



# Competency Framework Specifications

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Authors: Valerie Smothers

Author email: [vsmothers@jhmi.edu](mailto:vsmothers@jhmi.edu)

## Version History

Version No.	Date	Changed By	Changes Made
0.1	2008-07-17	Valerie Smothers	Initial draft
0.2	2009-10-06	Valerie Smothers	Added lom to replace/supplement framework title and identifier, renamed CompetencyDefinitions CompetencyObjects, made category and references subelements fo CompetencyObject, added XtensibleInfo, added CompetencyMap subelements.
0.3	2009-12-23	Valerie Smothers	Removed Competency objects (will be a separate spec) and competency map; put relation at the root.
0.4	2010-03-25	Valerie Smothers	Required elements form lom and eliminated any overlap. Required URI identifier. Changes to non-hierarchical relationships. Changed structure of relations to be 1 to 1 rather than 1 to many.
0.41	2010-05-06	Valerie Smothers	Further simplified relations. Eliminated references.
0.5	2010-07-28	Valerie Smothers	Added SupportingInformation element.

0.6	2011-07-14	Valerie Smothers	<p>Added Includes element. Remove the use of broader/narrower than for relations of framework to top competency objects</p> <p>Allow competency object broader than competency framework.</p> <p>Allow framework includes framework.</p> <p>If using 'broader than', the broader thing must be a competency object</p> <p>Made Relations optional.</p> <p>Updated graphics.</p>
0.61	2011-09-06	Valerie Smothers	<p>Added language forbidding hierarchical conflicts.</p> <p>Changed format, added examples for supporting information. Added XtensibleInfo container.</p>
0.62	2011-10-10	Valerie Smothers	<p>Added note about hierarchical conflicts with examples, modified definition of includes element, added recommended metadata description.</p>
0.7	2011-10-17	Valerie Smothers	<p>Added status, replaces, and replacedBy elements.</p>
0.71	2011-11-6	Valerie Smothers	<p>Removed XtensibleInfo and added namespace qualified extensibility to CompetencyFramework.</p> <p>Allowed multiple replaces and isReplacedBy elements. Changed value of Relations element.</p> <p>Added SKOS and DCMI Terms to references.</p> <p>Changed references to LOM.</p>
0.72	2011-11-14	Valerie Smothers	<p>Added corrections related extensibility. Updated sample XML.</p>
0.73	2011-11-14	Valerie Smothers	<p>Made replaces and IsReplacedBy elements in the MedBiquitous namespace to resolve content model problems.</p>
0.74	2011-12-09	Valerie Smothers	<p>Removed Status element. Added EffectiveDate and RetiredDate as optional elements.</p>
0.75	2011-12-14	Valerie Smothers	<p>Corrected typos. Added lifecycle status as recommended lom element.</p>

.76	2-12-03-23	Valerie Smothers	Clarifications and corrections to address inconsistencies. Added image for Healthcare Lom.
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This specification would not be possible without the previous work of Claude Ostyn, in particular the Proposal for a Simple Reusable Competency Map. Claude paved the way for this specification and others related to advanced uses of learning technologies. For access to Claude's work, visit:

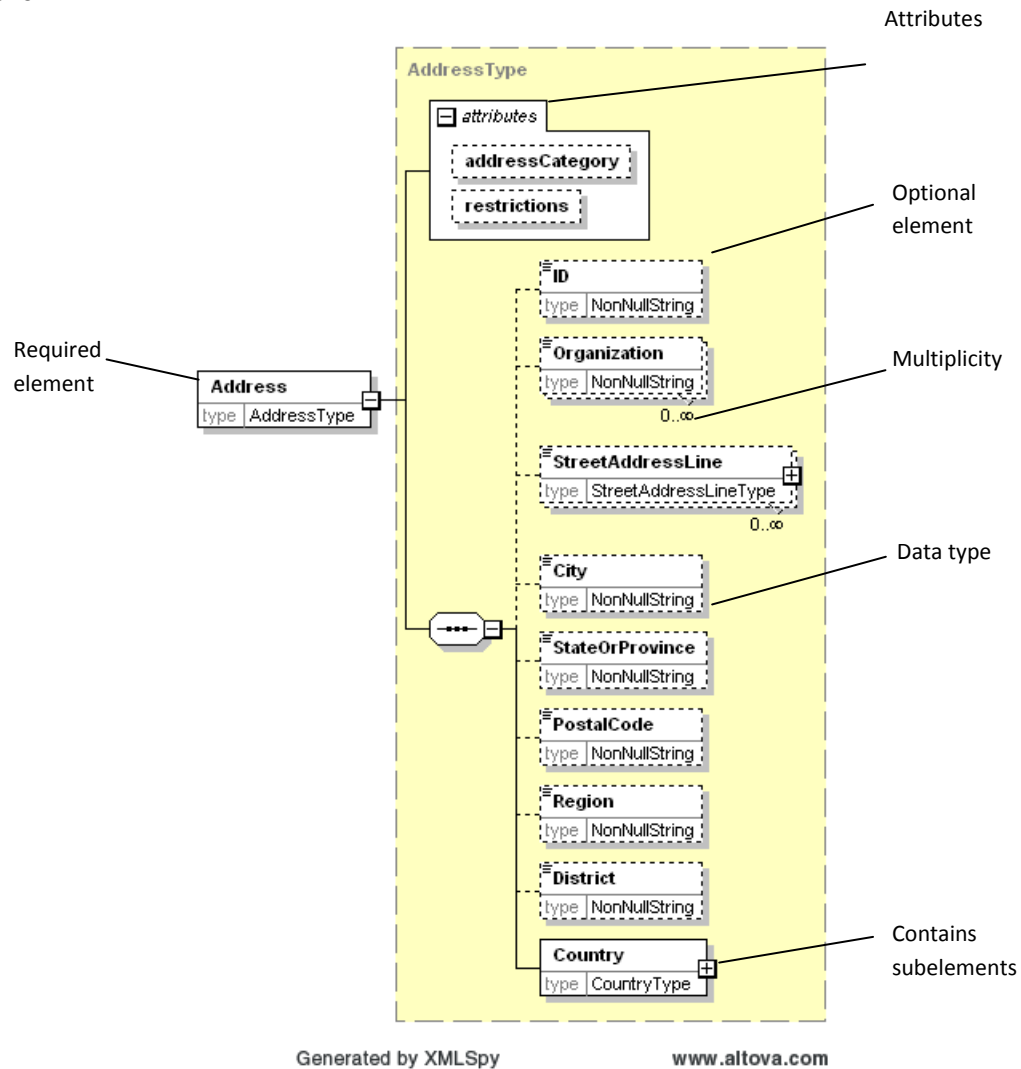
<http://www.ostyn.com/resources.htm>

## 2 Documentation Conventions

This document uses the following conventions:

Convention	Description
<b>Bold Text</b>	When used with an XML element name, indicates that the element contains sub-elements.
<i>Italics</i>	When used in an XML element description, an attribute of the XML element.
<b>Monospaced type</b>	Sample XML tags, code, schema, or portion thereof.

