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XML for CMI Communication

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ABSTRACT

This document discusses using XML to encode the communication from an LMS/CMI system to content, and from content back to the LMS/CMI system.

This document includes examples, and XML schemas describing the communication.

KEY WORDS

HTTP
CMI
LMS
AU

Course structure
Communication, CBT
Guidelines

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1 Introduction

1.1 Purpose

This document is designed to describe an XML binding for the AICC CMI communication data model. It uses the following approaches to this description: XML schemas for the binding, and examples of messages using the XML bindings.

1.2 Scope

This document provides a guide to binding the CMI communication data model to an XML file. The scope of this document does not extend to how this information may be used. One use includes communicating information on student behaviors and performance from an Offline CMI system to an LMS. Other uses for this binding may also be appropriate.

1.3 Document Conventions

The version number used herein is broken into 3 parts. The first part is the major version, the second is the minor version, and the third is the errata version. The specification version is a combination of the first two (major and minor). The namespace of XSDs will only reflect the specification version (i.e. the major and minor version numbers). The errata version is specific to each document (i.e., the errata version is not necessarily synchronized for the specification document and each XSD document). For example, the spec may be on version 1.2 while the main document might be 1.2.3, ToAU schema might be on 1.2.5 and ToLMS might be on 1.2.7.

2 Communication Data Model

This section covers all the data that may be communicated between the CMI and content.

In the following chapters, the binding of this data to an XML format is described in an XML schema (XSD).

The table below lists all elements in this data model. Each element is defined and described in *CMI Guidelines for Interoperability* version 4.0, AICC document CMI001. The section indicated is where the description is located.

Table Legend:

Data Element	Indicates the name of the data element.
Section	This column refers to the CMI Guidelines document (CMI001 version 4.0). It indicates the chapter and section in which the definition of the data element may be found.
CMI Obligation	This indicates whether the data element is required or optional for a CMI or LMS system.
Comm Directn	The direction in which the data travels. If it goes to the CMI from the AU the → symbol is used. If it goes from the AU to the CMI the ← symbol appears. If the data values goes both ways, the ↔ symbol appears.
AU Obligation	This indicates whether the data element is required or optional for an AU (or content).

Data Element	Section	CMI Obligation	Comm Directn	AU Obligation
Core	2.1	Mandatory	↔	Mandatory
Core.Student Id	2.1.1	Mandatory	→	Optional
Core.Student Name	2.1.2	Mandatory	→	Optional
Core.Output File (N/A)	2.1.3	N/A		N/A
Core.Lesson Location	2.1.4	Mandatory	↔	Mandatory
Core.Credit	2.1.5	Mandatory	→	Optional
Core.Lesson Status	2.1.6	Mandatory	↔	Mandatory
Core.Exit	2.1.7	Mandatory	←	Mandatory
Core.Entry	2.1.8	Mandatory	→	Optional
Core.File Path (N/A)	2.1.9	N/A		N/A
Core.Score	2.1.10	Mandatory	↔	Mandatory
Core.Session Time	2.1.11	Mandatory	←	Mandatory
Core.Total Time	2.1.12	Mandatory	→	Optional
Core.Lesson Mode	2.1.13	Optional	→	Optional
Suspend Data	2.2	Mandatory	↔	Mandatory
Launch Data	2.3	Mandatory	→	Optional
Comments From Learner	2.4	Optional	←	Optional
Itemized Comments From Learner	2.5	Optional	←	Optional
Itemized Comments From Learner.Content	2.5.1	Optional	←	Optional
Itemized Comments From Learner.Course_Id	2.5.2	Optional	←	Optional
Itemized Comments From Learner.Date	2.5.3	Optional	←	Optional
Itemized Comments From Learner.Student_Id	2.5.4	Optional	←	Optional
Itemized Comments From Learner.Lesson_Id	2.5.5	Optional	←	Optional
Itemized Comments From Learner.Location	2.5.6	Optional	←	Optional
Itemized Comments From Learner.Time	2.5.7	Optional	←	Optional
Comments From LMS	2.6	Optional	→	Optional

