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Information technology — Sharable Content Object Reference Model (SCORM®) 2004 3rd Edition —

Part 4: Sequencing and Navigation Version 1.1

Technologies de l'information — Modèle de référence d'objet de contenu partageable (SCORM®) 2004 3e édition —

Partie 4: Séquencement et navigation Version 1.1

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

In exceptional circumstances, the joint technical committee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;

— type 3, when the joint technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC TR 29163-4, which is a Technical Report of type 3, was prepared by the Advanced Distributed Learning (ADL) Initiative (as SCORM® 2004 3rd Edition Sequencing and Navigation Version 1.1) and was adopted, under a special "fast-track procedure", by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by the national bodies of ISO and IEC.

ISO/IEC TR 29163 consists of the following parts, under the general title *Information technology — Sharable Content Object Reference Model (SCORM®) 2004 3rd Edition*:

— *Part 1: Overview Version 1.1*

— *Part 2: Content Aggregation Model Version 1.1*

— *Part 3: Run-Time Environment Version 1.1*

— *Part 4: Sequencing and Navigation Version 1.1*

Advanced Distributed Learning (ADL)

SCORM® 2004 3rd Edition Sequencing and Navigation (SN) Version 1.1

For questions and comments visit
Ask The Experts at ADLNet.gov

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SECTION 1
SCORM® Sequencing and Navigation (SN)

1.1. Introduction to the SCORM Sequencing and Navigation (SN) Book

The Sharable Content Object Reference Model (SCORM) is often described as a set of books on a bookshelf. The Sequencing and Navigation (SN) book is one of a set of books (refer to Figure 1.1a: *The Sequencing and Navigation Book as Part of the SCORM Bookshelf*). More information on the other SCORM books and their relationships to one another can be found in the SCORM 2004 3rd Overview book. The SCORM SN book describes how SCORM conformant content may be sequenced to the learner through a set of learner or system-initiated navigation events. The branching and flow of that content may be described by a predefined set of activities.

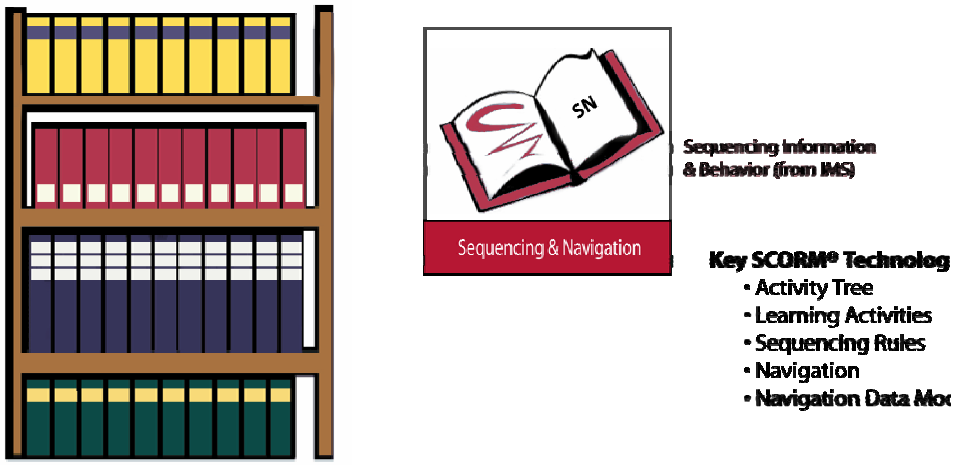

Figure 1.1a The Sequencing and Navigation Book as Part of the SCORM Bookshelf

1.1.1. What is Covered in the SCORM Sequencing and Navigation Book?

There are several key concepts that are introduced in the SCORM SN book. The book covers the essential Learning Management System (LMS) responsibilities for sequencing content objects (Sharable Content Objects [SCOs] or Assets) during run-time and allowing SCOs to indicate navigation requests. In addition, guidance is offered for providing navigation controls to learners. General subjects discussed include:

- Sequencing Concepts and Terminology (e.g., Learning Activities, Activity Trees, Clusters)
- Sequencing Definition Model (i.e., detailed descriptions and requirements of the sequencing information that can be applied to learning activities)

- Sequencing Behavior Model (i.e., detailed descriptions of LMS behaviors to prescribed sequencing information and learner's experience with learning content)
- Navigation Controls and Requirements
- Navigation Data Model

Communication between content and LMSs facilitates use of SCORM Sequencing and Navigation to present content to learners based on learner choices and performance at run-time. This communication also enables LMSs to track learner completion and progress while content is presented to the learner. This book describes in detail how sequencing behaviors are applied to track learner progress.

