

## From *microcontents* to micro-learning objects – which semantics are required? (Semantics for Microlearning)

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**Abstract:** Microlearning has been considered as a specific pedagogical approach that focuses on the use of *microcontents* as a special, small and subjective account of the concept of “learning resource”. In other direction, the learning object paradigm focuses on the reuse of learning resources by means of metadata. At first glance, both approaches may be considered as complementary. However, the micro approach to learning (arguably) emphasizes subjective views, quick creation of information and a degree of casualness. This entails that the creation of metadata should follow the same philosophy, which would eventually result in a specific style or idiom in the creation of learning objects. Further, the micro approach would result in a much larger cardinality of the set of available learning objects, which also poses challenges to the current architecture of repositories and specifications. This paper provides an initial discussion on some of these issues, aimed at fostering further work in the intersection of both paradigms.

### 1. Introduction

The paradigm of *microlearning*, as the application of pedagogical design techniques based in the use of *microcontents*, poses new challenges both to the current architecture for the storage and retrieval of educational resources and to the consideration of specific established pedagogies (Tscherteu, 2005). Some authors have argued about its complementary character (Eichenauer, 2005). In any case, microlearning as an emerging research stream provides several new trends like a specific model for learning distinct from existing styles and models, among others.

The concept of “learning object” (McGreal, 2005) has become widespread in the last years as the key structuring concept for learning resources – described by metadata records. In principle, a microcontent piece with educational purpose plus metadata describing both the piece itself and its educational usages may be considered as a regular learning object. However, the microcontent vision entails that those descriptions should come from subjective personal views of the world, e.g. those views offered by blog authors.

Consequently, the description, storage and retrieval of “micro-learning objects” should follow some principles that are in coherence with the concrete creation of context of microcontents. For example, micro-metadata would have the requirement to be easy to edit – just as blog posts are. Further, microcontent results in a proliferation of micro-metadata records to a volume that requires a careful consideration from the technical perspective.

The objective of this paper is that of discussing the specificities of the creation of learning objects based on microcontent, providing a point of departure for further elaboration and discussion on the implications of the approach and style of microcontent in their application to reuse for educational needs.

The rest of this paper is structured as follows. Section 2 discusses a definition of microcontent with regards to its relationship to the concept of learning object, providing a number of proposed principles for a practice of turning microcontents into metadata-described learning objects. Then, Section 3 discusses the use of the IMS DRI (2003) specification for repositories in the context of microlearning. Section 4 turns attention to the most important semantic descriptions that should be commonly available to describe microcontents – and the ways in which the annotations could be provided. Finally, conclusions and outlook are provided in Section 5.

## 2. Are microcontents learning objects?

This is a hard definitional problem, since both terms, “learning object” and “microcontent” are to some extent fuzzily defined. Let’s start our discussion from the “version 1.0” definition provided in the *microlearning* Web site<sup>1</sup>.

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1 <http://www.microlearning.org>

A (very) small unit of digital information that is self-contained, individually referable/ addressable, allowing use/re-use in different loosely structured macro-contexts and macro-containers. (See also content)

(1) **MC is small**: It contains a very limited amount of information compared with other forms of cultural “content”. The reasons are physical limitations (screen size, interface complexity: see Micromedia) and cognitive limitations (limited attention span of PC and Web users, but also of media users in general).

(2) **MC is individually referable and addressable**: It is defined or at least definable by a set of formally declared metadata (like a specific URL / permalink, a time-stamp, an author name, an IP address, connection data, a subject line, a tag or keyword ...). Microcontent is the element that forms the metaweb.

(3) **MC is self-contained**: It is a unit of information that can stand for itself not only formally (through metadata) but also semantically. It can clearly be separated from its macro-context. It is not locked into a macro-text or – important for Web 2.0 – into an application. It is focused around a single idea or small set of related ideas (>> meme). It is accompanied and defined by explicit or implicit metadata.

(4) **MC is reusable and remixable**: It is content set free to separate and form new patterns, in the mind of the user, on the screen of a device or within the processing logic of an application. It is “small pieces loosely joined”, enabling new technologies of aggregation and syndication and new sociocultural practices (> Web 2.0, social software). It allows new “fuzzy” forms of texts, new open patterns of sign, new collaborative practices of communication and semiosis.

Self-containment and relative small size were two characteristics used by Polsani (2003) in his definition and discussion of learning objects: “a Learning Object is an independent and self-standing unit of learning content that is predisposed to reuse in multiple instructional contexts”. If we use terminology of learning objects to describe microcontents, a first important principle can be established:

**Principle #1** Microcontents – when described as learning objects – result in aggregation level 1 learning objects as defined by LOM (i.e. they do not *have parts*).

Further restrictions could be put in the general description.

**Principle #2** *Micrometadata* will have a subset of the metadata requirements targeted at microcontents, removing any unnecessary or rarely applicable metadata element.