Data Element	Section	CMI Obligation	Comm Directn	AU Obligation
Evaluation (N/A)	2.7	N/A		Optional
Evaluation.Comments_File	2.7.1	N/A		Optional
Evaluation.Course_Id	2.7.2	Optional	→	Optional
Evaluation.Interactions_File	2.7.3	N/A		Optional
Evaluation.Objective_Status_File	2.7.4	N/A		Optional
Evaluation.Path_File	2.7.5	N/A		Optional
Evaluation.Performance_File	2.7.6	N/A		Optional
Objectives	2.8	Optional	↔	Optional
Objectives.ID	2.8.1	Optional	↔	Optional
Objectives.Score	2.8.2	Optional	↔	Optional
Objectives.Status	2.8.3	Optional	↔	Optional
Objectives.Date	2.8.4	Optional	←	Optional
Objectives.Time	2.8.5	Optional	←	Optional
Objectives.Mastery Time	2.8.6	Optional	←	Optional
Student Data	2.9	Optional	↔	Optional
Student Data.Attempt Number	2.9.1	Optional	→	Optional
Student Data.Tries	2.9.2	Optional	←	Optional
Student Data.Tries.Score	2.9.2.1	Optional	←	Optional
Student Data.Tries.Status	2.9.2.2	Optional	←	Optional
Student Data.Tries.Time	2.9.2.3	Optional	←	Optional
Student Data.Mastery Score	2.9.3	Optional	→	Optional
Student Data.Max Time Allowed	2.9.3	Optional	→	Optional
Student Data.Time Limit Action	2.9.4	Optional	→	Optional
Student Data.Tries During Lesson	2.9.5	Optional	←	Optional
Student Data.Sessions Journal	2.9.7	Optional	→	Optional
Student Data.Sessions Journal.Score	2.9.7.1	Optional	→	Optional
Student Data.Sessions Journal.Status	2.9.7.2	Optional	→	Optional
Student Preference	2.1	Optional	↔	Optional
Student Preference.Audio	2.10.1	Optional	↔	Optional
Student Preference.Language	2.10.2	Optional	↔	Optional
Student Preference.Lesson Type	2.10.3	Optional	↔	Optional
Student Preference.Speed	2.10.4	Optional	↔	Optional
Student Preference.Text	2.10.5	Optional	↔	Optional
Student Preference.Text Color	2.10.6	Optional	↔	Optional
Student Preference.Text Location	2.10.7	Optional	↔	Optional
Student Preference.Text Size	2.10.8	Optional	↔	Optional
Student Preference.Video	2.10.9	Optional	↔	Optional
Student Preference.Windows	2.10.10	Optional	↔	Optional
Interactions	2.11	Optional	←	Optional
Interactions.ID	2.11.1	Optional	←	Optional
Interactions.Objectives	2.11.2	Optional	←	Optional
Interactions.Date	2.11.3	Optional	←	Optional
Interactions.Time	2.11.4	Optional	←	Optional
Interactions.Type	2.11.5	Optional	←	Optional
Interactions.Correct Responses	2.11.6	Optional	←	Optional
Interactions.Weighting	2.11.7	Optional	←	Optional
Interactions.Student Response	2.11.8	Optional	←	Optional
Interactions.Result	2.11.9	Optional	←	Optional
Interactions.Latency	2.11.10	Optional	←	Optional
Paths	2.12	Optional	←	Optional
Paths.Location Id	2.12.1	Optional	←	Optional
Paths.Date	2.12.2	Optional	←	Optional

Data Element	Section	CMI Obligation	Comm Directn	AU Obligation
Paths.Time	2.12.3	Optional	←	Optional
Paths.Status	2.12.4	Optional	←	Optional
Paths.Why Left	2.12.5	Optional	←	Optional
Paths.Time In Element	2.12.6	Optional	←	Optional
Student Demographics	2.13	Optional	→	Optional
Student Demographics.City	2.13.1	Optional	→	Optional
Student Demographics.Class	2.13.2	Optional	→	Optional
Student Demographics.Company	2.13.3	Optional	→	Optional
Student Demographics.Country	2.13.4	Optional	→	Optional
Student Demographics.Experience	2.13.5	Optional	→	Optional
Student Demographics.Familiar Name	2.13.6	Optional	→	Optional
Student Demographics.Instructor Name	2.13.7	Optional	→	Optional
Student Demographics.Native Language	2.13.8	Optional	→	Optional
Student Demographics.State	2.13.9	Optional	→	Optional
Student Demographics.Street Address	2.13.10	Optional	→	Optional
Student Demographics.Telephone	2.13.11	Optional	→	Optional
Student Demographics.Title	2.13.12	Optional	→	Optional
Student Demographics.Years Experience	2.13.13	Optional	→	Optional

3 XML Communication Schemas

The information sent to the AU differs from the information sent to the LMS. Two XML schemas are thus defined to represent the CMI XML: toAU.xsd and toLMS.xsd respectively.

While the schemas allow a description of the data type for each element, the description is not necessarily comprehensive for the complex data types in the AICC CMI Guidelines. Because the data types for some of the elements are so complex, it would burden the schemas to the point where understanding is compromised. The schemas are not meant to be a comprehensive test suite for CMI communication instances.

Best practice recommendation: Producers of CMI XML should omit leading and trailing whitespace for element values. Consumers of CMI XML should strip leading and trailing whitespace when processing element values.