The document uses graphics generated by Altova XML Spy® software, which uses the following graphical conventions.



### 3 Conformance

To conform to the MedBiquitous Competency Framework specification, an XML document shall:

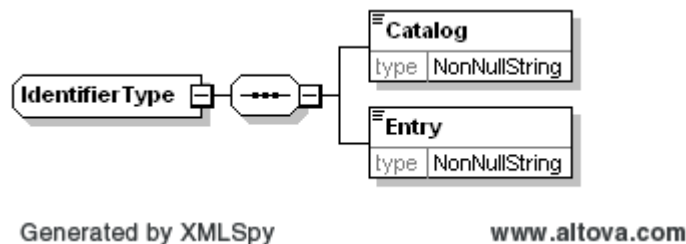
- Validate against the Competency Framework XML Schema available at:  
<http://ns.medbiq.org/competencyframework/v1/competencyframework.xsd>
- Conform to any additional requirements stated in this specification.
- Optionally include elements not defined in this document only in permitted areas and only if those elements are namespace qualified.

## 4 Common Data Types

Most of the elements and attributes in MedBiquitous XML documents use the data types defined by the W3C XML 1.0 schema definition [XSD]. In some cases MedBiquitous creates its own datatypes as part of its best practices or to meet a specific requirement. Commonly used datatypes are described below.

### 4.1 IdentifierType

Many of the elements in Competency Framework use the IdentifierType datatype, which allows competency framework developers to indicate the catalog or source of the identifier along with the identifier. This two-part approach facilitates the exchange of competency frameworks across systems by preventing identifier duplication. Competency references may reference MedBiquitous Competency Objects [Competency Objects], IEEE Reusable Competency Definitions [IEEE RCD], or external competency frameworks.



Elements using the IdentifierType have Catalog and Entry subelements, which are described in the table that follows.

#### IdentifierType Subelements

Element	Description	Required	Multiplicity	Datatype
<b>Catalog</b>	Catalog indicates the identification or cataloguing scheme for the entry. URIs may be used in many cases and are required for MedBiquitous Competency Objects and MedBiquitous Competency Frameworks. In others, organizations may wish to use an internal cataloguing scheme.	Required	1	Non-null string
<b>Entry</b>	Entry is the value of the identifier within the cataloguing scheme specified by the Catalog element.	Required	1	Non-null string

The following example shows an identifier for a competency definition that uses a URI cataloging schema.

```
<Identifier>
  <Catalog>URI</Catalog>
  <Entry>http://www.medschool.edu/competencies/kp87t</Entry>
</Identifier>
```

The next example shows an identifier for a competency definition that uses a local cataloging schema. Note that organizations may include a catalogue other than a URI for use within local systems as long as a URI identifier is present.

```
<Identifier>
  <Catalog>Medschool University</Catalog>
  <Entry>2005.10.87</Entry>
</Identifier>
```

## 5 Introduction

This document describes MedBiquitous Competency Frameworks specification in detail. It is intended for use by anyone who wants to develop tools or implement electronic systems for linking competencies to educational and performance data and resources.

The use of outcome and competency frameworks is a growing part of healthcare education and maintenance of certification. Many nations or states have accreditation frameworks for health professions schools and programs as well as requirements to demonstrate lifelong learning and competency in medical specialties/subspecialties. Currently, there is no standard way to represent these competencies in healthcare, and therefore no easy way to import/export competencies across systems. Once competencies are expressed in a common format, they can be used as the backbone of education and performance management systems.

- Learners and educators can search for learning resources addressing a particular competency.
- Educators can determine where specific competencies are addressed in a curriculum.
- Boards and hospitals can track and manage competency data for the professional.
- Administrators can map one competency framework to another.

The objective of the specification is to provide a consistent format and data structure for defining a competency framework. This, combined with other existing and emerging specifications, enables educational resources and activities to be tied to a competency framework.

The standard allows extensions so that data beyond the core set identified in this document may be communicated to other organizations. This specification is intended to work in concert with other specifications.

## 6 Other Standards, Specifications, or Schema Referenced

This standard references the following standards, specifications, or schemas. The informative references here, which describe how these references are used, link to formal references appearing later in this document.

- ANSI/MEDBIQ LO.10.1-2008, Healthcare Learning Object Metadata [[Healthcare LOM](#)]  
Healthcare LOM provides the format for identifiers and metadata about the competency framework.
- Competency Object [[Competency Object](#)]  
Competency Framework may reference individual statements of expectation using a MedBiquitous defined format or the 1484.20.1-2007 - IEEE Standard for Learning Technology-Data Model for Reusable Competency Definitions.
- DCMI Terms, October 11, 2010. [[DCMITerms](#)]  
Competency Framework has elements based on DCMI Terms.
- 1484.12.3-2005, IEEE Standard for Learning Technology-Extensible Markup Language (XML) Schema Definition Language Binding for Learning Object Metadata [[LOM](#)]  
Healthcare LOM extends the IEEE LOM standard.
- 1484.20.1-2007 - IEEE Standard for Learning Technology-Data Model for Reusable Competency Definitions [[IEEE RCD](#)]  
Competency Framework may reference individual statements of expectation using a MedBiquitous defined format or the IEEE Reusable Competency Definition.
- SKOS Simple Knowledge Organizations System Namespace Document – HTML Variant, 18 August 2009 Recommendation Edition [[SKOS](#)]  
The Competency Framework uses select SKOS vocabulary classes for conceptual relationships.
- XHTML™ 1.0 The Extensible HyperText Markup Language (Second Edition), A Reformulation of HTML 4 in XML 1.0. W3C Recommendation 26 January 2000, revised 1 August 2002. [[XHTML](#)]  
XHTML provides the format for supporting information embedded in the competency framework.



