# (at least) 27 questions to ask your LMS vendor about SCORM

Ensure your RFP for a learning management system gets you what you want and expect from SCORM.

# SCORM FOR LMS RFPS: BEYOND A CHECKBOX

Somebody told you that your RFP needs to include a requirement for SCORM conformance. What does that mean? Why do you need it? What exactly should you be looking for in an LMS? What requirements should be added to the RFP? How will you judge the proposals, i.e., how do you know a vendor really knows what they are talking about and can do what they propose to do?

Yep, there are a lot of things you need to ask as you start this process if you want to have a LMS that meets your needs and expectations. We've come up with at least 27 things to talk to your LMS vendor about specifically related to SCORM to help you make that happen. Just putting in a checkbox that asks if they do SCORM isn't enough.

This paper will describe the impacts of these implementations and some hard-hitting questions you should ask your LMS vendor to ensure that their implementation adheres to the intent of the specification rather than simply the letter.

## LET'S TALK SCORM

Requirements for Sharable Object Content Reference Model (SCORM) conformance have intentionally been of a limited scope to allow for market flexibility. SCORM allows great freedom of implementation; this freedom is a blessing for promoting wide adoption, but also a curse in that freedom can be abused. True interoperability requires intent on the part of the developer. It requires going beyond the minimum requirements of the specification and developing a supporting infrastructure that fully capitalizes on the power of the specification.

SCORM is a great standard, but it only gets us about 90% of the way down the road to true interoperability. Even amongst products that are ADL certified there are a number of different implementations, interpretations and design decisions – all of which have a significant impact on interoperability. Interoperability issues will arise, even in the best SCORM implementations. It is not a question of "if" but rather "when" and "how many".

ADL puts the market in a position to define what is good and what is not. As we see it, there are three levels of SCORM conformance: (1) the bare minimum, (2) good enough, and (3) conformance that truly embraces the spirit of SCORM. Our goal is to help readers distinguish between these levels so that they

can formulate solution requirements that meet the spirit and goals of SCORM rather than just the letter of the specification.

## WHAT IS SCORM AND WHY DO I NEED IT?

SCORM is the de facto industry standard for e-learning interoperability. That's a fancy way of saying that if you ever have a situation where e-learning courseware is coming from one party and should be played in a Learning Management System created by another party, SCORM is the common language that the two parties speak to work together. A full discussion of SCORM, its benefits and implementations is beyond the scope of this paper, but if you're a bit uncertain about what SCORM is, it would be wise to pause now and go read up. There is a great explanation of what SCORM is, why you need it (and why you might not need it) available in the SCORM Explained section of our website.

## SCORM FOR LMS RFPS

The rest of this paper will talk about specific aspects of SCORM that have been known to vary across LMS implementations and cause obstacles to successful implementation of SCORM. Before purchasing an LMS, you should at least be aware of how the LMS vendor has chosen to deal with each of these aspects.

The issues are broken down into five high level groups:

- **Interoperability: Standards Support** - discusses the different versions of SCORM and helps you understand exactly what a vendor means when they claim they "support SCORM".
- **Interoperability: Debugging, Diagnostics and Development** - talks about the process for getting new content into an LMS and ensuring that it works properly.
- **Learner Experience / Usability** - helps you ensure that the process for actually delivering training is robust and usable.
- **System Logic** - discusses how SCORM fits into the larger picture of an LMS systems and helps you ensure that it "makes sense" in your training context.
- **Technical Implementation** - a place to "geek out" a bit and talk about the nitty gritty technical details of what makes a good SCORM implementation from a technical perspective.

Within each section are a series of questions you should ask, along with an explanation of what to look for in a response and some questions for further elaboration.

## DISCLAIMER OF BIAS

My name is Mike Rustici. I wrote this paper. I am a SCORM guru and I am a vendor. My company sells a

product, the SCORM Engine, that implements SCORM for many LMS systems. LMSs that use the SCORM Engine will do very well in meeting the criteria set out in this paper.

I fully acknowledge this bias, and you should too. But also know that we wrote the SCORM Engine to be the best SCORM implementation possible. We put a lot of time, energy, money, blood, sweat and tears into making the SCORM Engine exceptional (ok, well, maybe not a LOT of blood, but I'm sure we had a paper cut or two). The SCORM Engine implements the principles in this paper because years of experience have shown that they are the best way to create a great SCORM implementation. In some sense, this paper shares a bit of our "secret sauce" for what makes the SCORM Engine great.

