# SCO-defined cmi data fields – wriggling out of the run-time data model straitjacket

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## 1. Abstract

This paper describes limitations of the current CMI Data Model used by SCORM (especially with regard to the current use of suspend data) and proposes a solution which allows a more flexible approach to storing structured data on the LMS while retaining the benefits of the current model.

## 2. Problem definition

The current SCORM data model consists of a number of fields and data structures available for SCOs to store state information which is persisted between learner sessions. The fields available cover most of the common data storage needs of SCOs and provide an essential way for organisations to track course usage and employee progression through learning objects. This model does a good job of covering the data needs that are common to almost all learning objects, but is limiting when data that falls outside the model needs to be stored.

When a SCO needs to track some data which does not fit in to the data model, developers can make us of the `cmi.suspend_data` field to store ad-hoc information. If more than one item of data needs to be stored however, the developer must come up with a scheme to encode all of the relevant information in a single string which must then be decoded whenever suspend data is retrieved from the LMS. This causes a number of problems:

- If the data is important to the organisation, there is no easy way for the LMS to produce reports or management information based on that data
- The amount of data that can stored is limited to 64000 characters, and must be written/read in a single chunk
- The data is unstructured, with no way for the LMS to check the format of the data
- The data stored may not be in an easily human-readable form, which can hamper testing and diagnosis of problems in development

## 3. Use cases

We have come across several cases where the shortcomings of suspend data have caused problems on projects:

- A course developed for a major UK healthcare provider had several sections. The client wanted each section to have separate tracking for percentage completion, route taken through the section and passed/failed status. Some of their requirements could

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have been met through the `cmi.objectives` data structure or by splitting the course into multiple SCOs but there was no way to expose all the information they required in a way that their LMS could utilise.

- One course for a major airline required users to choose their job role, which affected the subset of the learning presented to them. The client would have liked to be able to run reports detailing, for instance, the percentage of baggage-handlers who had successfully completed the course. The information for the chosen role was stored in suspend data but there was no easy way for the LMS to access that data.

# 4. Proposed solution

We propose a method of allowing a SCO to define additional fields to be created in the data model by the LMS for storing data that does not currently fit well within the pre-defined data model.

Developers would specify in the SCO manifest file any additional data fields required by the SCO along with any relevant information:

- the type of field (string, number etc) **or**
- a list of the allowed values for the field (for instance "baggage handler", "air crew", "flight deck" etc. for the second usage case above)
- the length of the field
- a default initial value if relevant.

On importing the course, the LMS could allocate storage for these fields in its database and they would then be available for that SCO to use as with any other data model field.

This approach would have several benefits:

- the data in the fields would be exposed in an easily accessible way in the LMS for the purposes of reporting – potentially a major advantage for organisations looking to calculate the ROI of their online learning investment and a major plus for organisations selling learning to be able to offer information that precisely fits the needs of the purchasing organisation
- the LMS can check values being sent to the fields and raise appropriate errors if the wrong type or size of data is sent. This would speed up testing and encourage a more rigorous approach to development.
- developers can produce code that is more maintainable – a call to set a value in `cmi.user_fields.user_role` is much easier to understand than a function which takes that data, rolls it up with all the other suspend data and sends/receives that data in one big chunk.

# 5. Integration and other technical issues

This functionality would be in addition to the current core data model so existing SCOs would not need to be updated as a result of this functionality. SCO's which do not need to take advantage of this functionality could be developed, packaged and deployed in the usual way.

There would inevitably need to be some checking by the LMS to ensure that SCOs do not try to create an unreasonable number of fields and a minimum upper limit to this could be defined in the SCORM standard (although there are risks to standardising this - like the

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lowest permitted maximum value of suspend_data, what is reasonable at the time the standard is written, may be insufficient after a few years).

Requiring that these fields be available for reporting would also be a new area for the SCORM, which currently more or less lets the LMS do what it wants with cmi data fields.

## 6. Summary and recommendations

In summary, we recommend the provision of a mechanism whereby a SCO can specify at additional data model fields at import time, which will be created by the LMS. These fields will be available at run-time in the same way as existing pre-defined fields in the CMI Data Model.

The solution will facilitate greater availability of information to organisations using LMS's and a more structured approach to development of SCOs with complex information requirements.

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