## 7 Terminology

Much of the terminology in this area is ill-defined or ambiguous, often employed differently (and sometimes interchangeably) by different professionals [[Harden 1](#)]. To ensure clarity and consistency we provide working definitions of the terminology we use in the context of this paper:

- **Competence** – possession of sufficient and necessary knowledge, skill and attitude by an individual to allow her to safely and effectively perform a specific job.
- **Competency** – a statement describing a specific ability, or set of abilities, requiring specific knowledge, skill and/or attitude. Competencies are used to set performance standards that must be met [[Albanese 1](#)].
- **Competency Framework** – an organized and structured representation of a set of interrelated and purposeful competency objects.
- **Competency Object** – an umbrella term used to describe any abstract statement of learning or performance expectations, and information related to the statement. Statements can be learning outcomes, competencies per se, learning objectives, professional roles, topics, classifications/collections, etc. The Competency Object may include additional data to expand on or support the statement. The Object is abstract in the sense that it does not inherently contain information about connections of the statement to individuals or events or other objects.
- **Learning Objective** – the intended aggregate learner endpoint for an activity, typically directly linked to the means by which it is to be achieved. Learning objectives may be derived from competencies or learning outcomes.
- **Learning Outcome** – the intended aggregate learner endpoint for a program, typically independent of the means by which the outcome is achieved. Used to identify, define and communicate the skills and qualities graduates should have [[Harden 2](#)].
- **Learning Object** – a digital resource used to support learning.
- **Performance** – a demonstration of practice, such as patient care. Can be used as evidence of one or more competencies.

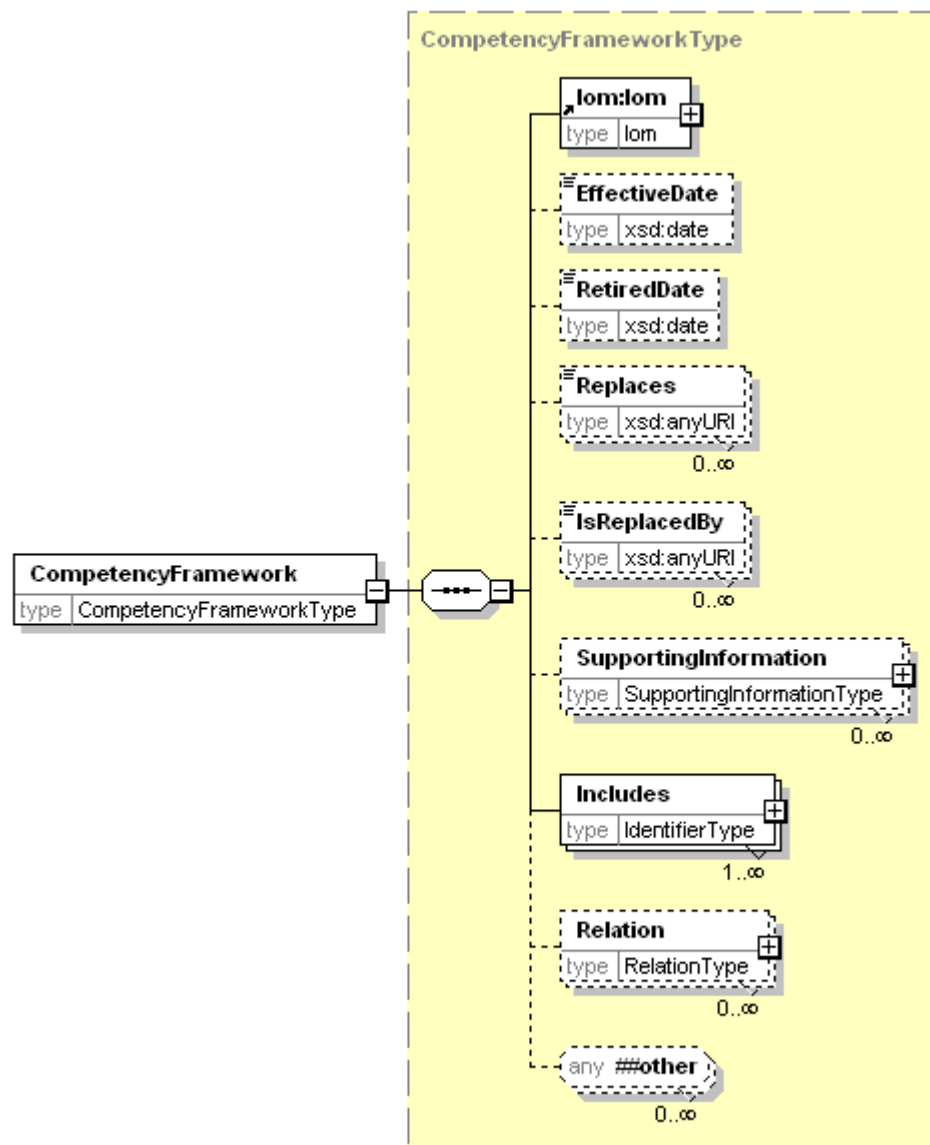
## 8 Competency Framework Schema

The following sections explain the Competency Framework Schema grammar. Values in bold under XML Tags column indicate that the element has sub-elements.

All the elements having sub-elements will be defined in separate sections. All elements without sub-elements will be defined within the appropriate element sections that use them.

### 8.1 CompetencyFramework

CompetencyFramework is the root element. It contains subelements that describe a set of related competency objects as well as the relationships among those competencyobjects, if applicable. CompetencyFramework must occur once within a competency framework document.



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*CompetencyFramework Element Information*

Element	Description	Required	Multiplicity	Datatype
<b>CompetencyFramework</b>	CompetencyFramework is the root element. It describes a set of related competency definitions and their relationships.	Required	1	Container
<b>lom</b>	<p>lom is the subelement of CompetencyFramework. It contains subelements that define title, publisher, and other descriptive information about this competency framework.</p> <p>The lom element is defined in the Healthcare Learning Object Metadata standard defined by MedBiquitous. Please see the Healthcare Learning Object Metadata Specifications and Description document for more information on the sub-elements of lom. For information on which subelements of lom are required or recommended for Competency Frameworks, see section Lom Required and Recommended Elements.</p>	Required	1	Container  For more information, see <a href="#">[Healthcare LOM]</a> and <a href="#">[LOM]</a> .
<b>EffectiveDate</b>	EffectiveDate is a subelement of CompetencyFramework. It describes the date this competency framework becomes or became effective.	Optional	0 or 1	Date
<b>RetiredDate</b>	RetiredDate is a subelement of CompetencyFramework. It describes the date upon which this competency framework was retired.	Optional	0 or 1	Date

