

*What Is...*

# IMS Simple Sequencing?

by Warwick Bailey

## *In Brief*

### What is IMS Simple Sequencing?

IMS Simple Sequencing (IMS SS) is a specification used to describe paths through a collection of learning activities.

IMS SS declares the relative order in which electronic learning activities are to be presented to a learner and the conditions under which a resource is selected, delivered, or skipped during presentation.

IMS SS is labeled as simple because the specification considers only a limited number of common sequencing strategies, not because the specification itself is simple.

IMS SS relies on the concept of learning *activities*, such as content or test questions. Activities are associated with other activities into a hierarchy, resulting in an *activity tree*. A *parent* activity and its *children* are referred to as a *cluster* of activities.

An activity has one or more objectives associated with it. Objectives are typically used to record the scores of test items. Objectives may also add objective maps, so that the result of an assessment item may be used to influence the sequencing behaviour in a widely separated branch of the activity tree.

An activity may additionally include auxiliary resources. Auxiliary resources provide the learner with help, glossaries or other context sensitive services.

Activity clusters have *sequencing rules* and *limit conditions* associated with them. *Sequencing rules* are used to influence the order of activities presented to the learner. *Limit conditions*, such as attempt limits, duration limits and date limits, are used by the sequencing rules to further influence when an activity is sequenced next to a learner.

### What is IMS Simple Sequencing for?

IMS SS finds application in a number of areas of e-learning. Principal among these are:

- Creating multiple paths through one set of learning activities.
- Creating patterns of formative assessment.
- Creating summative assessments.
- Creating Decision Trees.
- Adding Context Sensitive Network Services to Content.
- Creating Step Through Tutorials.

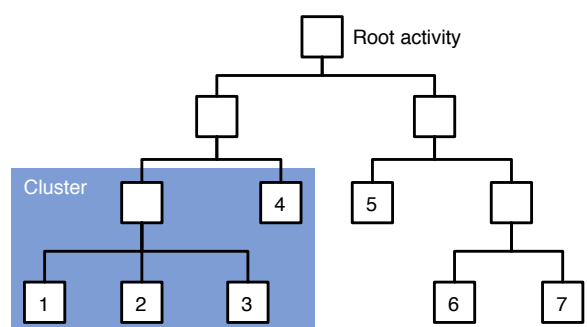
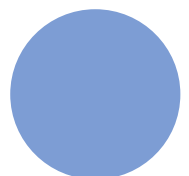
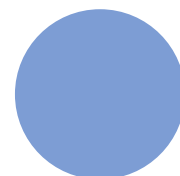
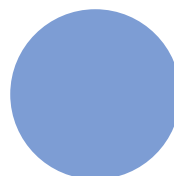


Diagramme of a sequencing activity tree



# Technical Details

## How IMS Simple Sequencing works

IIMS SS works by a computer system reading instructions and determining which activity to present next to the learner.

The instructions are known as sequencing information. The process of determining the next activity is called sequencing behaviour.

Sequencing information is broken down into two categories: the definition information model and the tracking information model.

Definition information is added by an author or a tool to an XML file. Currently the only XML file recognized for this purpose is the `imsmanifest.xml` file used in IMS CP. The result is one or more activity trees integrated with a set of sequencing instructions.

Tracking information is collected when a learner works with activities: at run time. It is a record of the learner's attempts at an activity and the learner's progress towards an activity's objectives.

Sequencing behaviour is defined in terms of six processes: the navigation, termination, rollup, selection, sequencing and delivery processes.

The combined behaviour, or overall sequencing process, operates as a repeating loop of the six processes working on the two information categories.

The loop typically starts when a learner clicks a user interface control, such as button or hyperlink, to move to the next activity. This event is mapped to the navigation process, which generates two further events.

The first event triggers the termination process and ensures that information about the current activity is processed before the next activity is shown.

The second event triggers the sequencing process in which a combination of sequencing rules and limit conditions identify the next activity to be delivered.

The sequencing process then hands over control to the delivery process that initiates sequencing state before the activity is presented to the learner. When the learner is ready to move on, the whole loop is repeated.

The rollup process is invoked when an activity terminates and has activities above it and next to it in the activity tree. The state of the terminated activity is combined with the state of its activities adjacent to it to determine the state of the tracking information model of the parent. In this way, sophisticated strategies for combining, weighting and aggregating the individual scores of activity objectives may be created using rollup rules.

The selection process may be invoked when an activity has child activities. The procedure of choosing an ordered or randomized list of only some child activities from the total set of all children is called the selection process

## Requirements

The first requirement for using IMS SS is a tool for adding sequencing rules, rollup rules and limit conditions to a collection of activities within a content package. Although a schema driven XML editor may be used for this process, an authoring environment dedicated to IMS SS will save considerable time.

