

Interoperability between metadata systems used for learning, education and training —

Part 1: Code of practice for the development of application profiles

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Committees responsible for this British Standard

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- British Educational Communications and Technology Agency
- British Educational Suppliers Association
- Cabinet Office (e-Government Unit, formerly called Office of the e-Envoy)
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The following bodies were also represented in the drafting of the standard:

- Centre for Interactive Assessment Development
- deBurca
- Echelon
- First Creative Limited
- Learning and Teaching Scotland
- Local Government Association
- Metier
- Microsoft Corporation
- Museums, Libraries and Archives Council (formerly called Resource)
- Nelson Thomes Limited
- Oracle UK
- Pearson Broadband
- Promisor Incorporated
- SNS Associates
- The Northern Ireland Council for the Curriculum, Examinations and Assessment
- The Royal National College for the Blind
- UKOLN

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Foreword

This British Standard code of practice has been prepared by Technical Committee IST/43, which comprises people with a wide experience of learning delivered using Information and Communications Technology (ICT), from a variety of different companies and organizations. BSI Committee IST/43, whose constitution is shown in this British Standard, takes collective responsibility for its preparation under the authority of the Standards Policy and Strategy Committee. The Committee wishes to acknowledge the personal contribution of Ian Ibbotson, David Jennings, Gill Osguthorpe, Seb Schmoller and Neil Smith.

BS 8419 consists of the following parts:

- *Part 1: Code of practice for the development of application profiles;*
- *Part 2: Code of practice for the development of interoperability between application profiles.*

Part 1 of this British Standard provides recommendations for organizations that are creating application profiles of international metadata standards for use in relation to teaching and learning, focusing on the following two application profiles that are currently in use in the UK.

- The Dublin Core Metadata Initiative's (DCMI's) [1] Dublin Core Metadata Element Set (DCMES) described in BS ISO 15836.
- The Institute of Electrical and Electronics Engineers' (IEEE's) [2] standard for Learning Object Metadata (LOM), IEEE 1484.12.1-2002.

Part 2 provides recommendations for methodologies that will enable developers and implementers to maximize interoperability, focusing on how to make data transfer between metadata systems as automatic as possible.

This British Standard exists alongside a number of relevant international and national frameworks and emerging standards pertaining to metadata and interoperability. These include:

- industry standards and specifications such as those issued by the IEEE, the IMS Global Learning Consortium (IMS) or the DCMI;
- *de facto* technical standards such as those issued by the World Wide Web Consortium (W3C);
- standards and specifications, such as the *e-Government Metadata Standard* (e-GMS) embraced within the *e-Government Interoperability Framework* (e-GIF).

Although this standard is not specifically designed for metadata systems that store personal data, if you do store such information, the user's attention is drawn to the Data Protection Act 1998 [3], specifically the restrictions on the transfer of data between organizations.

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification, and particular care should be taken to ensure that claims of compliance are not misleading.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 31 and a back cover.

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Introduction

The education and learning market has been transformed in recent years by a number of factors, including:

- growth in the power and capabilities of ICT, which has led to increasing use of e-learning as a means of delivering and accessing learning, education, and training;
- increased diversity and complexity of courses and qualifications, and the introduction of complex job-specific competency frameworks;
- extensive digitization of library and cultural learning resources, thereby rendering these capable of deployment in e-learning;
- a variety of UK Government policy initiatives aimed at promoting lifelong learning and vocational training, and at expanding the use of ICT across the all levels and types of education and training.

Within the context of learning, education and training, metadata is structured data used to describe the characteristics of a learning resource, a data object or a component of a learning technology system. Its effective creation, structuring and deployment is critical to:

- the cost-effective and smooth transfer of data between the ICT systems which are used in learning, education and training;
- the effective cataloguing, searching and retrieving of learning materials.

The aim of this British Standard is therefore to provide guidance on the use of metadata standards and specifications for learning resources in the UK, to establish methods for creating profiles of these standards and specifications and to maximize the opportunities for interoperability with other profiles.

The fulfilment of this aim will have benefits for a number of organizations and individuals, including:

- enhanced potential for systems and solution vendors to enable markets for their products and services, and the achievement of greater integration of content from multiple producers;
- more scope for producers of learning materials to exploit new markets and increase the potential for reuse of their content;
- simplification of accreditation processes and establishment of equivalencies between courses and qualifications by awarding and assessment bodies;
- ability for procurers of systems and content to avoid vendor lock-in, economize on content costs, and enable integration between systems;
- improved choice, and improved quality of learning-provision for learners;
- better facilities for teachers, and other learning, education and training practitioners, to search for and utilize learning resources described by different metadata schemas and profiles.

