Army Business Rules and Best Practices Guide for Distributed Learning (DL) Development

The Army University
The Army Distributed Learning Program Directorate (DDL TADLP-D)

Version 1.3
01 May 2019
## Release Summary

<table>
<thead>
<tr>
<th>Version</th>
<th>Release Date</th>
<th>Changes in Release</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.3</td>
<td>29 April 2019</td>
<td>Consolidated conformance testing rules.</td>
</tr>
<tr>
<td>1.2</td>
<td>15 April 2019</td>
<td>New appendix for common content issues on the ALM</td>
</tr>
<tr>
<td>1.1</td>
<td>01 April 2019</td>
<td>Updates for rule verification and BRBP checklist.</td>
</tr>
<tr>
<td>1.0</td>
<td>12 July 2018</td>
<td>Initial release</td>
</tr>
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1 Introduction

Welcome to the Army Business Rules and Best Practices Guide for Distributed Learning (DL) Development. This guide serves as a resource for all personnel involved in the creation of DL products for Army DL-Producing Activities (ADLPAs). Contained within this guide are the business rules and supporting best practices that apply to the development of DL products for delivery on Army Learning and Content Management Capability (ALCMC) information systems. The purpose of the guidance is to afford DL developers a clear and straightforward path to meeting all Army requirements for the creation and delivery of fully functional and conformant Army DL products.

This introduction discusses what you can expect from the guide, what the guide expects of you, and how the information within is laid out.

1.1 Intended Audience

The information in this guide applies primarily to programmers and instructional systems designers. However, any personnel involved in the creation of DL products can benefit from a clear understanding of the requirements that apply to the DL creation process.

1.2 Required Knowledge

Many of the business rules and best practices contain technical concepts related to instructional systems and web programming. The guide assumes you have either working knowledge or familiarity in the following skill areas:

- The Analysis, Design, Development, Implementation, and Evaluation (ADDIE) instructional design model
- The Shareable Content Object Reference Model (SCORM) 2004 3rd Edition specification
- JavaScript and eXtensible Markup Language (XML) programming
- General usage of Learning Management Systems

While the above list is not exhaustive, it covers the major areas of requisite knowledge for the contents of this guide. There are many available resources to assist DL developers in gaining mastery in the required areas, and it is highly encouraged that you seek out all the education you can to better DL creation endeavors.
1.2.1 Required Reading

This guide assumes that you have read the following resources fully and have a solid understanding of the concepts within them, regardless of your skill level:

- **SCORM Users Guide for Programmers**: The Advanced Distributed Learning (ADL) Initiative provides this document as an introduction to the key concepts of the SCORM 2004 specification for developers with little prior exposure. The ADL guide provides a foundation to build upon using other resources like the SCORM 2004 specification documentation.


- **SCORM 2004 3rd Edition Technical Specification**: ADL provides three technical documents that make up the SCORM 2004 3rd Edition specification as a whole: the Content Aggregation Model (CAM) document, the Sequencing and Navigation (SN) document, and the Run-Time Environment (RTE) document. The specification documents define all facets of the SCORM 2004 3rd Edition specification such as data model elements, the application programming interface (API) for communication with the Learning Management System (LMS), and LMS requirements for supporting SCORM.

  **IMPORTANT**: It is imperative that you understand all of the information in the entire SCORM 2004 3rd Edition specification.


- **Army SCORM Acceptance Criteria**: The Army Distributed Learning Program (TADLP) provides a set of criteria for DL developers to follow when creating DL products to ensure all requirements for acceptance by the Army are met. The acceptance criteria should be used in tandem with the business rules in this guide.

  The Army SCORM Acceptance Criteria can be found on the TADLP website: https://www.atsc.army.mil/tadlp/implementation/compliance/acceptance_criteria.asp.

  You should read all of the above resources carefully prior to beginning any work toward creating a DL product. You should also keep documentation such as the SCORM 2004 3rd Edition specification handy as reference material throughout the entire development process.
1.3 What this Guide Is

This business rules and supporting information within this guide exist to provide DL developers with the baseline requirements for creating Army DL products that:

- Meet Army DL conformance requirements
- Provide all functionality required by the Army
- Meet all Army DL deliverable requirements

The business rules are formatted to provide end-goals for developers that apply broadly to all types of Army DL products foremost while minimizing the number of rules specific to various content types. This guide provides some necessary implementation examples, but it is otherwise up to developers to decide how best to follow the rules in DL products. The business rules avoid narrow specificity where possible in order to give developers the freedom to create robust products of a variety of types to meet the needs of the Army.

1.3.1 What this Guide Isn’t

As you read this guide, keep in mind that it is not meant to teach basic skills such as programming for web development in general or how to work technology such as SCORM into DL products from scratch. Rather than attempting to provide comprehensive educational guidance that already exists in resources such as those mentioned in the Required Reading section, it is assumed that you are at a point where you have the knowledge, capabilities, and approval to create an Army DL product and simply need to know what specific requirements it must meet during the DL creation process.
1.4 How to Use this Guide

Now that the expectations for the relationship between you and this guide have been laid out, this section will instruct you on how to navigate the business rules, best practices, and other information in the remainder of the guide.

1.4.1 Content Notation

Before discussing how the sections of the guide are laid out and how to reference the information in each one, you should familiarize yourself with the notation this guide uses. Each section contains business rules, best practices, general discussion, and illustrations such as code examples. Business rules, best practices, and code examples have icons next to them for easy identification, as shown in figures 1 through 3 below.

**Business Rule Example:**

**Business Rule 1.1: Discrete Independent Content Blocks**

Independent LCOs shall be discrete blocks of learning content that do not make reference to other LCOs or placement in a hierarchy in any of the content.

![Figure 1: An example business rule](image1.png)

**Best Practice Example:**

**Best Practice: Separate Content Window**

Launch content in its own window separate from the LMS player to provide more control over the window behavior and reduce the risks associated with forceful window closure since it is not part of a frame set.

![Figure 2: An example best practice](image2.png)

**Code Example:**

**Setting a SCORM Navigation Request when Exiting a Lesson**

```javascript
if(getValue("cmi.completion_status") == "completed")
    setValue("adl.nav.request", "exit");
else
    setValue("adl.nav.request", "suspendAll");
```

![Figure 3: An example code sample](image3.png)
Each instance of the business rules and best practices that you encounter throughout the guide is accompanied by an explanation to provide context and help you understand its importance. Business rules themselves often contain best practices that are closely linked, and some best practices stand out on their own.

Pay attention to all important notes in explanations as well, as they contain critical information pertaining to specific rules. Figure 4 demonstrates how an important note appears in the guide.

**IMPORTANT:** This is an example of an important note.

Figure 4: Important note example

### 1.4.2 Section Layout

The rest of the major sections of this guide are all about the business rules themselves and any supporting information, appearing in the following order:

- **Section 2: The Army Learning Environment:** An overview of the Army learning environment in which DL products reside, its major components, and the broad goals developers should keep in mind.

- **Section 3: Business Rules and Best Practices:** Lists of all the business rules and best practices in the guide given up front for quick reference.

- **Section 4: The Business Rules and Best Practices Checklist:** Introduces the accompanying checklist that must be submitted alongside each individual content package and provides instructions for completing it.

- **Section 5: Design:** The business rules and best practices that apply to designing a DL product before commencing development and programming work.

- **Section 6: Development:** The business rules and best practices that apply during the construction of a DL product and the implementation of its content and functionality.

- **Section 7: Testing:** The business rules and best practices that apply to validating a functional DL product after development is finished.

- **Section 8: Delivery:** The business rules and best practices that apply to delivering a finished DL product to the Army and ensuring that everything the Army requires is present.

- **Section 9: Appendices:** Supplementary information such as discussions of Army metadata fields and SCORM 2004 3rd Edition programming for instructional strategies.

The business rules and supporting information in this guide are presented within a life-cycle-style set of phases, discussed in Section 2, to provide you with clear context of requirements and why they exist.
1.4.2.1 IMI Types
While the business rules are intended to have broad applicability to all types of Interactive Multimedia Instruction (IMI), certain IMI types such as SCORM content that requires an LMS, have their own requirements and corresponding rules. The business rules for each major IMI type appear in their own subsection of each of the major sections (Design, Development, Testing, and Delivery) after the rules that apply to all IMI types. The guide currently has guidance for the SCORM 2004 3rd Edition IMI type.

1.5 Future Editions
As a closing note for the introduction, this guide recognizes that the Army learning environment is subject to change as new technology is introduced. As the Army adopts new standards and specifications that enable new types of DL products, this guide will be updated to include new business rules for the creation of those products. Future editions will cover the process of designing, developing, testing, and delivering IMI types such as asynchronous DL using the Experience API (xAPI) and its profiles, 3D desktop and web simulations, and virtual reality products.
2 The Army Learning Environment

The guide uses the term “Army learning environment” to describe the collections of technologies, platforms, and content that comprise DL as a whole for the Army. This section provides a brief overview of the relevant parts of the Army learning environment and a discussion of the expectations for developers creating a DL product.

2.1 DL Delivery Platforms

The ALCMC mentioned in the Introduction section is comprised in large part by the delivery platforms for DL content – systems such as LMSs that deliver content to learners and track their performance.

The ALCMC’s two major delivery platforms for DL are the Army Learning Management System (ALMS) and the Enterprise Lifelong Learning Center (ELLC). The ALMS is based on the Saba® enterprise learning platform, and the ELLC is based on the Blackboard® learning platform. Both platforms fully support SCORM 2004 3rd Edition content and have separate environments for testing content, but the key differences between the two platforms are that the ALMS is far larger, hosts all auto-scoring content, and its SCORM run-time environment requires content to adhere more strictly to the SCORM specification. Note that other Army DL delivery platforms are beyond the guide’s scope.

By now you have seen “SCORM 2004 3rd Edition”, or its short-hand reference “SCORM”, appear multiple times in the guide. The Army has adopted SCORM 2004 3rd Edition as the primary technology to support content interoperability and provide a standardized data communication and tracking model between learning content and LMS platforms. Therefore, this guide focuses primarily on the creation of SCORM-based DL content, which means web-based IMI levels 1, 2, and 3 products hosted on an LMS.

Additional focus is given to the ALMS specifically because of the key differences between it and the ELLC platform. The ALMS requires strict content conformance and does not automatically provide content behavior that is not specified, which means that DL content that can function on the ALMS will by default function on other platforms like the ELLC due to its strict conformance to SCORM enabling interoperability.

As you use this guide, remember that in the current Army learning environment, it is assumed that developers are creating a web-based DL product built using the SCORM 2004 3rd Edition specification. Army acceptance of standards and specifications that would drive business rules and acceptance criteria for other IMI types are still forthcoming.
2.2 Key Concepts

You will see terms such as “Learning Content Object” (LCO), “interoperability”, and the learner’s “learning experience” frequently within this guide. You should become familiar with the general concepts behind the terms in this section so that you can best understand the business rules and their importance. The terms do not apply to any one standard, specification, or IMI type.

- **DL creation process**: The general process of Design, Development, Testing, and Delivery used by this document to categorize the business rules and best practices. The DL creation process is not normative like the ADDIE model process, but rather this guide uses it as a convenient and clear method to describe the overall process of making DL products.

- **Learning Content Object**: An LCO is a collection of content items, called learning content in this guide, combined into a modular and interoperable resource for use on a system. Note that in SCORM terms, an LCO is referred to as a Shareable Content Object (SCO).

- **Content package**: A content package is a file that contains content and accompanying metadata. It is a general concept that has been incorporated into standard formats such as the IMS Content Packaging specification used in SCORM.

- **Interoperability**: The concept of interoperability appears frequently in this guide and refers to the ability of LCOs to be transferred between systems and function consistently. Interoperability also implies that LCOs are fully self-contained, which is a key principle in specifications like SCORM.

- **Learning experience**: The learning experience simply refers to the learner’s ability to experience learning content without confusion or difficulty. This concept can be equated to “ease of use” or “user experience”.
2.3 The Road to Delivery

Before you begin reviewing the business rules and best practices themselves, be sure to understand what the Army expects of developers throughout the DL creation process. The guide assumes that since you are reading this document, you have been approved to create a DL product for the Army and need to know what needs to be done throughout the process. As a DL developer, the major goals you must accomplish are:

- Follow the approved Instructional Multimedia Design Plan (IMDP)
- Implement instructional design requirements
- Implement functional requirements such as general content behavior and SCORM usage
- Validate full conformance to Army requirements using Army testing tools
- Conduct validation testing on the delivery platform’s testing environment
- Ensure the final deliverable package includes all necessary items and documentation

Once the Army has received the final deliverable package, it will perform the following:

- Perform the Government Document Review (GDR) process to validate items such as Army test tool logs and delivery platform results.
- Functional testing on the delivery platform to validate functional behavior and identify any issues that hinder or prevent the learning experience.
- Make content available to learners on the delivery platform once the DL product is deemed acceptable.

**Note:** This document refers to this step as “platform delivery,” which is not the same as delivery of a final product to the Government.

The lists above provide an overview of what goes into creating and delivering DL products within the Army learning environment. Always confer with the appropriate ADLPA point of contact to ensure that you are clear on all of the requirements and exact processes that you must follow.
## 3 Business Rules and Best Practices

This section contains lists of all the business rules and best practices found in the guide, and where each is located. Use this section for quick reference after you have read the full guide.

### 3.1 List of Business Rules

This section contains a list of all the business rules in the guide, organized by section.

<table>
<thead>
<tr>
<th>Design</th>
<th>Content Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All Learning Content</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Content Structure</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Business Rule 1.1.1: Discrete Independent Content</strong></td>
<td>Independent LCOs shall be discrete blocks of learning content that do not make reference to placement in a hierarchy or to other LCOs anywhere in the content.</td>
</tr>
<tr>
<td><strong>Business Rule 1.1.2: Consistent Content Titles</strong></td>
<td>All LCOs shall contain the same topic title in content packaging resources and in the instructional content presented to the learner.</td>
</tr>
<tr>
<td><strong>Business Rule 1.1.3: Internal Learning Content</strong></td>
<td>Instructional content that directly contributes to satisfying mastery requirements for an LCO must be located within its content package and not referenced by an external URL.</td>
</tr>
<tr>
<td><strong>Metadata</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Business Rule 1.1.4: Metadata Requirement</strong></td>
<td>Metadata is required for all content packages and their LCOs or launchable assets.</td>
</tr>
<tr>
<td><strong>Business Rule 1.1.5: External Metadata Files</strong></td>
<td>Metadata for an object must be contained with its own valid XML file that conforms to the IEEE LOM model schema and is referenced within the content packaging model.</td>
</tr>
<tr>
<td><strong>SCORM Content</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Content Structure</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Business Rule 1.2.1: Single-SCO Content Packages</strong></td>
<td>SCORM 2004 3rd Edition content packages must be limited to a single SCO for the purposes of modularity and interoperability.</td>
</tr>
</tbody>
</table>
**Business Rule 1.2.2: Army Metadata Fields**

All SCORM 2004 3rd Edition metadata files must be formatted to include the following fields to meet Army requirements:

- **General Identifier Fields**
  - Catalog; Entry

- **General Fields**
  - Title; Language; Description; Keywords; Type of Metadata

- **Life Cycle Fields**
  - Version; Status of Package Submittal; Proponent’s Role; Proponent’s Name, Address and Email; Date of Submittal

- **Metadata Fields**
  - Catalog Identifier; Entry Identifier; Schema; Language

- **Technical Fields**
  - Format

- **Rights Fields**
  - Cost; Copyright and Other Restrictions

- **Classification Fields**
  - MOS and Skill Level; SQI; ASI; Task Numbers and Task Descriptions; Learning Objectives; 508 Compliant; Security Level (Foreign Disclosure)

**Development**

**All Learning Content**

**General Programming**

**Business Rule 2.1.1: Allowable File Name Characters**

Files in Army learning content packages shall contain only the following allowable characters from the RFC 3986 unreserved character set:

- _ . A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c d e f g h i j k l m n o p q r s t u v w x y z 0 1 2 3 4 5 6 7 8 9

**Business Rule 2.1.2: Allowable Folder Name Characters**

Folders in Army learning content packages shall contain only the following allowable characters from the RFC 3986 unreserved character set:

- _ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c d e f g h i j k l m n o p q r s t u v w x y z 0 1 2 3 4 5 6 7 8 9

**Business Rule 2.1.3: External URL Encoding**

External resource names that contain characters not in the allowable list (see Business Rules 2.1.1 and 2.1.2) shall be referenced in Army learning content using a percent-encoded URL.
<table>
<thead>
<tr>
<th>Business Rule 2.1.4: File Extension Separation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A single period character shall be used to separate a file’s name from its extension.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Business Rule 2.1.5: Maximum File Path Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>File paths in Army learning content packages shall not exceed 256 characters in length.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Business Rule 2.1.6: Browser Data Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning content shall not store data using the web browser’s built-in methods such as cookies or Web Storage.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Business Rule 2.1.7: Server-side Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning content shall not make use of any server-side technologies such as scripting or database implementations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Business Rule 2.1.8: Error-Free Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>All code in learning content must not produce any file or script errors when executed in the web browser.</td>
</tr>
</tbody>
</table>

**Required Behavior**

<table>
<thead>
<tr>
<th>Business Rule 2.1.9: Bookmarking Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-scoring LCOs shall contain functionality to bookmark the learner’s progress whenever the learner exits the content.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Business Rule 2.1.10: Assessment Data Obfuscation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit-producing assessment learning content must obfuscate question and answer data so that the data is not in a plaintext format easily recognizable by the learner.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Business Rule 2.1.11: Consistent Exit Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning content must record the learner’s progress consistently regardless of the method through which the learner exits the content.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Business Rule 2.1.12: Adobe Flash Restriction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning content must not use Adobe’s Flash technology at any point during runtime, nor include any Flash files in deliverables.</td>
</tr>
</tbody>
</table>
### SCORM Content

#### General Programming

**Business Rule 2.2.1: Window Closure**
SCORM 2004 3rd Edition learning content must not forcefully close the LMS player window through its programming, nor instruct the learner to close the LMS player window using the browser exit button, during an attempt unless required by the LMS.