This second principle entails that structured metadata – e.g. content aggregation metadata as in IMS CP (2005)– is not applicable.

**Principle #3** *Micrometadata* will at least include identification information to accomplish for individual referability and addressability.

This third principle is a direct consequence of the definition above.

**Principle #4** *Micrometadata* should provide easily editable descriptions that enable software tools to provide services of loose composition, selection and filtering.

These proposed principles are of course arguable and subject to refinement or replacement, but they serve as an initial proposal to frame microcontent in the broader existing conceptual framework of learning objects.

### 3. Is the IMS DRI adequate for micro-content?

The architecture of the IMS DRI Phase 1 specification version 1.0 (IMS 2003) aims to “provide recommendations for the interoperation of the most common repository functions”. If we consider microcontent as a concrete kind of learning objects, the specification is, at least in principle, relevant also to microlearning scenarios. IMS DRI 1.0 allows for the definition of metadata-only repositories: “Repositories may hold actual assets or the meta-data that describe assets”. This would be the most common case for microcontent, since the content items would likely be stored at the user facilities (blog, Wiki, etc.) while repositories for search would only store descriptions (or even references to the places in which the descriptions are actually stored).

DRI defines the interactions between core functional components (resource utilizers and repositories) that support interoperability, including:

- SEARCH, GATHER, (ALERT)/EXPOSE
- REQUEST/DELIVER
- SUBMIT/STORE

Note: ALERT is a core function, but is not addressed within this version of the DRI specification.

The DRI Project Group is focusing on these core interoperability functions within the functional architecture. The following functional diagram of the IMS DRI specification depicts the core interaction addressed (the rest of the elements are blurred since they are not covered by Phase 1).

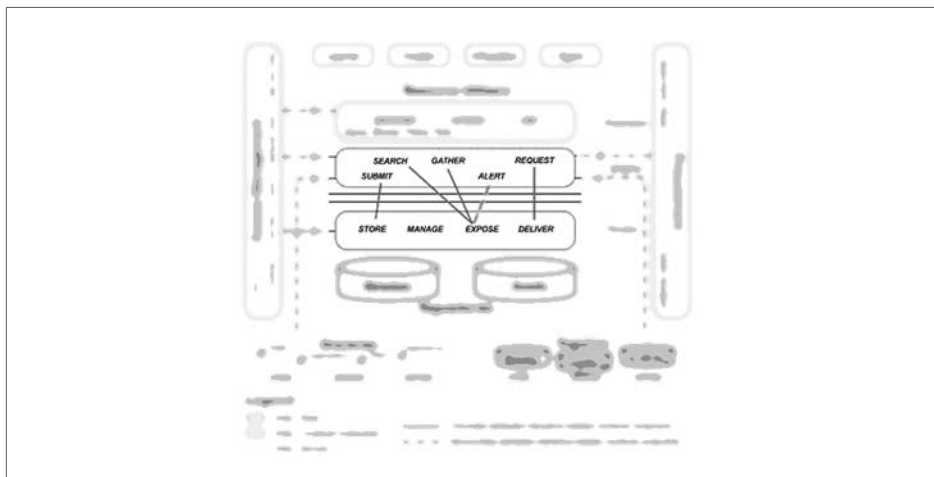


Figure 1. IMS DRI first phase functional model

The Search reference model defines the searching of the meta-data associated with content exposed by repositories. Compatibility of SEARCH/EXPOSE in semantic repositories must be provided by some kind of mediation layer. This raises the need for additional elements:

- A *Query mediator*, which takes as input either Z39.50 or XQuery queries and transform it to a search in the internal format of the semantic repository.
- A *Semantic-Search* function to directly search in semantic terms.

The following diagram depicts the overall functional architecture resulting from the analysis of the IMS DRI specification (only the relevant portions of the DRI 1.0 functions are depicted).

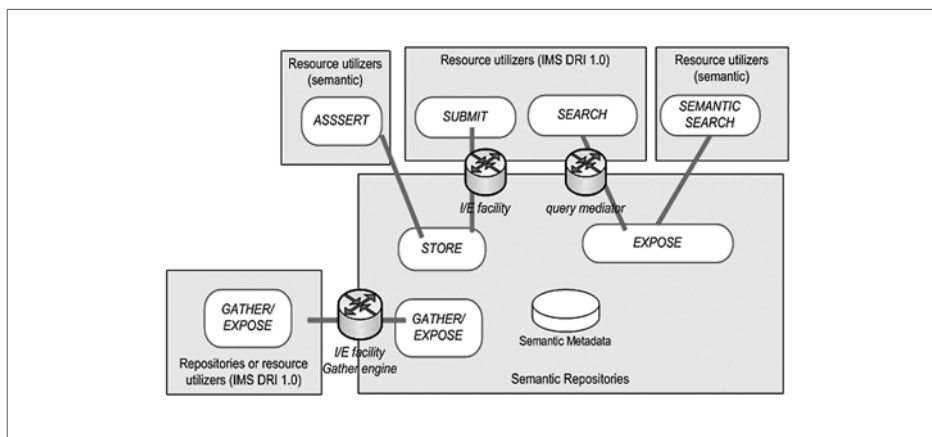


Figure 2. IMS DRI combined with a semantic repository

The conventional search, gather and submit functions require specific components to bridge from the non-semantic to the semantic representation.