The steps that are typically involved in developing an application profile and achieving system interoperability are shown in Figure 1. These steps reflect the relationship between Part 1 and Part 2 of this British Standard. Part 1 covers steps 1 to 8 and Part 2 covers steps 9 to 15.

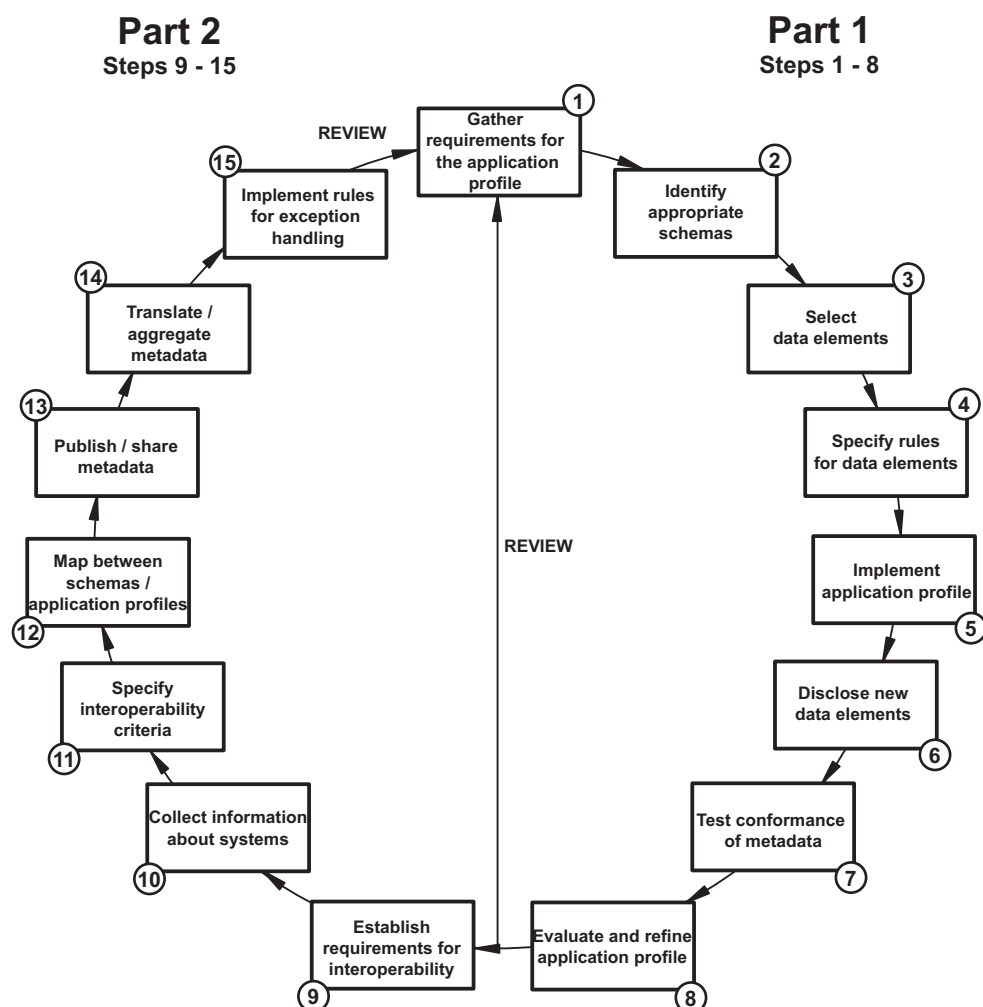


Figure 1 — Tasks involved in developing an application profile and establishing interoperability

This British Standard code of practice is intended for practitioners who develop and implement e-learning, e-learning content and e-learning systems, including (but not limited to):

- a) instructional designers, developers, publishers, and vendors of e-learning materials and qualifications;
- b) developers and vendors of software systems which are used in the design and delivery of e-learning and assessment;
- c) those with responsibility for procuring e-learning materials or software systems for e-learning and assessment.

1 Scope

This British Standard gives recommendations for achieving interoperability between systems in learning, education and training.

The standard provides guidance:

- a) on the development and reuse of application profiles;
- b) for the use of application profiles where interoperability is a requirement.

