MACE application profile version 4.4 (October 2009)

The unifying MACE metadata schema has been defined as an application profile[1] of the widely accepted IEEE LOM[2] standard. The current document expresses the particularities of the MACE application profile:

a. The LOMv1.0 base schema has been extended with data elements (**table 1**), vocabulary values (**table 2**), a faceted classification of architectural terms (**table 3**) and a taxonomy of learning competences (**table 4**), in order to integrate the different types of metadata considered in MACE[3]. New and extended value spaces, as well as the terms of both classifications, might be updated from time to time.

b. The value space of data element 4.1:Technical.Format has been extended to Repertoire of ISO/IEC 10646-1:2003[4], in order to accommodate file format and media type names not adhering to IANA's[5] registration guidelines (RFC4288[6]).

c. Certain data elements have been made mandatory (**table 5**) in order to ensure integrity of metadata instances and facilitate access to and use of the associated content.

d. Two types of learning objects (LO) can be described using the MACE application profile:
   i. Real world objects (RWO): they model objects of the real world that are relevant during learning in Architecture (e.g. architectural projects and the designers taking part on them).
   ii. Digital and non-digital media objects (MO): actual content resources, in many cases referring to or depicting RWOs.

   Relationships among and between RWOs and MOs are expressed through the LOMv1.0 *relation* category (7.x data elements).

   Table 6 indicates metadata traits that are specific to the different LO types, all of them logically deductible from the MACE conceptual data schema.

e. User feedback is not described by way of this schema; hence no use is made of the LOMv1.0 *annotation* category (8.x data elements).

[1] IMS Global Learning Consortium. "Application Profile Guidelines" (http://www.imsglobal.org/ap/index.html)
[2] IEEE 1484.12.1 - 2002: "IEEE Standard for Learning Object Metadata" (http://ltsc.ieee.org/wg12/files/LOM_1484_12_1_v1_Final_Draft.pdf)
[3] MACE Joint deliverable: "JD1 – Metadata taxonomy and their integration in MACE" (http://www.mace-project.eu/media/deliverables/JD/JD1/JD1%20-%20Metadata%20taxonomy%20and%20their%20integration%20in%20MACE.pdf)
[4] Information technology -- Universal Multiple-Octet Coded Character Set (UCS) (http://www.iso.org/iso/iso_catalogue/catalogue_ics/catalogue_detail_ics.htm?csnumber=39921)
[5] Internet Assigned Numbers Authority (http://www.iana.org/)
[6] Media Type Specifications and Registration Procedures (http://tools.ietf.org/html/rfc4288)

Table 1: Additional data elements

Nr	Name	Explanation	Size	Order	Value Space	Datatype	Example
1.9	Learning Object Kind	Distinguishes between RWOs and MOs.	1	unspecified	media object real world object	Vocabulary (State)	-
4.8	Geographical Location	Geographical location of a built architectural project.	1	unspecified	KML specification, as defined by the Open Geospatial Consortium (http://www.opengeospatial.org/standards/kml/).	CharacterString (smallest permitted maximum: 1000 char)	"<Placemark><description>Headquarters of the Fraunhofer-Gesellschaft</description><name> Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.</name><address> Hansastraße 27c, 80686 Munich, Germany </address> <Point> <coordinates> 48.268569,11.933899,0 </coordinates></Point> </Placemark>"
9.2.2.3	Min EQF	Minimum proficiency level of the respective competence expected to be achieved by the consumer of the LO.	1	unspecified	Proficiency levels defined in the European Qualifications Framework (EQF, http://ec.europa.eu/education/lifelong-learning-policy/doc44_en.htm).	Vocabulary (Enumerated)	If by consuming the LO it is expected that a user develops *at least* a basic general knowledge of constructive and management procedures, to where the user can work or further study the theme under direct supervision in a structured context. Then, 9.2.2.1:Classification.TaxonPath.Taxon.Id="111", 9.2.2.2:Classification.TaxonPath.Taxon.Entry= ("en", "Knowledge of constructive and management procedures") and 9.2.2.3:Classification.TaxonPath.Taxon.MinEQF=1.
9.2.2.4	Max EQF	Maximum proficiency level of the respective competence expected to be achieved by the consumer of the LO.	1	unspecified	Proficiency levels defined in the European Qualifications Framework (EQF, http://ec.europa.eu/education/lifelong-learning-policy/doc44_en.htm).	Vocabulary (Enumerated)	If by consuming the LO it is expected that a user develops *at most* a factual and theoretical knowledge in broad contexts within urban design, to where the user can: (a) exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; and (b) supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities. Then, 9.2.2.1:Classification.TaxonPath.Taxon.Id="105", 9.2.2.2:Classification.TaxonPath.Taxon.Entry= ("en", "Knowledge of urban design") and 9.2.2.4:Classification.TaxonPath.Taxon.MaxEQF=4.