Element	Description	Required	Multiplicity	Datatype
<b>Replaces</b>	<p>Replaces is a subelement of CompetencyFramework. Replaces indicates a related competency framework that is supplanted, displaced, or superseded by the described framework.</p> <p>Implementers must use a URI to represent the related framework.</p> <p>Replaces is based on the Dublin Core term replaces. For more information, see <a href="#">[DCMITerms]</a>.</p>	Optional	0 or more	anyURI
<b>IsReplacedBy</b>	<p>IsReplacedBy is a subelement of CompetencyFramework. IsReplacedBy indicates a related competency framework that supplants, displaces, or supersedes the described framework.</p> <p>Implementers must use a URI to represent the related framework.</p> <p>IsReplacedBy is based on the Dublin Core term isReplacedBy. For more information, see <a href="#">[DCMITerms]</a>.</p>	Optional	0 or more	anyURI
<b>SupportingInformation</b>	<p>SupportingInformation is the subelement of CompetencyFramework. It contains subelements that include or link to supporting information, such as descriptions of the rationale for developing the framework and its intended use. See section SupportingInformation for more information.</p>	Optional	0 or more	Container
<b>Includes</b>	<p>Includes is the subelement of CompetencyFramework. It contains subelements that uniquely identify competencies included in this competency framework. All competencies included in the framework must be referenced using the Includes element, including any competency object or framework referenced in a relations element.</p>	Required	1 or more	IdentifierType  See section 4.1 IdentifierType for more information.

Element	Description	Required	Multiplicity	Datatype
<b>Relation</b>	Relation is the subelement of CompetencyFramework. It contains subelements that define a relationship between two components of a framework. See section Relation for more information.	Optional	0 or more	Container
<b>Elements from other namespaces</b>	CompetencyFramework may include elements from other namespaces provided those elements are namespace qualified.	Optional	0 or more	any

Example:

```

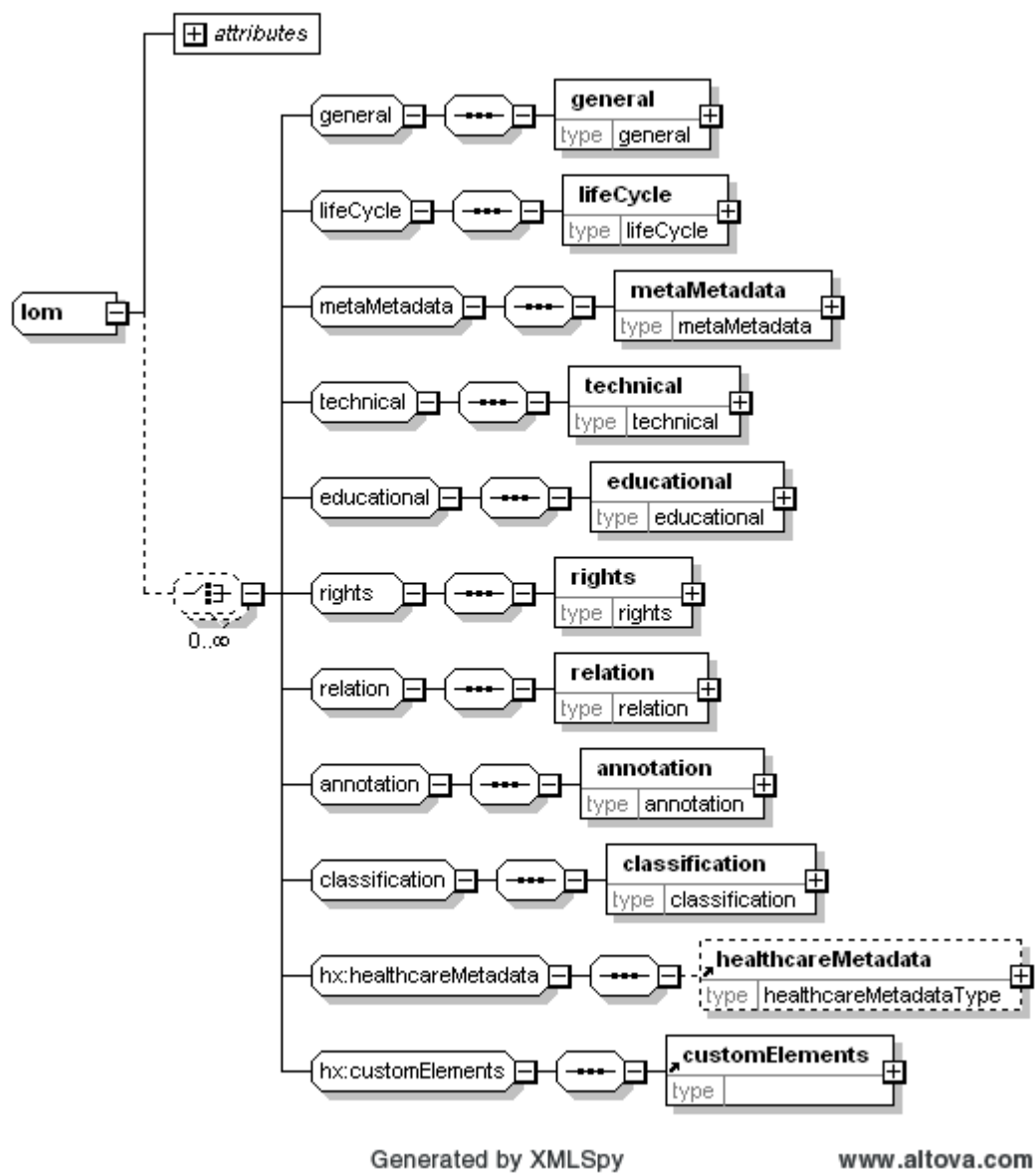
<CompetencyFramework>
  <lom:lom>
    . . .
  </lom:lom>
  <EffectiveDate>2011-12-09</EffectiveDate>
  <Replaces>http://www.example.org/competency1</Replaces>
  <SupportingInformation>
    . . .
  </SupportingInformation>
  <Includes>
    . . .
  </Includes>
  <Includes>
    . . .
  </Includes>
  <Includes>
    . . .
  </Includes>
  <Relation>
    . . .
  </Relation>

```

```
<Relation>  
.  
.  
.  
</Relation>  
<Relation>  
.  
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.  
</Relation>
```

## 8.2 Lom Required and Recommended Elements

lom is the subelement of CompetencyFramework. It contains subelements that define title, publisher, and other descriptive information about this competency framework.



The table that follows indicates which elements of healthcare lom are required or recommended for use in the Competency Framework. Note that additional lom elements may be used.