Where application profiles are developed solely for local use, then this standard as a whole is not applicable although individual recommendations could still prove useful.

The standard is applicable across all sectors and levels of learning, education and training. Whilst the requirements of different communities can lead to the development of different application profiles, the processes underlying the development will be common.

The standard provides guidance on the reuse of the BS ISO 15836 Dublin Core Metadata Element Set (DCMES) developed by the Dublin Core Metadata Initiative (DCMI) [1] and the IEEE 1484.12.1-2002 standard for Learning Object Metadata (LOM) developed by the Institute of Electrical and Electronics Engineers (IEEE) Learning Object Metadata Working Group [2].

The standard makes recommendations about encoding mechanisms (e.g. XML DTD, XML schema, RDF) for application profile bindings but does not mandate the use of any particular encoding mechanism.

The standard does not provide mechanisms for evaluating or comparing the educational value of learning resources.

The standard is intended to optimize, rather than completely remove, human interaction in the transfer of information between systems.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS ISO 15836:2003, *Information and documentation — The Dublin Core metadata element set*.

IEEE 1484.12.1-2002, *Standard for Learning Object Metadata*.

3 Terms and definitions

For the purposes of this part of BS 8419, the following terms and definitions apply.

3.1

aggregation model

model that describes the grouping of learning objects by aggregation level

NOTE An aggregation model might, for example, include information on what constitutes an atomic learning object, and how atomic learning objects are aggregated with other atomic learning objects and other aggregations.

3.2

aggregation level

functional granularity of a particular learning object

[IEEE 1484.12.1-2002]

EXAMPLE

An individual file or asset would have a very low level, a lesson slightly higher, and a course or set of courses higher still.

3.3

application profile

schemas consisting of data elements drawn from one or more namespaces, combined together by implementers and optimized for a particular local application

NOTE The purpose of an application profile is to adapt or combine existing schemas into a form that is tailored to the functional requirements of a particular application, while retaining interoperability with the original base schemas.

3.4

atomic learning object

learning object that is indivisible within a particular context

3.5

attribute

characteristic of an object or entity

3.6

binding

formal method of representing a metadata instance using a particular technology

3.7

community of practice

group of people who share common goals and activities

3.8

competency map

description of a set of key skills or competencies and associated attainment levels

3.9

conceptual data model

abstract view of a data model

3.10

core element set

group of data elements that are intended to be common across a number or application profiles

3.11

data element

basic unit of identifiable and definable data which has a data element name and one or more values for expressing (a) particular fact(s)

3.12

data model

description of the organization of data in a manner that reflects an information structure

3.13

datatype

set of distinct values characterized by properties of those values and by operations on those values

3.14

e-learning

learning facilitated by information and communication technologies

NOTE The scope of the standard is not limited to e-learning and includes metadata describing other forms of learning.

3.15

e-learning system

information technology system used to enable the provision of learning materials and support processes to learners, to help learners, tutors and administrators track the learners' progress, and to facilitate the convenient updating of learning materials

NOTE This definition includes IT products known as Managed Learning Environments, Virtual Learning Environments or Learning Content Management System but is not necessarily coterminous with them.

3.16

entity

any concrete or abstract thing that exists did exist, or might exist, including associations among these things

EXAMPLE

A person, object, event, idea or process.

3.17**interoperability**

ability of two or more systems or components to exchange information and to use the information that has been exchanged

[IEEE 610-1991]

3.18**learner profile**

metadata instance made up of information about a particular individual typically including elements such as personal learner information, a competency/skill map, future learning goals or formal record of qualification

3.19**learning object**

discrete learning resource that can be reused to facilitate learning and is capable of being used to achieve a specified learning objective

3.20**learning resource**

resource that is used for learning

NOTE A learning resource can include material for viewing or reading, task instructions, simulations or assessments. A learning resource can comprise discrete learning objects and can be digital.

3.21**metadata**

structured data used to describe the characteristics of an entity

NOTE 1 This standard is concerned with metadata that describes learning resources, data objects or components of a learning technology system.

NOTE 2 Where metadata are included in an entity they are often referred to as embedded metadata; and where they are linked to an entity, they are referred to as external metadata.

EXAMPLE

Metadata about a book might include data elements such as author, publisher, title, etc.

3.22**metadata instance**

set of metadata describing a single entity

EXAMPLE

A metadata instance could be used to describe a single learning resource, a learner profile or a competency map.

