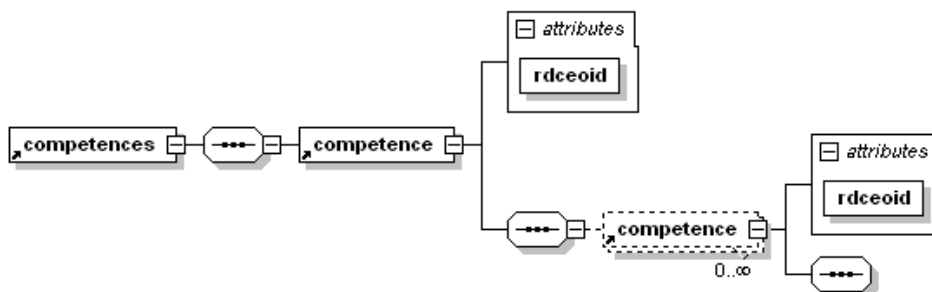
2.4. Competences

Figure 6: The expression of competences in the information model

The last but not the least element of the information model, is the element competence. The expression of competence is actually covered by several works and formalisms, in particular by the formalism IMS-RDCEO [3, 4]. This formalism allows to express competences in order to index and share them between learning environments. These competences are

centralized in catalogues which can be referred by various formalisms, such as LOM[2], IMS-LIP[3], IMS-SS[4], but also by the CRM results formalism. In the results formalism, each result can be associated to one or more competences. These competences point on the competences identifiers expressed in an external catalogue.

3. Conclusion

The proposed results model approaches the assessment from a conceptual point of view, which has for result a flexible formalism allowing to express a great number of products and assessment results. The conceptual model and the information model formalism clarify the process of assessment at the origin of assessment results. They specially express assessment results which ILE are likely to communicate within the framework of a LMS or to another ILE. This is a standardization proposition which is not in competition with learner activity tracking [5]. Moreover, the proposition aiming is not to explain what the learner did during the activity, but to express his/her results in order to share and re-use them between the services of the LMS. Assessment results are attended. This is a prescriptive vision of the learning activity. The assessment result is awaited during the activity. Obtaining this result should be scenarized and the result used by scenarios like those described with LDL [6] or IMS-LD[5]. A proof of concept prototype implementing CRM and a LDL scenarios engine has been implemented [1, 7, 8]. The next step is now to communicate, share and improve the CRM model so as to create a real assessment results standard.

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