#### Content Aggregation

**Business Rule 2.2.2: SCORM Manifest and Schemas**
SCORM 2004 3rd Edition content packages must contain a manifest file (imsmanifest.xml) and all of the SCORM 2004 3rd Edition base and extension schemas in the root level of the package.

**Business Rule 2.2.3: SCORM Content Package Files**
All files that make up the content for a SCORM 2004 3rd Edition SCO must be contained within its content package and referenced in the imsmanifest.xml file.

**Business Rule 2.2.4: SCORM Objectives Global to System**
The adlseq:objectivesGlobalToSystem attribute of the organization element must be set to “false” in all Army SCORM 2004 3rd Edition content packages.

**Business Rule 2.2.5: Assessment Objective Satisfaction**
SCORM 2004 3rd Edition assessment SCOs shall include the imsss:primaryObjective element in the manifest and set the satisfiedByMeasure attribute of the element to “true”.

**Business Rule 2.2.6: Assessment Mastery Score Declaration**
SCORM 2004 3rd Edition assessment SCOs shall include an imsss:primaryObjective element in the manifest and declare a mastery score using the imsss:minNormalizedMeasure element.

#### Run-Time Environment

**Business Rule 2.2.7: SCORM Data Model**
All SCORM 2004 3rd Edition SCOs must track learner performance using only the SCORM 2004 3rd Edition data model; assessment SCOs must use the Interactions data model element to record all learner performance.
## Business Rule 2.2.8: SCORM Required API Calls for Assessments

Credit-producing assessment SCORM 2004 3\(^{rd}\) Edition SCOs must at a minimum use the SCORM API as follows:

<table>
<thead>
<tr>
<th>Method Calls</th>
<th>Data Model Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call at least once:</td>
<td>Set a valid value at least once:</td>
</tr>
<tr>
<td>▪ Initialize</td>
<td>▪ cmi.exit</td>
</tr>
<tr>
<td>▪ GetLastError</td>
<td>▪ cmi.completion_status</td>
</tr>
<tr>
<td>▪ Commit</td>
<td>▪ cmi.scaled_score</td>
</tr>
<tr>
<td>▪ Terminate</td>
<td>▪ cmi.session_time</td>
</tr>
<tr>
<td></td>
<td>▪ cmi.interactions.n.correct.response.n.pattern</td>
</tr>
<tr>
<td></td>
<td>▪ cmi.interactions.n.learner_response</td>
</tr>
<tr>
<td></td>
<td>▪ cmi.interactions.n.latency</td>
</tr>
<tr>
<td></td>
<td>▪ cmi.interactions.n.timestamp</td>
</tr>
<tr>
<td></td>
<td>▪ cmi.interactions.n.type</td>
</tr>
<tr>
<td></td>
<td>▪ cmi.interactions.n.result</td>
</tr>
</tbody>
</table>

## Business Rule 2.2.9: SCORM Required API Calls for Non-Assessments

Credit-producing non-assessment SCORM 2004 3\(^{rd}\) Edition SCOs must at a minimum use the SCORM API as follows:

<table>
<thead>
<tr>
<th>Method Calls</th>
<th>Data Model Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call at least once:</td>
<td>Set valid value at least once:</td>
</tr>
<tr>
<td>▪ Initialize</td>
<td>▪ cmi.exit</td>
</tr>
<tr>
<td>▪ Commit</td>
<td>▪ cmi.success_status</td>
</tr>
<tr>
<td>▪ Terminate</td>
<td>▪ cmi.completion_status</td>
</tr>
<tr>
<td></td>
<td>▪ cmi.location</td>
</tr>
<tr>
<td></td>
<td>▪ cmi.session_time</td>
</tr>
</tbody>
</table>

## Business Rule 2.2.10: SCORM Navigation Request

All SCORM 2004 3rd Edition SCOs must set an appropriate navigation request using the adl.nav.request data model element during run-time.
## Testing

### All Learning Content

#### Platform Testing

**Business Rule 3.1.1: Target Platform Testing**
All LCOs must be tested on the target delivery platform testing environment with identical configuration settings to the live version of the platform.

**Business Rule 3.1.2: Computer Configuration**
All LCOs must be tested using a computer configuration (i.e., hardware, operating system, web browser) that at a minimum matches the Baseline Home Computer Configuration.

#### Army Testing Tools

**Business Rule 3.1.3: Conformance Testing Tools**
All LCOs must be validated with conformance testing tools and methods required by the Army for the specific IMI type.

### SCORM Content

#### Platform Testing

**Business Rule 3.2.1: SCORM Strict Mode**
All SCOs must be tested on the target delivery platform testing environment using strict conformance settings when available. Any configuration options that relax conformance shall not be active.

#### Army Testing Tools

**Business Rule 3.2.2: SCORM Conformance Testing**
All SCORM 2004 3rd Edition content packages and SCOs must pass all tests performed by the ADL SCORM 2004 3rd Edition Conformance Test Suite’s Content Package Conformance Test.

**Business Rule 3.2.3: Army Conformance Testing**
All SCORM 2004 3rd Edition content packages and SCOs must pass all tests performed by the SCORM Resource Validator.

## Delivery

### All Learning Content

#### Packaging

**Business Rule 4.1.1: Content Package Format**
All LCOs must be contained in an approved content package format that the ALCMC delivery platform natively supports.

#### Deliverable Items

**Business Rule 4.1.2: Content Package Deliverables**
All finalized LCOs and content packages that are consumable by the learner on an ALCMC delivery platform or computer must be delivered electronically to the Government.
Business Rule 4.1.3: Source Material Deliverables
All final contract deliverables – such as LCOs, development source files, answer keys, and test logs – must be delivered to the Government on a DVD-ROM, and include any supporting software or tools.

SCORM Content

Packaging

Business Rule 4.2.1: SCORM Content Package Deliverables
All SCOs for use by learners must be contained in a package interchange file (PIF) per the SCORM 2004 3rd Edition specification that the ALCMC delivery platform natively supports.

Deliverable Items

Business Rule 4.2.2: SCORM Validation Deliverables
All SCOs delivered to the Army must also be accompanied by proof of passing results from Army SCORM 2004 3rd Edition conformance testing tools.

3.2 List of Best Practices
This section contains a list of all the best practices in the guide, organized by section.

Design

SCORM Content

General Best Practices

Best Practice: Use Army-recommended Sequencing
Use the Army-recommended sequencing for SCORM 2004 3rd Edition content packages. Sequencing includes logic like rollup rules that vary depending on the content type (assessment or non-assessment) and desired instructional strategy (single or multiple attempts).

Best Practice: Assign Organization and SCO Titles in the Manifest
Give the organization and each SCO correct titles in the manifest for a SCORM package. Avoid using default values such as “A001” which may confuse the learner.

Development

All Learning Content

Required Behavior

Best Practice: Bookmarking Prompt
LCOs that contain bookmarking functionality should provide the learner with the option at reentry to resume their progress at the content from the location bookmarked during the previous learning session.
### General Best Practices

**Best Practice: Address Usage of Internet Explorer Compatibility View**

Use the X-UA-Compatible header or a graceful degradation development strategy to handle the potential for some learners to have Internet Explorer’s Compatibility View active.

**Best Practice: Develop for Low-Bandwidth Learner Environments**

Develop content so that it provides an adequate learning experience even in low-bandwidth environments.

### SCORM Content

**General Programming**

**Best Practice: Separate Content Window**

Launch content in its own window separate from the LMS player to provide more control over the window behavior and reduce the risks associated with forceful window closure since it is not part of a frameset.

**Best Practice: Avoid Top-Level Window Closure**

Avoid using methods that will result in a window being closed from the top level, such as top.close(). The window.close() method is acceptable, since its will not affect framesets and works without issue for separate content windows.

**Content Aggregation**

**Best Practice: Set a Primary Objective for Each SCO**

Set a primary objective for each SCO, whether the SCO is scoring or not, to increase interoperability. It is better to define an objective in the manifest than to rely on the LMS to automatically apply a default objective that the content has no control over.

**Run-Time Environment**

**Best Practice: Set an Appropriate Navigation Request**

Assessment SCOs should always set a navigation request of “exit”. Non-assessment SCOs may set a value of “suspendAll” or “exit” depending on whether the learner has completed content or intends to resume progress later.

Set the navigation request shortly before the Terminate method for simplicity, especially when modifying third party code.
4 The Business Rules and Best Practices Checklist

The Army Business Rules and Best Practices SCORM 2004 CMI Checklist (referred to within this document as “the BRBP checklist”) is a companion file to this document that is intended to be filled out and submitted by DL developers. You are expected to complete and submit a separate BRBP checklist for each content package within a given course as part of the final set of deliverables. This section of the guide explains the fields within the checklist and provides guidance for how to fill out a BRBP checklist.

4.1 Purpose of the BRBP Checklist

The purpose of having DL developers fill out a BRBP checklist for each content package is to provide a clear way to verify that the business rules within this document have been followed, which will ensure that your DL product has the best chance of being accepted by the Army. Each completed BRBP checklist serves as your attestation to the Army that each content package within your delivered DL product conforms to the business rules as outlined in this document.

IMPORTANT: You must fill out a BRBP checklist for every content package that you deliver as part of your DL product. For example, a DL product containing a pretest, 10 lessons, and a posttest should have 12 BRBP checklists delivered alongside it.
4.2 Description of BRBP Checklist Fields

The BRBP checklist contains two fields at the top as well as four columns corresponding to fields for each business rule. Figure 5 below shows a preview of the BRBP checklist.

- **Course**: The name of the course to which this content package belongs.
- **Package**: The name of the content package that this BRBP checklist validates.
- **Comments**: Any comments or extra information that you feel is important to communicate to the Army regarding a given business rule. For example, you may need to explain why a given rule has not been followed, or there may be something that you wish to clarify about a specific business rule.
- **Rating**: A yes-or-no rating that states whether the given business rule has been followed. Values of “Y”, “N”, and “N/A” are expected and preferred. The Rating column will automatically color-code the text and cell background color according to these three values. Figure 6 shows an example of auto-formatted cells for each of these values.

  ![Figure 6: An example of auto-formatted cells based on the values “Y”, “N”, and “N/A”](image)

- **Date**: The date that the given business rule was evaluated. Valid dates will automatically format as “DD-MMM-YYYY”.
- **Evaluator**: The name of the person evaluating the given business rule.
While filling out the checklist, developers should ask the questions below in particular.

<table>
<thead>
<tr>
<th>Yes/No</th>
<th>Question</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Is all code and markup free of errors?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ensure all JavaScript, XML, and other code in the DL product is valid and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>does not produce errors when run.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Are all required SCORM API methods and data model elements present?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ensure Business Rules 2.2.8, 2.2.9, and 2.2.10 are followed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does the content pass the ADL SCORM 2004 3rd Edition Conformance Test Suite?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ensure the content can pass the ADL test suite and that the resulting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>logs do not contain errors, per Business Rule 3.2.2.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does the content pass the Metadata Editor validation test?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ensure the content’s metadata passes the Metadata Editor validation test</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and that the resulting logs do not contain errors, per Business Rule</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.2.2.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does the content pass the SCORM Resource Validator without errors?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ensure the content passes the SCORM Resource Validator and that the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>resulting log does not contain errors, per Business Rule 3.2.2.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does the Army Log Parser produce a passing result based on the other test</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tool results?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ensure the logs from the other Army testing tools pass the Army Log</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parser tests and the resulting log states that the content is</td>
<td></td>
</tr>
<tr>
<td></td>
<td>conformant, per Business Rule 3.2.2.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does the content perform as expected on the LMS testing environment?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ensure the content performs correctly when passed, failed, and suspended,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and that Business Rules 2.1.7, and 2.1.8 are followed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Was the content tested with the correct configuration on the LMS?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ensure Business Rule 3.2.1 is followed.</td>
<td></td>
</tr>
</tbody>
</table>

If the answer is "Yes" to each question above, and all other Army business rules and best practices have been followed, a SCORM 2004 3rd Edition DL product has a high chance of functioning correctly and being accepted upon delivery.

**IMPORTANT:** Remember that these questions are not a substitute for following all of the business rules in the guide and completing the official checklist.
5 Design

This section of the guide covers the requirements that pertain to the first phase of the DL creation process: Design. In this phase, it is assumed that no development or programming work has begun, and that developers are making design decisions that pertain to content structure and creating metadata to describe the content.

Information in this section:

- Business rules and best practices for the structure of content in Army DL products.
- Business rules and best practices for creating metadata for Army DL products.

IMI types addressed:

- All Army learning content
- SCORM content

The business rules in this section are themselves normative. Explanations of business rules, best practices, and examples are informative in nature.
5.1 All Learning Content

The information in this section pertains to the design phase requirements for all IMI types.

5.1.1 Content Structure

The information in this section pertains to the structure of learning content regardless of IMI type.

---

Business Rule 1.1.1: Discrete Independent Content

Independent LCOs shall be discrete blocks of learning content that do not make reference to placement in a hierarchy or to other LCOs anywhere in the content.

Why is this business rule important?

Business Rule 1.1.1 ensures that an independent content object is truly independent of other content objects and does not rely on or make reference to LCOs outside of itself. An independent LCO is meant for reuse in multiple locations within the Army learning environment and must not be bound to other LCOs or specific contexts.

What happens if the rule is not followed?

Failure to follow Business Rule 1.1.1 causes an independent LCO to violate its purpose as an interoperable content object and become dependent on use with the LCO(s) or context(s) it references.

How can I verify that this rule has been satisfied?

You should verify that the given LCO does not reference any other LCOs by name, number, or hierarchy placement anywhere in the content package titles, manifest, metadata, or content that is viewed as part of the learner experience.

You may ignore Business Rule 1.1.1 in cases where the LCO is explicitly designed as an introduction to a course; be sure to note this in the corresponding comments field and provide an “N/A” rating for this rule when filling out the accompanying BRBP checklist.
**Business Rule 1.1.2: Consistent Content Titles**

All LCOs shall contain the same topic title in content packaging resources and in the instructional content presented to the learner.

**Why is this business rule important?**

Business Rule 1.1.2 ensures that there is no risk of the learner being confused about their location within learning content. The rule pertains primarily to content packaging standards and how delivery platforms such as an LMS display the titles of items. For example, an organization of packaged content can have its own title that may differ from the title shown in content itself. Titling must be consistent throughout instructional content.

**What happens if the rule is not followed?**

Failure to follow Business Rule 1.1.2 creates the risk of learners becoming confused and having their learning experience hindered.

**How can I verify that this rule has been satisfied?**

You should verify that the title in the instructional content matches the title exactly as it is formatted in the content package resources. If the title appears in multiple places within the packaging resources, ensure that each occurrence of the title matches every other occurrence. You can test whether Business Rule 1.1.2 has been satisfied by verifying that the title as it appears in the LMS Table of Contents matches the title as it is displayed from within the content on the target delivery platform.
**Business Rule 1.1.3: Internal Learning Content**

Instructional content that directly contributes to satisfying mastery requirements for an LCO must be located within its content package and not referenced by an external URL.

Why is this business rule important?

Business Rule 1.1.3 ensures that learning content (i.e., text and media) that is critical to a learning objective is readily accessible from within a content package, as opposed to an outside location that may change uncontrollably. The rule enforces the portability and availability of learning content.

The Army may allow exceptions for non-critical material, usually for large items such as Field Manuals and Soldier Training Publications. However, all files that reside outside of the content package must be stored in an Army repository or within an Army LMS where they are protected from removal, replacement, or updates.

What happens if the rule is not followed?

Failure to follow Business Rule 1.1.3 creates the risk of critical learning content that is not within a content package (i.e., an external URL) changing or becoming unavailable uncontrollably. Learning content that is incomplete due to partial unavailability or changes cannot fulfill its educational purpose for the learner.

How can I verify that this rule has been satisfied?

Except where otherwise explicitly permitted by the Army, you should verify that all learning content is packaged locally within the content package and referenced through the use of relative URLs. You can test whether Business Rule 1.1.3 has been satisfied by running the LCO locally in an offline context and ensuring that no broken links are encountered; the ADL SCORM 2004 3rd Edition Conformance Test Suite can be used for this purpose when obtaining logs for SCORM 2004 3rd Edition SCOs.
5.1.2 Metadata

The information in this section pertains to the creation of metadata for learning content regardless of IMI type.

---

**Business Rule 1.1.4: Metadata Requirement**

Metadata is required for all content packages and their LCOs or launchable assets.

Why is this business rule important?

Business Rule 1.1.4 ensures that all DL content has the metadata required for use within the ALCMC for content management purposes. Different IMI types will specify standards for their metadata.

What happens if the rule is not followed?

Failure to follow Business Rule 1.1.4 causes a DL product to be incomplete, which means the Army will not accept the product when it is delivered.

