



# Competency Object Specifications

---

Version: 0.51

Date: November 15, 2011

Authors: Valerie Smothers

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

## Version History

Version No.	Date	Changed By	Changes Made
0.1	11 Feb 2010	Valerie Smothers	Initial draft
0.2	24 Mar 2010	Valerie Smothers	URI's required for identifier, eliminated overlap with lom, required certain lom elements. Added sample xml.
0.3	20 May 2010	Valerie Smothers	Changed structure of category element to be similar to Atom category element.
0.4	14 Sep 2010	Valerie Smothers	Added Supporting Information element. Filled out Data Elements section.
0.51	15 November 2011	Valerie Smothers	Revised graphics and template; Added Status, replaces, isReplacedBy, updated list of recommended and required elements of lom. (to be completed)

## MedBiquitous Consortium XML Public License and Terms of Use

MedBiquitous XML (including schemas, specifications, sample documents, Web services description files, and related items) is provided by the copyright holders under the following license. By obtaining, using, and or copying this work, you (the licensee) agree that you have read, understood, and will comply with the following terms and conditions.

The Consortium hereby grants a perpetual, non-exclusive, non-transferable, license to copy, use, display, perform, modify, make derivative works of, and develop the MedBiquitous XML for any use and without any fee or royalty, provided that you include the following on ALL copies of the MedBiquitous XML or portions thereof, including modifications, that you make.

1. Any pre-existing intellectual property disclaimers, notices, or terms and conditions. If none exist, the following notice should be used: "Copyright © [date of XML release] MedBiquitous Consortium. All Rights Reserved. <http://www.medbiq.org>"
2. Notice of any changes or modification to the MedBiquitous XML files.
3. Notice that any user is bound by the terms of this license and reference to the full text of this license in a location viewable to users of the redistributed or derivative work.

In the event that the licensee modifies any part of the MedBiquitous XML, it will not then represent to the public, through any act or omission, that the resulting modification is an official specification of the MedBiquitous Consortium unless and until such modification is officially adopted.

THE CONSORTIUM MAKES NO WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, WITH RESPECT TO ANY COMPUTER CODE, INCLUDING SCHEMAS, SPECIFICATIONS, SAMPLE DOCUMENTS, WEB SERVICES DESCRIPTION FILES, AND RELATED ITEMS. WITHOUT LIMITING THE FOREGOING, THE CONSORTIUM DISCLAIMS ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND ANY WARRANTY, EXPRESS OR IMPLIED, AGAINST INFRINGEMENT BY THE MEDBIQUITOUS XML OF ANY THIRD PARTY PATENTS, TRADEMARKS, COPYRIGHTS OR OTHER RIGHTS. THE LICENSEE AGREES THAT ALL COMPUTER CODES OR RELATED ITEMS PROVIDED SHALL BE ACCEPTED BY LICENSEE "AS IS". THUS, THE ENTIRE RISK OF NON-PERFORMANCE OF THE MEDBIQUITOUS XML RESTS WITH THE LICENSEE WHO SHALL BEAR ALL COSTS OF ANY SERVICE, REPAIR OR CORRECTION.

IN NO EVENT SHALL THE CONSORTIUM OR ITS MEMBERS BE LIABLE TO THE LICENSEE OR ANY OTHER USER FOR DAMAGES OF ANY NATURE, INCLUDING, WITHOUT LIMITATION, ANY GENERAL, DIRECT, INDIRECT, INCIDENTAL, CONSEQUENTIAL, OR SPECIAL DAMAGES, INCLUDING LOST PROFITS, ARISING OUT OF ANY USE OF MEDBIQUITOUS XML.

---

Copyright MedBiquitous Consortium, 2011. All Rights Reserved.

LICENSEE SHALL INDEMNIFY THE CONSORTIUM AND EACH OF ITS MEMBERS FROM ANY LOSS, CLAIM, DAMAGE OR LIABILITY (INCLUDING, WITHOUT LIMITATION, PAYMENT OF ATTORNEYS' FEES AND COURT COSTS) ARISING OUT OF MODIFICATION OR USE OF THE MEDBIQUITOUS XML OR ANY RELATED CONTENT OR MATERIAL BY LICENSEE.