My motivation for writing this paper is not to sell more licenses of the SCORM Engine. My motivation is to help the e-learning industry as a whole become more efficient and more interoperable. Quite frankly, I am tired of hearing some people blame SCORM for interoperability problems, when in reality is it poor implementations of SCORM by vendors that are causing the problems. This paper is intended as a stake in the ground for the industry to start defining what constitutes "good SCORM" vs "bad SCORM". (For more on this rant, read It's time for me to say it, SCORM doesn't suck…).

# INTEROPERABILITY: STANDARDS SUPPORT

## 1 WHAT VERSIONS OF SCORM DO YOU SUPPORT?

SCORM has evolved since its original inception in 2000. During that time, content has been developed to each of the different versions of the standard. To be broadly useful, a LMS should be able to play content that uses any SCORM version. Just like your fancy new Blu-ray player can play old DVDs, the burden of maintaining backwards compatibility should fall on your LMS.

Currently, SCORM comes in five flavors:

- SCORM 1.1
- SCORM 1.2
- SCORM 2004 2nd Edition
- SCORM 2004 3rd Edition
- SCORM 2004 4th Edition

A thorough explanation of these versions and the history behind them can be found in our eLearning Standards Roadmap. At a minimum, the LMS should support SCORM 1.2 as it is the most broadly adopt-

ed version of SCORM. An LMS that is serious about standards support should support at least one of the SCORM 2004 editions. Content developed to SCORM 1.1 is rare and support for this legacy standard isn't often needed.

## 2 DO YOU SUPPORT AICC HACP?

As mentioned in the eLearning Standards Roadmap, there is a related specification called AICC that is still broadly used within the industry. AICC is especially useful for content that will not be hosted on the LMS server as it is not susceptible to the cross domain scripting problem. There are several different implementations of AICC, one file-based, one HTTP-based (web-based) and another ECMAScript-based (browser-based). In most all cases, when one refers to "AICC", the references points to the HTTP-based implementation known as HACP. Your LMS should support AICC HACP to ensure broad content compat-ibility.

## 3 ARE YOU SCORM CERTIFIED BY ADL? IF SO, FOR WHAT VERSIONS? IF NOT, PLEASE PRO-VIDE TEST SUITE LOGS SHOWING YOUR CONFORMANCE.

ADL offers a formal certification program that employs independent auditors to ensure that an LMS is in fact SCORM conformant. Formal ADL certification is the best way to ensure that an LMS is SCORM confor-

mant. Certification will ensure that the system meets the letter of the specification, but not necessarily that it is a functional system that meets all of your needs...that is what the rest of the questions in this paper are for.

ADL will certify systems as being conformant with a particular version of SCORM. A LMS is not "SCORM Certified", it is "SCORM 2004 3rd Edition Certified" or "SCORM 1.2 LMS-RTE3 Certified" (more on the "RTE3" bit in the next question). Also note that ADL only certifies the specific version of the LMS that it tests against. If a vendor has changed their SCORM implementation since becoming certified, it is no longer technically certified.

Certification costs money, requires some paperwork and isn't for everybody. It is okay if a vendor isn't formally certified, but certainly better if they are. If they are not certified, there is still a way to ensure that their claim of SCORM conformance is legitimate, ask them for their test suite logs. ADL produces a freely-available conformance test suite that runs all of the same tests that a certification auditor runs. The logs from these tests are easily saved and shared as proof that a product can pass the tests.

A product that can not pass the full set of conformance tests is **MOST DEFINITELY NOT SCORM CONFOR-**

**MANT**. The LMS might be SCORM-ish, SCORM-like, SCORM-y or SCORM-ified but it is not SCORM confor-mant. Implementations like this are the most dangerous. They lead to unending compatibility problems for their users and degrade the entire industry. If there is one thing you take away from this paper, please demand that your vendor provide some kind of proof of their SCORM conformance.