How can I verify that this rule has been satisfied?

You should verify that each content package contains valid metadata files that are well-formed and valid according to the given IMI type’s metadata specifications.
Business Rule 1.1.5: External Metadata Files

Metadata for an object must be contained with its own valid XML file that conforms to the IEEE LOM model schema and is referenced within the content packaging model.

Why is this business rule important?

Business Rule 1.1.5 ensures that metadata files are both discrete from the content they support and valid to the Institute of Electrical and Electronics Engineers (IEEE) standard for learning object metadata (LOM) to support interoperability.

What happens if the rule is not followed?

Failure to follow Business Rule 1.1.5 causes metadata to be invalid according to formatting requirements. The result is a DL product that is incomplete, which means the Army will not accept the product when it is delivered.

How can I verify that this rule has been satisfied?

You should verify that each content package contains discrete metadata files that conform to the IEEE LOM schema and that each file is properly referenced within the content package manifest file. Figure 7 shows an example of a reference to a separate metadata file within a SCORM 2004 3rd Edition SCO manifest file. The adlcp:location element contains the reference to the metadata_course.xml file.

Reference to an external metadata file from within the package manifest

```xml
<metadata>
  <schema>ADL SCORM</schema>
  <schemaversion>2003 3rd Edition</schemaversion>
  <adlcp:location>metadata_course.xml</adlcp:location>
</metadata>
</organizations default="CCC">
```

Figure 7: Code sample for a reference to an external metadata file from within the package manifest
5.2 SCORM Content

The information in this section pertains to the design phase requirements for SCORM 2004 3rd Edition DL products. The guide considers the design phase for SCORM 2004 3rd Edition to cover manifest creation and configuration, and the creation of accompanying metadata.

5.2.1 Content Structure

The information in this section pertains to the structure of SCORM content.

Business Rule 1.2.1: Single-SCO content packages
SCORM 2004 3rd Edition content packages must be limited to a single SCO for the purposes of modularity and interoperability.

Why is this business rule important?

Business Rule 1.2.1 ensures that SCOs maximize interoperability and portability by keeping content packages as small as possible.

What happens if the rule is not followed?

Failure to follow Business Rule 1.2.1 can create large and difficult to manage content packages. Individual modules in a multi-SCO package lose portability, and the difficulty in diagnosing and repairing issues is increased in content packages with many components – especially where SCORM sequencing logic is concerned.

How can I verify that this rule has been satisfied?

You should verify that the manifest file contains a single organization element with a single item element. Figure 8 provides an example of how to define a single SCO package in a manifest file.

Single SCO package defined in a content package manifest using one organization element

```xml
<organizations default="CCC">
  <organization identifier="CCC" adlseq:objectivesGlobalToSystem="false">
    <title>Captains Career Course</title>
    <item identifier="CCCM01" identifierref="CCCM01_resources">
      <title>Captains Career Course Module 01</title>
    </item>
  </organization>
</organizations>
```

Figure 8: Code sample for a single SCO package defined in a manifest
5.2.2 Metadata

The information in this section pertains to the creation of metadata for Army SCORM 2004 3rd Edition DL products.

### Business Rule 1.2.2: Army Metadata Fields

All SCORM 2004 3rd Edition metadata files must be formatted to include the following fields to meet Army requirements:

- **General Identifier Fields**
  - Catalog; Entry

- **General Fields**
  - Title; Language; Description; Keywords; Type of Metadata

- **Life Cycle Fields**
  - Version; Status of Package Submittal; Proponent’s Role; Proponent’s Name, Address and Email; Date of Submittal

- **Metadata Fields**
  - Catalog Identifier; Entry Identifier; Schema; Language

- **Technical Fields**
  - Format

- **Rights Fields**
  - Cost; Copyright and Other Restrictions

- **Classification Fields**
  - MOS and Skill Level; SQI; ASI; Task Numbers and Task Descriptions; Learning Objectives; 508 Compliant; Security Level (Foreign Disclosure)

### Why is this business rule important?

Business Rule 1.2.2 ensures that metadata files contain all the information that the Army needs to support learning content tracking and interoperability.

**IMPORTANT:** Refer to the Army SCORM 2004 3rd Edition Metadata appendix for details on implementing required Army metadata fields, such as default field value requirements.

### What happens if the rule is not followed?

Failure to follow Business Rule 1.2.2 causes metadata to be invalid according to formatting requirements. The result is a DL product that is incomplete, which means the Army will not accept the product when it is delivered.
How can I verify that this rule has been satisfied?

You should verify that all metadata files contained within the content package adhere to the guidelines presented in the Army SCORM 2004 3rd Edition Metadata appendix and that all elements are present within each metadata file.

5.2.3 General Best Practices

This section contains best practices for the general design of SCORM content that have broad applications and are not closely linked to specific business rules.

---

**Best Practice: Use Army-recommended Sequencing**

Use the Army-recommended sequencing for SCORM 2004 3rd Edition content packages. Sequencing includes logic like rollup rules that vary depending on the content type (assessment or non-assessment) and desired instructional strategy (single or multiple attempts).

**Best Practice: Assign Organization and SCO Titles in the Manifest**

Give the organization and each SCO correct titles in the manifest for a SCORM package. Avoid using default values such as “A001” which may confuse the learner.

This best practice is relates directly to Business Rule 1.1.2 for ensuring consistency in titles. A SCORM content package manifest has a title element for the organization element, and a title for each SCO within as well – the LMS will display all titles in a table of contents. Developers often overlook assigning organization titles in the manifest, especially when using authoring tools that assign default values, which can cause confusion to the learner. Figure 9 provides an example of setting consistent organization and SCO titles in a manifest.

```xml
<organizations default="CCC">
    <organization identifier="CCC" adlseq:objectivesGlobalToSystem="false">
        <title>Captains Career Course</title>
        <item identifier="CCCM01" identifierref="CCCM01_resources">
            <title>Captains Career Course Module 01</title>
        </item>
    </organization>
</organizations>
```

*Figure 9: Code sample for matching organization and SCO titles in a content package manifest*
6 Development

This section of the guide covers the requirements that pertain to the second phase of the DL creation process: Development. In this phase, it is assumed that the design decisions have been made and it is time to begin programming work.

What you will find in this section:

- Business rules and best practices for general programming requirements for Army DL products.
- Business rules and best practices for the general key functionality required in Army DL products.
- Business rules and best practices for using specific technologies such as SCORM 2004.

Content types addressed:

- All Army learning content
- SCORM content

The business rules in this section are themselves normative. Explanations of business rules, best practices, and examples are informative in nature.
6.1 All Learning Content

The information in this section pertains to the development of learning content for all IMI types.

6.1.1 General Programming

The information in this section pertains to general programming principles that are critical to all DL products regardless of IMI type.

---

**Business Rule 2.1.1: Allowable File Name Characters**

Files in Army learning content packages shall contain only the following allowable characters from the RFC 3986 unreserved character set:

- _ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c d e f g h i j k l m n o p q r s t u v w x y z 0 1 2 3 4 5 6 7 8 9

---

**Why is this business rule important?**

Business Rule 2.1.1 ensures that a standard file naming convention exists to enforce Army DL content interoperability, and that filenames do not contain any characters (such as special characters) that could cause problems related to the syntax for file paths on delivery platforms.

**What happens if the rule is not followed?**

Failure to follow Business Rule 2.1.1 creates a risk of content failing to operate correctly on its delivery platform due to unsupported syntax in file names.

**How can I verify that this rule has been satisfied?**

You should verify that each file you create and/or that is created by your DL authoring tool of choice only contains characters from the list presented in Business Rule 2.1.1 above.
Business Rule 2.1.2: Allowable Folder Name Characters

Folders in Army learning content packages shall contain only the following allowable characters from the RFC 3986 unreserved character set:

- _ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c d e f g h i j k l m n o p q r s t u v w x y z 0 1 2 3 4 5 6 7 8 9

Why is this business rule important?

Business Rule 2.1.2 ensures that a standard folder naming convention exists to enforce Army DL content interoperability, and that folders names do not contain any characters (such as special characters) that could cause problems related to the syntax for file paths on delivery platforms.

IMPORTANT: While Business Rules 2.1.1 and 2.1.2 may appear similar, Business Rule 2.1.2 differs in that the period character (".") allowed in file names is not allowed in folder names.

What happens if the rule is not followed?

Failure to follow Business Rule 2.1.2 creates a risk of content failing to operate correctly on its delivery platform due to unsupported syntax in path names created using folder names.

How can I verify that this rule has been satisfied?

You should verify that each folder you create and/or that is created by your DL authoring tool of choice only contains characters from the list presented in Business Rule 2.1.2 above.
Business Rule 2.1.3: External URI Encoding

External resource names that contain characters not in the allowable lists (see Business Rules 2.1.1 and 2.1.2) shall be referenced in Army learning content using a percent-encoded URL.

Why is this business rule important?

Business Rule 2.1.3 ensures that a standard convention exists for accessing external resources from learning content, and minimizes the risk of problems on delivery platforms regarding the syntax for file paths.

What happens if the rule is not followed?

Failure to follow Business Rule 2.1.3 creates a risk of content failing to operate correctly with regard to external resources it references due to unsupported syntax in path names.

How can I verify that this rule has been satisfied?

You should verify that any external URIs contained within the content package are properly percent-encoded where necessary so that the DL product operates properly. Ensure that any external links behave as expected during target platform testing, and use percent-encoding wherever the need arises in order to ensure proper function.

Business Rule 2.1.4: File Extension Separation

A single period character ("." ) shall be used to separate a file’s name from its extension.

Why is this business rule important?

Business Rule 2.1.4 ensures that a standard file naming convention exists for interoperability of Army DL content interoperability, and minimizes the risk of problems on delivery platforms regarding the syntax for file paths.

What happens if the rule is not followed?

Failure to follow Business Rule 2.1.4 creates a risk of content failing to operate correctly on its delivery platform due to incorrect syntax in file names.

How can I verify that this rule has been satisfied?

You should verify that each file you create and/or that is created by your DL authoring tool of choice only contains a single period character between the file name and its extension. Ensure that you are able to view file extensions on your operating system in order to verify this.
**Business Rule 2.1.5: Maximum File Path Length**

File paths in Army learning content packages shall not exceed 256 characters in length.

Why is this business rule important?

Business Rule 2.1.5 ensures that a standard file naming convention exists for interoperability of Army DL content interoperability, and minimizes the risk of problems on delivery platforms regarding the allowable length of file paths.

What happens if the rule is not followed?

Failure to follow Business Rule 2.1.5 creates a risk of content failing to operate correctly on its delivery platform as a result of file paths that exceed the length limit. A file path that exceeds the allowable length limit can result in the delivery platform not storing or serving the file.

How can I verify that this rule has been satisfied?

You should verify that each file and folder you create uses concise names that are no longer than needed in order to convey relevant information. For example, you might consider using a shorthand identifier for a lesson name instead of the full name when creating files and folders within the content package (e.g. a folder named “CCCM01” instead of “Captains_Career_Course_Module_01”).
**Business Rule 2.1.6: Browser Data Storage**

Learning content shall not store data using the web browser’s built-in methods such as cookies or Web Storage.

**Why is this business rule important?**

Business Rule 2.1.6 exists due to the fact that many learners in the Army learning environment use machines that have heightened security configurations that often include disabling built-in web browser data storage mechanisms such as cookies or Web Storage. Developers should make use of data storage capabilities in an approved technology like SCORM, depending on the IMI type for the content.

**What happens if the rule is not followed?**

Failure to follow Business Rule 2.1.6 creates a risk of content failing to operate correctly due to unsupported functionality, causing a detriment to the learner’s experience.

**How can I verify that this rule has been satisfied?**

You should verify that the implementation of your LCO does not include the use of any local storage technologies. You can ensure that Business Rule 2.1.6 has been satisfied by testing the LCO in a browser with caching, cookies, and other local storage options disabled and confirming proper operation.

---

**Business Rule 2.1.7: Server-side Technology**

Learning content shall not make use of any server-side technologies such as scripting or database implementations.

**Why is this business rule important?**

Business Rule 2.1.7 ensures that learning content does not make use of server-side technologies not endorsed for use on ALCMC delivery platforms for security reasons. Server-side technologies include use of languages such as Hypertext Preprocessor (PHP), relational database implementations, or servlets.

**What happens if the rule is not followed?**

Failure to follow Business Rule 2.1.7 means the Army will not accept a DL product due to security concerns.

**How can I verify that this rule has been satisfied?**

You should verify that the implementation of your LCO does not include the use of any server-side technologies by methods such as code analysis and design document review.
**Business Rule 2.1.8: Error-Free Code**

All code in learning content must not produce any file or script errors when executed in the web browser.

**Why is this business rule important?**

Business Rule 2.1.8 ensures that learning content has been created correctly and will not cause errors in the learner’s web browser when it is run.

**What happens if the rule is not followed?**

Failure to follow Business Rule 2.1.8 causes a DL product to be incomplete, which means the Army will not accept the product when it is delivered. Additionally, code errors can cause DL to function improperly or not at all, which may prevent the learner from experiencing content as intended.

**How can I verify that this rule has been satisfied?**

You should verify that your LCO runs without producing any file or script errors through standard debugging and quality assurance processes. You can verify whether Business Rule 2.1.8 has been satisfied by enabling your browser’s error-reporting functions when testing your LCO.
6.1.2 Required Behavior

The information in this section pertains to the functional behavior requirements for learning content regardless of IMI type.

---

**Business Rule 2.1.9: Bookmarking Requirement**

Non-assessment LCOs shall contain functionality to bookmark the learner’s progress whenever the learner exits the content.

---

**Why is this business rule important?**

Business Rule 2.1.9 ensures that the learner can experience content at their own pace with the ability to exit and return without loss of progress. Bookmarking is a necessity for long learning objects and sequences of learning objects where full completion can require multiple sittings.

**IMPORTANT:** Credit-producing assessment content is always exempt from the bookmarking requirement. The Army may provide standard exceptions to short non-assessment learning objects, such as introductions, or other LCOs as required.

---

**Best Practice: Bookmarking Prompt**

LCOs that contain bookmarking functionality should provide the learner with the option at reentry to resume their progress from the location bookmarked during the previous learning session.

---

**What happens if the rule is not followed?**

Failure to follow Business Rule 2.1.9 causes a DL product to be incomplete due to a missing critical item of functionality, which means the Army will not accept the product when it is delivered.

---

**How can I verify that this rule has been satisfied?**

You should verify that your LCO supports bookmarking. You can test this by running the LCO on the target delivery platform testing environment, exiting after making some progress, then reentering and verifying that your bookmarking functionality works as intended.

You may ignore Business Rule 2.1.9 in cases of credit-producing assessment content or where otherwise explicitly waived by the Army; be sure to note this in the corresponding comments field and provide an “N/A” rating for this rule when filling out the accompanying BRBP checklist.
**Business Rule 2.1.10: Assessment Data Obfuscation**

Credit-producing assessment learning content must obfuscate question and answer data so that the data is not in a plaintext format easily recognizable by the learner.

**Why is this business rule important?**

Business Rule 2.1.10 exists to mitigate the risk of the learner cheating by looking at assessment data contained in files using well-known methods such as the web browser’s developer tools. While it is impossible to prevent all cheating, ensuring that assessment data is not plainly visible to the most common methods of cheating in DL provides reasonable protection of the data.

**What happens if the rule is not followed?**

Failure to follow Business Rule 2.1.10 increases the risk of learners cheating by looking at the assessment data and reducing the effectiveness of the DL product.

**How can I verify that this rule has been satisfied?**

You should verify that question and answer data is not present in an easily readable format; ideally, this data would not be in plaintext. If the framework you are using requires plaintext question and answer data, then you should minify the data.

You may ignore Business Rule 2.1.10 if this is a non-scoring SCO; be sure to note this in the corresponding comments field and provide an “N/A” rating for this rule when filling out the accompanying BRBP checklist.
Business Rule 2.1.11: Consistent Exit Behavior

Learning content must record the learner’s progress consistently regardless of the method through which the learner exits the content.

Why is this business rule important?

Business Rule 2.1.11 exists to provide the learner with a consistent learning experience. There are typically multiple ways for the learner to exit a DL product, especially one that is web-based, and developers must ensure that each exit method (e.g., the browser’s “Exit” button or the content’s programmed “Exit” button) produces the same results for the learner.

What happens if the rule is not followed?

Failure to follow Business Rule 2.1.11 creates the risk of content failing to operate correctly in certain circumstances, including failure to bookmark or record the learner’s progress toward credit.

How can I verify that this rule has been satisfied?

You should verify that your LCO reports correct results and statuses in cases where the learner exits the content through the content’s programming as well as through the browser’s “Exit” button. You can test this by running the content on the target delivery platform testing environment and exiting the content via both methods.
Business Rule 2.1.12: Adobe Flash Restriction
Learning content must not use Adobe’s Flash technology at any point during runtime, nor include any Flash files in deliverables.

Why is this business rule important?
Business Rule 2.1.12 ensures that learning content remains available to the learner without reliance on the Adobe Flash technology which will become unsupported in web browsers by the end of 2020.

What happens if the rule is not followed?
Failure to follow Business Rule 2.1.12 creates the risk of content becoming unsupported in the learner’s computing environment as Adobe Flash is progressively restricted in both Windows and the web browser.