LICENSEE SHALL NOT OBTAIN OR ATTEMPT TO OBTAIN ANY PATENTS, COPYRIGHTS OR OTHER PROPRIETARY RIGHTS WITH RESPECT TO THE MEDBIQUITOUS XML.

THIS LICENSE SHALL TERMINATE AUTOMATICALLY IF LICENSEE VIOLATES ANY OF ITS TERMS AND CONDITIONS.

The name and trademarks of the MedBiquitous Consortium and its members may NOT be used in advertising or publicity pertaining to MedBiquitous XML without specific, prior written permission. Title to copyright in MedBiquitous XML and any associated documentation will at all times remain with the copyright holders.

## Table of Contents

<b>1</b>	<b>Acknowledgements.....</b>	<b>6</b>
<b>2</b>	<b>Introduction .....</b>	<b>8</b>
<b>3</b>	<b>Documentation Conventions.....</b>	<b>Error! Bookmark not defined.</b>
<b>4</b>	<b>Terminology .....</b>	<b>11</b>
<b>5</b>	<b>Data Elements .....</b>	<b>Error! Bookmark not defined.</b>
<b>6</b>	<b>Other Schema Referenced.....</b>	<b>Error! Bookmark not defined.</b>
<b>7</b>	<b>Competency Object Schema Grammar.....</b>	<b>13</b>
7.1	CompetencyObject .....	13
7.2	References Element.....	20
7.3	Supporting Information Element.....	21
<b>8</b>	<b>Sample XML Documents.....</b>	<b>24</b>
<b>9</b>	<b>References.....</b>	<b>26</b>

# 1 Acknowledgements

The MedBiquitous Consortium wishes to acknowledge the help of the MedBiquitous Competencies Working Group members, invited experts, and other individuals that contributed to the creation of this document, including:

- Rosalyn Scott, M.D., Department of Veterans Affairs, Co-Chair
- Tim Willet, M.D., CRI Critical Care Education Network, Co-Chair
  
- Susan Albright, Tufts University
- Mary Pat Aust, American Association of Critical-Care Nurses
- Theresa Barrett, New Jersey Academy of Family Physicians
- Chris Candler, M.D., University of Oklahoma
- Matthew Cownie, University of the West of England
- Allan Cumming, M.D., University of Edinburgh
- Tom Doyle, METI
- Rachel Ellaway, Ph.D., Northern Ontario School of Medicine
- Bob Englander, M.D., Association of American Medical Colleges
- Maria Esquela, Advanced Informatics
- Lynne Galiatsatos, American College of Cardiology
- Vladimir Goodkovsky, University of Virginia
- Simon Grant, Ph.D., Jisc Cetis
- Peter Greene, M.D., Johns Hopkins University
- David Hadden, TheraSim
- David Hananel, METI
- Ted Hanss, University of Michigan
- Ronald Harden, M.D., IVIMEDS
- Sean Hilton, M.D., St. George's University of London
- Logan Holt, TheraSim
- David Kiger, Tufts University
- Linda Lewin, M.D., University of Maryland
- Matt Lewis, Outcomes, Inc.
- Chandler Mayfield, University of California, San Francisco
- J.B. McGee, M.D., University of Pittsburgh
- Michael Mintzer, M.D., Department of Veterans Affairs
- Kasem Mohsen, TheraSim

---

Copyright MedBiquitous Consortium, 2011. All Rights Reserved.

- David Price, M.D., American Board of Family Medicine
- Carla Pugh, M.D, Northwestern University
- Doris Quinn, Vanderbilt University
- Dan Rehak, Ph.D.
- Isarin Sathitruangsak, Tufts University
- Valerie Smothers, MedBiquitous
- Lesley Southgate, M.D., St. George's University of London
- David Stern, M.D., University of Michigan
- Lana Vukovljak, American Association of Diabetes Educators
- Jeff Williamson, American Medical Informatics Association
- Nabil Zary, Karolinska Institute

Specification authors also received technical guidance from members of the MedBiquitous Technical Steering Committee.