3.1 From LMS to AU XML Schema

This section describes the XSD that should be used for the LMS to AU communication (aka toAU.XSD)

```
<?xml version="1.0" encoding="UTF-8"?>
<schema targetNamespace="http://www.aicc.org/xmlbindings/cmixml/1.0/ToAU"
xmlns="http://www.w3.org/2001/XMLSchema"
xmlns:aicc="http://www.aicc.org/xmlbindings/cmixml/1.0/ToAU"
elementFormDefault="qualified">
  <annotation>
    <documentation>The version number is broken into 3 parts. The first
part is the major version, the second is the minor version, and the third
is the errata version. The specification version is a combination of the
first two (major and minor). The namespace of XSDs will only reflect the
specification version (i.e. the major and minor version numbers). The
errata version is specific to each document(i.e., the errata version is
not necessarily synchronized for the specification document and each XSD
document). For example, the spec may be on version 1.2 while the main
document might be 1.2.3, ToAU schema might be on 1.2.5 and ToLMS might be
on 1.2.7.</documentation>
  </annotation>
  <element name="toAUCommunication">
    <complexType>
      <sequence>
        <element name="core">
          <complexType>
            <sequence>
              <element name="studentId"
type="aicc:CMIIentifierINI"/>
              <element name="studentName"
type="aicc:CMISTudentName"/>
              <element name="lessonLocation"
type="aicc:CMIStrng255INI"/>
              <element name="credit">
                <simpleType>
                  <restriction base="string">
                    <enumeration value="credit"/>
                    <enumeration value="no-credit"/>
                    <enumeration value=""/>
                  </restriction>
                </simpleType>
              </element>
              <element name="lessonStatus" type="aicc:statusType"/>
            </sequence>
          </complexType>
        </element>
      </sequence>
    </complexType>
  </element>
</schema>
```

```

        <element name="entry">
            <simpleType>
                <restriction base="string">
                    <enumeration value="ab-initio"/>
                    <enumeration value="resume"/>
                    <enumeration value=""/>
                </restriction>
            </simpleType>
        </element>
        <element name="score" type="aicc:scoreType"/>
        <element name="totalTime" type="aicc:CMITimespan"/>
        <element name="lessonMode" minOccurs="0">
            <simpleType>
                <restriction base="string">
                    <enumeration value="browse"/>
                    <enumeration value="normal"/>
                    <enumeration value="review"/>
                </restriction>
            </simpleType>
        </element>
        <group ref="aicc:extension"/>
    </sequence>
</complexType>
</element>
<element name="suspendData" type="aicc:CMIStrng4096INI"/>
<element name="launchData" type="aicc:CMIStrng4096INI"/>
<element name="commentsFromLms" type="aicc:CMIStrng4096INI "
minOccurs="0"/>
    <element name="evaluation" minOccurs="0">
        <complexType>
            <sequence>
                <element name="courseId"
type="aicc:CMIIIdentifierDevID"/>
                <group ref="aicc:extension"/>
            </sequence>
        </complexType>
    </element>
    <element name="objectives" minOccurs="0">
        <complexType>
            <sequence>
                <element name="objective" maxOccurs="unbounded">
                    <complexType>
                        <sequence>
                            <element ref="aicc:id"/>
                            <element name="score" type="aicc:scoreType"
minOccurs="0"/>
                            <element name="status"
type="aicc:statusType" minOccurs="0"/>
                        <group ref="aicc:extension"/>
                    </sequence>
                </complexType>
            </element>
        </sequence>
    </complexType>
</element>
    <element name="studentData" minOccurs="0">
        <complexType>

```

```

        <sequence>
            <element name="attemptNumber" type="integer"
minOccurs="0"/>
            <element name="masteryScore" type="aicc:CMIDecimal"
minOccurs="0"/>
            <element name="maxTimeAllowed"
type="aicc:CMITimespan" minOccurs="0"/>
            <element name="timeLimitAction" minOccurs="0">
                <simpleType>
                    <restriction base="string">
                        <enumeration value="Exit, Message"/>
                        <enumeration value="Exit, No Message"/>
                        <enumeration value="Continue, Message"/>
                        <enumeration value="Continue, No Message"/>
                    </restriction>
                </simpleType>
            </element>
            <element name="sessionsJournal" minOccurs="0">
                <complexType>
                    <sequence>
                        <element name="session"
maxOccurs="unbounded">
                            <complexType>
                                <sequence>
                                    <element name="score"
type="aicc:scoreType" minOccurs="0"/>
                                    <element name="status"
type="aicc:statusType" minOccurs="0"/>
                                    <group ref="aicc:extension"/>
                                </sequence>
                            </complexType>
                        </element>
                    </sequence>
                </complexType>
            </element>
            <group ref="aicc:extension"/>
        </sequence>
    </complexType>
</element>
    <element name="studentPreference" minOccurs="0">
        <complexType>
            <sequence>
                <element name="audio" minOccurs="0">
                    <simpleType>
                        <restriction base="integer">
                            <minInclusive value="-1"/>
                            <maxInclusive value="100"/>
                        </restriction>
                    </simpleType>
                </element>
                <element name="language" type="aicc:CMIStrng255INI"
minOccurs="0"/>
                <element name="lessonType"
type="aicc:CMIStrng255INI" minOccurs="0"/>
                <element name="speed" minOccurs="0">
                    <simpleType>
                        <restriction base="integer">