How can I verify that this rule has been satisfied?
You should verify that your LCO does not contain Adobe Flash content by ensuring there are zero files with the Flash file extensions shown in the table below.

<table>
<thead>
<tr>
<th>File Extension</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWF (*.swf)</td>
<td>Flash delivery file</td>
</tr>
<tr>
<td>FLV (*.flv)</td>
<td>Flash video file</td>
</tr>
<tr>
<td>FLA (*.fla)</td>
<td>Flash source file</td>
</tr>
<tr>
<td>SWT (*.swt)</td>
<td>Flash template file</td>
</tr>
<tr>
<td>SWC (*.swc)</td>
<td>Flash element file</td>
</tr>
</tbody>
</table>
6.1.3 General Best Practices

This section contains best practices for the general development of all learning content that have broad applications and are not closely linked to specific business rules.

**Best Practice: Address Usage of Internet Explorer Compatibility View**

Use the X-UA-Compatible header or a graceful degradation development strategy to handle the potential for some learners to have Internet Explorer’s Compatibility View active.

Since Internet Explorer (IE) 11 is the primary approved web browser for Army DL platforms, there is always the potential for some learners to have Compatibility View active for Army domains either through preexisting security configuration or their own actions. Compatibility View causes IE 11 to render content in what equates to IE 7’s document mode, meaning many modern features such as support of HTML5 will not be active. The two methods of handling Compatibility View are:

- Using the X-UA-Compatible header to instruct the browser to use the latest document mode on web pages that Compatibility View would negatively affect. See Figure 10 for how the X-UA-Compatible header is used in an HTML document.

- Adopt a graceful degradation strategy within content such that if features aren’t supported, a fallback option is substituted instead – this is most often done via programming.

```html
<!DOCTYPE html>
<html>
<head>
  <meta http-equiv="X-UA-Compatible" content="IE=edge">
  ...
  </head>
  ...
</html>
```

*Figure 10: Code sample for using X-UA-Compatible header to trigger the latest IE document mode*
Best Practice: Avoid Developing Content with Adobe Flash

Avoid developing content using Adobe Flash whenever possible due to its close end-of-support date in 2020, and instead use media and scripting functionality that is natively supported by web browsers.

Not only will support for the Adobe Flash Player in web browsers cease in 2020, the level of support will undergo a planned reduction in the years prior as well. This means that Flash Player support will eventually become opt-in and not be active by default across all web browsers. Due to the unknown potential effects of the technology’s end-of-life phase on security configurations, developers should avoid using Adobe Flash whenever possible to avoid DL content becoming unsupported in the near-future. Many of the features that Adobe Flash provides are natively supported by web browsers through technology such as HTML5.

Best Practice: Develop for Low-Bandwidth Learner Environments

Develop content so that it provides an adequate learning experience even in low-bandwidth environments.

Not all learners will have high-bandwidth connections due to reasons such as geographic location or hardware limitations. Developers should optimize all files used in DL content to ensure that they have the smallest possible file sizes while maintaining adequate fidelity, and employ strategies such as content chunking that avoid requiring the learner to load large sets of files all at once.
6.2 SCORM Content

The information in this section pertains to the development of SCORM content. Remember that the business rules in the previous section apply to this IMI type as well.

6.2.1 General Programming

The information in this section pertains to the requirements for general functionality of SCORM content.

Business Rule 2.2.1: Window Closure

Unless required by the LMS, SCORM 2004 3rd Edition learning content must not forcefully close the LMS player nor instruct the learner to close the LMS player using the browser exit button.

Why is this business rule important?

Business Rule 2.2.1 exists to prevent SCORM content from interrupting the active connection between itself and the LMS. The LMS loads SCORM content in its own player window, and if the window gets closed for any reason other than the automatic LMS actions that occur after attempt termination, both the storage and evaluation of data from the content can be negatively affected (e.g., the learner may not receive credit for completing a SCO).

**IMPORTANT:** Ensure that Business Rule 2.2.1 is followed for all ALMS SCORM content especially. The ALMS will always suspend an attempt on SCORM content wherein the player window was closed forcefully. Note that the “player window” is the browser window in which the LMS displays content when launched, often containing the table of contents.

Best Practice: Separate Content Window

Launch content in its own separate window from the LMS player to provide more control over the window behavior and reduce the risks associated with forceful window closure.

The LMS player window is a frameset that contains pages responsible for LMS tracking and other functionality. Issues caused by closing the LMS player window can be avoided by programming content to launch in a separate window from the LMS player window. It is common practice to have the entry point for content be a “launcher” page that will load in the LMS player window and then open a separate window containing the critical learning content.
**Best Practice: Avoid Top-Level Window Closure**

Avoid using methods that will result in a window being closed from the top level, such as `top.close()`. The `window.close()` method is acceptable, since its will not affect framesets and works without issue for separate content windows.

Because it is common for the LMS player window to contain framesets with pages that are not visible to the learner but perform critical LMS functions, closing the LMS player window can cause issues.

**What happens if the rule is not followed?**

Failure to follow Business Rule 2.2.1 creates the risk of either SCORM content or the learner closing the LMS player window and interrupting the sequence of behavior the LMS needs to perform while the window is active – this can cause issues with data tracking and completion credit.

**How can I verify that this rule has been satisfied?**

You should verify that you have followed all of the best practices outlined in this section when developing the SCO, then ensure during testing that exiting the content does not force the LMS player window to close. If an authoring tool was used during development, you may have to manually edit the content package files in order to ensure proper window closure if there are no appropriate configuration options available in the tool.
6.2.2 Content Aggregation

The information in this section pertains to the requirements that relate to the content aggregation model part of the SCORM 2004 3rd Edition specification, such as constructing the manifest for a content package to give the LMS handling instructions.

Business Rule 2.2.2: SCORM Manifest and Schemas

SCORM 2004 3rd Edition content packages must contain a manifest file (imsmanifest.xml) and all of the SCORM 2004 3rd Edition base and extension schemas in the root level of the package.

Why is this business rule important?

Business Rule 2.2.2 ensures that SCORM content packages are built to the SCORM 2004 3rd Edition specification. The inclusion of all schemas in the content package promotes interoperability by having all the reference documents contained within in the package rather than requiring external lookup which may fail.

What happens if the rule is not followed?

Failure to follow Business Rule 2.2.2 creates two risks: one being that a SCORM content package may not be valid to the SCORM 2004 3rd Edition specification, and the other being that a SCORM content package may not be able to be validated using the Army test tools due to a schema not being present in the package – either case means that the Army will not accept the content package when it is delivered.

How can I verify that this rule has been satisfied?

You should verify that imsmanifest.xml and all of the SCORM 2004 3rd Edition base and extension schemas are present in the root level of the content package. The ADL SCORM 2004 3rd Edition Conformance Test Suite will not produce passing results if the proper schema files are not present.
Business Rule 2.2.3: SCORM Content Package Files

All files that make up the content for a SCORM 2004 3rd Edition SCO must be contained within its content package and referenced in the imsmanifest.xml file.

Why is this business rule important?

Business Rule 2.2.3 ensures that SCORM content packages are built to the SCORM 2004 3rd Edition specification. The inclusion and reference to each file in the content package promotes interoperability. Additionally, the Army test tools specifically test for the presence of files in the packages and for references to all packaged files in the manifest.

What happens if the rule is not followed?

Failure to follow Business Rule 2.2.3 creates the risk of a SCORM content failing validation testing using the Army test tools. Failure to pass the test tools means the content package will not be accepted by the Army.

How can I verify that this rule has been satisfied?

You should verify that all files within the content package are referenced within the manifest, including all manifest, metadata, and schema files as outlined in Business Rule 2.2.2. The SCORM Resource Validator will not produce passing results if Business Rule 2.2.3 has not been followed.
Business Rule 2.2.4: SCORM Objectives Global to System

The adlseq:objectivesGlobalToSystem attribute of the organization element must be set to “false” in all Army SCORM 2004 3rd Edition content packages.

Why is this business rule important?

Business Rule 2.2.4 ensures that SCOs do not make their objective data available to the entire LMS. The default value for the organization adlseq:objectivesGlobalToSystem attribute is “true” and this rule requires must be explicitly set to false. See Figure 11 for an example of setting the adlseq:objectivesGlobalToSystem attribute to “false” in a content package’s manifest.

Setting adlseq:objectivesGlobalToSystem to “false” for the organization

```xml
<organizations default="CCC">
  <organization identifier="CCC" adlseq:objectivesGlobalToSystem="false">
    ...
  </organization>
</organizations>
```

Figure 11: Code sample for setting the adlseq:objectivesGlobalToSystem attribute to false

What happens if the rule is not followed?

Failure to follow Business Rule 2.2.4 creates the risk of objective data from a particular SCO overwriting or conflicting with objective data from another SCO. Giving robust unique identifiers to objectives is an often overlooked practice, meaning many SCOs have the same default objective names. Keeping objectives out of the global system scope reduces the risk of conflicts.

How can I verify that this rule has been satisfied?

You should verify that the adlseq:objectivesGlobalToSystem attribute is present within the organization element and set to “false” in any content package you create.
**Business Rule 2.2.5: Assessment Objective Satisfaction**

SCORM 2004 3rd Edition assessment SCOs shall include the imsss:primaryObjective element in the manifest and set the satisfiedByMeasure attribute of the element to “true”.

**Why is this business rule important?**

Business Rule 2.2.5 ensures content functionality by requiring SCORM 2004 3rd Edition assessment SCOs to explicitly state they require a minimum declared score, or measure, the learner must achieve to pass. See Figure 12 for an example of setting an item’s primary objective satisfiedByMeasure attribute to “true” in a content package’s manifest.

---

**Declaring a mastery score using the imsss:minNormalizedMeasure element**

```xml
<organizations default="CCC">
  <organization identifier="CCC" adlseq:objectivesGlobalToSystem="false">
    <title>Captains Career Course</title>
    <item identifier="CCCM01" identifierref="CCCM01_resources">
      <title>Captains Career Course Module 01 Exam</title>
      <imsss:sequencing>
        <imsss:controlMode choice="false" choiceExit="false" flow="true"/>
        <imsss:objectives>
          <imsss:primaryObjective satisfiedByMeasure="true" objectiveID="CCC_M01_EXAM">
            ...
          </imsss:primaryObjective>
        </imsss:objectives>
      </imsss:sequencing>
    </item>
  </organization>
</organizations>
```

*Figure 12: Code sample for setting the satisfiedByMeasure attribute of a primary objective*
Best Practice: Set a primary objective for each SCO

Set a primary objective for each SCO, whether the SCO is scoring or not, to increase interoperability. It is better to define an objective in the manifest than to rely on the LMS to automatically apply a default objective that the content has no control over.

Even when a SCO does not set or require a score, it is beneficial to assign a primary objective to it in the manifest for control purposes. Default objectives can cause issues if Business Rule 2.2.4 is not followed, since there will potentially be many globally-scoped objectives with the same conflicting default ID.

What happens if the rule is not followed?

Failure to follow Business Rule 2.2.5 prevents SCORM 2004 3rd Edition assessment SCOs from functioning as intended and creates the risk of the learner not receiving credit or receiving credit when they have not passed the assessment.

How can I verify that this rule has been satisfied?

If this is a scoring SCO, you should verify that the imsss:primaryObjective element is present in the manifest and that the satisfiedByMeasure attribute is set to “true”.

You may ignore Business Rule 2.2.5 in cases of non-scoring content or where otherwise explicitly waived by the Army; be sure to note this in the corresponding comments field and provide an “N/A” rating for this rule when filling out the accompanying BRBP checklist. Remember that you should still set a primary objective for each SCO as outlined in the best practices.
**Business Rule 2.2.6: Assessment Mastery Score Declaration**

SCORM 2004 3\textsuperscript{rd} Edition assessment SCOs shall include a \texttt{imsss:primaryObjective} element in the manifest and declare a mastery score using the \texttt{imsss:minNormalizedMeasure} element.

**Why is this business rule important?**

Business Rule 2.2.6 ensures content interoperability by requiring SCORM 2004 3\textsuperscript{rd} Edition assessment SCOs to explicitly state their required mastery scores. See Figure 13 for an example of declaring a mastery score for a primary objective using the \texttt{imsss:primaryObjective} element.

**Declaring a mastery score using the \texttt{imsss:minNormalizedMeasure} element**

```xml
<organizations default="CCC">
    <organization identifier="CCC" adlseq:objectivesGlobalToSystem="false">
        <title>Captains Career Course</title>
        <item identifier="CCCM01" identifierref="CCCM01_resources">
            <title>Captains Career Course Module 01 Exam</title>
            <imsss:sequencing>
                <imsss:controlMode choice="false" choiceExit="false" flow="true"/>
                <imsss:objectives>
                    <imsss:primaryObjective satisfiedByMeasure="true" objectiveID="CCC_M01_EXAM">
                        <imsss:minNormalizedMeasure>0.8</imsss:minNormalizedMeasure>
                    </imsss:primaryObjective>
                </imsss:objectives>
            </imsss:sequencing>
        </item>
    </organization>
</organizations>
```

**Figure 13: Code sample for declaring a mastery score within an item’s primary objective**

**IMPORTANT:** Remember that SCORM mastery scores are expressed as scaled values on a scale of 0.0 to 1.0 rather than a raw value of 0 to 100.

**What happens if the rule is not followed?**

Failure to follow Business Rule 2.2.6 reduces interoperability because SCORM assessment LCOs that do not have declared mastery scores must rely on manual configuration each time they are loaded on an LMS.
How can I verify that this rule has been satisfied?

If this is a scoring SCO, you should verify that the imsss:primaryObjective element is present, that the imsss:minNormalizedMeasure element exists within the imsss:primaryObjective element, and that a mastery score has been set within the imsss:minNormalizedMeasure element.

You may ignore Business Rule 2.2.6 in cases of non-scoring content or where otherwise explicitly waived by the Army; be sure to note this in the corresponding comments field and provide an “N/A” rating for this rule when filling out the accompanying BRBP checklist. Remember that you should still set a primary objective for each SCO as outlined in the best practices.

6.2.3 Run-Time Environment

The information in this section pertains to the requirements that relate to the run-time environment part of the SCORM 2004 3rd Edition specification, such as usage of the SCORM API within content.

Business Rule 2.2.7: SCORM Data Model

All SCORM 2004 3rd Edition SCOs must track learner performance using only the SCORM 2004 3rd Edition data model; assessment SCOs must use the Interactions data model element to record all learner performance.

Why is this business rule important?

Business Rule 2.2.7 ensures content interoperability by requiring SCORM 2004 3rd Edition content to track its data using the standard mechanism provided by the specification. Other methods of data storage are not permitted, per Business Rule 2.1.5.

What happens if the rule is not followed?

Failure to follow Business Rule 2.2.7 prevents content from being able to track its data consistently, which may prevent it from functioning as intended.

How can I verify that this rule has been satisfied?

You should verify that you have only used SCORM 2004 3rd Edition data model elements to track learner progress and performance. You should also verify that you have not implemented any local storage solutions per Business Rule 2.1.5.
Business Rule 2.2.8: SCORM Required API Calls for Assessments

Credit-producing assessment SCORM 2004 3rd Edition SCOs must at a minimum use the SCORM API as follows:

<table>
<thead>
<tr>
<th>Method Calls</th>
<th>Data Model Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call at least once:</td>
<td>Set a valid value at least once:</td>
</tr>
<tr>
<td>Initialize</td>
<td>cmi.exit</td>
</tr>
<tr>
<td>GetLastError</td>
<td>cmi.completion_status</td>
</tr>
<tr>
<td>Commit</td>
<td>cmi.scaled_score</td>
</tr>
<tr>
<td>Terminate</td>
<td>cmi.session_time</td>
</tr>
<tr>
<td></td>
<td>cmi.interactions.n.correct.response.n.pattern</td>
</tr>
<tr>
<td></td>
<td>cmi.interactions.n.learner_response</td>
</tr>
<tr>
<td></td>
<td>cmi.interactions.n.latency</td>
</tr>
<tr>
<td></td>
<td>cmi.interactions.n.timestamp</td>
</tr>
<tr>
<td></td>
<td>cmi.interactions.n.type</td>
</tr>
<tr>
<td></td>
<td>cmi.interactions.n.result</td>
</tr>
</tbody>
</table>

Why is this business rule important?

Business Rule 2.2.8 ensures that the minimum required run-time behavior for SCORM 2004 3rd Edition assessment SCOs is present when the learner attempts the content. The Army specifically tests for the method calls and data model elements outlined in this rule during validation and acceptance testing.

IMPORTANT: All items listed in Business Rule 2.2.8 must be present during run-time to prevent failure during Army validation and acceptance testing.

What happens if the rule is not followed?

Failure to follow Business Rule 2.2.8 causes content to fail Army validation and acceptance testing and puts the content at risk of not functioning as intended.

How can I verify that this rule has been satisfied?

If this is a scoring SCO, you should verify that each one of the above methods is called at least once and that each one of the above data model elements is set at least once during the course of normal operation of your LCO. The Army Multi Log Parser will not produce passing results if Business Rule 2.2.8 has not been followed.