3.23**metadata registry****MDR**

information system for registering metadata element sets and application profiles

[ISO/IEC 11179-3:2003, definition **3.2.22**]

EXAMPLE

The UK Govtalk website maintains a registry of XML based metadata schemas at <http://www.govtalk.gov.uk/schemasstandards/xmlschema.asp>.

3.24**Resource Description Framework****RDF**

language based on statements for representing information about resources in the World Wide Web enabling the information to be exchanged between applications without loss of meaning

NOTE 1 RDF is particularly (but not exclusively) intended for representing metadata about Web resources, such as the title, author, and modification date of a Web page, copyright and licensing information about a Web document, or the availability schedule for some shared resource.

NOTE 2 RDF was developed by the World Wide Web Consortium (W3C) [4].

3.25

Resource Description Framework schema

RDF schema

specification designed for representing how particular resources relate to other resources defined in the schema or to resources defined in other schemas

NOTE The RDF schema is a World Wide Web Consortium (W3C) specification [4].

3.26

schema

set of semantic units (e.g. data elements) along with their attributes, such as name, identifier, definition or relationship to other semantic units

3.27

document schema

file describing the tag structure of an XML-encoded document, as in an XML Document Type Definition

3.28

scheme

designates or characterizes a set of valid metadata values

NOTE 1 This is sometimes referred to as an “encoding scheme”.

NOTE 2 Some authors use this term interchangeably with “schema”.

EXAMPLE

Within a metadata system a format for dates may be specified, such as through the use of the ISO 8601 scheme which specifies the string format yyyy-mm-dd.

3.29

Uniform Resource Identifier

URI

compact string of characters for identifying an abstract or physical resource

3.30

Uniform Resource Locator

URL

compact string of characters for identifying a resource available via the internet

3.31

use case

methodology used in systems analysis intended to facilitate the gathering of user and system requirements

NOTE As a minimum a single use case would typically define the user type, an action they need to perform and the environment in which it is to be performed.

3.32

value

data value

3.33

value space

set of values for a given datatype

3.34

vocabulary

dictionary of words related to a particular subject field

3.35

eXtensible Markup Language

XML

specification derived from SGML describing a widely used syntax for document and data markup

NOTE 1 XML is a World Wide Web Consortium (W3C) specification [5].

NOTE 2 Standard Generalized Markup Language (SGML) is specified in BS 6868, which is identical to ISO 8879.

3.36**eXtensible Markup Language attribute****XML attribute**

name-value pair associated with an XML element, expressed as part of the attribute's start tag

EXAMPLE

In the following XML snippet, the attribute name is `xml:lang` and the attribute value is "en".

```
<langstring xml:lang="en">Human Resources</langstring>
```

3.37**eXtensible Markup Language Document Type Definition****XML DTD**

formal description of the components of a specific document or class of documents defining rules of structure that XML documents need to follow, mandatory and optional XML elements and the XML attributes associated with them, and the order in which XML elements appear

NOTE DTDs pre-date XML schemas and do not support the use of datatypes or namespaces.

3.38**eXtensible Markup Language element****XML element**

component of an XML document, delimited by start-tags and end-tags or, for empty elements, by an empty-element tag

NOTE Each XML element has a type and may have a set of XML attribute specifications.

3.39**eXtensible Markup Language namespace****XML namespace**

collection of terms and syntax, identified by a URI reference, which is used in XML documents as element types and attribute names

NOTE 1 XML namespaces differ from the "namespaces" conventionally used in computing disciplines in that the XML version has internal structure and is not, mathematically speaking, a set.

NOTE 2 The syntax used for URI is defined in an Internet Society's Internet Engineering Task Force document [6].

3.40**eXtensible Markup Language schema****XML schema**

specification designed for describing, parsing and validating the tag structure of a class of XML documents [adapted from the CORES [7] glossary]

NOTE 1 XML schemas are, themselves, represented in XML.

NOTE 2 An XML schema is an example of a document schema.

NOTE 3 An XML schema is a World Wide Web Consortium (W3C) specification [5].

3.41**eXtensible Stylesheet Language****XSL**

family of specifications for defining XML document transformation and presentation

NOTE 1 XSL consists of three parts:

- a) XSL Transformations (XSLT), a language for transforming XML;
- b) XML Path Language (XPath), an expression language used by XSLT to access or refer to parts of an XML document;
- c) XSL Formatting Objects (XSL-FO), an XML vocabulary for specifying formatting semantics.

NOTE 2 XSL is a World Wide Web Consortium (W3C) specification [8].