Table 2: Vocabulary data elements with extended value spaces[7]

Nr	Name	Additional values	Notes
2.2	Status	built demolished rebuilt renovated unbuilt	The added values are meant for RWOs where 5.2:Educational.LearningResourceType='project'.
2.3.1	Role	architect constructor designer engineer owner other	Except for 'other', the added values are meant for RWOs where 5.2:Educational.LearningResourceType= 'project'. 'other' may be used with any LO.
3.2.1	Role	provider	Any metadata contribution any time after the creation of the instance.
4.4.1.1	Type	application software	Software used during architectural practice.
4.4.1.2	Name	if Type= 'application software' then: 3dsmax allplan archicad artlantis autocad blender cinema4d coreldraw flash formz illustrator indesign lightwave maya microstation other photoshop revit rhinoceros sketchup vectorworks	

[7] The source of all listed values should be "MACEv4.4" for them to be differentiated from the values present in the LOMv1.0 base schema. Values that have been dropped from previous versions of this application profile are still valid but should no longer be added to metadata instances.

5.2	Learning Resource Type	3D model case study designer info page other project project document regulations revised exercise technical drawing	'project' and 'designer' refer to the two currently contemplated types of RWOs. 'other' denotes any non-listed learning resource type.
7.1	Kind	hasbeentaughtby hasbeenworkedonby hascollaboratedwith hastaught hasworkedon	'hasbeentaughtby': has been taught by (designer → designer) 'hasbeenworkedonby': has been worked on by (project → designer) 'hascollaboratedwith': has collaborated with (designer ←→ designer) 'hastaught': has taught (designer → designer) 'hasworkedon': has worked on (designer → project)
9.1	Purpose	conceptual design constructing context identification technical design theories and concepts	First level of the MACE faceted architectural classification.

Table 3: Faceted architectural classification – Example

Nr	Name	Value
9.1	Purpose	conceptual design
9.2.1	Source	(“de”, “MACE Catalogue - Funktionelle Typologie”) or (“en”, “MACE Catalogue – Functional Typology”) or (“es”, “MACE Catalogue - Tipología Funcional”) or (“it”, “MACE Catalogue - Tipologia Funzionale”) or (“nl”, “MACE Catalogue - Functionele Typologie”)
9.2.2.1	Id	“functionalTypology110”
9.2.2.2	Entry	(“en”, “commercial”) or (“it”, “commerciale”)
9.2.2.1	Id	“functionalTypology120”
9.2.2.2	Entry	(“de”, “bankwesen”) or (“en”, “banking”) or (“en”, “financial facility”) or (“es”, “banca”) or (“es”, “zona de finanzas”) or (“fr”, “système bancaire”) or (“it”, “banca”)

A LO can be classified according to different Architecture-related purposes with terms from diverse taxonomical catalogues. A complete relation and a description of the considered purposes (facets), catalogues (taxonomies) and terms (only less common terms are described) can be found separately in two different formats[8]: an XML document and a set of MS-Excel® spreadsheets. In these documents it is also indicated which of those terms may be selected when describing content resources.

[8] The documentation about this application profile is available from the download section of the MACE project web site (http://www.mace-project.eu/index.php?option=com_content&task=view&id=131&Itemid=144).

Table 4: Taxonomy of learning competences – Example

Nr	Name	Value
9.1	Purpose	competency
9.2.1	Source	("en", "MACE Catalogue – Competencies")
9.2.2.1	Id	"1"
9.2.2.2	Entry	("en", "Architecture Competency Classification")
9.2.2.1	Id	"109"
9.2.2.2	Entry	("en", "Underst. of structural and technological design")
9.2.2.3	Min EQF	1
9.2.2.4	Max EQF	3

A LO can be classified also according to the learning competencies it helps develop in its consumer. An open taxonomy of competency domains has been started from the two main disciplines considered: Architecture and Engineering. Users are encouraged to create new competencies[9] reflecting the outcome of the learning processes they are engaged in as teachers or learners. New domains arranging the defined competencies into more specific areas of knowledge and activity are equally welcome.