1.1.2. Using the SCORM Sequencing and Navigation Book

This book should prove useful to LMS and authoring tool vendors wishing to support SCORM in their products, and to anyone wishing to understand how sequencing intentions can be applied to content and the relationship between sequencing intentions and LMSs, such as SCORM content developers.

Early portions of this book, *Section 1: SCORM® Sequencing and Navigation (SN)* and *Section 2: Sequencing Concepts*, cover the concepts that apply to SCORM Sequencing. These sections are recommended reading for those seeking an introduction to the concepts behind SCORM Sequencing and who may not wish to delve into deep technical details.

Section 3: The Sequencing Definition Model is the first section providing thorough technical details about Sequencing. This section explains each piece of sequencing information that may be used to describe sequencing strategies during content development as well as examples of how they may be used.

Section 4: Sequencing Behaviors describes in detail what information is being tracked for sequencing purposes and how learner progress with content objects affects the tracking information. This section covers SCORM sequencing behavior in detail, which includes specific LMS behavior requirements for applying sequencing information to the tracking information.

Section 5: The SCORM® Navigation Model describes a run-time data model that enables content objects to query the LMS for sequencing state and to indicate to the LMS desired navigation requests. This section also provides guidance to LMSs for providing appropriate navigation controls to learners.

In addition, *Appendix C* provides updated and detailed, normative, pseudo code that explicitly defines SCORM Sequencing Behaviors.

1.1.3. Relationship with other SCORM Books

The SCORM SN book describes the responsibilities of LMSs for sequencing content objects for a learner at run-time. In the context of SCORM, content objects are either SCOs, which may communicate during run-time, or Assets that do not communicate during run-time. The SCORM SN book describes how sequencing information can be applied to define various sequencing strategies, how sequencing information is interpreted at run-time to make sequencing evaluations and how navigation requests, triggered through a learner's interactions with content objects, are processed to identify the next content object for delivery (launch). The actual launch of the identified content object is out of scope of this book, but is described in the SCORM RTE book [4].

The following sections explain the relationships between the SCORM SN book and the remaining SCORM books. In addition, frequently used terminology will be introduced at a high level to eliminate the need for the reader to become an expert in the entire SCORM to understand this book. It is strongly recommended that LMS vendors, content developers and authoring tool developers read each SCORM book to fully understand the purpose, details, relationships and advantages of all of the SCORM components.

1.1.3.1 The SCORM Content Aggregation Model (CAM) Book

The SCORM Content Aggregation Model (CAM) book contains information on Metadata, Content Packages, and ADL Sequencing and Navigation Content Package extensions. There are several dependencies between the SCORM CAM book and the SCORM SN book.

Metadata is "data about data." Simply put, Metadata is information that describes the different components (Content Aggregations, Content Organizations, Activities, SCOs and Assets) of the SCORM content model. Metadata is necessary for search and discovery of content objects. At this time, the SCORM SN book does not define a relationship with metadata; metadata has no impact on processing navigation requests or sequencing behaviors.

A *Content Package*, in a general sense, bundles content objects with a prescribed content structure. A SCORM Content Package may represent a SCORM course, lesson, module or may simply be a collection of related content objects that may be stored in a SCORM repository. All SCORM Content Packages contain the `imsmanifest.xml` file. This file describes the contents of the package and may include an optional description of the content structure.

SCORM Content Packages may include additional information that describes how an LMS is intended to process the Content Package and manage its contents. Some of the information is utilized by the SCORM SN book.

- Several elements in a SCORM Content Package affect initialization and management of a content object's run-time data model. These elements have no effect on the behaviors described in the SCORM SN book.

- Other elements in a SCORM Content Package describe initial values for specific elements of a content object's run-time data model. Sequencing only identifies a content object for delivery; therefore, these elements have no effect on the behaviors described in the SCORM SN book.
- Content object launch locations and launch parameters are also described as elements in a SCORM Content Package. Again, sequencing only identifies a content object for delivery; therefore, these elements have no effect on the behaviors described in the SCORM SN book.
- When a SCORM Content Package includes a description of content structure, sequencing information may be added to define an intended approach to sequencing the package's content objects. The SCORM SN book defines how the defined content structure, in the content package, is to be interpreted as an Activity Tree – a fundamental structure used for sequencing purposes.
- A SCORM Content Package may include User Interface (UI) elements that are intended to provide guidance to an LMS on how certain UI navigation controls are to be presented, enabled and/or hidden. The sequencing behaviors described in the SCORM SN book do not rely on which or how UI navigation controls are enabled or triggered (navigation events), it is only concerned with the processing of LMS-invoked navigation requests.