- Joel Farrell, IBM, Technical Steering Committee Chair
- James Fiore, American Board of Surgery
- Steve Kenney, American Osteopathic Association
- Andrew Rabin, CECity
- Dan Rehak, Learning Technologies Architect
- Dan White, American Board of Internal Medicine

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:

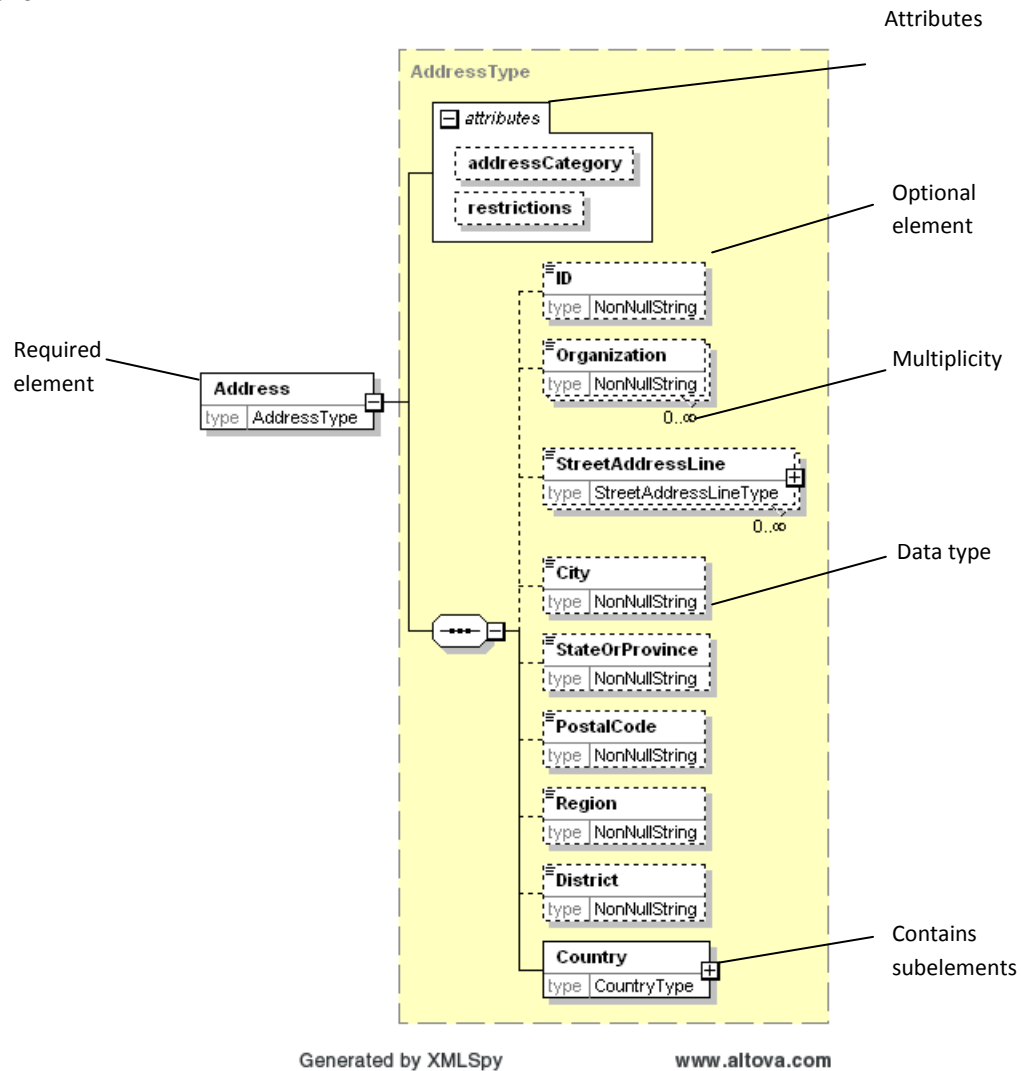
<http://www.ostyn.com/resources.htm>

## 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 be a conformant instance of the MedBiquitous Competency Object specification, an XML document shall:

- Shall validate against the Competency Object XML Schema available at:  
<http://ns.medbig.org/competencyobject/v1/competencyobject.xsd>
- Shall conform to any additional requirements stated in this specification.
- May include elements not defined in this document only in permitted areas and only if those elements are namespace qualified.

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.

## 4 Introduction

This document describes MedBiquitous Competency Objects specification in detail. It is intended for use by anyone who wants to develop tools or implement electronic systems for defining and uniquely identifying competencies. The status of the document is indicated at the bottom of the page; draft documents are subject to review and approval through the MedBiquitous and ANSI standards development processes (see [http://www.medbig.org/working\\_groups/consortium\\_process/MedBiquitousANSIProcess.pdf](http://www.medbig.org/working_groups/consortium_process/MedBiquitousANSIProcess.pdf)).