Note: ADL has indicated that a more robust certification process will likely be put in place soon that requires ongoing conformance testing and enables systems to loose their certification if they do not maintain their implementations. [Sept 2009]

## 4 WHAT LEVEL OF SCORM 1.2 CONFORMANCE DO YOU SUPPORT?

Conformance with SCORM 1.2 is broken down into three levels, LMS-RTE1, LMS-RTE2 and LMS-RTE3. The levels indicate how much of the SCORM run-time data model the LMS supports. LMS-RTE1 indicates that the LMS developer has done the absolute bare minimum it could to call itself SCORM conformant. LMS-RTE3 indicates full support. Support for LMS-RTE1 or LMS-RTE2 is generally a red flag that the vendor pays lip service to SCORM so that it can "check the SCORM box" (on lesser RFPs than the one you are writ-ing), but that the vendor cares little for becoming truly interoperable.

**5** **WHAT IS YOUR POLICY REGARDING ADOPTING NEW VERSIONS OF STANDARDS?**

Some organizations will always be on the cutting edge and adopting the latest industry innovations. Others prefer to wait for significant adoption or specific client demand before moving forward. Look for their history of actually following through with staying on the cutting edge if they tout this as an important part of their business strategy.

**6** **HOW MUCH EXPERIENCE HAVE YOU HAD DELIVERING SCORM CONFORMANT CONTENT?**

It is often a good idea to probe a vendor's depth of expertise. Deep expertise not only predicts a quality implementation, but also ensures that competent technical personnel will be available for troubleshooting compatibility issues as they arise.

Some related questions to consider include:

- How many different content developers have you worked with, and with what kinds of content?
- Can you provide references at organizations that have implemented content similar to our in your LMS?
- Do you participate in the process of evolving the standards?

# INTEROPERABILITY: DEBUGGING, DIAGNOSTICS AND DEVELOPMENT

The process for importing new content into an LMS, validating its behavior and diagnosing problems can be time consuming and frustrating if the LMS vendor has not provided adequate resources, tools and access to information.

## 7  HOW IS CONTENT IMPORTED INTO THE LMS?

The process for importing content into an LMS can often be arduous and limiting. Ask for a demonstration of this process and ensure that it is inline with your expectations. Specifically note how long it takes to add a basic SCORM module to the system.

Is the process quick and efficient? How many clicks does it take? Are there shortcuts that can be used during development and testing? If not, your administrators and content developers will have a miserable time trying to test out new content.

How does the LMS deal with very large courses, for instance 2GB or more? Is there a way to just import

some of the course assets (say one or two files) rather than re-importing the entire course? Can the LMS import a SCORM PIF file (a SCORM course packaged up in a ZIP file)?

Once the content is imported, how easy is it to register a user to experience that content? Is this process quick and efficient? If not, are there shortcuts that can be used during development? Can a registration be reset so that testers can easily try alternative scenarios? There can be a lot of variation in the way this is implemented. If it is a common task for you, you should "dig into the weeds" and see how easy this really is.

## 8 HOW IS CONTENT UPDATED AND HOW ARE NEW VERSIONS DEPLOYED?

Content is rarely static forever. Typos and errors are fixed and instructional material is updated. When this happens, the LMS needs to provide a mechanism to import the updates and create new versions of the content as necessary.

What aspects of a course can be updated without creating a new version of the course? What is the process for publishing an update or new version? Sometimes simple updates (like typo fixes) need to be made without much fuss. Other times, big changes to the course warrant creating a separate new

instance of the course in the LMS. You will want an LMS that allows for both types of updates with an appropriate level of effort.

When a new version of a course is created, what happens to users who are currently taking the old version? Are they automatically moved to the new version? Do they continue on the old version? Do they lose existing progress data if they are half way through the course? For minor changes, learners should be able to experience the updated content without interruption. For major version updates, it can be very hard for an LMS to move users to the updated content while maintaining their progress information.

One of the elegant aspects about SCORM is that the logic describing how the course is organized and functions is concentrated into one file, the course manifest (written in XML). Changes to the sequencing or reorganizing the existing assets can be accomplished by simply swapping out this file rather than re-uploading the entire course package.