```

```

                <minInclusive value="-100"/>
                <maxInclusive value="100"/>
            </restriction>
        </simpleType>
    </element>
    <element name="text" minOccurs="0">
        <simpleType>
            <restriction base="integer">
                <enumeration value="-1"/>
                <enumeration value="0"/>
                <enumeration value="1"/>
            </restriction>
        </simpleType>
    </element>
    <element name="textColor" type="aicc:CMISString255INI"
minOccurs="0"/>
    <element name="textLocation"
type="aicc:CMISString255INI" minOccurs="0"/>
    <element name="textSize" type="aicc:CMISString255INI"
minOccurs="0"/>
    <element name="video" type="aicc:CMISString255INI"
minOccurs="0"/>
    <element name="windows" minOccurs="0">
        <complexType>
            <sequence>
                <element name="window" type="string"
maxOccurs="unbounded"/>
            </sequence>
        </complexType>
    </element>
    <group ref="aicc:extension"/>
</sequence>
</complexType>
</element>
<element name="studentDemographics" minOccurs="0">
    <complexType>
        <sequence>
            <element name="city" type="aicc:CMISString255INI"
minOccurs="0"/>
            <element name="class" type="aicc:CMIIdentifierINI"
minOccurs="0"/>
            <element name="company" type="aicc:CMISString255INI"
minOccurs="0"/>
            <element name="country" type="aicc:CMISString255INI"
minOccurs="0"/>
            <element name="experience"
type="aicc:CMISString255INI" minOccurs="0"/>
            <element name="familiarName"
type="aicc:CMISString255INI" minOccurs="0"/>
            <element name="instructorName"
type="aicc:CMISString255INI" minOccurs="0"/>
            <element name="nativeLanguage"
type="aicc:CMISString255INI" minOccurs="0"/>
            <element name="state" type="aicc:CMISString255INI"
minOccurs="0"/>
            <element name="streetAddress"
type="aicc:CMISString255INI" minOccurs="0"/>

```

```

minOccurs="0"/>
    <element name="telephone" type="aicc:CMISString255INI"
minOccurs="0"/>
    <element name="title" type="aicc:CMISString255INI"
    <element name="yearsExperience" minOccurs="0">
        <simpleType>
            <restriction base="integer">
                <minInclusive value="0"/>
                <maxInclusive value="99"/>
            </restriction>
        </simpleType>
    </element>
    <group ref="aicc:extension"/>
</sequence>
</complexType>
</element>
<group ref="aicc:extension"/>
</sequence>
<attribute name="version" type="string" use="required"/>
</complexType>
</element>
<element name="date" type="string"/>
<element name="id" type="aicc:CMIIdentifierDevID"/>
<simpleType name="statusType">
    <restriction base="string">
        <enumeration value="passed"/>
        <enumeration value="failed"/>
        <enumeration value="completed"/>
        <enumeration value="incomplete"/>
        <enumeration value="not attempted"/>
        <enumeration value="browsed"/>
    </restriction>
</simpleType>
<complexType name="scoreType">
    <sequence>
        <element name="raw" type="aicc:CMIDecimal" nillable="true"/>
        <element name="max" type="aicc:CMIDecimal" minOccurs="0"/>
        <element name="min" type="aicc:CMIDecimal" minOccurs="0"/>
    </sequence>
</complexType>
<element name="time" type="string"/>
<group name="extension">
    <sequence>
        <any namespace="##other" processContents="strict" minOccurs="0"
maxOccurs="unbounded"/>
    </sequence>
</group>
<simpleType name="CMISString255INI">
    <restriction base="string">
        <maxLength value="255"/>
        <whiteSpace value="collapse"/>
        <pattern value="^[^\r]*"/>
    </restriction>
</simpleType>
<simpleType name="CMIIdentifierINI">
    <restriction base="string">
        <maxLength value="255"/>

```

```

        <whiteSpace value="collapse"/>
        <pattern value='^[^\s]+'/>
    </restriction>
</simpleType>
<simpleType name="CMIStudentName">
    <restriction base="string">
        <maxLength value="255"/>
        <whiteSpace value="collapse"/>
        <pattern value="\c\ - ]+, [\c\ - \. ]*" />
    </restriction>
</simpleType>
<simpleType name="CMITimespan">
    <restriction base="string">
        <pattern value="\d{2,4}:\d{2}:\d{2}(\.\d{1,2})?" />
    </restriction>
</simpleType>
<simpleType name="CMIStrng4096INI">
    <restriction base="string">
        <maxLength value="4096"/>
        <whiteSpace value="collapse"/>
        <pattern value="^[^\[]*" />
    </restriction>
</simpleType>
<simpleType name="CMIIdentifierDevID">
    <restriction base="string">
        <pattern value="[A-Za-z\d_\-\{\}]" />
    </restriction>
</simpleType>
<simpleType name="CMIDecimal">
    <restriction base="string">
        <maxLength value="255"/>
        <pattern value="(-)?\d*(.\d+)" />
    </restriction>
</simpleType>
</schema>

```

3.2 From AU to LMS XML Schema

This section describes the XSD that should be used for the AU to LMS communication (aka toLMS.XSD)

```

<?xml version="1.0" encoding="UTF-8"?>
<schema targetNamespace="http://www.aicc.org/xmlbindings/cmixml/1.0/ToLMS"
xmlns:aicc="http://www.aicc.org/xmlbindings/cmixml/1.0/ToLMS"
xmlns="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified">
    <annotation>
        <documentation>The version number is broken into 3 parts. The first
part is the major version, the second is the minor version, and the third
is the errata version. The specification version is a combination of the
first two (major and minor). The namespace of XSDs will only reflect the
specification version (i.e. the major and minor version numbers). The
errata version is specific to each document(i.e., the errata version is
not necessarily synchronized for the specification document and each XSD
document). For example, the spec may be on version 1.2 while the main
document might be 1.2.3, ToAU schema might be on 1.2.5 and ToLMS might be
on 1.2.7.</documentation>
    </annotation>
    <element name="toLMSCommunication">
        <complexType>