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, enabling the following:

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

The objective of the specification is to provide a consistent format and data structure for defining a competency a competency object. This specification is meant to be used in concert with complementary specifications, including the MedBiquitous Competency Framework specification.

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.

## 5 Other Standards, Specifications, or Schema Referenced

This standard references: [\(verify\)](#)

- 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 IEEE Reusable Competency Definition.
- DCMI Terms [[DCMITerms](#)]  
Competency Framework may indicate is this framework replaces or is replaced by another framework using 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.
- Simple Knowledge Organizations System [[SKOS](#)]  
The Competency Framework uses select SKOS vocabulary classes nfor conceptual relationships.
- XHTML™ 1.0 The Extensible HyperText Markup Language (Second Edition) [[XHTML](#)]  
XHTML provides the format for supporting information embedded in the competency framework.

## 6 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 by the CWG 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.

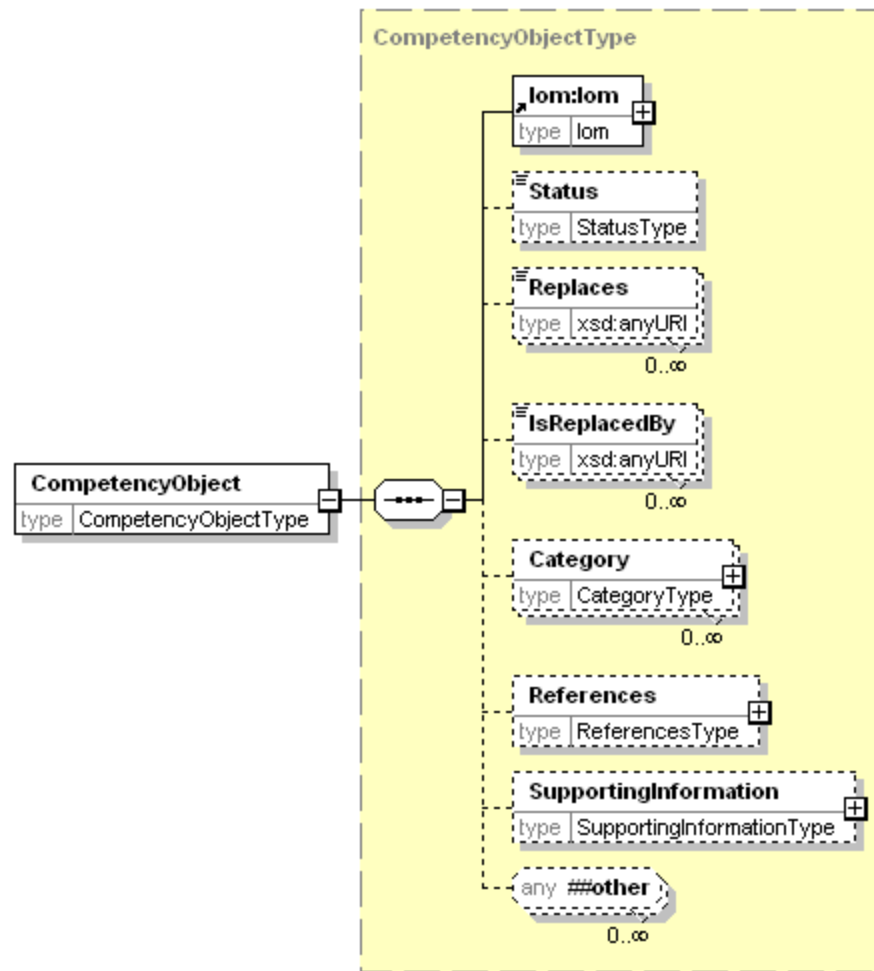
## 7 Competency Object Schema Grammar

The following sections explain the Competency Object 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.

### 7.1 CompetencyObject

CompetencyObject is the root element. It contains subelements that define and uniquely identify a competency. CompetencyObject must occur once within a competency object document.



