Competency Framework Implementation Guidelines

Version History

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Table of Contents

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2 Overview

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. Once competencies are expressed in a common format, they can be used as the backbone of education and performance management systems.

The MedBiquitous Competency Framework provides 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. With these specifications in place, educators can better manage competency-based curricula and resources, learners and regulators can better manage competency data, and a broad range of users can search for learning resources and activities based on competencies.

This implementation guide provides general guidance for common implementations of the MedBiquitous Competency Framework Standard version 1.0. Specific adaptations for your environment may be necessary.

3   General Guidelines

The world of competency-based education and assessment in the health professions is evolving rapidly. Some competency frameworks are well established and have been in use for several years. Newer concepts, including milestones and Entrustable Professional Activities, are just being implemented. In parallel, long standing tools like educational objectives and outcomes are still important in designing and communicating the expectations for an educational program or activity. Often terminology is used in different ways by different audiences. In order to determine if something is a competency framework, we encourage you to consider the characteristics of the framework and how it will be used.

The MedBiquitous Competency Framework standard can represent any interrelated set of statements describing learning or performance expectations. Statements can be learning outcomes, competencies, learning objectives, professional roles, topics, classifications/collections, etc. The Competency Objects included in a Competency Framework may be broad, describing professional activities or characteristics, or they may be small, describing discrete skills knowledge, or attitudes expected of learners. If a framework describes a set of expectations that you have of learners, it is likely appropriate to represent using the MedBiquitous Competency Framework.

3.1   Context Specific Requirements

Before implementing the Competency Framework, analyze the context in which it will be used and determine:

1.   What technical standard you will use to define competency objects included in the framework.
2.   Which data elements and attributes are necessary to achieve your goals.
3.   Whether additional business rules or policies are necessary to achieve your goals.
4.   Whether your business partners have additional requirements or business rules or policies.

The MedBiquitous Competency Framework XML schema may be modified to support context-specific requirements and restrictions. For more information, see "Adapting the Schema to Meet your Requirements."

3.2   Referencing Human Readable Competency Frameworks and Introductory Materials

Usually organizations publish human readable versions of a competency framework as a web page, web site, or document using an electronic document format like PDF. Often these publications include introductory matter that explain the rationale behind the competency framework. It can be helpful for those implementing the competency framework to read those materials. MedBiquitous recommends either using the SupportingInformation Link element to include a link to the human readable version of the competency framework or including the prefix in the SupportingInformation element using the xhtml:div tag. The former references external resources, the latter embeds the introductory materials in the XML document.

As the competency framework is updated, the SupportingInformation element can also be used to reference or provide details on the changes made to the most recent version. For more information on versioning, see Versioning Competency Objects and Frameworks.

3.3   Modeling a Competency List

For competency frameworks that consist of a list of competencies with no hierarchical order or other relationships, follow the principles below.

- Create a Competency Object document for each statement of expectation in your framework.
- Assign a URI to each Competency Object. You can do this by uploading the Competency Object document to a location on your website.
- In the competency framework document, use the Includes element to reference each Competency Object document.

There is no need to specify Relationships in the Competency Framework document.

3.4   Modeling a Competency Hierarchy

For competency frameworks that consist of a hierarchical model, follow the principles below.

- Create a Competency Object document for each statement of expectation in your framework.
- Assign a URI to each Competency Object. You can do this by uploading the Competency Object document to a location on your website.
- In the Competency Framework document, use the Includes element to reference each Competency Object document.
- In the Competency Framework document, use the Relation element to specify the hierarchical relationships in the competency framework.

3.5   Modeling Non-hierarchical relationships

For a competency model that includes non-hierarchical relationships, follow the principles below.

- Create a Competency Object document for each statement of expectation in your framework.
- Assign a URI to each Competency Object. You can do this by uploading the Competency Object document to a location on your website.
- In the Competency Framework document, use the Includes element to reference each Competency Object document.
- In the Competency Framework document, use the Relation element to specify the non-hierarchical relationships in the competency framework.

3.6   Versioning Competency Frameworks

Competency frameworks usually change over time. Because much data and resources reference or include the competency frameworks, it's important to follow best practices for managing different versions of the framework.