You may ignore Business Rule 2.2.8 if this is a credit-producing non-scoring SCO, but you must follow Business Rule 2.2.9 instead; be sure to note this in the corresponding comments field and provide an “N/A” rating for this rule when filling out the accompanying BRBP checklist.
Business Rule 2.2.9: SCORM Required API Calls for Non-Assessments

Credit-producing non-assessment SCORM 2004 3rd Edition SCOs must at a minimum use the SCORM API as follows:

<table>
<thead>
<tr>
<th>Method Calls</th>
<th>Data Model Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call at least once:</td>
<td>Set valid value at least once:</td>
</tr>
<tr>
<td>Initialize</td>
<td>cmi.exit</td>
</tr>
<tr>
<td>Commit</td>
<td>cmi.success_status</td>
</tr>
<tr>
<td>Terminate</td>
<td>cmi.completion_status</td>
</tr>
<tr>
<td></td>
<td>cmi.location</td>
</tr>
<tr>
<td></td>
<td>cmi.session_time</td>
</tr>
</tbody>
</table>

Why is this business rule important?

Business Rule 2.2.9 ensures that the minimum required run-time behavior for SCORM 2004 3rd Edition non-assessment SCOs is present when the learner attempts the content. The Army tests specifically for the method calls and data model elements outlined in this rule during validation and acceptance testing.

**IMPORTANT:** All items listed in Business Rule 2.2.9 must be present during run-time to prevent failure during Army validation and acceptance testing.

What happens if the rule is not followed?

Failure to follow Business Rule 2.2.9 causes content to fail Army validation and acceptance testing and puts the content at risk of not functioning as intended.

How can I verify that this rule has been satisfied?

If this is a non-scoring SCO, you should verify that each one of the above methods is called at least once and that each one of the above data model elements is set at least once during the course of normal operation of your LCO. The Army Multi Log Parser will not produce passing results if Business Rule 2.2.9 has not been followed.

You may ignore Business Rule 2.2.9 if this is a credit-producing scoring SCO, but you must follow Business Rule 2.2.8 instead; be sure to note this in the corresponding comments field and provide an “N/A” rating for this rule when filling out the accompanying BRBP checklist.
Business Rule 2.2.10: SCORM Navigation Request

All SCORM 2004 3rd Edition SCOs must set an appropriate navigation request using the adl.nav.request data model element during run-time.

Why is this business rule important?

Business Rule 2.2.10 ensures content interoperability by requiring SCORM 2004 3rd Edition content to be explicit in what it needs the LMS to do. Not all LMSs will automatically perform actions like navigation requests or have navigation buttons present in the player, so developers must program SCORM 2004 3rd Edition content without assuming the delivery platform will provide functionality not specified in the content itself.

Best Practice: Set an appropriate navigation request

Assessment SCOs should always set a navigation request of “exit”. Non-assessment SCOs may set a value of “suspendAll” or “exit” depending on whether the learner has completed content or intends to resume progress later.

Set the navigation request shortly before the Terminate method for simplicity, especially when modifying 3rd party code.

Figure 14 contains sample code illustrating how a navigation request might be set based on the completion status at the time that the learner exits the content.

Setting a Navigation Request when Exiting a Non-Assessment SCO

```javascript
if(getValue("cmi.completion_status") == "completed")
    setValue("adl.nav.request", "exit");
else
    setValue("adl.nav.request", "suspendAll");
```

Figure 14: Code sample for setting a SCORM 2004 3rd Edition navigation request

IMPORTANT: Some DL authoring tools do not include navigation requests in published content. Be prepared to modify JavaScript code to set a navigation request.
What happens if the rule is not followed?

Failure to follow Business Rule 2.2.10 creates the risk of content not functioning as intended on an LMS with regard to how the system behaves after the learner finishes an attempt – this can prevent the learner from receiving credit for completion.

How can I verify that this rule has been satisfied?

You should verify that you have set the ad1.nav.request data model element in accordance with the best practice outlined in this section.
7 Testing

This section of the guide covers the requirements that pertain to the third phase of the DL creation process: Testing. In this phase, it is assumed that development has finished and the DL product is ready for validation testing to ensure it meets Army requirements.

**What you will find in this section:**

- Business rules and best practices for validation testing of DL products on ALCMC delivery platforms.
- Business rules and best practices for the use of Army DL testing tools.

**Content types addressed:**

- All Army learning content
- SCORM content

The business rules in this section are themselves normative. Explanations of business rules, best practices, and examples are informative in nature.
7.1 All Learning Content

The information in this section pertains to the testing of learning content for all IMI types.

7.1.1 Platform Testing

The information in this section pertains to the requirements for testing Army DL products on delivery platforms regardless of the IMI type.

---

**Business Rule 3.1.1: Target Platform Testing**

All LCOs must be tested on the target delivery platform testing environment with content configuration settings identical to the live version of the platform.

---

**Why is this business rule important?**

Business Rule 3.1.1 ensures that the performance of a DL product during testing by developers will match performance during Army testing and platform delivery. Developers must only test their LCOs on the target delivery platform using the same content configuration settings that would be applied to the live version. While there may exist third-party platforms for testing content, the results of testing on anything other than the target platform cannot be used as a substitute for the requirement.

**IMPORTANT:** Confer with the appropriate Army point of contact to confirm the configuration settings to use for testing content prior to commencing testing activities, or to request that content be set up for testing by the Army.

**What happens if the rule is not followed?**

Failure to follow Business Rule 3.1.1 creates the risk of a DL product not functioning as intended on the target delivery platform because the DL product was tested in an environment that does not match.

**How can I verify that this rule has been satisfied?**

You should verify that the LCO you are testing is configured on the target platform such that the settings match those of the live platform. Check with the appropriate POC(s) to confirm configuration settings.
Business Rule 3.1.2: Computer Configuration

All LCOs must be tested using a computer configuration (i.e., hardware, operating system, web browser) that at a minimum matches the Baseline Home Computer Configuration.

Why is this business rule important?

Business Rule 3.1.2 ensures that the performance of a DL product during testing by developers will match performance during Army testing and platform delivery. Developers must only test their LCOs using a setup that at a minimum matches the Baseline Home Computer Configuration that covers the majority of Army learners.

**IMPORTANT:** The Baseline Home Computer Configuration can be found on the TADLP website: https://www.atsc.army.mil/tadlp/implementation/config/home_computer.asp.

What happens if the rule is not followed?

Failure to follow Business Rule 3.1.2 creates the risk of a DL product not functioning as intended on the target delivery platform due to software-related deficiencies, such as issues with Internet Explorer’s Compatibility View, not found during testing.

How can I verify that this rule has been satisfied?

You should verify that the machine you are conducting target platform testing on has hardware specifications that either match or exceed those outlined in the Baseline Home Computer Configuration.
7.1.2 Army Testing Tools

The information in this section pertains to the requirements for testing Army DL products using conformance testing tools regardless of the IMI type.

---

**Business Rule 3.1.3: Conformance Testing Tools**

All LCOs must be validated with conformance testing tools and methods required by the Army for the specific IMI type.

**Why is this business rule important?**

Business Rule 3.1.3 ensures that a DL product meets Army requirements by requiring proof of content conformance using standardized testing tools and methods. Note that each IMI type will have a different set of requirements and test tools that the Army specifies.

**IMPORTANT:** Keep track of all log files and results produced during testing; they are required deliverables when it comes time to submit a DL product to the Army.

**What happens if the rule is not followed?**

Failure to follow Business Rule 3.1.3 means a DL product has not been validated for conformance and will not be accepted by the Army.

**How can I verify that this rule has been satisfied?**

You should verify that you have proof of proper functionality by providing the appropriate log files and testing results when you submit your LCO to the Army.
7.2 SCORM Content

7.2.1 Platform Testing

The information in this section pertains to the requirements for testing Army SCORM 2004 3rd Edition DL products on delivery platforms.

Business Rule 3.2.1: SCORM Strict Mode

All SCOs must be tested on the target delivery platform testing environment using strict conformance settings when available. Any configuration options that relax conformance shall not be active.

Why is this business rule important?

Business Rule 3.2.1 builds upon Business Rule 3.1.1 by requiring that the configuration options for SCORM 2004 3rd Edition content on an LMS match what the live version of the platform uses. SCORM 2004 3rd Edition content on Army LMSs such as the ALMS is not configured with any relaxed conformance settings for Army testing and platform delivery.

See the ALMS CTE Content Configuration appendix for a discussion of how this business rule applies on the ALMS.

What happens if the rule is not followed?

Failure to follow Business Rule 3.2.1 means a DL product has not been validated for conformance and will not be accepted by the Army.

How can I verify that this rule has been satisfied?

You should verify that you have properly configured your SCO on the target delivery platform during platform testing using the information available within this guide and/or by conferring with the appropriate Army POC(s).
7.2.2 Army Testing Tools

The information in this section pertains to the requirements for testing Army SCORM 2004 3rd Edition DL products using conformance testing tools regardless of the IMI type.

---

**Business Rule 3.2.2: SCORM Conformance Testing**

All SCORM 2004 3rd Edition content packages and SCOs must pass all tests performed by the ADL SCORM 2004 3rd Edition Conformance Test Suite’s Content Package Conformance Test.

---

**Why is this business rule important?**

Business Rule 3.2.2 builds upon Business Rule 3.1.2 to ensure that a SCORM 2004 3rd Edition DL product meets the SCORM 2004 3rd Edition specification requirements by requiring proof of content conformance using a standardized test. Passing results from all of the tests performed by the ADL test suite Content Package Conformance Test are required.

**IMPORTANT:** Keep track of all log files and results produced during testing; they are required deliverables when it comes time to submit a DL product to the Army.

For more information, see the Army SCORM Acceptance Criteria on the TADLP website: https://www.atsc.army.mil/tadlp/implementation/compliance/acceptance_criteria.asp

---

**What happens if the rule is not followed?**

Failure to follow Business Rule 3.2.2 means a DL product has not been validated for conformance and will not be accepted by the Army.

---

**How can I verify that this rule has been satisfied?**

You should verify that the ADL test suite produces fully-passing results with a positive conformance statement, and that the log files produced by the test suite are submitted alongside your SCO as proof of SCORM 2004 3rd Edition conformance.
Business Rule 3.2.3: Army Conformance Testing Tools

All SCORM 2004 3rd Edition content packages and SCOs must pass all tests performed by the SCORM Resource Validator.

Why is this business rule important?

Business Rule 3.2.3 builds upon Business Rule 3.1.2 to ensure that a SCORM 2004 3rd Edition DL product meets Army requirements by requiring proof of content conformance through an automated Army testing. Passing results from all of the tests performed by SCORM Resource Validator are required.

**IMPORTANT:** Keep track of all log files and results produced during testing; they are required deliverables when it comes time to submit a DL product to the Army.

For more information, see the Army SCORM Acceptance Criteria on the TADLP website: https://www.atsc.army.mil/tadlp/implementation/compliance/acceptance_criteria.asp

What happens if the rule is not followed?

Failure to follow Business Rule 3.2.2 means a DL product has not been validated for conformance and will not be accepted by the Army.

How can I verify that this rule has been satisfied?

You should verify that the SCORM Resource Validator produces fully-passing results, and that the log files produced by the application are submitted alongside your SCO as proof of Army SCORM 2004 3rd Edition conformance.
8 Delivery

This section of the guide covers the requirements that pertain to the final phase of the DL creation process: Delivery to the Army. In this phase, it is assumed that post-development testing has finished, the DL product has been validated for conformance to Army requirements, and the product is ready to be submitted.

What you will find in this section:

- Business rules and best practices for packaging formats that LCOs must follow.
- Business rules and best practices for deliverable items required by the Army.

Content types addressed:

- All Army learning content
- SCORM content

The business rules in this section are themselves normative. Explanations of business rules, best practices, and examples are informative in nature.
8.1 All Learning Content

The information in this section pertains to the delivery of learning content of all IMI types.

8.1.1 Packaging

The information in this section pertains to the requirements for deliverable items for Army DL products regardless of the IMI type.

Business Rule 4.1.1: Content Package Format

All LCOs must be contained in an approved content package format that the ALCMC delivery platform natively supports.

Why is this business rule important?

Business Rule 4.1.1 ensures content interoperability by requiring LCOs to use standard content packages that can be loaded onto a delivery platform for use by the learner. Each IMI type defines content format standards that include how modules of content must be packaged.

What happens if the rule is not followed?

Failure to follow Business Rule 4.1.1 creates the risk of an LCO not being supported by the delivery platform due to its packaging and, consequently, not accepted by the Army.

How can I verify that this rule has been satisfied?

You should verify that your LCO is delivered in the approved content package format that is natively supported by the target delivery platform.
8.1.2 Deliverable Items

The information in this section pertains to the requirements for deliverable items for Army DL products regardless of the IMI type.

Business Rule 4.1.2: Content Package Deliverables

All finalized LCOs and content packages that are consumable by the learner on an ALCMC delivery platform or computer must be delivered electronically to the Government.

Why is this business rule important?

Business Rule 4.1.2 ensures the finalized DL products are delivered to the Army in a format suitable for physical records keeping. Content package deliverables must be submitted electronically to the Government.

What happens if the rule is not followed?

Failure to follow Business Rule 4.1.2 means a DL delivery package is incomplete and will not be accepted by the Army.

How can I verify that this rule has been satisfied?

You should verify that your LCO has been delivered to the Army via electronic means. If you have not done this yet but have agreed to do so later, be sure to note this in the corresponding comments field and provide an “N” rating for this rule when filling out the accompanying BRBP checklist.
Business Rule 4.1.3: Source Material Deliverables

All final contract deliverables – such as LCOs, development source files, answer keys, and test logs – must be delivered to the Government on a DVD-ROM, and include any supporting software or tools.

Why is this business rule important?

Business Rule 4.1.3 ensures that all supporting materials for DL products are delivered to the Army so that changes to products can be made if necessary and that the Army has possession of all components of contracted work.

What happens if the rule is not followed?

Failure to follow Business Rule 4.1.3 means a DL delivery package is incomplete and will not be accepted by the Army.

How can I verify that this rule has been satisfied?

You should verify that all non-LCO deliverables as well as any additional software required to modify them are in the Army’s possession.
8.2 SCORM Content

The information in this section pertains to the requirements for delivery of Army SCORM 2004 3rd Edition DL products.

8.2.1 Packaging

The information in this section pertains to the requirements for deliverable items for Army SCORM 2004 3rd Edition DL products.

**Business Rule 4.2.1: SCORM Content Package Deliverables**

All SCOs for use by learners must be contained in a package interchange file (PIF) per the SCORM 2004 3rd Edition specification that the ALCMC delivery platform natively supports.

**Why is this business rule important?**

Business Rule 4.2.1 builds upon Business Rule 4.1.1 to ensure content interoperability by requiring SCOs to use the packaging format specified by the SCORM 2004 3rd Edition specification. While some delivery platforms may accept SCORM 2004 3rd Edition content in other formats, the Army requires PIFs for all SCORM 2004 3rd Edition content.

**What happens if the rule is not followed?**

Failure to follow Business Rule 4.2.1 creates the risk of SCOs not being supported by the delivery platform due to the packaging format, which prevents Army acceptance.

**How can I verify that this rule has been satisfied?**

You should verify that the SCO is delivered to the Army in PIF format.
8.2.2 Deliverable Items

The information in this section pertains to the requirements for deliverable items for Army SCORM 2004 3rd Edition DL products.

---

**Business Rule 4.2.2: SCORM Validation Deliverables**

All SCOs delivered to the Army must also be accompanied by proof of passing results from Army SCORM 2004 3rd Edition conformance testing tools.

---

**Why is this business rule important?**

Business Rule 4.2.2 ensures that proof of conformance testing is provided to the Army for all delivered SCORM 2004 3rd Edition content. Business Rule 3.2.2 lists the conformance testing tools from which output is required for delivery.

For more information, see the Army SCORM Acceptance Criteria on the TADLP website:

https://www.atsc.army.mil/tadlp/implementation/compliance/acceptance_criteria.asp

---

**What happens if the rule is not followed?**

Failure to follow Business Rule 4.2.2 means a DL product has no proof that it has been validated for conformance and will not be accepted by the Army.

---

**How can I verify that this rule has been satisfied?**

You should verify that you have delivered valid testing tool files and that they show passing results from each testing tool.
9 Appendices

This section of the guide contains various appendices that support the business rules.

**What you will find in this section:**

- The Army SCORM 2004 3rd Edition Metadata appendix
- The Army SCORM 2004 3rd Edition Programming for Instructional Strategies appendix
- The ALMS CTE SCORM 2004 3rd Edition Content Testing appendix
- The Addressing Common ALMS Content Issues appendix
9.1 Army SCORM 2004 3rd Edition Metadata

This appendix discusses implementation details for metadata that describes Army SCORM 2004 3rd Edition DL content. Where Business Rule 1.2.2 lists the required fields for metadata, the discussion here is about how the fields appear in an XML document, and the required values for specific fields.

Each resource (e.g. an organization or SCO) must be accompanied by metadata that describes the resource itself. There are six primary elements in which metadata fields and values exist: general, lifeCycle, metaMetadata, technical, rights, and classification. Figure 15 provides a condensed example of how each element appears in a metadata file. Note that there are multiple classification elements, and that each element contains multiple fields.

---

**Primary elements in a SCORM 2004 3rd Edition metadata file**

```xml
<?xml version="1.0"?>
<lom xmlns="http://ltsc.ieee.org/xsd/LOM"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://ltsc.ieee.org/xsd/LOM lomStrict.xsd">
<general>…</general>
<lifeCycle>…</lifeCycle>
<metaMetadata>…</metaMetadata>
<technical>…</technical>
<rights>…</rights>
<classification>…</classification>
</lom>
```

Figure 15: Code sample for primary elements in a SCORM 2004 3rd Edition metadata file
Table 1 lists all the fields in an Army SCORM 2004 3rd Edition metadata file, the path for each in the XML document, and the required value(s) where applicable. Use the table as a quick reference when creating metadata files for SCORM 2004 3rd Edition content. The subsections following this table provide a detailed discussion of each the metadata fields.