Due to the dynamic nature of this classification, no static documentation is existing thereof. However, a list of the currently defined domains and competencies is available through a web service[10].

[9] Domains and competencies can be created using the MACE Competence Administration tool (http://maceservices.ou.nl/CompetenceAdmin/).
[10] Information about the existing competence services is accessible on line (http://mace.ou.nl/doku.php?id=competenceservices).

Table 5: Required data elements

Nr	Name	Conditions	Reason
1.1.1	Catalog		To identify the LO within the repository
1.1.2	Entry		To identify the LO within the repository
1.2	Title		Name of the LO
1.3	Language		To help properly interpreting the content
1.9	Learning Object Kind		To know whether the LO is a MO or a RWO
2.3.1	Role	2.3.2 or 2.3.3 are present	If a contribution date or a contributor entity are present, we should also include the kind of action performed, for the contribution to be meaningful
3.1.1	Catalog		To identify the metadata instance
3.1.2	Entry		To identify the metadata instance
3.2.1	Role		At least one complete contribution should be present with role ‘creator’ or ‘provider’
3.2.2	Entity		At least one complete contribution should be present with role ‘creator’ or ‘provider’
3.2.3	Date		At least one complete contribution should be present with role ‘creator’ or ‘provider’
3.2.1	Role	3.2.2 or 3.2.3 are present	If a contribution date or a contributor entity are present, we should also include the kind of action performed, for the contribution to be meaningful
4.3	Location	Digital MO	We should be able to locate all digital MOs
4.4.1.1	Type	4.4.1.2 is present	Minimum completeness for a technical requirement

4.4.1.2	Name	4.4.1.1 is present	Minimum completeness for a technical requirement
6.3	Description	6.2='yes'	If we state that copyright or other restrictions apply to the use of the LO, we should specify what those restrictions are
7.1	Kind	7 is present	If a related LO is present, we should indicate the kind of relationship
7.2.1.1	Catalog	7.2.1 is present, or 7 is present and 7.2.2 is not	We require some way of referring to the related LO, either by its complete identifier (catalog and entry) or by its description
7.2.1.2	Entry	7.2.1 is present, or 7 is present and 7.2.2 is not	We require some way of referring to the related LO, either by its complete identifier (catalog and entry) or by its description
7.2.2	Description	7 is present and 7.2.1 is not	We require some way of referring to the related LO, either by its identifier or by its description
9.1	Purpose	9.2, 9.3 or 9.4 are present	If we are classifying the LO we should include the purpose of doing this
9.2.2.1	Id	9.1, 9.2, 9.3 or 9.4 are present	If we are classifying the LO, we should assign it at least one term from the catalogues available for the intended purpose. The identifier of the chosen term(s) should be specified

Table 6: Specificities for the different types of LOs considered

LO	Data elements		Values	
	Required	Disallowed	Restricted vocabularies[11]	Disallowed
RWO		4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11	5.2: designer, project, other	
Project RWO			2.2: unbuilt, built, renovated, demolished, rebuilt 2.3.1: designer, owner, constructor, other 7.1: ispartof/haspart (project ←→ project), isbasedon/ isbasisfor (project ←→ project), isreferencedby (project → MO), hasbeenworkedonby	
Designer RWO		2.1, 2.2, 2.3.2, 4.8	1.7: atomic 1.8: 1 2.3.1: initiator, terminator 7.1: hasworkedon, hastaught/hasbeentaughtby, hascollaboratedwith, isreferencedby (designer → MO)	
MO	4.1	4.8	7.1: ispartof/haspart (MO ←→ MO), isversionof/hasversion (MO ←→ MO), isformatof/hasformat (MO ←→ MO), references (MO → MO, MO → RWO), isreferencedby (MO → MO), isbasedon (MO → MO, MO → RWO), isbasisfor (MO → MO), requires/isrequiredby (MO ←→ MO)	2.2: unbuilt, built, renovated, demolished, rebuilt 2.3.1: designer, owner, constructor 5.2: designer, project
Digital MO	4.3			
Non-digital MO		4.2, 4.3, 4.4, 4.5, 4.6		

[11] Accepted values for the mentioned data elements are restricted to those listed.