- Whenever a substantive change has been made to a competency framework, a new unique identifier and version number should be assigned to the Competency Framework document.
- Use the EffectiveDate and RetiredDate elements to indicate when a version of a framework goes into effect and when the framework will or did retire.
- If a Competency Framework document is a new version of an existing framework, use the Replaces element to point to the Competency Framework document corresponding to the previous version.
- If a Competency Framework document has been superseded by a more recent version, use the IsReplacedBy element to point to the Competency Framework document corresponding to the version that supersedes the current document.
- Retired Competency Framework documents should remain published in an accessible location for a minimum of 5 years.
- If more comprehensive change management is required, IMS Learning Object Discovery and Exchange should be considered. See the following website for more information: http://www.imsglobal.org/lode.html
- As a best practice, include or referencing a strikeout version of the human readable competency framework using the SupportingInformation element.

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3.7   Publishing Competency frameworks

Because competency frameworks serve as a key reference point for competency-related data and resources, Competency Framework documents should be published at a location accessible using the URI that serves as a unique identifier for that Competency Framework docuement. users should be able to access the Competency Framework and Competency Object documents online ro download them for use in a local system.

In addition, the MedBiquitous Competencies Working Group recommends having a URI where the most recent version of the Competency Framework document is always accessible. For an example, see the World Wide Web Consortium's standards: http://www.w3.org/TR/html5/

3.8   Schema Locations

In order to validate Competency Framework XML documents, you may wish to store all of the associated schemas on a local server and reference those local copies for validation. To use local copies, the schema locations of the following schemas must be changed within the competencyframework.xsd schema document.

- competencyframework.xsd
- healthcarelom.xsd
- healthcaremetadata.xsd
- healthcarevocabularies.xsd
- xhtml1-strict.xsd

Change the schemaLocation attribute of the import element to change the location used for validation. The following example shows import statements that have been changed to use local versions of the schemas. In this example, the xsd files are all in the same directory as the competencyframework.xsd file. The schemaLocation attribute may use relative referencing, so the example schemaLocation references the file name since the file is in the same directory.

```
<xsd:import namespace="http://ltsc.ieee.org/xsd/LOM"
schemaLocation="healthcarelom.xsd"/>
<xsd:import namespace="http://www.w3.org/1999/xhtml"
schemaLocation="xhtml1-strict.xsd"/>
```

Competency Framework instance documents may then reference the local copy of the competencyframework.xsd schema in the schemaLocation attribute of the root element as in the example below. In this example, the competencyframework.xsd schema is in the same directory as the instance document.

```
<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:xhtml=http://www.w3.org/1999/xhtml
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 healthcarelom.xsd
http://ns.medbiq.org/lom/extend/v1/ healthcaremetadata.xsd
http://www.w3.org/1999/xhtml xhtml1-strict.xsd">
```

Please note that changing the location of the schemas used for validation does not affect the conformance status of Competency Framework instance document.

3.9   Declaring Imported Schema

The Competency Framework schema imports several schemas for its use. The following schemas must be declared in an instance document when elements from those schemas are included in a Curriculum Inventory instance document:

- healthcarelom.xsd
- healthcaremetadata.xsd
- healthcarevocabularies.xsd
- xhtml1-strict.xsd

In the following example, the namespaces associated with these schemas are declared in the root CurriculumInventory element and assigned prefixes to be used when referencing elements from that namespace.

```
<CompetencyFramework xmlns="http://ns.medbiq.org/competencyframework/v1/"
xmlns:lom="http://ltsc.ieee.org/xsd/LOM"
```

```xml
xmlns:hx="http://ns.medbiq.org/lom/extend/v1/"
xmlns:xhtml=http://www.w3.org/1999/xhtml
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 healthcarelom.xsd
http://ns.medbiq.org/lom/extend/v1/ healthcaremetadata.xsd
http://www.w3.org/1999/xhtml xhtml1-strict.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>
    <SupportingInformation>
        <xhtml:div>
            <xhtml:p>The Association of Worldwide Physicians has created
<xhtml:em>The Competency Physician</xhtml:em> to guide the development of
curricula for physicians and to guide the development of regulatory
assessments.</xhtml:p>
        </xhtml:div>
    </SupportingInformation>
    <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>
        <Reference1>
            <Catalog>URI</Catalog>
            <Entry>http://www.example.org/competency1</Entry>
        </Reference1>
        <Relationship>http://www.w3.org/2004/02/skos/core#narrower
        </Relationship>
        <Reference2>
            <Catalog>URI</Catalog>
            <Entry>http://www.example.org/competency3</Entry>
        </Reference2>
    </Relation>
    <Relation>
        <Reference1>
            <Catalog>URI</Catalog>
            <Entry>http://www.example.org/competency1</Entry>
        </Reference1>
```

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

3.10 Adapting the Schema to Meet Your Requirements

Organizations implementing the Competency Framework may wish to further restrict the scope of data considered valid or add new data not addressed in the standard. The Competency Framework schema is designed to support either of these scenarios.