## 9 WHAT TOOLS ARE AVAILABLE TO THE LMS USER AND CONTENT DEVELOPER WHEN CREATING / IMPORTING CONTENT?

Is there a sandbox environment for LMS administrators to use when testing new content? Is this sandbox available to external content developers (if so, are additional licenses required for them)? Does the sand-

box precisely replicate the production environment? A robust sandbox that precisely mimics the production environment is a valuable tool that is often an oversight until after procurement (at which point there are financial barriers to its formation). Ensure that the sandbox is only for content development and testing. Often, there is one sandbox that is both for testing new LMS versions/features/customizations and for testing content. This situation can lead to very disappointing results when content works well in the sandbox, but not in the production system because they are not precisely the same. A sandbox doesn't necessarily have to be a separate system, an isolated area of the production system can be just as effective.

## 10 WHAT KIND OF DIAGNOSTIC INFORMATION IS AVAILABLE TO TROUBLESHOOT PROBLEMATIC CONTENT?

SCORM enables some complex behaviors. Often, when something goes wrong, a fix is not readily identifiable; a debugging effort will be required. In many LMSs there is no diagnostic information to assist with this debugging. The lack of these tools can lead to a painful situation in which the content developer is forced to repeatedly "guess and check" to ascertain the root cause of the problem (this can be especially painful if the content import process is onerous).

There are three primary touch points between the content and the LMS, each of them creates potential interoperability problems for which diagnostic tools should be available:

**Content packaging (import)** - To be imported, a content package presents an XML document called the imsmanifest to the LMS. The LMS reads this document to learn everything it needs to know about the content. It is possible that this document will be improperly formatted or inconsistent with the LMSs expectations. When that is the case, what kind of error messages does the LMS provide? Are they intelligible to the average user? Does the LMS do any validation beyond simple XML format validation? Can the LMS handle slightly imperfect manifests, or does any imperfection cause the entire course to be rejected?

**Run-time** - After it is launched, content will write data to the LMS and read data from the LMS using the SCORM run-time API. This data is exchange as a series of read and write operations. Each of these operations can succeed or it can fail based on the a number of factors. These calls are at the heart of SCORM and control whether content is completed, what the learner's score is recorded as, and just about everything else that really matters. When something is behaving unexpectedly, the first thing to look at is the series of run-time communication calls between the content and the LMS. Does the LMS provide a list of

the run-time calls made by the content? If an API call fails, does the LMS provide detailed information as to why it failed? Is this list of calls available after the content unloads (this is important as many SCORM courses make the most significant API calls as they are unloading)?

Sequencing - SCORM 2004 courses will often include sequencing rules that the LMS must interpret to navigate the learner between SCOs. These rules operate on their own data model (called the "activity tree") that is separate from, but related to, the run-time data reported by the SCO. Does the LMS provide information about the current state of the sequencing activity tree? Does the LMS provide any indication of which sequencing rules were executed (and which were not) when the learner navigates between SCOs? It is rare to find LMSs that make this level of detail available, but it is invaluable when developing sequenced SCORM 2004 content.

## 11 WHAT KIND OF ERROR MESSAGES DOES THE LMS PROVIDE?
When something goes wrong (in each of the three areas above), what kind of error message does the LMS provide? Is it a generic message that is the same for all errors? Is it overly technical and only interpretable by the LMSs software developers? Is it something that a content developer can understand and use? Does the message vary depending on whether you are in the sandbox or the production system?

Content packaging errors should be intelligible to the content developer. Run-time errors should never be displayed to any user as many of them are in fact intentional behavior. However, they should provide very detailed descriptions of the error using the built-in SCORM error diagnostic API call. Sequencing errors are a bit more complex. In the sandbox, the exact sequencing error condition should be displayed to the content developer. In a production environment, a more intelligent message should be made available to the learner. For example, a message to the content developer might look like "Error: SB.2.2-1 - flowed into a parent activity with sequencing control flow=false", wheras the same error would be represented to the learner as "Please make a selection from the menu to continue.".

## 12  WHAT IS YOUR PROCESS FOR RESOLVING INTEROPERABILITY ISSUES?

Interoperability issues are a fact of life. While every LMS vendor should seek to eliminate these issues, the true test of a company's support is how they deal with issues when they arise. Does the LMS vendor provide accessible and knowledgeable support staff to resolve SCORM interoperability issues? Are the support personnel willing to work directly with content developers to resolve interoperability issues? What is the support process for resolving these issues? Is the LMS vendor willing to admit a mistake and issue a free patch, or is it always up to the content developer to create a workaround? How does the LMS vendor go about issuing patches for interoperability?