### *lom Element Usage Information*

Element	Description	Required	Multiplicity	Datatype
<b>lom</b>	lom is the subelement of CompetencyFramework. It contains subelements that define title, publisher, and other descriptive information about this competency framework.  For more information on these elements, see <a href="#">[LOM]</a> and <a href="#">[Healthcare LOM]</a>	Required	1	Container  For more information on lom and its subelements, see <a href="#">[Healthcare LOM]</a> and <a href="#">[LOM]</a> .
<b>general</b>	A container for general metadata elements.	Required	1	Container
<b>general:identifier</b>	A container for identifier information.	Required	1 or more	Container
<b>general:identifier:catalog</b>	The cataloging system for the unique identifier. For competency frameworks, the catalog must be URI.  Note that organizations may include a catalogue other than URI for use within local systems as long as a URI identifier is present in the XML document.	Required	1	Restricted. See Description for details.

Element	Description	Required	Multiplicity	Datatype
<b>general:identifier:entry</b>	<p>Defines a unique identifier for the competency framework. For competency frameworks, identifiers must be in the form of a URI.</p> <p>Note that organizations may include an entry other than a URI for use within local systems as long as a URI identifier is present in the XML document.</p>	Required	1	anyURI
<b>general:title</b>	Defines the title for this competency framework in one or more languages.	Required	1	LanguageString
<b>general: description</b>	A short description of the competency framework.	Recommended	0 or more	LanguageString
<b>lifecycle</b>	A container for elements relating to the lifecycle of the framework.	Recommended	0 or 1	Container
<b>lifecycle: status</b>	A container for elements describing the status of the competency framework.	Recommended	0 or 1	Container
<b>lifecycle: status: source</b>	The source of the vocabulary for status. Use LOMv1.0.	Recommended	0 or 1	Restricted See Description for details.
<b>lifecycle: status: value</b>	The status of the competency framework. Valid values are: draft, final, revised, unavailable. Use of draft and final values is recommended.	Recommended	0 or 1	Restricted. See Description for details.

Element	Description	Required	Multiplicity	Datatype
<b>lifecycle: contribute</b>	A container for elements the people and organizations that have contributed to the competency framework.	Recommended	0 or 1	Container
<b>lifecycle: contribute: role</b>	A container for elements describing the publisher and other entities involved in the development of this framework. Use the role and entity elements within the lifecycle element to indicate the publisher of the competency framework. Role should have a value of publisher and be paired with an entity describing the publisher.	Recommended	0 or more	Container
<b>lifecycle: contribute: role:source</b>	The source of the vocabulary for role. When describing the publisher, use LOMv1.0.	Recommended	0 or 1	Restricted. See Description for details.
<b>lifecycle: contribute: role: value</b>	The role being described. To describe the publisher, value should be publisher.	Recommended	0 or 1	Restricted. See Description for details.
<b>lifecycle: contribute: entity</b>	Use the role and entity elements within the lifecycle element to indicate the publisher of the competency framework. Entity includes a vcard reference to the publisher and should be paired with a role that has a value of publisher.	Recommended	0 or more	CharacterString in VCARD format. See <a href="#">[LOM]</a> for details.

Element	Description	Required	Multiplicity	Datatype
<b>educational</b>	A container element for elements related to the educational aspects of the framework.	Recommended	0 or 1	Container
<b>educational: context</b>	A container for elements describing the educational environment for which the competency framework is intended.	Recommended	0 or more	Container
<b>educational: context:source</b>	The source of the vocabulary for educational context. To use the MedBiquitous vocabulary, use HEALTHCARE_LOMv1.	Recommended	0 or 1	Restricted. See Description for details.
<b>educational:context:value</b>	<p>The educational context for which the framework is intended. Use a term from the following MedBiquitous vocabulary (described in HealthcareLOM):</p> <ul style="list-style-type: none"> <li>• patient education</li> <li>• caregiver education</li> <li>• primary education</li> <li>• secondary education</li> <li>• vocational training</li> <li>• undergraduate education</li> <li>• undergraduate professional education</li> <li>• graduate professional education</li> <li>• continuing professional development</li> </ul>	Recommended	0 or 1	Restricted. See Description for details.

Element	Description	Required	Multiplicity	Datatype
<b>rights</b>	A container element for information on copyright and other restrictions.	Recommended	0 or 1	Container
<b>rights: copyrightAndOtherRestrictions</b>	A container for elements indicating whether or not copyright or other restrictions exist on the competency framework.	Recommended	0 or 1	Container
<b>rights: copyrightAndOtherRestrictions:source</b>	The source of the vocabulary used to describe copyright and other restrictions. To use the lom vocabulary, use LOMv1.0.	Recommended	0 or 1	Restricted. See Description for details.
<b>rights: copyrightAndOtherRestrictions:value</b>	Indicates whether or not copyright and other restrictions exist. Valid values are yes and no.	Recommended	0 or 1	Restricted. See Description for details.
<b>rights: description</b>	The description element within rights provides a brief description of the copyright or other constraints on the competency framework. The description may include a link to a license.	Recommended	0 or 1	LanguageString
<b>healthcareMetadata</b>	A container element for healthcare related metadata.	Recommended	0 or 1	Container
<b>healthcareMetadata:healthcareEducation</b>	A container element for healthcare education related metadata.	Recommended	0 or 1	Container

Element	Description	Required	Multiplicity	Datatype
<b>healthcareMetadata:healthcareEducation:targetAudience</b>	A container element for information about the target audience for whom this framework is intended.	Recommended	0 or 1	Container
<b>healthcareMetadata:healthcareEducation:targetAudience:profession</b>	The health profession for which this competency framework is intended.	Recommended	0 or 1	LanguageString

Example:

```

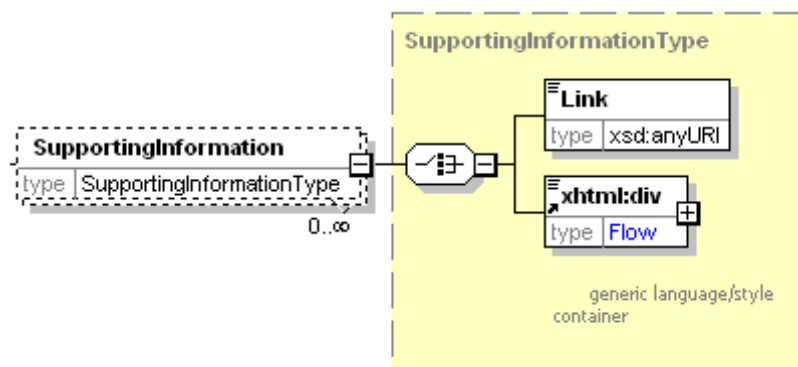
<lom:lom>
  <lom:general>
    <lom:identifier>
      <lom:catalog>URI</lom:catalog>
      <lom:entry>http://www.example.org/framework1</lom:entry>
    </lom:identifier>
    <lom:title>
      <lom:string language="en">The Competent Physician</lom:string>
    </lom:title>
    <lom:description>
      <lom:string language="en">The Competent Physician describes the knowledge, skills, and
abilities a physician should have.</lom:string>
    </lom:description>
  </lom:general>
  <lom:lifeCycle>
    <lom:version>
      <lom:string>1.0</lom:string>
    </lom:version>
  </lom:lifeCycle>
  <lom:contribute>