```



```

<sequence>
  <element name="contentIds" minOccurs="0">
    <annotation>
      <documentation>This is a placeholder element used to
store IDs related to the content in order to eliminate repetition of
data.</documentation>
    </annotation>
    <complexType>
      <sequence>
        <element name="studentId"
type="aicc:CMIIIdentifierINI" minOccurs="0"/>
        <element name="courseId"
type="aicc:CMIIIdentifierDevID" minOccurs="0"/>
        <element name="lessonId"
type="aicc:CMIIIdentifierDevID" minOccurs="0"/>
        <group ref="aicc:extension"/>
      </sequence>
    </complexType>
  </element>
  <element name="core">
    <complexType>
      <sequence>
        <element name="lessonLocation"
type="aicc:CMIStrng255INI"/>
        <element name="lessonStatus">
          <simpleType>
            <restriction base="aicc:statusType">
              <whiteSpace value="collapse"/>
            </restriction>
          </simpleType>
        </element>
        <element name="exit">
          <simpleType>
            <restriction base="string">
              <enumeration value="time-out"/>
              <enumeration value="suspend"/>
              <enumeration value="logout"/>
              <enumeration value=""/>
            </restriction>
          </simpleType>
        </element>
        <element name="score" type="aicc:scoreType"/>
        <element name="sessionTime" type="aicc:CMITimespan"/>
        <group ref="aicc:extension"/>
      </sequence>
    </complexType>
  </element>
  <element name="suspendData" type="aicc:CMIStrng4096INI"/>
  <element name="commentsFromLearner"
type="aicc:CMIStrng4096INI" minOccurs="0"/>
  <element name="itemizedCommentsFromLearner" minOccurs="0">
    <complexType>
      <sequence>
        <element name="comment" maxOccurs="unbounded">
          <complexType>
            <sequence>
              <element name="content"

```

```

type="aicc:CMIStrng255CSV"/>
                                <element name="date" type="aicc:CMIDate"
minOccurs="0"/>
                                <element name="location"
type="aicc:CMIStrng255CSV" minOccurs="0"/>
                                <element name="time" type="aicc:CMITime"
minOccurs="0"/>
                                <group ref="aicc:extension"/>
                                </sequence>
                                </complexType>
                                </element>
                                </sequence>
                                </complexType>
                                </element>
                                <element name="objectives" minOccurs="0">
                                <complexType>
                                <sequence>
                                <element name="objective" maxOccurs="unbounded">
                                <complexType>
                                <sequence>
                                <element ref="aicc:id"/>
                                <element name="score" type="aicc:scoreType"
minOccurs="0"/>
                                <element name="status"
type="aicc:statusType" minOccurs="0"/>
                                <element name="date" type="aicc:CMIDate"
minOccurs="0"/>
                                <element name="time" type="aicc:CMITime"
minOccurs="0"/>
                                <element name="masteryTime"
type="aicc:CMITimespan" minOccurs="0"/>
                                <group ref="aicc:extension"/>
                                </sequence>
                                </complexType>
                                </element>
                                </sequence>
                                </complexType>
                                </element>
                                <element name="studentData" minOccurs="0">
                                <complexType>
                                <sequence>
                                <element name="triesDuringLesson" minOccurs="0">
                                <simpleType>
                                <restriction base="integer">
                                <minInclusive value="0"/>
                                </restriction>
                                </simpleType>
                                </element>
                                <element name="tries" minOccurs="0">
                                <complexType>
                                <sequence>
                                <element name="try">
                                <complexType>
                                <sequence>
                                <element name="score"
type="aicc:scoreType" minOccurs="0"/>
                                <element name="status"

```

```

type="aicc:statusType" minOccurs="0"/>
    <element name="time"
type="aicc:CMITime" minOccurs="0"/>
    <group ref="aicc:extension"/>
    </sequence>
    <attribute name="tryNumber" type="int"
use="required"/>
    </complexType>
    </element>
    </sequence>
    </complexType>
    </element>
    <group ref="aicc:extension"/>
    </sequence>
    </complexType>
    </element>
    <element name="studentPreference" minOccurs="0">
    <complexType>
    <sequence>
    <element name="audio" minOccurs="0">
    <simpleType>
    <restriction base="integer">
    <minInclusive value="-1"/>
    <maxInclusive value="100"/>
    </restriction>
    </simpleType>
    </element>
    <element name="language" type="aicc:CMIStrng255INI"
minOccurs="0"/>
    <element name="lessonType"
type="aicc:CMIStrng255INI" minOccurs="0"/>
    <element name="speed" minOccurs="0">
    <simpleType>
    <restriction base="integer">
    <minInclusive value="-100"/>
    <maxInclusive value="100"/>
    </restriction>
    </simpleType>
    </element>
    <element name="text" minOccurs="0">
    <simpleType>
    <restriction base="integer">
    <enumeration value="-1"/>
    <enumeration value="0"/>
    <enumeration value="1"/>
    </restriction>
    </simpleType>
    </element>
    <element name="textColor" type="aicc:CMIStrng255INI"
minOccurs="0"/>
    <element name="textLocation"
type="aicc:CMIStrng255INI" minOccurs="0"/>
    <element name="textSize" type="aicc:CMIStrng255INI"
minOccurs="0"/>
    <element name="video" type="aicc:CMIStrng255INI"
minOccurs="0"/>
    <element name="windows" minOccurs="0">