Put another way, how does the LMS handle content with differing interpretations of the standard? When an interoperability error is discovered, how does the vendor ensure that it won't happen again? Does the LMS provide configuration options to accommodate different types of content, potentially even misbehaving content?

## LEARNER EXPERIENCE / USABILITY

SCORM provides only minimal guidance about how the LMS should present a SCORM course to the user. The guidance is intended to ensure that the required user interface elements are present, but allows the LMS a lot of freedom to provide a user experience optimized for its environment. As mentioned in the introduction, freedom is both a blessing and a curse. When procuring an LMS, you want to ensure that the actual user experience of taking online training is a pleasant one. Some LMSs provide notoriously un-usable interfaces. The best way to do that is to try it out yourself as an actual user would. Here are some things to look for and consider.

### 13 HOW MANY WINDOWS DOES THE LMS OPEN?

Some LMSs open chains of three or four browser windows just to deliver a simple course. If the user in-advertently closes one of these windows, it can be possible for the course to stop functioning. Get a feel for what it is like to launch a course and if the user can mess things up by inadvertently closing windows. You might want to ensure that the user is not required to press a specific "exit" button to close a course. All results data should still be saved even if the user just closes the browser window.

## 14 DOES THE LMS PROVIDE ANY INDICATION OF PROGRESS AND STATUS TO THE LEARNER?

It is often helpful for a learner to know how s/he is doing on a course. What kind of feedback is given to the learner? Does the LMS provide an indication of the learner's status on each activity (satisfaction, completion, score, etc)? Is this display configurable to accommodate different courses?

## 15 IS THERE AN EASY TO USE COURSE MENU?

SCORM courses are typically represented as a set of hierarchically structured activities. The LMS should provide a "table of contents" to the user that allows the user to select an activity to launch. The availability of this table of contents as well as which activities are visible and selectable can be controlled by SCORM 2004 sequencing rules. How does the LMS represent this table of contents? Is it intuitive and easy to use? Does it remain visible when a SCO has been launched? How many clicks does it take to navigate between SCOs?

## 16 HOW DOES THE SCORM PLAYER RESPOND TO LARGE COURSES?

When a SCORM course has many SCOs (say 100-200), how does the LMS respond? Is the user interface still intuitive and usable? Is the navigation between SCOs still fast and responsive? Is it still responsive even if complex sequencing logic is being used?

## 17 CAN THE USER INTERFACE BE CUSTOMIZED FOR EACH COURSE?

Different SCORM courses have different expectations for how they will be delivered. Some expect to be launched in a new window, others expect to be launched in frameset. Some expect to occupy the full screen, some adapt to minimal screen real estate, some require a window of a very specific size. Some courses benefit from showing the table of contents at all times, others would operate better if it were hidden. Some courses benefit from showing detailed progress data, others don't report this data so it simply becomes a distraction. The more configuration options an LMS provides, the better the experience will be for the learner. At a minimum, the LMS should provide different interfaces for SCORM courses with just one SCO (and thus no need for LMS provided navigation) vs SCORM courses with many SCOs (and thus a need for good inter-SCO navigation).

# SYSTEM LOGIC

SCORM is very tightly scoped. It covers the interaction between the LMS and the content and no more (with good reason). There is a lot of functionally surrounding e-learning content delivery that is relevant and important to real world training. Many people are frustrated by the functionality LMSs implement on the periphery of SCORM. Often SCORM is blamed for these problems, when the real problem is that the LMS implementer failed to provide the LMS infrastructure to make SCORM useful and behave as expected. Here are some LMS functions to consider that are "outside the scope" of SCORM, but can have a dramatic impact on SCORM's usefulness within a system.

## 18 WHAT REPORTS ARE AVAILABLE TO EXTRACT SCORM DATA?

SCORM provides content with the ability to report a wealth of data about the learner's experience with a course. The content can provide as much or as little of this data as is relevant. SCORM requires the LMS to store this data only for the current attempt on a SCO. Once that attempt is over, there is no formal requirement for the LMS to persist the data. SCORM also doesn't specify how the LMS should make the tracked data available for the learner or administrators to view and report on.