Generated by XMLSpy

www.altova.com

## CompetencyObject Element Information

Element	Description	Required	Multiplicity	Datatype
<b>CompetencyObject</b>	CompetencyObject is the root element. It contains subelements that define a single competency in detail.	Required	1	Container

---



Element	Description	Required	Multiplicity	Datatype
<b>lom</b>	<p>lom is the subelement of CompetencyObject. It contains subelements that define identifier, title, description, publisher, and other descriptive information about this competency.</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 and the IEEE Standard for Learning Technology-Extensible Markup Language (XML) Schema Definition Language Binding for Learning Object Metadata, 1484.12.3-2005, <a href="http://ieeexplore.ieee.org/servlet/opac?punumber=10263">http://ieeexplore.ieee.org/servlet/opac?punumber=10263</a> for more information on the sub-elements of lom.</p> <p>The following sub-elements of lom are required in a competency object:</p> <p><b>identifier</b></p> <p>Defines a unique identifier for the competency. For competency objects, identifiers must be in the form of a URI.</p> <p><b>title</b></p> <p>Defines the title for this competency in one or more languages.</p> <p>The description element is recommended to provide a description of the competency in one or more languages should a description be necessary.</p> <p>Other recommended: publisher, copyright, description,</p>	Required	1	Container  For more information, see ANSI/MEDBIQ LO.10.1-2008 Healthcare Learning Object Metadata Specifications and Description Document and <a href="#">healthcarelom.xsd</a> .

Element	Description	Required	Multiplicity	Datatype
Category	<p>Category is the subelement of CompetencyObject. It is modeled after the Atom category element and defines a category associated with this competency. Category has the following attributes:</p> <p><i>term</i> The category for this competency object. The term attribute is required.</p> <p><i>scheme</i> A URI for the categorization scheme. As a best practice, category definitions may be posted at the URI referenced.</p> <p><i>label</i> A human-readable label for the term that may be displayed in end user applications.</p> <p>Example:</p> <pre>&lt;category term= "measurable outcomes" scheme= "<a href="http://tinyurl.com/2fosonk">http://tinyurl.com/2fosonk</a>" /&gt;</pre>	Optional	0 or more	Empty
<b>References</b>	<p>References is the subelement of CompetencyObject. References contains subelements that define specific references to the literature related to this competency. See section References element for more information.</p>	Optional	0 or 1	Container

Element	Description	Required	Multiplicity	Datatype
<b>SupportingInformation</b>	SupportingInformation is the subelement of CompetencyObject. It contains subelements that include or link to supporting information, such as formatted or lengthy descriptions of the competency object. See section SupportingInformation for more information.	Optional	0 or more	Container
<b>XtensibleInfo</b>	XtensibleInfo contains sub-elements defined by the organization implementing the schema. See section XtensibleInfo for more information.	Optional	0 or 1	Container

Example:

```
<CompetencyObject xmlns="http://ns.medbiq.org/competencyobject/v1/"
xmlns:lom="http://ltsc.ieee.org/xsd/LOM" xmlns:ex="http://ltsc.ieee.org/xsd/LOM/extend"
xmlns:ag="http://ltsc.ieee.org/xsd/LOM/unique" xmlns:voc="http://ltsc.ieee.org/xsd/LOM/vocab"
xmlns:a="http://ns.medbiq.org/address/v1/" xmlns:hx="http://ns.medbiq.org/lom/extend/v1/"
xmlns:hv="http://ns.medbiq.org/lom/vocab/v1/" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://ns.medbiq.org/competencyobject/v1/_object.xsd">

  <lom:lom>

    <lom:general>

      <lom:identifier>

        <lom:catalog>URI</lom:catalog>

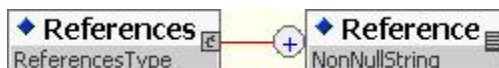
        <lom:entry>http://www.example.org/competency/12345</lom:entry>

      </lom:identifier>
```

```
<lom:title>
  <lom:string language="en">Professionalism</lom:string>
</lom:title>
<lom:description>
  <lom:string language="en">Exhibiting character, spirit, and standing suitable to the
profession.</lom:string>
</lom:description>
</lom:general>
</lom:lom>
<Category term ="role"/> >
<References>
  <Reference>Advancing education in medical professionalism: Anresource from the ACGME Outcome Project,
The Accreditation Council for Graduate Medical Education, 2004. Accessed online 24 March 2010 at:
http://www.acgme.org/outcome/implement/profm\_resource.pdf</Reference>
</References>
</CompetencyObject>
```

## 7.2 References Element

References contains subelements that define specific references to the literature related to this competency.