```

```

                <complexType>
                    <sequence>
                        <element name="window" type="string"
maxOccurs="unbounded" />
                    </sequence>
                </complexType>
            </element>
            <group ref="aicc:extension" />
        </sequence>
    </complexType>
</element>
<element name="interactions" minOccurs="0">
    <complexType>
        <sequence>
            <element name="interaction" maxOccurs="unbounded">
                <complexType>
                    <sequence>
                        <element ref="aicc:id" minOccurs="0" />
                        <element name="interactionObjectives"
minOccurs="0">
                            <complexType>
                                <sequence>
                                    <element ref="aicc:id"
maxOccurs="unbounded" />
                                </sequence>
                            </complexType>
                        </element>
                        <element name="date" type="aicc:CMIDate"
minOccurs="0" />
                        <element name="time" type="aicc:CMITime"
minOccurs="0" />
                        <element name="type" minOccurs="0">
                            <simpleType>
                                <restriction base="string">
                                    <enumeration value="true-false" />
                                    <enumeration value="choice" />
                                    <enumeration value="fill-in" />
                                    <enumeration value="matching" />
                                    <enumeration value="performance" />
                                    <enumeration value="sequencing" />
                                    <enumeration value="likert" />
                                    <enumeration value="numeric" />
                                </restriction>
                            </simpleType>
                        </element>
                        <element name="correctResponses"
minOccurs="0">
                            <complexType>
                                <sequence>
                                    <element name="correctResponse"
type="string" maxOccurs="unbounded" />
                                </sequence>
                            </complexType>
                        </element>
                        <element name="weighting"
type="aicc:CMIDecimal" minOccurs="0" />
                    </sequence>
                </complexType>
            </element>
        </sequence>
    </complexType>

```

```

type="string" minOccurs="0"/>
minOccurs="0"/>
type="aicc:CMITimespan" minOccurs="0"/>
    <group ref="aicc:extension"/>
    </sequence>
  </complexType>
</element>
</sequence>
</complexType>
</element>
<element name="paths" minOccurs="0">
  <complexType>
    <sequence>
      <element name="path" maxOccurs="unbounded">
        <complexType>
          <sequence>
            <element name="locationId"
type="aicc:CMIIdentifierINI" minOccurs="0"/>
            <element name="date" type="aicc:CMIDate"
minOccurs="0"/>
            <element name="time" type="aicc:CMITime"
minOccurs="0"/>
            <element name="status" minOccurs="0">
              <simpleType>
                <restriction base="string">
                  <enumeration value="passed"/>
                  <enumeration value="completed"/>
                  <enumeration value="failed"/>
                  <enumeration value="incomplete"/>
                </restriction>
              </simpleType>
            </element>
            <element name="whyLeft" minOccurs="0">
              <simpleType>
                <restriction base="string">
                  <enumeration value="student
selected"/>
                  <enumeration value="lesson
directed"/>
                  <enumeration value="exit"/>
                  <enumeration value="directed
departure"/>
                </restriction>
              </simpleType>
            </element>
            <element name="timeInElement"
type="aicc:CMITimespan" minOccurs="0"/>
            <group ref="aicc:extension"/>
          </sequence>
        </complexType>
      </element>
    </sequence>
  </complexType>
</element>

```

```

        <group ref="aicc:extension"/>
      </sequence>
      <attribute name="version" type="string" use="required"/>
    </complexType>
  </element>
  <element name="date" type="aicc:CMIDate"/>
  <element name="id" type="aicc:CMIIdentifierDevID"/>
  <simpleType name="statusType">
    <restriction base="string">
      <enumeration value="passed"/>
      <enumeration value="failed"/>
      <enumeration value="completed"/>
      <enumeration value="incomplete"/>
      <enumeration value="not attempted"/>
      <enumeration value="browsed"/>
    </restriction>
  </simpleType>
  <complexType name="scoreType">
    <sequence>
      <element name="raw" type="aicc:CMIDecimal"/>
      <element name="max" type="aicc:CMIDecimal" minOccurs="0"/>
      <element name="min" type="aicc:CMIDecimal" minOccurs="0"/>
    </sequence>
  </complexType>
  <group name="extension">
    <sequence>
      <any namespace="##other" processContents="strict" minOccurs="0"
maxOccurs="unbounded"/>
    </sequence>
  </group>
  <simpleType name="CMIStrng255INI">
    <restriction base="string">
      <maxLength value="255"/>
      <whiteSpace value="collapse"/>
      <pattern value="^[^r]*"/>
    </restriction>
  </simpleType>
  <simpleType name="CMIIdentifierINI">
    <restriction base="string">
      <maxLength value="255"/>
      <whiteSpace value="collapse"/>
      <pattern value='^[^s]+'/>
    </restriction>
  </simpleType>
  <simpleType name="CMITimespan">
    <restriction base="string">
      <pattern value="\d{2,4}:\d{2}:\d{2}(\.\d{1,2})?"/>
    </restriction>
  </simpleType>
  <simpleType name="CMIStrng4096INI">
    <restriction base="string">
      <maxLength value="4096"/>
      <whiteSpace value="collapse"/>
      <pattern value="^[^\[]*" />
    </restriction>
  </simpleType>
  <simpleType name="CMIIdentifierDevID">