```

```
<lom:entity> BEGIN:VCARD&#13;&#10;VERSION:2.1&#13;&#10;ORG:Association of Worldwide
Physicians&#13;&#10;END:VCARD </lom:entity>
  <lom:role>
    <lom:source>LOMv1.0</lom:source>
    <lom:value>publisher</lom:value>
  </lom:role>
</lom:contribute>
</lom:lifeCycle>
<lom:educational>
  <lom:context>
    <lom:source>HEALTHCARE_LOMv1</lom:source>
    <lom:value>undergraduate professional education</lom:value>
  </lom:context>
</lom:educational>
<lom:rights>
  <lom:copyrightAndOtherRestrictions>
    <lom:source>LOMv1.0</lom:source>
    <lom:value>yes</lom:value>
  </lom:copyrightAndOtherRestrictions>
  <lom:description>
    <lom:string language="en">Creative Commons Attribution 3.0 Unported license,
http://creativecommons.org/licenses/by/3.0/</lom:string>
  </lom:description>
</lom:rights>
<hx:healthcareMetadata>
  <hx:healthcareEducation>
    <hx:targetAudience>
      <hx:profession>
        <lom:string language="en">physician</lom:string>
      </hx:profession>
    </hx:targetAudience>
  </hx:healthcareEducation>
</hx:healthcareMetadata>
</lom:lom>
```

### 8.3 SupportingInformation

SupportingInformation includes or links to supporting information, such as descriptions of the rationale for developing the framework and its intended use.



*SupportingInformation Element Information*

Element	Description	Required	Multiplicity	Datatype
<b>SupportingInformation</b>	SupportingInformation is the subelement of CompetencyFramework. It contains subelements that include or link to supporting information, such as descriptions of the rationale for developing the framework and its intended use.	Optional	0 or more	Container
<b>Link</b>	Link is the subelement of SupportingInformation. It provides a URL or URI reference to a supporting resource, such as a pdf or html file describing the purpose of the framework in detail.  Link must contain a valid URI.	Either Link or xhtml:div is required	0 or 1	Restricted
<b>xhtml:div</b>	A div element is a mixed type element referenced from XHTML. The div element can include a mix of text and XHTML tags as specified by the XHTML schema.	Either Link or xhtml:div is required	0 or 1	Container  For more information, see <a href="#">[XHTML]</a> .

The following example provides a link:

```
<SupportingInformation>
  <Link>http://www.scottishdoctor.org/resources/scottishdoctor3.doc</Link>
</SupportingInformation>
```

The following example shows the use of XHTML:

```
<SupportingInformation>
  <xhtml:div>
    <xhtml:h2>The Scottish Deans Medical Curriculum Group (SDMCG)</xhtml:h2>
    <xhtml:p>Following the publication of ‘Tomorrow’s Doctors’ by the UK General
    Medical Council (GMC) in 1993, the five Scottish Medical Schools (Universities of Aberdeen,
    Dundee, Edinburgh, Glasgow and St Andrews) had a series of meetings to discuss the implications
```

of the recommendations. As a result of these discussions, the Scottish Deans' Medical Curriculum Group (SDMCG) was set up in 1999. The purpose of the SDMCG is to discuss and where necessary coordinate the development, delivery and evaluation of their undergraduate curricula and to ensure that the graduates from each school are of an equivalent standard.

The Group comprises two members from each School, one of whom is the Teaching Dean or equivalent. The Group also has as members a medical education IT expert, an educationalist, who also acts as the Project Officer, a Post Graduate Dean and an administrator. The activities of the Group are funded by the five Schools, with earlier support coming from NHS Education for Scotland. The SDMCG reports to the Board for Academic Medicine in Scotland.

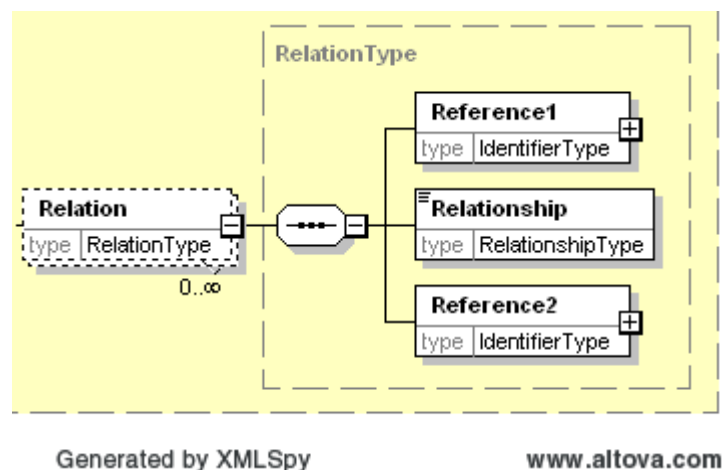
The Scottish Doctor publications have been the most visible results of the SDMCG's activities. Other projects include ones on standard setting, student portfolios, learning in acute care, communication skills and anatomy and some of these projects are ongoing. There is also a standing IT/informatics subgroup (The Medical Education Informatics Group). The SDMCG has proved a valuable forum for the Schools to discuss national issues such as Government or NHS consultation documents or guidance from specialty groupings about undergraduate medical curricular content. The Group has recently appointed a Senior University Teacher in Law, Ethics and Risk Management. The holder of this post, which is funded by the Medical and Dental Defence Union of Scotland, works with all five Schools on their continuing development of this important curricular theme.

</xhtml:div>

</SupportingInformation>

## 8.4 Relation

Relation defines a relationship between two components of a framework.