- What reports does the LMS provide?

- Does the LMS track data for all prior attempts on courses, or just the most recent attempt? How are these reported?
- What report data can the learner see? Is it too much (for example, seeing question answers)?
- Do reports include access to the entire SCORM data model?
- Do reports provide information on individual question results? Can the LMS report data across all attempts on of a course to provide things like question item analysis?

## 19 HOW DOES DATA REPORTED VIA SCORM FEED INTO THE REST OF THE SYSTEM?

SCORM contains logic that precisely defines when a SCORM package is considered "completed" or "satisfied". It contains logic to identify a precise score and many other data model elements. However, SCORM doesn't say that "once the course is completed, the learner should receive credit for it in the LMS and it should show up on his/her transcript". How the data created and tracked by SCORM affects the rest of the LMS system is beyond the scope of SCORM, but should be considered carefully to ensure that it is in line with expectations. Some things to consider:

- What triggers a course to be "recorded on the learner's transcript"? Does it just need to be completed? Does it need to be satisfied? What if it is recorded as completed but failed? Is a

score required? Do all individual activities need to be completed, or does only the rolled up status (as dictated by SCORM sequencing rules) matter?

- Once a course is completed, can a user take it again? Does this new launch start a new attempt, or simply resume the previous attempt? Does the data reported in this subsequent launch affect the prior status? In other words, can a previously completed course become incomplete? What is the process for starting a new attempt?

- What score is recorded in the "gradebook"? Is it the score for the entire course? Do scores for individual activities show up outside of detailed reports?

- In SCORM 1.2, where there are no formal rules for "rolling up" status and score, how are status and score calculated for a course with more than one SCO?

- How do SCORM courses fit into the larger LMS picture? Are they their own entity, or are they a part of a larger curriculum or other structure?

## 20 WHAT OPTIONS ARE AVAILABLE FOR LAUNCHING A SCORM COURSE?

Must a SCORM course always be launched for credit? Is there a way to preview or browse a SCORM course? As mentioned above, is there a way to review a SCORM course once completed? When alternative launch types are used, does the LMS set the cmi.mode (normal, review or browse) and cmi.credit

(credit vs no credit) data model elements appropriately to indicate the alternative launch format to the content? Setting these data mode elements can signal the content to adapt its behavior to the appropriate context (for instance, during browse mode, test questions might not be displayed).

## 21 WHAT DOES THE LMS DO WITH SCORM METADATA?

SCORM allows content to specify tremendous amounts of metadata describing the courseware. What does the LMS do with this metadata? Is it used when searching the course library? Is it displayed to users at all? If so, which (of the many) metadata fields are used and how? Is the metadata only used at the course level, or will the LMS consider metadata that is defined at the activity, SCO or file level as well?

## TECHNICAL IMPLEMENTATION

SCORM specifies a technical interface, or what should be done, but SCORM does not specify *how* to create that interface. There are many technical implementation decisions that can significant impact the usability of SCORM. Warning, you are now entering the "geek out" section of the paper, please put on your pocket protector.

## 22 DOES THE LMS REQUIRE JAVA APPLETS OR OTHER PLUG-INS BE AVAILABLE IN THE BROWSER?

Browser plug-ins, especially Java applets, can create huge support headaches as you deploy your LMS. Many LMSs use plug-ins to relay SCORM data from the web browser to the server. These implementations are notorious for causing compatibility problems. With AJAX supported in virtually every modern browser, an LMS should not need to use Java applets or plug-ins to support SCORM. (A common misconception is that "SCORM requires Java". This is false, SCORM requires JavaScript, which is a common an innocuous technology available in all browsers. ADL also implemented many of its sample applications in Java, however this was an arbitrary choice, not something required by the standard.)

## 23 HOW WELL DOES IT SCALE?

Scalability is obviously a general concern for any software system. There are two aspects of SCORM that present new dimensions to scalability. First, a LMS must be able to handle SCORM courses that frequently report a lot of data. Second, SCORM LMSs should be able to handle large SCORM courses that contain many SCOs and have very large file sizes.