The second requirement is for a system that interprets sequencing rules, rollup rules and limit conditions at run time to determine which activity is selected, delivered, or skipped during presentation. The component of learning technology systems that manages this run time interpretation of sequencing

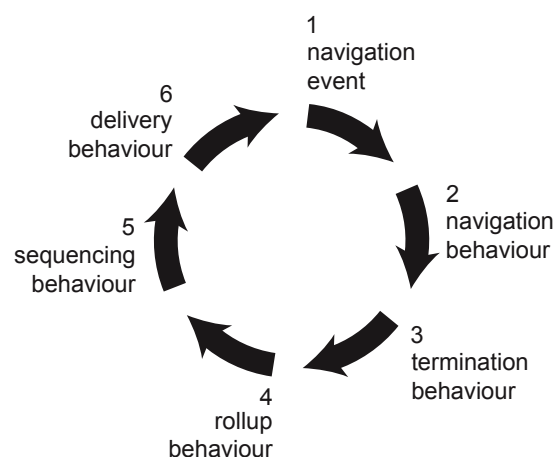


Diagram of overall sequencing loop

information is known as a sequencing engine.

Systems, components and tools emerged from the academic and commercial communities in 2004 that begin to satisfy these two requirements.

## Related Specifications

IMS Content Packaging (IMS CP) is related because the `imsmanifest.xml` file provides a ready structure for nesting activities into a hierarchy. The hierarchy, or organization, is composed of item elements, with each item element acting as a pointer to a real resource, such as web page that contains a lesson or test. IMS CP items are mapped to activities in IMS SS. The organization of nested items becomes the sequencing activity tree.

ADL SCORM 2004 is related in that it integrates IMS SS into the other specifications that it profiles.

In practice, the only large community that has worked with the IMS SS specification is the SCORM 2004 community. The result is that modifications to the sequencing specification have been fed back into the SCORM 2004 documentation rather than the IMS SS specification, which at the time of writing remains at version 1.0. The SCORM 2004 documentation contains the most up to date experience of implementing IMS SS.

Of interest too, is the IMS Question and Test Interoperability (IMS QTI) specification which defines the a standard description for assessment items. Because outcomes from assessment items may be used to influence sequencing rules, future work may identify IMS QTI and IMS SS as complementary specifications for building formative and summative assessments.

One other IMS specification deals with the sequencing of learning activities: IMS Learning Design (IMS LD). Unlike IMS SS, IMS LD supports a multiple users and roles. IMS SS only supports a single user in the role of learner.

## Implementations

ADL. To date, the largest community of practice to have worked with IMS SS specification is the

SCORM 2004 community. All SCORM 2004 implementations are a slight variation on the IMS SS specification and include refinements and additions suggested by implementors of SCORM 2004. ADL provide an reference implementation of a sequencing engine distributed as a part of the SCORM 2004 Sample Run Time Environment. Visit: <http://www.adlnet.org>

Icodeon. In the UK, Icodeon Ltd have released a sequencing engine that is an implementation of IMS SS. The engine is a small software library that enables system integrators to rapidly add sequencing functionality to new or existing systems. Visit: <http://www.icodeon.com>

JISC eLearning Program. The JISC e-Learning Program has supported work, led by the University of Hull e-Services Integration Group, to integrate the Icodeon Sequencing Engine into a web service framework. This work has been further extended to develop applications that integrate IMS SS with test items written to the IMS QTI version 2 specification. Visit: <http://www.hull.ac.uk/esig/assis.html>

Giunti Labs. The Italian based e-Learning company has demonstrated products that incorporate IMS SS into content authoring tools and VLEs. Visit: <http://www.giuntilabs.com>

Carnegie Mellon Learning Systems Architecture Lab. This group is closely associated with the development of SCORM 2004 and have released a version of the popular RELOAD Editor tool. The release includes support for visual authoring of sequencing rules. Visit: <http://www.lsal.cmu.edu/adl/scorm/tools/reload/>

Mississippi State University. The InSite Studio Tool is an authoring tool for instructional designers that exports SCORM 2004 conformant content, including sequencing rules. A visual authoring environment for creating sequenced collections of activities. Visit: <http://thorax.erc.msstate.edu/insite/default.aspx>



# Resources

## People, Products and Services

The CETIS Educational Content Special Interest Group (EC-SIG) offers information, support and advice to people working with IMS SS and related specifications. Contact [s.macneill@strath.ac.uk](mailto:s.macneill@strath.ac.uk), or go to: [http://www.cetis.ac.uk/members/educational\\_content](http://www.cetis.ac.uk/members/educational_content)

## Resources on the Internet

The IMS Simple Sequencing Specification is published on the IMS Global Learning Consortium website. The current version, Version 1.0 Final Specification, was released in March 2003. Visit: <http://www.imsglobal.org>

A complete description of the use of IMS SS within SCORM 2004 is provided in the Sequencing and Navigation book for the SCORM published by ADL. Visit: <http://www.adlnet.org>

The Carnegie Mellon Learning Systems Architecture Lab publishes a "SCORM Best Practices Guide for Content Developers". The document is a useful guide to using the sequencing behaviours described in IMS SS. Visit: <http://www.lsal.cmu.edu/lisal/expertise/projects/developersguide/>

Technical papers describing the integration of the Icodeon Sequencing Engine into e-learning systems and the integration of IMS SS and IMS QTI are available from Icodeon. Visit: <http://www.icodeon.com>

## About this guide

This guide was produced by CETIS, the Centre For Educational Technology Interoperability Standards. For other CETIS briefings, visit <http://www.cetis.ac.uk/static/briefings.html>

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Warwick has worked with implementations of SCORM and IMS specifications in VLEs, item banks and web services. Visit: <http://www.icodeon.com>

## About CETIS

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