*Relation Element Information*

Element	Description	Required	Multiplicity	Datatype
<b>Relation</b>	<p>Relation is the subelement of Competency Framework. It contains subelements that define a relationship between two components of a framework. The following types of relationships are allowed:</p> <ul style="list-style-type: none"> <li>• A competency may have a broader competency.</li> <li>• Conversely, a competency may have a narrower competency.</li> <li>• A competency may have a narrower external framework.</li> <li>• Conversely, an external framework may have a broader competency.</li> <li>• A competency may be related to another competency.</li> <li>• A competency may be related to an external framework.</li> </ul> <p>No other relationships may be defined. Cyclical references are forbidden as are any references that result in a hierarchical conflict. For more information, see the note about hierarchical conflict following this section.</p>	Optional	0 or more	Container

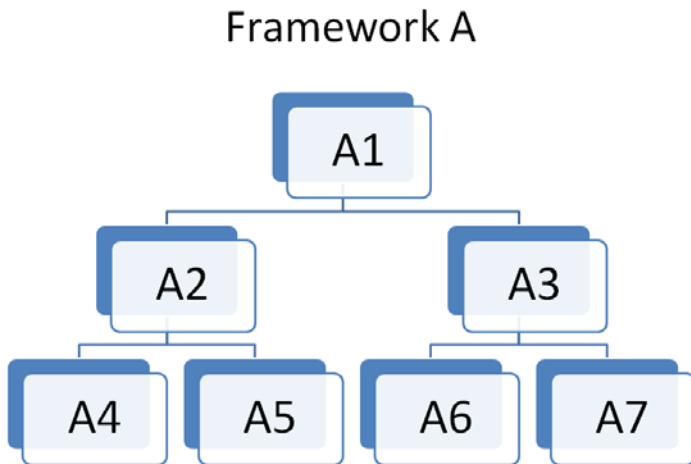
<b>Reference1</b>	Reference1 is the subelement of Relation. It identifies a single competency with a relationship to the components specified in Reference2.	Required	1	Container
<b>Relationship</b>	<p>Relationship is a subelement of Relation. It defines the nature of the relationship between the components of the framework specified in Reference1 and Reference2.</p> <p>Valid values are:</p> <p><a href="http://www.w3.org/2004/02/skos/core#broader">http://www.w3.org/2004/02/skos/core#broader</a> which means has broader concept</p> <p><a href="http://www.w3.org/2004/02/skos/core#narrower">http://www.w3.org/2004/02/skos/core#narrower</a> which means has narrower concept</p> <p><a href="http://www.w3.org/2004/02/skos/core#related">http://www.w3.org/2004/02/skos/core#related</a> which means has related concept.</p> <p>Has broader concept and has narrower concept, indicated by <a href="http://www.w3.org/2004/02/skos/core#broader">http://www.w3.org/2004/02/skos/core#broader</a> and <a href="http://www.w3.org/2004/02/skos/core#narrower">http://www.w3.org/2004/02/skos/core#narrower</a>, are converse relationships. If Component1 has broader concept Component2, Component2 must have narrower concept Component1. The converse relationship does not need to be explicitly encoded; it should be understood based on the nature of the relationship between the two components.</p> <p>Has related concept, <a href="http://www.w3.org/2004/02/skos/core#related">http://www.w3.org/2004/02/skos/core#related</a>, may be used for any relationship that is non-hierarchical.</p> <p>The valid values of the relation element are taken from the Simple Knowledge Organizations System [<a href="#">SKOS</a>].</p>	Required	1	Restricted
<b>Reference2</b>	Reference2 is the subelement of Relation. It identifies the component that has a relationship to the component specified in Reference1.	Required	1	Container

Example:

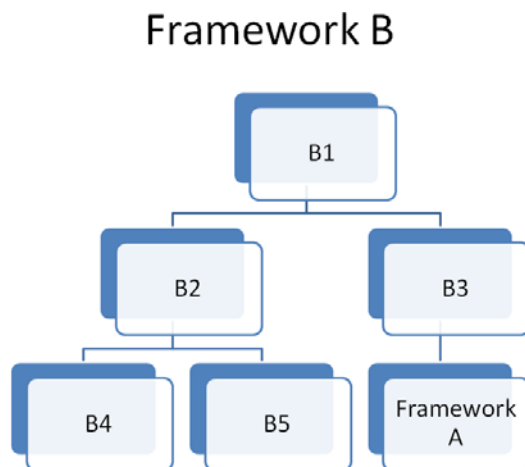
```
<Relation>
  <Reference1>
    <Catalog>URI</Catalog>
    <Entry>http://www.example.org/competency123</Entry>
  </Reference1>
  <Relationship>http://www.w3.org/2004/02/skos/core#broader</Relationship>
  <Reference2>
    <Catalog>URI</Catalog>
    <Entry>http://www.example.org/competency234</Entry>
  </Reference2>
</Relation>
```

## 8.5 Note about Hierarchical Conflict

The ability to define relations to external competency objects and frameworks provides a great deal of flexibility in defining a competency framework, but it also has the potential to lead to confusion. This standard explicitly forbids any relations that result in a hierarchical conflict, as in the example below.

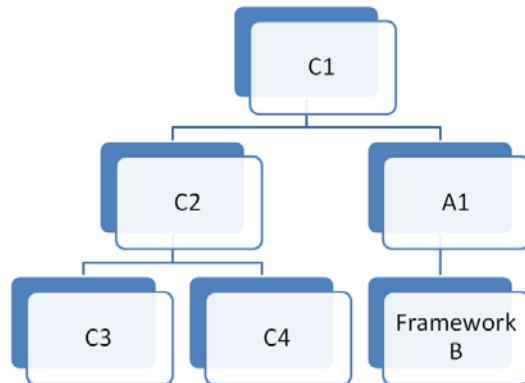


Framework A has no external references.

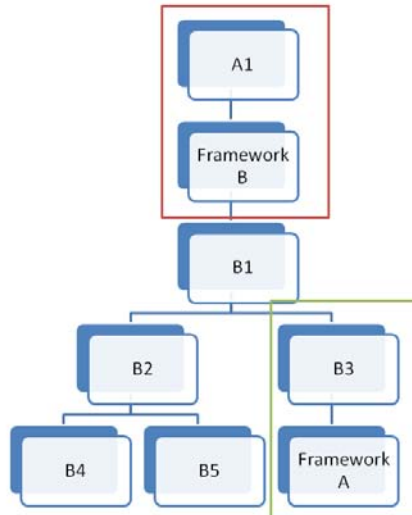


Framework B incorporates Framework A. Competency object B3 is broader than Framework A.

