Syntax and Semantics of Learning Object Metadata
The IEEE/IMS LOM and Beyond

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- Many different specifications/versions of LO metadata exist; most are rather similar
- Metadata syntax is clearly defined; two main bindings, RDF/XML and plain XML, exist
- Syntactic interoperability is rather easy to achieve and mainly a technical problem
- Semantic descriptions of metadata should be improved to enhance annotation coherence
- Formalized semantic descriptions are required to support semantic interoperability
- Metadata for LO is usually difficult to obtain
- Authors should be encouraged to add metadata to new LO through various means
- Harvesting metadata from existing metadata is possible, but can be improved
- Deriving new metadata from content is possible to some degree and for certain fields
- Metadata derivation must be improved, especially elements related to learning
- LO metadata should provide immediate benefits for teachers and learners
- Immediate uses of metadata are of comparable importance as discovery of LO for reuse
- Annotation of LO with metadata at fine granularity can improve reuse

Executive Summary

Learning objects (LO) can be annotated with metadata like any other elements like webpages; see the semantic web. But similar to these cases many LO suffer from a lack of metadata in their actual instances. One reason for this is the focus on metadata as a means for discovering LO for reuse. While this is an important factor, it seems to be not enough to encourage authors to add metadata to their works. Other complementing approaches seem therefore desirable, of which the most important is employing metadata to provide immediate and direct benefits to the teacher or learners, regardless of other future uses. Another remedy could be harvesting metadata from existing other sources and the derivation of new one from the learning material itself and its environment, for instance the learning management system (LMS) they reside in.

Several specifications/standards for LO metadata (LOM) exist; but one (group) of them is very prominent and important and therefore the continuing focus of this chapter. This is the metadata according to IMS, which was the basis for and is very similar to the IEEE LOM standard. This chapter describes the content of the IMS specification: what information can be stored, its syntax, and to some degree its semantics as well. It also discusses the usefulness and problems of these elements. The differences to the IEEE standard are highlighting and a brief overview on conformance and custom extensions is given. A partial metadata example for both XML and RDF/XML shows the two different main syntactic bindings.

While most standards currently use plain XML, RDF bindings are under development and possess several advantages, notably the ease of talking about the metadata itself, e.g. how it was created (automatically derived or annotated manually). The binding is clearly syntax, but it also influences semantics, especially through providing a different framework for metadata design and use, and better support for automatic reasoning. For the latter, taxonomies and ontologies are important and therefore discussed too. Interoperability depends on a clear binding and is a main aspect of metadata, as it should be exchangeable between authors or learning management systems (LMS). While syntactic exchange is comparably easy to achieve, semantic differences are much more problematic and additionally more difficult to identify.

The next part is concerned with practical aspects and starts with an overview of problems of LO metadata in actual use, especially the problem of it missing very often. It describes remedies, including harvesting and derivation of metadata and discusses approaches for these extractions for all elements of the IMS specification in detail. Extraction can be based on the content or the environment (e.g. other and "near" information in LMS). Regarding the general need for direct benefits of metadata to encourage authors to add it (or introduce software for automatic derivation), some uses cases are presented and discussed, such as annotation through users, adaptation in several ways (presentation, course composition and user modeling) and LO discovery.

The chapter concludes with several practical examples of such use cases for both offline and online LO (harvesting, offline, and online use of metadata), for instance automatic index creation or rendering a navigation and awareness helper as a graphical roadmap. The Austrian subset/extension of LOM for official electronic schoolbooks is presented briefly too.

Some implications are discussed at the end, concluding that various metadata versions/standards should be supported, adding metadata must be eased for authors, and that automatic metadata derivation should be both improved and employed to a larger degree.