<table>
<thead>
<tr>
<th>Field</th>
<th>XML Paths</th>
<th>Required Value(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalog</td>
<td>general.identifier.catalog</td>
<td>ATIA</td>
</tr>
<tr>
<td>Entry</td>
<td>general.identifier.entry</td>
<td>TBD</td>
</tr>
<tr>
<td>Title</td>
<td>general.title</td>
<td></td>
</tr>
<tr>
<td>Language</td>
<td>general.language</td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>general.description</td>
<td></td>
</tr>
<tr>
<td>Keywords</td>
<td>general.keyword</td>
<td></td>
</tr>
<tr>
<td>Aggregation Level</td>
<td>general.aggregationLevel</td>
<td></td>
</tr>
<tr>
<td>Version</td>
<td>lifeCycle.version</td>
<td>1.0</td>
</tr>
<tr>
<td>Status</td>
<td>lifeCycle.status</td>
<td>final</td>
</tr>
<tr>
<td>ADLPA Role</td>
<td>lifeCycle.contribute.role</td>
<td>publisher</td>
</tr>
<tr>
<td>ADLPA Name, Address, Email</td>
<td>lifeCycle.contribute.entity</td>
<td></td>
</tr>
<tr>
<td>Date of Submission</td>
<td>lifeCycle.contribute.date</td>
<td></td>
</tr>
<tr>
<td>Metadata Catalog Identifier</td>
<td>metaMetadata.identifier.catalog</td>
<td>TBD</td>
</tr>
<tr>
<td>Metadata Entry Identifier</td>
<td>metaMetadata.identifier.entry</td>
<td>TBD</td>
</tr>
<tr>
<td>Metadata Specifications</td>
<td>metaMetadata.metadataSchema</td>
<td>LOMv1.0, SCORM_CAM_v1.3, ADLv1.0</td>
</tr>
<tr>
<td>Metadata Language</td>
<td>metaMetadata.language</td>
<td></td>
</tr>
<tr>
<td>File Formats</td>
<td>technical.format</td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>rights.cost</td>
<td>no</td>
</tr>
<tr>
<td>Copyright and Other Restrictions</td>
<td>rights.copyrightAndOtherRestrictions</td>
<td>no</td>
</tr>
<tr>
<td>MOS and Skill Level Classification</td>
<td>classification.purpose</td>
<td>discipline</td>
</tr>
<tr>
<td>Description</td>
<td>classification.description</td>
<td></td>
</tr>
<tr>
<td>Keyword</td>
<td>classification.keyword</td>
<td></td>
</tr>
<tr>
<td>SQI Classification</td>
<td>classification.purpose</td>
<td>discipline</td>
</tr>
<tr>
<td>Description</td>
<td>classification.description</td>
<td></td>
</tr>
<tr>
<td>Keyword</td>
<td>classification.keyword</td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td>Purpose</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
<td>------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>ASI Classification</td>
<td>classification.purpose</td>
<td>discipline</td>
</tr>
<tr>
<td>Task Numbers and Descriptions Classification</td>
<td>classification.purpose</td>
<td>educational objective</td>
</tr>
<tr>
<td>Learning Objectives (Action, Condition, Standard) Classification</td>
<td>classification.purpose</td>
<td>educational objective</td>
</tr>
<tr>
<td>508 Compliant Classification</td>
<td>classification.purpose</td>
<td>accessibility restrictions</td>
</tr>
<tr>
<td>Security Level (Foreign disclosure) Classification</td>
<td>classification.purpose</td>
<td>security level</td>
</tr>
<tr>
<td>ADL-R Requirement Classification</td>
<td>classification.purpose</td>
<td>collection</td>
</tr>
</tbody>
</table>
9.1.1 General Identifier Fields
This section discusses the identifier fields within the general element of the metadata document.

9.1.1.1 Catalog and Entry
The two general identifier fields, catalog and entry, are used by the Army for management purposes. Both fields together represent a mechanism for assigning a unique identifier to the item the metadata file describes. The required value for the catalog element is “ATIA” and the required value for the entry element is “TBD”. Figure 16 contains sample code showing how the two fields appear.

The catalog and entry fields in SCORM 2004 3rd Edition metadata

```xml
<general>
  <identifier>
    <catalog>ATIA</catalog>
    <entry>TBD</entry>
  </identifier>
  ...
</general>
```

Figure 16: Code sample for catalog and entry fields in SCORM 2004 3rd Edition metadata

9.1.2 General Fields
This section discusses the non-identifier fields within the general element of the metadata document.

9.1.2.1 Title
The title field describes the name of the resource the metadata is for. Note that the string sub-element that contains the text value for the title field, and that the title value must match the one in the manifest. Figure 17 contains sample code showing how the title field appears.

The title field in SCORM 2004 3rd Edition metadata

```xml
<general>
  ...
  <title>
    <string>Captains Career Course</string>
  </title>
  ...
</general>
```

Figure 17: Code sample for title field in SCORM 2004 3rd Edition metadata
9.1.2.2 Language

The language field describes the language for the content of the resource using two-letter language codes specified in ISO 639-1. Figure 18 contains sample code showing how the language field appears.

![The title field in SCORM 2004 3rd Edition metadata](image)

```
<general>
  ...
  <language>en</language>
  ...
</general>
```

Figure 18: Code sample for language field in SCORM 2004 3rd Edition metadata


9.1.2.3 Description

The description field contains a general description of the resource. Note that the string sub-element that contains the text value for the description field. Figure 19 contains sample code showing how the description field appears.

![The description field in SCORM 2004 3rd Edition metadata](image)

```
<general>
  ...
  <description>
    <string>Basic description of the Captains Career Course</string>
  </description>
  ...
</general>
```

Figure 19: Code sample for description field in SCORM 2004 3rd Edition metadata
9.1.2.4 Keyword

The keyword field contains a keyword or phrase that describes the resource. There can be multiple keywords for any given resource. Note that the string sub-element that contains the text value for the keyword field. Figure 20 contains sample code showing how the keyword field appears.

The keyword field in SCORM 2004 3rd Edition metadata

```xml
<general>
  ...
  <keyword><string>Captain</string></keyword>
  <keyword><string>Leadership skills</string></keyword>
  ...
</general>
```

Figure 20: Code sample for keyword field in SCORM 2004 3rd Edition metadata

9.1.2.5 Aggregation Level

The aggregation level field identifies the type of resource the metadata describes in the context of its granularity, such as whether the resource is a SCO or an organization. The aggregation level for Army SCORM 2004 3rd Edition content must be one of the two following levels:

- “2” indicating a SCO
- “3” indicating a cluster of SCOS
- “4” indicating an organization

Note the source sub-element value is always “LOMv1.0”, and the value sub-element that contains the numeric value for the aggregation level. Figure 21 contains sample code showing how the aggregation level field appears.

The aggregation level field in SCORM 2004 3rd Edition metadata

```xml
<general>
  ...
  <aggregationLevel>
    <source>LOMv1.0</source>
    <value>2</value>
  </aggregationLevel>
  ...
</general>
```

Figure 21: Code sample for aggregation level field in SCORM 2004 3rd Edition metadata
9.1.3 Lifecycle Fields
This section discusses the fields within the lifeCycle element of the metadata document.

9.1.3.1 Version
The version field contains the version or edition of the resource. The version field must always be “1.0” for the initial delivery. Note that the string sub-element that contains the text value for the version field. Figure 22 contains sample code showing how the version field appears.

```xml
<lifeCycle>
  ...
  <version>
    <string>1.0</string>
  </version>
  ...
</lifeCycle>
```

Figure 22: Code sample for version field in SCORM 2004 3rd Edition metadata

9.1.3.2 Status
The status field contains the submittal status for the resource. Note the source sub-element value is always “LOMv1.0”, and the value sub-element that contains the status value. The status value must always be “final” for delivery. Figure 23 contains sample code showing how the status field appears.

```xml
<lifeCycle>
  ...
  <status>
    <source>LOMv1.0</source>
    <value>final</value>
  </status>
  ...
</lifeCycle>
```

Figure 23: Code sample for status field in SCORM 2004 3rd Edition metadata
9.1.4 Lifecycle Contributor Fields

This section discusses the contributor fields within the `lifeCycle` element of the metadata document. Contributor fields are contained within a `contribute` sub-element.

9.1.4.1 ADLPA Role

The `role` field describes the role of the ADLPA; the field has a required value of “publisher”. Note the `source` sub-element value is always “LOMv1.0”, and the `value` sub-element contains the role value. Figure 24 contains sample code showing how the `role` field appears.

```
<lifeCycle>
  <contribute>
    <role>
      <source>LOMv1.0</source>
      <value>publisher</value>
    </role>
  </contribute>
</lifeCycle>
```

Figure 24: Code sample for role field in SCORM 2004 3rd Edition metadata
9.1.4.2 ADLPA Name, Address, and Email

The entity field contains the name, address, and contact information of the ADLPA in vCard format per RFC 6350. The field value must contain the full name, address, school code, and e-mail of the ADLPA. Figure 25 contains sample code showing how the entity field appears.

The entity field in SCORM 2004 3rd Edition metadata

```xml
<lifeCycle>
  <contribute>
    ...
    <entity>
      BEGIN:VCARD VERSION:2.1
      N:U.S. Army Infantry School
      ORG:U.S. Army;Army Infantry School;Fort Benning
      NOTE:071 ADR;DOM;
      WORK:Suite 650;6751 Constitution Loop;Fort Benning,GA;31905-4502;U.S.
      EMAIL:INTERNET:soldierinfo@benning.army.mil END:VCARD
    </entity>
  </contribute>
</lifeCycle>
```

Figure 25: Code sample for entity field in SCORM 2004 3rd Edition metadata


9.1.4.3 Date of Submittal

The date field contains the date of approved submission of the resource in YYYY-MM-DD format. Note the datetime sub-element that contains the field value. Figure 26 contains sample code showing how the date field appears.

The date field in SCORM 2004 3rd Edition metadata

```xml
<lifeCycle>
  <contribute>
    ...
    <date>
      <datetime>2004-07-10</datetime>
    </date>
  </contribute>
</lifeCycle>
```

Figure 26: Code sample for date field in SCORM 2004 3rd Edition metadata
9.1.5 Meta-Metadata Identifier Fields
This section discusses the identifier fields within the metaMetadata element of the metadata document.

9.1.5.1 Catalog and Entry
The two meta-metadata identifier fields, catalog and entry, are used by the Army for content management purposes. Both fields together represent a mechanism for assigning a unique identifier for the item the metadata file describes. The required value for both elements is “TBD”. Figure 27 contains sample code showing how the meta-metadata identifier fields appear.

```
<identifier>
  <catalog>TBD</catalog>
  <entry>TBD</entry>
</identifier>
```

Figure 27: Code sample for the meta-metadata catalog and entry fields in SCORM 2004 3rd Edition metadata

9.1.6 Meta-Metadata Fields
This section discusses the non-identifier fields within the metaMetadata element of the metadata document.

9.1.6.1 Schema
The metadataSchema field identifies the name and version of a specification schema to which the metadata document abides. The Army requires three metadataSchema elements with the following values:

- “LOMv1.0”
- “SCORM_CAM_v1.3”
- “ADLv1.0”

Figure 28 contains sample code showing how the metadataSchema field appears.
The metadataSchema field in SCORM 2004 3rd Edition metadata

```xml
<metaMetadata>
    ...
    <metadataSchema>LOMv1.0</metadataSchema>
    <metadataSchema>SCORM_CAM_v1.3</metadataSchema>
    <metadataSchema>ADLv1.0</metadataSchema>
    ...
</metaMetadata>
```

Figure 28: Code sample for metadataSchema field in SCORM 2004 3rd Edition metadata

9.1.6.2 Language

The meta-metadata language field describes the language for the content of the resource using ISO 639-1 two letter language codes. Figure 29 contains sample code showing how the language field appears.

```xml
<metaMetadata>
    ...
    <language>en</language>
    ...
</metaMetadata>
```

Figure 29: Code sample for meta-metadata language field in SCORM 2004 3rd Edition metadata

9.1.7 Technical Fields
This section discusses the fields within the technical element of the metadata document.

9.1.7.1 Format
The format field identifies all the technical data types included within the resource the metadata describes using Multipurpose Internet Mail Extensions (MIME) types. Note that one format sub-element is required for each discrete data type. Figure 30 contains sample code showing how the format field appears.

```
<technical>
  ...
  <format>text/html</format>
  <format>image/jpeg</format>
  <format>video/mp4</format>
  ...
</technical>
```

Figure 30: Code sample for format field in SCORM 2004 3rd Edition metadata

9.1.8 Rights Fields
This section discusses the fields within the rights element of the metadata document.

9.1.8.1 Cost
The cost field indicates whether use of the resource the metadata describes requires payment. Note the source sub-element value is always “LOMv1.0”, and the value sub-element that contains the role value. The Army requires the value for the field to be “no”. Figure 31 contains sample code showing how the cost field appears.

```
<rights>
  <cost>
    <source>LOMv1.0</source>
    <value>no</value>
  </cost>
  ...
</rights>
```

Figure 31: Code sample for cost field in SCORM 2004 3rd Edition metadata
9.1.8.2 **Copyright and Other Restrictions**

The `copyrightAndOtherRestrictions` field indicates whether copyright or other restrictions apply to the use of the resource the metadata describes. Note the `source` sub-element value is always “LOMv1.0”, and the `value` sub-element that contains the role value. The Army requires the value for the field to be “no”. Figure 32 contains sample code showing how the `copyrightAndOtherRestrictions` field appears.

---

**The `copyrightAndOtherRestrictions` field in SCORM 2004 3rd Edition metadata**

```xml
<rights>
  <copyrightAndOtherRestrictions>
    <source>LOMv1.0</source>
    <value>no</value>
  </copyrightAndOtherRestrictions>
  ...
</rights>
```

**Figure 32: Code sample for `copyrightAndOtherRestrictions` field in SCORM 2004 3rd Edition metadata**

---

9.1.9 **Classification Types and Fields**

This section discusses the fields within the `classification` element of the metadata document. The Army requires a `classification` element for each of the following classifications:

- Military Occupation Speciality (MOS) and Skill Level
- Special Qualification Identifier (SQI; if learning content is classified with SQI)
- Additional Skill Identifier (ASI; if learning content is classified with ASI)
- Tasks
- Learning Objectives
- Section 508 Compliance
- Foreign Disclosure
- ADL Registry (if applicable)

**IMPORTANT:** Army DL metadata must contain at least five classification elements: MOS and Skill Level, Tasks, Learning Objective, Section 508 Compliance and Foreign Disclosure; the other fields are used only when applicable per direction of the ADLPA.
9.1.9.1 Purpose, Description, and Keyword

Each classification has the same three fields: purpose, description, and keyword. The values for each field will change depending on the type of classification. Note the source sub-element in the purpose field, which always has a value of “LOMv1.0”, and the value sub-element that contains the role value. For the description, and keyword fields, note the string sub-element that contains the value. Figure 33 contains sample code showing the purpose, description, and keyword fields using the ASI classification as an example.

Example ASI classification in SCORM 2004 3rd Edition metadata

```xml
<classification>
  <purpose>
    <source>LOMv1.0</source>
    <value>discipline</value>
  </purpose>
  <description>
    <string>Q6 Long Range Surveillance Leader</string>
  </description>
  <keyword>
    <string>Long Range Surveillance Leader</string>
  </keyword>
</classification>
```

Figure 33: Code sample for ASI classification in SCORM 2004 3rd Edition metadata
9.1.9.2 MOS and Skill Level

The MOS and Skill Level classification element requires a purpose field value of “discipline” and a textual description and keyword(s) of the MOS for the resource the metadata describes. Figure 34 contains sample code showing how the MOS and Skill Level classification element appears.

```
<classification>
  <purpose>
    <source>LOMv1.0</source>
    <value>discipline</value>
  </purpose>
  <description>
    <string>11C2 Indirect Fire Infantryman</string>
  </description>
  <keyword>
    <string>Indirect Fire Infantryman</string>
  </keyword>
</classification>
```

Figure 34: Code sample for MOS and Skill Level classification in SCORM 2004 3rd Edition metadata

9.1.9.3 SQI

The SQI classification element requires a purpose field value of “discipline” and a textual description and keyword(s) of the SQI for the resource the metadata describes. Figure 35 contains sample code showing how the SQI classification element appears.

```
<classification>
  <purpose>
    <source>LOMv1.0</source>
    <value>discipline</value>
  </purpose>
  <description>
    <string>E Mountaineer</string>
  </description>
  <keyword>
    <string>Mountaineer</string>
  </keyword>
</classification>
```

Figure 35: Code sample for SQI classification in SCORM 2004 3rd Edition metadata
9.1.9.4 ASI

The ASI classification element requires a purpose field value of “discipline” and a textual descriptions and keyword(s) of the ASI for the resource the metadata describes. Figure 36 contains sample code showing how the ASI classification element appears.