3.10.1 Creating a Profile of Competency Framework

If you wish to further restrict the scope of data deemed valid for a particular use of the Competency Framework Standard, you may create a profile of the Competency Framework Standard. The XML documents developed based on the profile must validate against the original Competency Framework XSD file in order for the profile to be valid.

1. **Identify the restrictions that you wish to make to the schema.** The following are a few examples of restrictions that may be included in a profile:
    a. Further restricting the contents of free text elements or attributes.
    b. Further restricting the contents of elements or attributes with required vocabularies (for example, permitting only 2 of the values in a list with 10 values)
    c. Placing limits on the range of acceptable values for elements with numeric values.
    d. Eliminating optional elements or attributes that will not be used.
    e. Requiring optional elements or attributes that must always be used.

2. **Create a version of the competencyframework.xsd file that implements your restrictions.** We recommend changing the name of the resulting XSD file and describing the restrictions made in annotations within the XSD file.

3. **Document your profile of the Competency Framework Standard.** Be sure to indicate that it is a profile of the standard, indicating the changes made and providing appropriate copyright references.

3.10.2 Extending the Competency Framework Standard

The Competency Framework schema allows for elements from other namespaces to be included under the root element. Use the steps that follow to extend the Competency Framework schema to incorporate new data.

1. **Write a new XML schema for new data elements and declare a targetNamespace.** Develop a new XSD schema that defines the data elements that are missing from the Curriculum Inventory. All new elements must be associated with a namespace. This can be achieved by

using the XSD targetNamespace attribute. The following example defines an element called Philosophy that can be used to describe the educational philosophy that the Competency Framework employs. The schema defines http://ns.myurl.com/philosophy/ as the targetNamespace, so the Philosophy element is associated with that namespace.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema targetNamespace="http://ns.myurl.com/philosophy/"
xmlns="http://ns.myurl.com/philosophy/"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
elementFormDefault="qualified" attributeFormDefault="unqualified">
    <xs:element name="Philosophy" type="xs:string"/>
</xs:schema>
```

2. **Place new namespace qualified elements below the root at the end of the XML instance document.**
   Declare the namespace of the schema with new data elements in the instance document. Usually this is done by declaring the namespace in the root element and assigning a prefix to the namespace. Then the prefix can be used when referencing the new elements. You may also declare a default namespace for an element and its subelements by declaring the namespace in the uppermost element belonging to that namespace. Then include the new element(s) just before the closing CompetencyFramework tag.

   In the example below, the prefix ph is declared for the http://ns.myurl.com/philosophy/ namespace within the CompetencyFramework root element. The ph prefix is then used to label the Philosophy element before the closing CompetencyFramework tag.

```xml
<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:xhtml=http://www.w3.org/1999/xhtml
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 healthcarelom.xsd
http://ns.medbiq.org/lom/extend/v1/ healthcaremetadata.xsd
http://www.w3.org/1999/xhtml xhtml1-strict.xsd">
    <lom:lom>
    . . .
    </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>
        <Reference1>
            <Catalog>URI</Catalog>
            <Entry>http://www.example.org/competency1</Entry>
        </Reference1>
        <Relationship>http://www.w3.org/2004/02/skos/core#narrower
        </Relationship>
        <Reference2>
            <Catalog>URI</Catalog>
            <Entry>http://www.example.org/competency3</Entry>
        </Reference2>
    </Relation>
    <Relation>
        <Reference1>
            <Catalog>URI</Catalog>
            <Entry>http://www.example.org/competency1</Entry>
        </Reference1>
        <Relationship>http://www.w3.org/2004/02/skos/core#narrower
        </Relationship>
        <Reference2>
            <Catalog>URI</Catalog>
            <Entry>http://www.example.org/competency2</Entry>
        </Reference2>
    </Relation>
    <Philosophy>Harden's model of learning outcomes</Philosophy>
</CompetencyFramework>
```

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5 Glossary

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.