## 24 HOW IS DATA SENT FROM THE CLIENT TO THE SERVER?

All of SCORM communication happens in the web browser. SCORM requires that this data be persisted (presumably to the server), but does not define how the data should be moved from the browser to the server. The technical implementation of this data transfer can have a big impact on the performance and responsiveness of the system. Make sure that the system isn't using a Java applet or other plug-in to handle this communication (as mentioned above).

There are three common strategies for handling this communication:

1.  Every time the content makes a SCORM run-time call the LMS will make a synchronous request to the server to save or retrieve the data. This solution is straight forward to implement, but can lead to very unresponsive systems. Each individual request to the server

incurs overhead. Considering the fact that reporting a single question result can easily require 6 or more individual SCORM calls, a system can easily become bogged down using this communication strategy.

2.  Other implementations will alter this strategy and only send data to the server when the LMS makes a call to the Commit API function. This strategy is certainly more scalable than #1, however it has other drawback. There are no requirements that content make calls to Commit. This leads to two negative situations, in the first, they call Commit after every API call, resulting in a scalability problem akin to #1. In the second, the content never calls Commit and data is not reliably saved to the server. Also, LMS developers will often make "synchronous AJAX" calls in these first two scenarios. When using a synchronous AJAX call, if the server is unresponsive, the entire web browser can become locked up and completely unresponsive until the server has finished processing the request.

3.  The best implementation strategy removes both synchronous processing and any correlation to SCORM API calls. In these implementations, all data is cached locally in the browser. Periodically an asynchronous process will look for dirty data that needs to be committed and send it to the server in the background. This strategy can be tricky to implement correctly, but it provides the best user experience and system scalability.

## 25 WHERE IS THE SCORM API LOCATED?

SCORM specifies that the SCORM API can be located either in a parent window (relative to the content), the opener window, or a parent of the opener window. All of these locations are perfectly valid from a technical SCORM perspective. However, they are not all ideal or equal. Some content doesn't properly search for and discover the SCORM API. Most testing environments provide the API in a direct parent window, and thus, most content is only tested in this deployment configuration. To achieve the best compatibility, the LMS should provide the SCORM API in a parent window, or at least provide a configuration option to locate the API there for misbehaving content.

## 26 HOW OFTEN IS SCORM 2004 SEQUENCING LOGIC REEVALUATED?

SCORM 2004 sequencing logic controls which LMS user interface elements are available to the user at any given moment. For instance, a sequencing rule might state that the next button is disabled until the learner passes a pretest. Thus, the timing of when an LMS re-evaluates the question "has the learner passed the pretest" has a direct impact on usability. In many LMSs the sequencing data is not re-evaluated until a SCO is unloaded. Thus, the learner would have to manually exit the pretest before finding out that s/he can now click on the next button. In more robust LMSs the sequencing data is re-evaluated

periodically and the user interface elements are enabled/disabled while the SCO is still loaded.

## 27 DO YOU ALLOW CONTENT TO BE HOSTED IN DIFFERENT DOMAINS? IF SO, HOW DO YOU ENABLE THIS CONFIGURATION?

Due to a well known browser security restriction, SCORM content must be hosted in the same domain as the LMS (if the LMS is at www.myLms.com, the content can not be at www.myContent.com, the content must also come from www.myLms.com). If you have a situation requiring content to be hosted in a different domain, the LMS vendor will have to make some accommodations for this scenario. There are many well defined workarounds all of which have merits.

# IN CONCLUSION

Craig Weiss recently published a blog post with a similar theme to this paper. My favorite quote:

"If your vendor says they are AICC/SCORM compliant, ask them specifically what does that mean?  – Again, put the onus on the vendor to explain it.   If they can't, start looking elsewhere."

Our hope is that the questions provided here will help you in your search and help you get a LMS that meets your needs and makes your SCORM experience a great one.

*Mike*

# INFO

## ABOUT RUSTICI SOFTWARE

Rustici Software creates products that simplify conformance with learning standards like SCORM and AICC. While other companies tolerate them, we embrace the standards and their intent. Really, *this is all we do*. Read more about it on our website or subscribe to our blog.

## BORN ON

This document was written in September 2009 and based on the best information available at that time.

## ACKNOWLEDGEMENTS

Thank you to Rebecca Bodrero of CTC, John Campbell of Imedia.it, Aaron Silvers of Grainger and Peter Berking of ADL for contributing their ideas and feedback to this paper.

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