```

```

    <restriction base="string">
      <pattern value="[A-Za-z\d_-\{\}\]*"/>
    </restriction>
  </simpleType>
  <simpleType name="CMISString255CSV">
    <restriction base="string">
      <maxLength value="255"/>
      <pattern value='^[^r]+'/>
    </restriction>
  </simpleType>
  <simpleType name="CMIDate">
    <restriction base="string">
      <length value="10"/>
      <pattern value="\d{4}/\d{2}/\d{2}"/>
    </restriction>
  </simpleType>
  <simpleType name="CMITime">
    <restriction base="string">
      <minLength value="8"/>
      <maxLength value="11"/>
      <pattern value="\d{2}:\d{2}:\d{2}[\.\d{1,2}]*"/>
    </restriction>
  </simpleType>
  <simpleType name="CMIDecimal">
    <restriction base="string">
      <maxLength value="255"/>
      <pattern value="(-)?\d*(.\d+)?"/>
    </restriction>
  </simpleType>
</schema>

```

4 XML Communication Examples

4.1 From LMS to AU XML Example

```

<?xml version="1.0" encoding="UTF-8"?>
<toAUCommunication version="1.0"
xmlns="http://www.aicc.org/xmlbindings/cmixml/1.0/ToAU"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.aicc.org/xmlbindings/cmixml/1.0/ToAU
ToAU_1.0.0.xsd">
  <core>
    <studentId>jqh1674</studentId>
    <studentName>Carsen, Randolph C</studentName>
    <lessonLocation>Section1.12</lessonLocation>
    <credit>credit</credit>
    <lessonStatus>incomplete</lessonStatus>
    <entry>resume</entry>
    <score>
      <raw>4</raw>
      <max>25</max>
      <min>0</min>
    </score>
    <totalTime>00:04:53.1</totalTime>
  </core>
</toAUCommunication>

```

```

    <lessonMode>normal</lessonMode>
  </core>
  <suspendData>
    eclnode = 12
    bookmark.1 = sec1.8
  </suspendData>
  <launchData>
    test = true
    repeat = false
    help = 3
  </launchData>
  <commentsFromLms>

```

Ignore Section 3.1. Use the handout for the correct version of this information. A new lesson with the revised Section should be available by August 2008.

```

  </commentsFromLms>
  <objectives>
    <objective>
      <id>apu001</id>
      <score>
        <raw>4</raw>
        <max>4</max>
      </score>
      <status>passed</status>
    </objective>
  </objectives>
  <studentData>
    <attemptNumber>1</attemptNumber>
    <masteryScore>20</masteryScore>
    <maxTimeAllowed>00:00:35:00</maxTimeAllowed>
    <timeLimitAction>Exit, Message</timeLimitAction>
    <sessionsJournal>
      <session>
        <score>
          <raw>4</raw>
          <max>25</max>
        </score>
        <status>incomplete</status>
      </session>
    </sessionsJournal>
  </studentData>
  <studentPreference>
    <audio>0</audio>
    <language>en-US</language>
    <lessonType>Boeing-A16</lessonType>
    <speed>0</speed>
    <text>1</text>
    <textColor>white</textColor>
    <textLocation>800,655</textLocation>
    <textSize>1</textSize>
    <video>320x200;1,1</video>
    <windows>
      <window>320x200: 1,1</window>
      <window>200,200; 800,655</window>
    </windows>
  </studentPreference>
  <studentDemographics>

```



```

<city>Springfield</city>
<class>B767-P14A-PA</class>
<company>NBA (Not Bankrupt Airlines)</company>
<country>USA</country>
<experience>9 yr PIC</experience>
<familiarName>Randy</familiarName>
<instructorName>BAM</instructorName>
<nativeLanguage>de</nativeLanguage>
<state>PA</state>
<streetAddress>21142 9th St</streetAddress>
<telephone>PA6-5000</telephone>
<title>pilot</title>
<yearsExperience>19</yearsExperience>
</studentDemographics>
</toAUCommunication>