ASI classification in SCORM 2004 3rd Edition metadata

```xml
<classification>
  <purpose>
    <source>LOMv1.0</source>
    <value>discipline</value>
  </purpose>
  <description>
    <string>Q6 Long Range Surveillance Leader</string>
  </description>
  <keyword>
    <string>Long Range Surveillance Leader</string>
  </keyword>
</classification>
```

Figure 36: Code sample for ASI classification in SCORM 2004 3rd Edition metadata
9.1.9.5 Tasks

The Tasks classification element requires a purpose field value of “educational objective” and a textual descriptions and keyword(s) of the critical tasks for the resource the metadata describes. Figure 37 contains sample code showing how the Tasks classification element appears.

```xml
<classification>
  <purpose>
    <source>LOMv1.0</source>
    <value>educational objective</value>
  </purpose>
  <description>
    <string>071-312-3003 Lay An M60 Machine Gun Using Field Expedients; 071-312-3007 Prepare A Range Card For An M60 Machine gun; 071-312-3025 Main An M60 Machine Gun</string>
  </description>
  <keyword>
    <string>Range Card</string>
  </keyword>
</classification>
```

Figure 37: Code sample for Tasks classification in SCORM 2004 3rd Edition metadata
9.1.9.6 Learning Objectives

The Learning Objectives classification element requires a purpose field value of “educational objective” and a textual descriptions and keyword(s) of the Action, Condition, and Standard for the resource the metadata describes. Figure 38 contains sample code showing how the Learning Objectives classification element appears.

### Learning Objectives classification in SCORM 2004 3rd Edition metadata

```
<classification>
  <purpose>
    <source>LOMv1.0</source>
    <value>educational objective</value>
  </purpose>
  <description>
    <string>Action: Lay An M60 Machine gun Using Field Expedients; Condition: Given Interactive Multimedia Instruction; Standard: The Standards are met when the learner has completed the IMI lesson and achieved a passing score on a separately administered test.</string>
  </description>
  <keyword>
    <string>M60 Machine Gun using Field Expedients</string>
  </keyword>
</classification>
```

*Figure 38: Code sample for Learning Objectives classification in SCORM 2004 3rd Edition metadata*
9.1.9.7 Section 508 Compliance

The Section 508 Compliance classification element requires a purpose field value of “accessibility restrictions”. The description field requires a value of either “508 Compliant” or “Not 508 Compliant”. The keyword field requires a value of either “508” or “Not 508”. Figure 39 contains sample code showing how the Section 508 Compliance classification element appears.

```xml
<classification>
  <purpose>
    <source>LOMv1.0</source>
    <value>accessibility restrictions</value>
  </purpose>
  <description>
    <string>508 Compliant</string>
  </description>
  <keyword>
    <string>508</string>
  </keyword>
</classification>
```

Figure 39: Code sample for Section 508 Compliance classification in SCORM 2004 3rd Edition metadata
9.1.9.8 Foreign Disclosure

The Foreign Disclosure classification element requires a purpose field value of “security level”. The description and keyword fields each require a value of the Foreign Disclosure statement in three character format (e.g. FD1). Figure 40 contains sample code showing how the Foreign Disclosure classification element appears.

```
Foreign Disclosure classification  in SCORM 2004 3rd Edition metadata
<classification>
  <purpose>
    <source>LOMv1.0</source>
    <value>security level</value>
  </purpose>
  <description>
    <string>FD1</string>
  </description>
  <keyword>
    <string>FD1</string>
  </keyword>
</classification>
```

Figure 40: Code sample for Foreign Disclosure classification in SCORM 2004 3rd Edition metadata

9.1.9.9 ADL Registry

The ADL Registry classification element requires a purpose field value of “collection” and a textual description and keyword(s) for the taxonomy of the content the metadata describes. Figure 41 contains sample code showing how the ADL Registry classification element appears.

```
ADL Registry classification  in SCORM 2004 3rd Edition metadata
<classification>
  <purpose>
    <source>LOMv1.0</source>
    <value>collection</value>
  </purpose>
  <description>
    <string>ADL/DOD Content Taxonomy Category</string>
  </description>
  <keyword>
    <string>DOD</string>
  </keyword>
</classification>
```

Figure 41: Code sample for ADL Registry classification in SCORM 2004 3rd Edition metadata

This appendix discusses the Army-recommended sequencing for SCORM 2004 3rd Edition DL products mentioned in the SCORM content design General Best Practices section.

9.2.1 Instructional Strategies

The Army employs three instructional strategies for SCORM 2004 3rd Edition DL products:

- **Unlimited Attempts**: Content that is designed to allow the learner as many attempts as necessary to achieve mastery uses the unlimited attempts instructional strategy. The content is programmed to make a final evaluation of the learner’s progress only when the learner successfully completes the content.

- **Single Attempt**: Content that is designed to allow the learner a single attempt uses the single attempt instructional strategy. The content is programmed to make a final evaluation of the learner’s progress regardless of their performance in the single attempt.

- **Multiple Limited Attempts**: Content that is designed to allow the learner only a specific number of attempts uses the multiple limited attempts instructional strategy. The content is programmed similarly to the unlimited attempts instruction strategy, with an attempt limit placed on the content using LMS configuration settings.

9.2.2 SCORM Components of an Instructional Strategy

There are two components of each instructional strategy that can be applied to SCORM 2004 3rd Edition content:

- **Manifest sequencing**: The usage of SCORM 2004 3rd Edition sequencing elements on both SCOs and their organizations within the manifest for a content package. Manifest sequencing instructs the LMS on how to handle evaluation of data after the learner’s attempt on content is finished.

- **SCORM API programming**: The usage of the SCORM 2004 3rd Edition API within a SCO’s content. SCORM API programming functions together with the sequencing in the manifest to provide a desired outcome with regard to how the LMS evaluates the learner’s attempts.

**IMPORTANT**: Remember that assessment and non-assessment content can require different implementations of each instructional strategy. The sub-section for each instructional strategy discusses the differences for both content types where necessary.
9.2.3 Unlimited Attempts Instructional Strategy

This section discusses how to implement the unlimited attempts instructional strategy for assessment and non-assessment SCORM 2004 3rd Edition content.

9.2.3.1 Assessment Content

Assessments with unlimited attempts use three rollup rules in the manifest and specific values for four data model elements in SCOs. Figure 42 illustrates the manifest and SCO API components for unlimited attempts assessment content.

Figure 42: Manifest sequencing and SCO API activity for unlimited attempts instructional strategy on assessment content
### 9.2.3.1.1 Organization Rollup Rules

The unlimited attempts instructional strategy for assessments uses three rollup rules in the organization sequencing to ensure performance. The three rollup rules used for the strategy are:

- **If all children are satisfied, send “completed”**
  
  When the learner exits the SCO after a successful attempt, tell the LMS that the learning content overall has a completion status of “completed”, so the system can evaluate the learning assignment.

- **If all children are satisfied, send “satisfied”**
  
  When the learner exits the SCO after a successful attempt, tell the LMS that the learning content overall has a satisfaction status (analogous with success status) of “satisfied”, so the learner can receive credit for the learning assignment upon evaluation.

- **If any children are not satisfied, send “incomplete”**
  
  When the learner exits the SCO after a failing attempt, tell the LMS that the learning content has an overall completion status of “incomplete”, so the system will not evaluate the learning assignment.

**IMPORTANT:** The rollup rule, *if any children are not satisfied, send “incomplete”* is critical to enabling the unlimited attempts instructional strategy. The overall completion status of “incomplete” works with specific values in the SCO API activity to ensure that the LMS does not evaluate the learning assignment on failed attempts, but retains data for the attempt.
Figure 43 contains an example of the markup required to add rollup rules to the organization sequencing for an unlimited attempts instructional strategy.

```
<organization>
  ...
  <item>...</item>
  <imsss:sequencing>
    <imsss:rollupRules>
      <imsss:rollupRule childActivitySet="all">
        <imsss:rollupConditions conditionCombination="all">
          <imsss:rollupCondition condition="satisfied"/>
        </imsss:rollupConditions>
        <imsss:rollupAction action="satisfied"/>
      </imsss:rollupRule>
      <imsss:rollupRule childActivitySet="all">
        <imsss:rollupConditions conditionCombination="all">
          <imsss:rollupCondition condition="satisfied"/>
        </imsss:rollupConditions>
        <imsss:rollupAction action="completed"/>
      </imsss:rollupRule>
      <imsss:rollupRule childActivitySet="any">
        <imsss:rollupConditions conditionCombination="any">
          <imsss:rollupCondition operator="not" condition="satisfied"/>
        </imsss:rollupConditions>
        <imsss:rollupAction action="incomplete"/>
      </imsss:rollupRule>
    </imsss:rollupRules>
  </imsss:sequencing>
</organization>
```

Figure 43: Code sample for organization rollup rules using the unlimited attempts instructional strategy
9.2.3.1.2 SCO Primary Objective

Per Business Rule 2.2.6, assessment SCOs must have a primary objective with a minimum normalized measure for the required mastery score. Figure 44 contains an example of the markup required to add a primary objective that includes a minimum passing score for a SCO in the manifest.

Primary objective for an assessment SCO using the unlimited attempts instructional strategy

```xml
<brn item identifier="SCO-ID" identifierref="SCO-RES" isvisible="true">
  <title>SCO Title</title>
  <imss:sequencing>
    <imss:objectives>
      <imss:primaryObjective satisfiedByMeasure="true" objectiveID="scoObj">
        <imss:minNormalizedMeasure>0.8</imss:minNormalizedMeasure>
      </imss:primaryObjective>
    </imss:objectives>
  </imss:sequencing>
</item>
```

Figure 44: Code sample for primary objective in an assessment SCO using the unlimited attempts instructional strategy
9.2.3.1.3 SCO API Activity

The unlimited attempts instructional strategy for assessments sets four specific SCORM 2004 3rd Edition data model elements within the SCO to ensure rollup performance. The four data model elements and their values for the unlimited attempts strategy are:

- **Set cmi.completion_status to “completed”**
  
The completion status of the SCO factors into rollup at the organization level. For assessments, the SCO should send a completion status value of “completed” when the learner completes the content, regardless of performance.

- **Set cmi.success_status to “passed” or “failed”**
  
The success status of the SCO factors into rollup for the organization level. As seen in the previous section, a value of “passed” (“satisfied” in the manifest sequencing) triggers the corresponding two rollup rules in the organization sequencing. The SCO should send a success status of either “passed” or “failed” based on the learner’s scaled score.

- **Set cmi.exit to “normal”**
  
The value for the cmi.exit data model element tells the LMS how to handle data for an attempt when the learner exits the SCO. A cmi.exit value of “normal” tells the LMS to finalize the data for a particular attempt and to begin a new data set if the learner launches the SCO again. An assessment SCO should send a cmi.exit value of “normal” when the learner ends their attempt, regardless of learner performance.

- **Set adl.nav.request to “exit”**
  
The navigation request affects the sequencing actions the LMS will apply to the SCO and its organization when the learner exits a SCO. A navigation request value of “exit” tells the LMS to exit the SCO in the system’s logical sequencing, which triggers an evaluation of the content tree with elements such as rollup rules.
9.2.3.2 Non-Assessment Content

Non-assessment content with unlimited attempts uses the same three rollup rules in the manifest as unlimited attempts assessments, but potentially different values for the four data model elements in SCOs. Figure 45 illustrates the manifest and SCO API components for unlimited attempts non-assessment content.

Figure 45: Manifest sequencing and SCO API activity for unlimited attempts instructional strategy on non-assessment content
9.2.3.2.1 Organization Rollup Rules

The unlimited attempts instructional strategy for non-assessment content uses the same three rollup rules in the organization sequencing that apply to assessments. Again, the three rollup rules used for the unlimited attempt strategy are:

- **If all children are satisfied, send “completed”**
  
  When the learner exits the SCO after a successful attempt, tell the LMS that the learning content overall has a completion status of “completed”, so the system can evaluate the learning assignment.

- **If all children are satisfied, send “satisfied”**
  
  When the learner exits the SCO after a successful attempt, tell the LMS that the learning content overall has a satisfaction status (analogous with success status) of “satisfied”, so the learner can receive credit for the learning assignment upon evaluation.

- **If any children are not satisfied, send “incomplete”**
  
  When the learner exits the SCO after a failing attempt, tell the LMS that the learning content has an overall completion status of “incomplete”, so the system will not evaluate the learning assignment.

9.2.3.2.2 SCO Primary Objective

Recall the best practice of assigning a primary objective for any SCO applies to all SCOs regardless of whether they are scoring or not. The difference between the two for the primary objective is that assessment SCOs are required to have a minimum normalized measure. Figure 46 contains an example of the markup required to add a primary objective to a non-assessment SCO.

```
<item identifier="SCO-ID" identifierref="SCO-RES" isvisible="true">
  <title>SCO Title</title>
  <imsss:sequencing>
    <imsss:objectives>
      <imsss:primaryObjective satisfiedByMeasure="false" objectiveID="scoObj" />
    </imsss:objectives>
  </imsss:sequencing>
</item>
```

Figure 46: Code sample for primary objective in a non-assessment SCO using the unlimited attempts instructional strategy
9.2.3.2.3 SCO API Activity

The unlimited attempts instructional strategy for non-assessment content sets the four SCORM 2004 3rd Edition data model elements found in the assessment strategy, but different potential values. The four data model elements and their values for the non-assessment content unlimited attempts strategy are:

- **Set cmi.completion_status to “completed” or “incomplete”**
  
  Non-assessment content should send a completion status value of “completed” if the learner completes the content. If the learner has not yet completed content, a value of “incomplete” will work with the organization rollup rules to prevent the LMS from evaluating attempts until the learner completes the content.

- **Set cmi.success_status to “passed” or “unknown”**
  
  A non-assessment SCO should send a success status value of “passed” when the learner completes the content. Although a non-assessment SCO will likely not have a score attached, it is still best practice to assign a success status with completion status for non-assessment content. It is also best practice to set success status to “unknown” as an initial value at the beginning of an assessment.

- **Set cmi.exit to “normal” or “suspend”**
  
  The value for the cmi.exit data model element depends on the intent of content developers as to whether learners should be able to review non-assessment content or not. When the design allows learners to review completed content, the content sends a cmi.exit value of “suspend” to tell the LMS to hold on to the attempt data. A cmi.exit value of “normal” will tell the LMS to create a new attempt data set if the learner launches the SCO again.

- **Set adl.nav.request to “exit” or “suspendAll”**
  
  When the design for non-assessment content allows for the learner to retain their attempt if it is not yet complete, the content sets a “suspendAll” navigation request to tell the LMS to retain the attempt and its data. Suspending the attempt allows the learner to complete the content over multiple sittings using content functionality such as bookmarking. When the learner completes the SCO, the content should send a navigation request value of “exit” to tell the LMS to evaluate the attempt and grant credit to the learner.
9.2.4 Single Attempt Instructional Strategy

This section discusses how to implement the single attempt instructional strategy for assessment and non-assessment SCORM 2004 3rd Edition content.

9.2.4.1 Assessment and Non-Assessment Content

The single attempt instructional strategy enforces a limit of one attempt on content. The single attempt instructional strategy best practices apply equally to assessment and non-assessment content. Figure 47 illustrates the manifest and SCO API components for the single attempt instructional strategy.

![Diagram](image-url)

Figure 47: Manifest sequencing and SCO API activity for single attempt instructional strategy on all content
9.2.4.1.1 Organization Rollup Rules

The single attempt instructional strategy uses two rollup rules in the organization sequencing to ensure rollup performance. The two rollup rules used for the strategy are:

- **If all children are satisfied, send “completed”**
  
  When the learner exits the SCO after a successful attempt, tell the LMS that the learning content overall has a completion status of “completed”, so the system can evaluate the learning assignment.

- **If all children are satisfied, send “satisfied”**
  
  When the learner exits the SCO after a successful attempt, tell the LMS that the learning content overall has a satisfaction status (analogous with success status) of “satisfied”, so the learner can receive credit for the learning assignment upon evaluation.

Note the absence of the rollup rule that communicates a completion status of “incomplete” on failed attempts; the intent of the single attempt strategy is that the LMS evaluates the attempt regardless of learner performance.
Figure 48 contains an example of the markup required to add rollup rules to the organization sequencing for the single attempts instructional strategy.

**Organization rollup rules for the single attempt instructional strategy**

```xml
<organization>
    ...
    <item>...</item>
    <imss:sequencing>
        <imss:rollupRules>
            <imss:rollupRule childActivitySet="all">
                <imss:rollupConditions conditionCombination="all">
                    <imss:rollupCondition condition="satisfied"/>
                </imss:rollupConditions>
                <imss:rollupAction action="satisfied"/>
            </imss:rollupRule>
            <imss:rollupRule childActivitySet="all">
                <imss:rollupConditions conditionCombination="all">
                    <imss:rollupCondition condition="satisfied"/>
                </imss:rollupConditions>
                <imss:rollupAction action="completed"/>
            </imss:rollupRule>
        </imss:rollupRules>
    </imss:sequencing>
</organization>
```

Figure 48: Code sample for organization rollup rules using the single attempt instructional strategy
9.2.4.1.2 SCO Primary Objective

Per Business Rule 2.2.6, assessment SCOs must have a primary objective with a minimum normalized measure for the required mastery score. If the SCO is a non-assessment SCO, a mastery score is not required. Figure 49 contains an example of the markup required to add a primary objective that includes a minimum passing score for a SCO in the manifest.

```
Primary objective for an assessment SCO using the single attempt instructional strategy

<item identifier="SCO-ID" identifierref="SCO-RES" isvisible="true">
  <title>SCO Title</title>
  <imss:sequencing>
    <imss:objectives>
      <imss:primaryObjective satisfiedByMeasure="true" objectiveID="scoObj">
        <imss:minNormalizedMeasure>0.8</imss:minNormalizedMeasure>
      </imss:primaryObjective>
    </imss:objectives>
  </imss:sequencing>
</item>
```

Figure 49: Code sample for primary objective in an assessment SCO using the single attempt instructional strategy
9.2.4.1.3 SCO API Activity

The single attempts instructional strategy sets the same four SCORM 2004 3rd Edition data model elements as the unlimited attempts instructional strategy. The four data model elements and their values for the single attempt strategy are:

- **Set cmi.completion_status to “completed”**

  The completion status of the SCO factors into rollup at the organization level. For assessments, the SCO should send a completion status value of “completed” when the learner completes the content, regardless of performance.