## Framework C



Framework C incorporates a competency from framework A and all of Framework B, saying that competency object A1 is broader than Framework B. This is a hierarchical conflict since Framework B explicitly defines Framework A, and therefore all of its competency objects, including A1, as narrower than competency object B3, which is a part of framework B. The resulting string of relations look like this:



The hierarchical relation shown in red clearly conflicts with the hierarchical relation shown in green.

## 9 Sample XML Documents

```

<?xml version="1.0" encoding="UTF-8"?>
<CompetencyFramework xmlns="http://ns.medbiq.org/competencyframework/v1/"
xmlns:lom="http://ltsc.ieee.org/xsd/LOM"
xmlns:hx="http://ns.medbiq.org/lom/extend/v1/"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://ns.medbiq.org/competencyframework/v1/
competencyframework.xsd http://ltsc.ieee.org/xsd/LOM
http://ns.medbiq.org/lom/healthcarelom.xsd
http://ns.medbiq.org/lom/extend/v1/
http://ns.medbiq.org/lom/healthcare/healthcaremetadata.xsd">
  <lom:lom>
    <lom:general>
      <lom:identifier>
        <lom:catalog>URI</lom:catalog>
        <lom:entry>http://www.example.org/framework1</lom:entry>
      </lom:identifier>
      <lom:title>
        <lom:string language="en">The Competent Physician</lom:string>
      </lom:title>
      <lom:description>
        <lom:string language="en">The Competent Physician describes
the knowledge, skills, and abilities a physician should have.</lom:string>
      </lom:description>
    </lom:general>
    <lom:lifeCycle>
      <lom:version>
        <lom:string>1.0</lom:string>
      </lom:version>
      <lom:contribute>
        <lom:entity>Association of Worldwide Physicians</lom:entity>
        <lom:role>
          <lom:source>LOMv1.0</lom:source>
          <lom:value>publisher</lom:value>
        </lom:role>
      </lom:contribute>
    </lom:lifeCycle>
    <lom:educational>
      <lom:context>
        <lom:source>HEALTHCARE_LOMv1</lom:source>
        <lom:value>undergraduate professional education</lom:value>
      </lom:context>
    </lom:educational>
    <lom:rights>
      <lom:copyrightAndOtherRestrictions>
        <lom:source>LOMv1.0</lom:source>

```

```

        <lom:value>yes</lom:value>
      </lom:copyrightAndOtherRestrictions>
      <lom:description>
        <lom:string language="en">Creative Commons Attribution 3.0
Unported license, http://creativecommons.org/licenses/by/3.0/</lom:string>
      </lom:description>
    </lom:rights>
    <hx:healthcareMetadata>
      <hx:healthcareEducation>
        <hx:targetAudience>
          <hx:profession>
            <lom:string language="en">physician</lom:string>
          </hx:profession>
        </hx:targetAudience>
      </hx:healthcareEducation>
    </hx:healthcareMetadata>
  </lom:lom>
  <EffectiveDate>2011-12-09</EffectiveDate>
  <Includes>
    <Catalog>URI</Catalog>
    <Entry>http://www.example.org/competency1</Entry>
  </Includes>
  <Includes>
    <Catalog>URI</Catalog>
    <Entry>http://www.example.org/competency2</Entry>
  </Includes>
  <Includes>
    <Catalog>URI</Catalog>
    <Entry>http://www.example.org/competency3</Entry>
  </Includes>
  <Relation>
    <Referencel>
      <Catalog>URI</Catalog>
      <Entry>http://www.example.org/competency1</Entry>
    </Referencel>

  <Relationship>http://www.w3.org/2004/02/skos/core#narrower</Relationshi
p>
    <Reference2>
      <Catalog>URI</Catalog>
      <Entry>http://www.example.org/competency3</Entry>
    </Reference2>
  </Relation>
  <Relation>
    <Referencel>
      <Catalog>URI</Catalog>
      <Entry>http://www.example.org/competency1</Entry>
    </Referencel>

```

```
<Relationship>http://www.w3.org/2004/02/skos/core#narrower</Relationshi
p>
  <Reference2>
    <Catalog>URI</Catalog>
    <Entry>http://www.example.org/competency2</Entry>
  </Reference2>
</Relation>
</CompetencyFramework>
```

## 10 References

For references citing a specific date or edition, only the edition cited applies. For references that do not cite a specific edition, the latest edition of the referenced document (including any amendments or corrigenda) applies.

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### DCMI Terms

DCMI Metadata Terms, October 11, 2010. Dublin Core Metadata Initiative Website. <http://dublincore.org/documents/2010/10/11/dcmi-terms/>. Accessed October 17, 2011.

### Harden 1

Harden RM. Learning outcomes and instructional objectives: is there a difference? *Medical Teacher* 2002; 24(2):151-5.

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Harden RM, Crosby JR, Davis MH and Friedman M. AMEE Guide No. 14: Outcome-based education: Part 5 – From competency to meta-competency: a model for the specification of learning outcomes. *Medical Teacher* 1999; 21(6):546-52.

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ANSI/MEDBIQ LO.10.1-2008, Healthcare Learning Object Metadata, MedBiquitous Website. [http://www.medbiq.org/std\\_specs/standards/index.html#HCLOM](http://www.medbiq.org/std_specs/standards/index.html#HCLOM). Accessed June 1, 2011.

### IEEE RCD

1484.20.1-2007 - IEEE Standard for Learning Technology-Data Model for Reusable Competency Definitions, IEEE Standards Association Website. <http://standards.ieee.org/findstds/standard/1484.20.1-2007.html>. Downloaded October 21, 2009.

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"IEEE Standard for Learning Technology-Extensible Markup Language (XML) Schema Definition Language Binding for Learning Object Metadata," *IEEE Std 1484.12.3-2005*, vol., no., pp.0\_1-46, 2005  
doi: 10.1109/IEEESTD.2005.97889

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SKOS Simple Knowledge Organizations System Namespace Document – HTML Variant, 18 August 2009 Recommendation Edition, W3C website. <http://www.w3.org/2009/08/skos-reference/skos.html>. Accessed November 10, 2011.

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Extensible Markup Language (XML) 1.0 (Fifth Edition), W3C Website. 26 November 2008 <http://www.w3.org/TR/2008/REC-xml-20081126/> . Accessed March 20, 2012.

**XHTML**

XHTML™ 1.0 The Extensible HyperText Markup Language (Second Edition), A Reformulation of HTML 4 in XML 1.0. W3C Recommendation 26 January 2000, revised 1 August 2002. W3C website. <http://www.w3.org/TR/2002/REC-xhtml1-20020801> . Accessed September 6, 2011.