The functional semantic architecture described above can be applied to micro-learning objects, but there are several issues that are especially relevant to microlearning settings:

- The ASSERT functions should follow the principles stated in the above section.
- Metadata ASSERTED should be considered in different ways depending on the author. Author information in LOM metadata is provided in the *Meta-Metadata* category. The important thing here is that metadata provided by the author of the microcontent must be provided with a differentiated relevance. Since microcontents are in many cases created in highly personal environments as blogs, the author's metadata must be supposed to reflect the original intentions and the world view required to properly understand the microcontent.
- The requirements on full content packaging as mandated by the IMS CP specification is to "heavyweight" for microcontents. Other lighter options must be devised.
- Query languages as XQuery are too specific of the document's structure, so that alternative languages must be investigated.
- Folksonomies as shared emergent conceptualizations (Gruber, 2005) provide the

adequate mean to annotate microcontents, since they are created in an environment in which a degree of subjectivity is a feature. However, the provision of computational semantics that are interoperable require a higher degree of abstractness and less subjectivity. The “linking to upper ontology” approach described elsewhere in application to other areas of knowledge (Sicilia et al., 2004) could provide a mechanism to bring the two worlds together.

In the following section, further discussion on the DRI SEARCH/EXPOSE function will be described, from the perspective of semantic location of (micro-)contents.

#### 4. Which semantics are required to SEARCH/EXPOSE microcontents?

The SEARCH/EXPOSE functionality basically provides a way to ask for resources that fulfill some given requirements. The response is actually metadata referring to the resources, not the resources themselves, which can be later asked through REQUEST/DELIVER.

Current learning management systems (LMS) and learning object repositories (Nash, 2005) based on standards are not oriented to the strict computational semantics requirements reflected in the above requirements. While they are of course useful search tools for educators, the economic gains in reusability require the support of automation to have rapid access to the resources that are candidates to fulfill strictly formulated objectives. In fact, standards of learning object metadata as LOM arguably fail to meet requirement the requirements of intelligent search since they are based on natural language text, which provides little options for automated processing based on complex need descriptions (Sánchez and Sicilia, 2005).

If we would like to provide microcontents with computational semantics while preserving their informal nature and the ways of creating them, a number of consideration must be made. They are summarized in the following list of requirements.

1. Informal, easy metadata creation. A technical solution to annotation that integrates well with the informal and loosely structured ways of creating microcontents.
2. Explicit linking to the author’s semantic metadata. This is required since authorship in microcontent is a key element that may even be used for the functionality of search, this is for example, a consequence of the popularity of some personal blogs.

3. Transparently bridging the gap from folksonomies to formal ontologies. This retains the ease of use and open collaborative nature of folksonomies while truly enabling software agents to deal with semantic metadata.
4. Tools considering micro-pedagogy. To date, no specific tools considering content structures as microcontents are available. However, building a bridge that communicates the learning object perspective and the microlearning side seems an obvious, necessary and not excessively costly task.
5. Mechanisms for reuse and federation of micro-metadata. An example to follow could be that of the MERLOT's federated search technology<sup>2</sup>.

## 5. Conclusions and outlook

Microcontents can be considered as fine granularity learning objects that are created in concrete environments that have some inherent subjectivity, and that are in many cases informal, not following a strong educational intention. Thus, the practice of creating metadata and using them for search has some specific characteristics. This paper has identified some of these potential characteristics, and examined microcontents in the framework of existing architectural repository specifications. This has led to some reflections on which semantics would be required for microcontents to be effective and preserve their properties.

Much work is required both in the technical and conceptual aspects discussed in this paper. On the technical side, mechanisms for the semantic search, selection and aggregation of microcontents are required if we want to really exploit the benefits of metadata (Koper, 2004). Further, tools for the "micro-annotation" of microcontents for popular technologies (blogs, Wikis, etc.) should be developed and studied from different perspectives – including human computer interaction. On the conceptual side, the main open problem is how to embed micro-pedagogies or micro-didactics into usable ontologies, so that software tools can be developed to aid humans in the setting of microlearning contexts – but for this, studies on learning theories must come before actual ontology engineering.

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<sup>2</sup> <http://fedsearch.merlot.org/search.jsp>



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