- **Set cmi.success_status to “passed” or “failed”**

  The success status of the SCO factors into rollup for the organization level. As seen in the previous section, a value of “passed” (“satisfied” in the manifest sequencing) triggers the corresponding two rollup rules in the organization sequencing. The SCO should send a success status of either “passed” or “failed” based on the learner’s scaled score.

- **Set cmi.exit to “normal”**

  The value for the cmi.exit data model element tells the LMS how to handle data for an attempt when the learner exits the SCO. A cmi.exit value of “normal” tells the LMS to finalize the data for a particular attempt and to begin a new data set if the learner launches the SCO again. An assessment SCO should send a cmi.exit value of “normal” when the learner ends their attempt, regardless of learner performance.

- **Set adl.nav.request to “exit”**

  The navigation request affects the sequencing actions the LMS will apply to the SCO and its organization when the learner exits a SCO. A navigation request value of “exit” tells the LMS to exit the SCO in the system’s logical sequencing, which triggers an evaluation of the content tree with elements such as rollup rules.

Note that the intent of the SCO API activity in both the single attempt and unlimited attempts instructional strategies is to tell the LMS to record a discrete set of data for each learner attempt. The difference between the two instructional strategies lies in the organization sequencing rollup rules, where a specific rollup rule is used to tell the LMS not to evaluate an attempt if the learner has not passed.
9.2.5 Multiple Limited Attempts Instructional Strategy

This section discusses how to implement the single attempt instructional strategy for assessment and non-assessment SCORM 2004 3rd Edition content.

9.2.5.1 Assessment and Non-Assessment Content

The multiple limited attempts instructional strategy is a variant of the unlimited attempts instructional strategy that enforces a specific limit of attempts on content. Figure 50 illustrates the manifest and SCO API components for the multiple limited attempts instructional strategy.

![Diagram of Instructional Strategy: Multiple Limited Attempts (All Content)]

Figure 50: Manifest sequencing and SCO API activity for multiple limited attempts instructional strategy on all content
9.2.5.1.1 Organization Rollup Rules
The multiple limited attempts instructional strategy uses the same organization rollup rules as the unlimited attempts instructional strategy. Refer to the Unlimited Attempts Instructional Strategy section for an explanation of the rollup rules.

9.2.5.1.2 SCO Primary Objective
The multiple limited attempts instructional strategy uses the same guidance for SCO primary objectives as the unlimited attempts instructional strategy. Refer to the Unlimited Attempts Instructional Strategy section for explanations of SCO primary objectives for both assessment and non-assessment content.

9.2.5.1.3 SCO API Activity
The multiple limited attempts instructional strategy uses the same guidance for SCO primary objectives as the unlimited attempts instructional strategy. Refer to the Unlimited Attempts Instructional Strategy section for explanations of SCO API activity requirements for both assessment and non-assessment content.

9.2.5.2 Understanding Attempt Limit Limitations
A learner attempt on SCORM 2004 3rd Edition content on an LMS includes the learner launching the content, completing their attempt, and exiting the content; the LMS then handles evaluation of the learner attempt based on the instructional strategy implementation. An LMS counts each time the learner launches the content off the system as an attempt. In contrast, SCORM 2004 3rd Edition allows tracking of learner attempts on individual SCOs using manifest programming, but attempt tracking only takes place when the learner has the learning content open – a single “launch” according to the LMS. For the purposes of consistent attempt tracking, the Army only uses the LMS attempt limit configuration setting for the multiple limited attempts instructional strategy.

The above information is critical to keep in mind, since the LMS will use the rollup rules in the content package, and the LMS will not perform conditional evaluation based on whether the learner has reached the attempt limit or not. For example, a failed attempt that is also the last attempt the learner has will still not be finalized, since the instructions to the LMS in the instructional strategy say to only finalize passing attempts. There is no reliable way to enforce conditional evaluation from within content, so the lack of such functionality is an acceptable limitation of SCORM 2004 3rd Edition content for LMS platforms.
9.3 ALMS CTE SCORM 2004 3rd Edition Content Configuration

This appendix discusses how to configure SCORM 2004 3rd Edition content on the ALMS Content Testing Environment (CTE) to conform to the business rules. Note that the content of this appendix expands on a small group of topics found in the ALMS CTE content configuration guidance provided by the Army Distributed Learning System (DLS). Developers should first refer to DLS’ guidance on configuring content on the ALMS CTE before reading this appendix.

An overview of DLS’ guidance can be found at: https://www.atsc.army.mil/tadlp/delivery/docs/ALMS_CTE_Guidance_Overview.pdf.

9.3.1 Strict Conformance

Recall Business Rule 3.1.1 and its extension to SCORM in Business Rule 3.2.1 in the Testing section of the guide:

- **Business Rule 3.1.1**: All LCOs must be tested on the target delivery platform testing environment with identical configuration settings to the live version of the platform.
- **Business Rule 3.2.1**: All SCOs must be tested on the target delivery platform testing environment using strict conformance settings when available. Any configuration options that relax conformance shall not be active.

These business rules exist because delivery platforms, such as the ALMS and ELLC for SCORM 2004 3rd Edition content, offer configuration options that involve relaxing standards and increasing the platform’s role in the content’s performance. The Army enforces content interoperability by requiring DL products to strictly adhere to the standards upon which they are built and avoid coupling with a specific delivery platform’s allowances for functionality.

9.3.2 SCORM Player Templates

The ALMS provides multiple player templates for SCORM content (both 1.2 and 2004). Note that both the SCORM 1.2 API and SCORM 2004 API are available in each player template. ALMS administrators typically configure SCORM 2004 3rd Edition content on the ALMS to use the “ARMY_SCORM_2004” player template, which has the following features:

- No vendor branding
- Table of Contents (TOC) and learning content appear in the same window
  - TOC is in a visible frame on the left side
  - Learning content is in a visible frame on the right side
- The initial player window size is 1024 pixels wide and 764 pixels high
  - The Table of Contents frame width is a static 200 pixels
The “ARMY_SCORM_2004” player template has reduced screen space due to the TOC frame, so developers may consider launching content in a separate window per the best practice in the SCORM content General Programming section.

**IMPORTANT:** Confer with ALMS administration points of contact for more information on available player templates depending on the needs of specific DL products.

### 9.3.2.1 Exit Options

The ALMS Exit Options are three choices that are presented to the learner after they close the content. Each exit option instructs the ALMS to take a specific set of SCORM 2004 3rd Edition sequencing actions: finalizing the attempt, suspending the attempt, or abandoning the attempt. The three exit option choices of “Exit and Finish”, “Exit and Resume Later”, and “Exit without saving” equate to the three SCORM 2004 3rd Edition navigation request values of “exitAll”, “suspendAll” and “abandonAll” – except each is applied by the ALMS directly rather than the content making the navigation request per Business Rule 2.2.10. Figure 51 demonstrates how the ALMS Exit Option window appears.

![Figure 51: ALMS Exit Options window](https://www.cts.lms.army.mil/?contextId=...)

**IMPORTANT:** ALMS Administrators do not enable the ALMS Exit Options when configuring content for testing and platform delivery.

The Exit Options reduce interoperability of content by making functionality for which the content should be responsible a responsibility of the ALMS. Furthermore, exit option usage can conflict with the programming of the content and cause performance issues such as preventing the learner from receiving credit. The ALMS Exit Options should be configured to be hidden for each SCORM 2004 3rd Edition content package. Figure 52 illustrates how the configuration option for the ALMS Exit Options should appear when they are hidden for content.
**Figure 52: ALMS content configuration option to hide ALMS Exit Options**

**IMPORTANT:** Do not use the ALMS Exit Options as a substitute for content functionality. SCORM 2004 3rd Edition content on the ALMS should not be tested with the ALMS Exit Options active.

### 9.3.2.2 SCORM Relaxed Mode

The ALMS provides a “relaxed mode” option for SCORM 2004 3rd Edition content that lifts the default strictness requirements for content such that the learner can complete it in more circumstances, such as when data model elements like success status are missing. ALMS administrators do not enable SCORM “relaxed mode” for content. SCORM “relaxed mode” reduces the interoperability of SCORM 2004 3rd Edition content by making the ALMS responsible for missing functionality that should be in the content itself. Figure 53 illustrates how the configuration option for SCORM “relaxed mode” should appear when it is inactive.

**Figure 53: ALMS content configuration option for SCORM “relaxed mode”**

**IMPORTANT:** Do not use the ALMS SCORM “relaxed mode” as a substitute for content functionality. SCORM 2004 3rd Edition content on the ALMS should not be tested with SCORM “relaxed mode” active.
9.4 Addressing Common ALMS Content Issues

This appendix discusses common content issues that developers may run into when developing distributed learning content for the Army Learning Management System. The discussion of each issue also provides a methodology for developers to use to address it.

**CAUTION:** The issues and methodologies discussed in this appendix are targeted toward qualified software engineers who can work with SCORM, JavaScript, and other technologies used in courseware. Do not attempt to modify code without qualified personnel.

### 9.4.1 “Not Evaluated” Learning Assignment Status

A learning assignment status of “Not Evaluated” is seen when the learner successfully completes a learning assignment’s content, but sees a status of “Not Evaluated” instead of the expected “Successful” status after the topic page refreshes. Attempt details will show SCORM completion and success statuses of “Completed” and “Passed” and in many cases a content attempt status of “Suspended” or “Active”.

The most common causes of the issue are:

- **ALMS Player Window Closure**
  The content closes the ALMS player window through code or the learner closes the ALMS player window themselves. The ALMS will suspend an active attempt if it is not allowed to close the player window through its own exit processes after content calls the SCORM Terminate method.

- **Missing Navigation Request**
  The ALMS is not given a valid SCORM 2004 navigation request and does not know how to automatically resolve sequencing in the activity tree after the content calls the Terminate method. The typical result is a “Please select a navigation action” message that appears in the ALMS player window content frame.

Note that the causes above assume the developer has otherwise configured content properly according to the business rules and best practices in this document, and it can report other status elements such as interactions to the ALMS correctly.
9.4.1.1 ALMS Player Window Closure

As previously mentioned, the ALMS will suspend an active learner attempt if the system’s exit processes are interrupted by the player window closing prematurely due to content code. Recall Business Rule 2.2.1 and the “Avoid Top-Level Window Closure” best practice that discuss player window closure. In many cases, when a learner successfully completes content but receives the “Not Evaluated” status for the learning assignment, the content has closed the player window using the “top.close()” method. Further proof can be seen when the attempt data shows the Content Attempt Status as “Suspended” or “Active” despite the successfully completed attempt.

The “top.close()” method refers to the “close” method of a given browser window being executed at the topmost level of the current page – this is most commonly seen as “window.top.close()” or “top.close()” in JavaScript code. Closing the topmost browser window ensures that even if a web page is in an HTML frameset, the window it is in will close. However, this behavior interrupts the ALMS’ sequence of actions to finalize and evaluate learner attempts, and should not be present in content’s code.

9.4.1.1.1 Diagnosis Methodology

Removing top-level window closure code involves disabling or removing code that executes the “top.close()” method, in accordance with Business Rule 2.2.1. The methodology below can assist developers in locating “top.close()” method calls and addressing them:

1. Consult authoring software documentation and configuration settings to disable top-level window closure behavior, if applicable.
2. Run content in the ALMS CTE.
3. Open the browser developer tools. The keyboard shortcut is F12 in all major browsers.
4. In the code debugger tab (“Debugger” in Internet Explorer and Firefox, and “Sources” in Chrome), find the location of the content files; the built-in search feature in the code debugger can be useful for this task.
5. After locating the SCO files, search within them for the “top.close()”. Search targets will include HTML and JavaScript files for SCORM 2004 courseware.
6. Set a breakpoint at each instance of “top.close()” method in the SCO files.
7. Successfully complete and exit the content. Note that if exiting the content requires the learner to close the ALMS player window, the content will have to be modified to launch in a separate browser window and/or include a GUI exit button.
8. If a previously set breakpoint is triggered, disable or remove the code.
9. Re-upload and test content on the ALMS CTE. Repeat the process as necessary.
9.4.1.1.2 Example: Captivate Content

This section illustrates the diagnosis methodology using courseware published by Adobe Captivate as an example. Each of the steps below describe the end-result of a developer following the respective step:

1. The developer determines that the Captivate software does not have a built-in option for preventing top-level window closure in the content code.
2. The developer upload the content to the ALMS CTE and launches it.
3. The developer opens the browser developer tools.
4. The developer opens the code debugger tab in the browser developer tools and locates the SCO files in the ALMS player window content frame.
5. The developer searches for “top.close()” and finds an instance in the CPM.js JavaScript file.
6. The developer sets a breakpoint on the line of code that contains the “top.close()” method.
7. The developer then successfully completes the content and exits.
8. The browser pauses on the breakpoint on the previous line of code, indicating that the code will be executed. The developer then knows to disable this piece of code.

After modifying the code, the developer can upload and test content on the ALMS CTE to verify that the new code resolved the issue. The example below illustrates the code the developer modified in the window.DoCPExit method defined in the CPM.js JavaScript file.

Before: CPM.js

```javascript
window.DoCPExit=function(){try{cp.em.fireEvent("CPMovieExit");if(cp.IsRunningInACAP||cp.IsRunningInALEC||cp.m_isLMSPreview){cp.currentWindow.open("goodbye.html","_self");return}if(cp.IsRunningInRoboHelp){var b=cp.currentWindow.open("","_self");b.close();return}cp.currentWindow!=cp.parentWindow&
```  

X

```javascript
window.DoCPExit=function(){try{cp.em.fireEvent("CPMovieExit");if(cp.IsRunningInACAP||cp.IsRunningInALEC||cp.m_isLMSPreview){cp.currentWindow.open("goodbye.html","_self");return}if(cp.IsRunningInRoboHelp){var 
b=cp.currentWindow.open("","_self");b.close();return}"cp.currentWindow!=cp.parentWindow&
```  

Figure 54: The window.DoCPExit method in CPM.js before and after modification
9.4.1.2 Missing Navigation Request

In some cases, a learner will exit content and the ALMS player window content frame will refresh and display a “Please select a navigation action” message that leaves no choice but to close the ALMS player window. Recall Business Rule 2.2.10 for setting a SCORM navigation request. SCORM 2004 courseware should always set an appropriate navigation request to ensure consistent behavior across run-time environments, not just the ALMS. Some systems may provide built-in sequencing and navigation support for content to fall back on, but other systems may not.

9.4.1.2.1 Diagnosis Methodology

Avoiding the “Please select a navigation action” message scenario involves configuring content to set an appropriate navigation request per Business Rule 2.2.10. The methodology below can assist developers in adding a SCORM navigation request to content:

1. Consult authoring software documentation and configuration settings to add a SCORM navigation request, if applicable.
2. Open all published SCORM content HTML and JavaScript files using a text or code editor.
3. Search for “adl.nav.request” to determine where it is set, and what value is given. If a navigation request is set and its value can be safely modified to the desired value, modify the value and skip to Step 6.
4. If there is no “adl.nav.request” value set anywhere or the existing code setting a value cannot be safely modified, find where the “Terminate” SCORM API method is called in the content code. The method will always be called “Terminate” when called directly.
5. Prior to the SCORM Terminate method call, and ideally before a Commit method call, add appropriate code to set a navigation request of “exit” using the code base’s functions.
6. Upload and test content on the ALMS CTE.

9.4.1.2.2 Example: Captivate Content

This section illustrates the methodology above using courseware published by Adobe Captivate as an example. Each of the steps below contain the end-result of the developer following the respective step in the methodology.

1. The developer determines that the Captivate software does not have a built-in option for configuring navigation requests.
2. The developer opens all published SCORM content HTML and JavaScript files in a code editor.
3. The developer searches for “adl.nav.request” and finds an existing navigation request value of “suspendAll” being set in the SCORM2004_Finish function of the scormdriver.js JavaScript file.
4. The developer determines that while a navigation request is being set, it is not safe to modify, because it relies a specific content configuration. The developer then finds that the SCORM2004_Finish function calls the SCORM Terminate method using its own function, SCORM2004_CallTerminate().
5. The developer locates the part of the code that calls the SCORM Commit method, and using the code base’s functions, sets a navigation request of exit calling the SCORM2004_CallSetValue function using the code’s style.

After adding the code, the developer can upload and test content on the ALMS CTE to verify that the new code resolved the issue. The example below illustrates the code the developer added to the SCORM2004_Finish function in the scormdriver.js JavaScript file.

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**Figure 55: The SCORM2004_Finish function in scormdriver.js before and after modification**

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