```

4.2 From AU to LMS XML Example

```

<?xml version="1.0" encoding="UTF-8"?>
<toLMSCommunication version="1.0" xmlns
="http://www.aicc.org/xmlbindings/cmixml/1.0/ToLMS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.aicc.org/xmlbindings/cmixml/1.0/ToLMS
ToLMS_1.0.0.xsd">
  <core>
    <lessonLocation>Section8.11</lessonLocation>
    <lessonStatus>passed</lessonStatus>
    <exit>logout</exit>
    <score>
      <raw>23</raw>
      <max>25</max>
      <min>0</min>
    </score>
    <sessionTime>00:17:34.2</sessionTime>
  </core>
  <suspendData>
    eclnode = 18
    bookmark.1 = sec1.8
    bookmark.2 = sec2.3
    bookmark.3 = sec4.12
  </suspendData>
  <commentsFromLearner>
    Not a bad lesson, but I would have liked to have seen more examples shown.
  </commentsFromLearner>
  <objectives>
    <objective>
      <id>apu002</id>
      <score>
        <raw>10</raw>
        <max>10</max>
      </score>
      <status>passed</status>
      <date>2005/10/23</date>
      <time>13:02:31</time>
      <masteryTime>00:02:45.1</masteryTime>
    </objective>
  </objectives>

```

```

</objective>
<objective>
  <id>apu003</id>
  <score>
    <raw>6</raw>
    <max>6</max>
  </score>
  <status>passed</status>
  <date>2005/10/23</date>
  <time>13:05:21</time>
  <masteryTime>00:01:15.2</masteryTime>
</objective>
</objectives>
<studentData>
  <triesDuringLesson>1</triesDuringLesson>
  <tries>
    <try tryNumber='1'>
      <score>
        <raw>23</raw>
      </score>
      <status>passed</status>
      <time>00:17:34.2</time>
    </try>
  </tries>
</studentData>
<studentPreference>
  <audio>0</audio>
  <language>en-US</language>
  <lessonType>Boeing-A16</lessonType>
  <speed>0</speed>
  <text>1</text>
  <textColor>white</textColor>
  <textLocation>800,655</textLocation>
  <textSize>1</textSize>
  <video>320x200;1,1</video>
  <windows>
    <window>320x200: 1,1</window>
    <window>200,200; 800,655</window>
  </windows>
</studentPreference>
<interactions>
  <interaction>
    <id>C001</id>
    <interactionObjectives>
      <id>apu002</id>
      <id>apu018</id>
    </interactionObjectives>
    <date>2005/10/23</date>
    <time>13:02:31</time>
    <type>matching</type>
    <correctResponses>
      <correctResponse>{a.3,b.1,c.4,d.2}</correctResponse>
    </correctResponses>
    <weighting>1</weighting>
    <studentResponse>a.3,b.1,c.4,d.2</studentResponse>
    <result>10</result>
    <latency>00:00:37.2</latency>
  </interaction>
</interactions>

```

```

</interaction>
<interaction>
  <id>C014</id>
  <interactionObjectives>
    <id>apu003</id>
  </interactionObjectives>
  <date>2005/10/23</date>
  <time>13:05:21</time>
  <type>performance</type>
  <correctResponses>
    <correctResponse>
      Bat Sw - On; Oil - Check; Master Sw - Start; Temp - Monitor; RPM - Monitor
    </correctResponse>
  </correctResponses>
  <weighting>1</weighting>
  <studentResponse>
      Bat Sw - On; Oil - Check; Master Sw - Start; Temp - Monitor; RPM - Monitor
    </studentResponse>
  <result>6</result>
  <latency>00:01:47.5</latency>
</interaction>
<interaction>
  <id>C014</id>
  <interactionObjectives>
    <id>apu004</id>
  </interactionObjectives>
  <date>2005/10/23</date>
  <time>13:08:32</time>
  <type>>true-false</type>
  <correctResponses>
    <correctResponse>T</correctResponse>
  </correctResponses>
  <weighting>1</weighting>
  <studentResponse>T</studentResponse>
  <result>1</result>
  <latency>00:00:04.5</latency>
</interaction>
<interaction>
  <id>C021</id>
  <interactionObjectives>
    <id>apu005</id>
  </interactionObjectives>
  <date>2005/10/23</date>
  <time>13:10:24</time>
  <type>choice</type>
  <correctResponses>
    <correctResponse>c</correctResponse>
  </correctResponses>
  <weighting>1</weighting>
  <studentResponse>c</studentResponse>
  <result>4</result>
  <latency>00:00:09.3</latency>
</interaction>
</interactions>
<paths>
  <path>
    <locationId>A002</locationId>
  </path>
</paths>

```

```
<date>2005/10/23</date>
<time>13:05:21</time>
<status>passed</status>
<whyLeft>student selected</whyLeft>
<timeInElement>00:03:41.3</timeInElement>
</path>
<path>
  <locationId>A003</locationId>
  <date>2005/10/23</date>
  <time>13:09:41</time>
  <status>passed</status>
  <whyLeft>student selected</whyLeft>
  <timeInElement>00:04:20</timeInElement>
</path>
</paths>
</toLMSCommunication>
```

5 Glossary

- AU** Assignable Unit. A module of computer based learning content (or CBT) that can be launched and tracked by a CMI system . The smallest logical unit of learning content in a course.
- CMI** Computer Managed Instruction. In this document, this term refers to the system that manages a course. Such systems may also be called an LMS or even an LCMS.
- LMS** Learning Management System. In this document, this term is used interchangeably with CMI.