To fully understand how sequencing- and navigation-specific elements are specified in a SCORM Content Package, it will be necessary to reference the SCORM CAM book [3].

1.1.3.2 The SCORM Run-Time Environment (RTE) Book

The SCORM Run-Time Environment (RTE) book describes the responsibilities of LMSs and content objects during run-time. In the context of SCORM, content objects are either SCOs, which may communicate during run-time, or Assets that do not communicate during run-time. The SCORM RTE book describes a common content object launch mechanism, a common communication mechanism between content objects and LMSs, and a common data model for tracking a learner's experience with content objects. These aspects create an environment where several of the ADL "-ilities" are satisfied. For example, content objects that communicate through the standardized communication mechanism can be moved from LMS to LMS without modification to their communication methods; this increases learning object portability and durability, thereby lowering the cost of development, installation and maintenance.

1.2. SCORM Sequencing Overview

Parts of the SCORM SN book are based on the IMS Simple Sequencing (SS) Specification [1] which defines a method for representing the intended behavior of an authored learning experience such that any LMS will sequence discrete learning activities in a consistent way. IMS SS is labeled as *simple* because it defines a limited number of widely used sequencing behaviors, not because the specification itself is simple. IMS SS is not all-inclusive. In particular, IMS SS does not address, but does not necessarily preclude, artificial intelligence-based sequencing, schedule-based sequencing, sequencing requiring data from closed external systems and services (e.g., sequencing of embedded simulations), collaborative learning, customized learning or synchronization between multiple parallel learning activities.

IMS SS recognizes only the role of the learner and does not define sequencing capabilities that utilize or are dependent on other actors, such as instructors, mentors or peers. The SCORM SN book does not prohibit usage in contexts involving other actors; however, it does not define roles of other actors or sequencing behaviors that result from participation of other actors.

The SCORM SN book defines how IMS SS is applied and is extended in a SCORM environment. It defines the required behaviors and functionality that SCORM conformant LMSs must implement to process sequencing information at run-time. More specifically, it describes the branching and flow of learning activities in terms of an Activity Tree, based on the results of a learner's interactions with launched content objects and an authored sequencing strategy.

SCORM does not place any requirements on an LMS-related to how or when Activity Trees are created, the internal representation of Activity Trees or the management of Activity Trees at run-time. However, the SCORM CAM book defines one representation of sequencing information via extensions to a SCORM Content Package, providing an interoperable mechanism to exchange content structure and sequencing information between different run-time components or LMSs.

In summary, SCORM Sequencing depends on: a defined structure of learning activities, the Activity Tree; a defined sequencing strategy, the Sequencing Definition Model; and the application of defined behavior to external and system triggered events, SCORM Sequencing Behaviors.

1.3. SCORM Navigation Overview

The SCORM SN book also describes how learner- and system-initiated navigation events can be triggered and processed, resulting in the identification of learning activities for delivery. Each learning activity identified for delivery will have an associated content object. The SCORM RTE book [4] (*Section 2.1.2: Launching Content Objects* describes how identified content objects are launched. The sequence of launched content objects, for a given learner and content structure, provides a unique learning experience (learner interaction with content objects); the SCORM RTE book describes how the LMS manages the resulting learning experience for SCOs and how that learning experience may affect the Activity Tree.

Navigation assumes the existence of user interface devices to trigger navigation events. These devices may be provided by the LMS or embedded in content objects. When a learner triggers such a device, the LMS translates the event into its corresponding navigation request, processes the request, and then may indicate the next learning activity for delivery. The SCORM SN book describes a run-time data model that SCOs may use to indicate desired navigation requests to the LMS.

The SCORM SN book imposes no requirements on the type or style of the user interface presented to a learner at run-time, including any user interface devices for navigation or accessing auxiliary services. The nature of the user interface and the mechanisms for interaction between the learner and the LMS are intentionally unspecified. Issues such as look and feel, presentation style and placement of user interface devices or controls are outside the scope of SCORM. Various recommendations are provided to help reduce interpretation of the SCORM Navigation Model until a formal navigation (and presentation) specification or standard is developed. However, an LMS is required to provide user interface devices that trigger navigation events whose processing would result in the identification of a deliverable content object.