### References Element Information

Element	Description	Required	Multiplicity	Datatype
References	References is the subelement of CompetencyObject. References contains subelements that define specific references to the literature related to this competency.	Optional	0 or 1	Container
Reference	Reference is the subelement of References. Each Reference contains a single reference to the literature related to this competency.	Optional	0 or more	Non-null string

Example:

<References>

<Reference>Advancing education in medical professionalism: Anresource from the ACGME Outcome Project, The Accreditation Council for Graduate Medical Education, 2004. Accessed online 24 March 2010 at: [http://www.acgme.org/outcome/implement/profm\\_resource.pdf](http://www.acgme.org/outcome/implement/profm_resource.pdf)</Reference>

<Reference>Embedding Professionalism in Medical Education: Assessment as a Tool for Implementation. National Board of Medical Examiners, 2002.

Accessed online 24 March 2010 at:

[http://www.nbme.org/PDF/NBME\\_AAMC\\_ProfessReport.pdf](http://www.nbme.org/PDF/NBME_AAMC_ProfessReport.pdf)

</References>

### 7.3 Supporting Information Element

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



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
Link	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

---

Element	Description	Required	Multiplicity	Datatype
xhtml:div	<p>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.</p> <p>For more information, see “XHTML™ 1.0 The Extensible HyperText Markup Language” at: <a href="http://www.w3.org/TR/xhtml1/">http://www.w3.org/TR/xhtml1/</a></p>	Either Link or xhtml:div is required	0 or 1	Container

---

Example:

```
<SupportingInformation>
```

```
  <Link>http://www.example.org/competencyobject1_formatted</Link>
```

```
</SupportingInformation>
```

Or

<SupportingInformation>

<xhtml:div>

<h1>Professionalism</h1>

<p>Respect</p>

<ol>

<li>Respects institutional staff and representatives; respects faculty during teaching sessions</li>

<li>Respects patient rights/dignity (privacy/confidentiality, consent); knocks on door, introduces self, drapes appropriately, and shows respect for patient privacy needs</li>

<li>Demonstrates tolerance to a range of behaviors and beliefs</li>

<li>Does not disturb small group sessions</li>

</ol>

<p>Caring and Compassion</p>

. . .

</xhtml:div>

</SupportingInformation>



## 8 Sample XML Documents

```
<CompetencyObject xmlns="http://ns.medbiq.org/competencyobject/v1/"
xmlns:lom="http://ltsc.ieee.org/xsd/LOM"
xmlns:ex="http://ltsc.ieee.org/xsd/LOM/extend"
xmlns:ag="http://ltsc.ieee.org/xsd/LOM/unique"
xmlns:voc="http://ltsc.ieee.org/xsd/LOM/vocab"
xmlns:a="http://ns.medbiq.org/address/v1/"
xmlns:hx="http://ns.medbiq.org/lom/extend/v1/"
xmlns:hv="http://ns.medbiq.org/lom/vocab/v1/"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://ns.medbiq.org/competencyobject/v1/_object.xsd">

  <lom:lom>

    <lom:general>

      <lom:identifier>

        <lom:catalog>URI</lom:catalog>

        <lom:entry>http://www.example.org/competency/12345</lom:entry>

      </lom:identifier>

      <lom:title>

        <lom:string language="en">Professionalism</lom:string>

      </lom:title>

      <lom:description>

        <lom:string language="en">Exhibiting character, spirit, and
standing suitable to the profession.</lom:string>

      </lom:description>

    </lom:general>

    <lom:lifeCycle>

      <lom:contribute>

        <lom:entity>BEGIN:VCARD\nFN:Center for Really Good
DocsEND:VCARD</lom:entity>
```

---

Copyright MedBiquitous Consortium, 2010. All Rights Reserved.

```
</lom:contribute>

</lom:lifeCycle>

</lom:lom>

<Category term = "role"/> >

<References>

    <Reference>Advancing education in medical professionalism: Anresource
from the ACGME Outcome Project, The Accreditation Council for Graduate
Medical Education, 2004. Accessed online 24 March 2010 at:
http://www.acgme.org/outcome/implement/profm_resource.pdf</Reference>

</References>

</CompetencyObject>
```

## 9 References

To be completed