

Progress Engine

The progress engine controls the progress of a lesson. When a learner starts a lesson or moves from activity to activity, it is the progress engine guiding their way. Without the progress engine, LAMS isn't LAMS.

This page covers some background to the progress engine, the overall system design as well as the implementation algorithm.

This page is based on the original LAMS 1.1 Progress Engine document in the lams_document project. It has been updated to reflect LAMS 2.1, but the original document makes more comparisons with LAMS 1.0, so if you want to see how the progress engine has evolved, check the original document. The UML diagrams on this page have been taken from that document (as screenshots) or are in one of the MagicDraw files in lams_common/design. MagicDraw v10 is the best version for updating these diagrams - you open the .zip file from within MagicDraw to access the diagrams.

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Background

To understand the progress engine, it is necessary to review some background concepts that related to LAMS progress engine. The main purpose of this section is to let new developers to understand the e-learning concept behind the design of progress engine and what progress engine is doing from user's point of view. If you knows LAMS concept already, please feel free to skip this section.

Learning Design

The concept of learning design has been defined in the IMS specification. The LAMS learning designs are not described in the same way as learning designs in the IMS standard, but the concept is the same. From progress engine's perspective, learning design defines a sequence of collaborative learning activities and tools required to support these activities. It defines the basic navigation rules that progress engine should cope with. Learning designs are also known as "**sequences**" as main structure of a learning design is a sequence of Activities, rather than a set of unordered Activities.

Activity

An Activity is the major element of a learning design. In another words, it is main learning object that sits inside the learning design. From progress engine's point of view, activities are the nodes of the sequence that the engine needs to navigate through. Generally they are a "box" of some kind on the learning design picture.

Lesson

While a learning design is a reusable template, the lesson is one instance that using the learning design template. A lesson should have a number of participating learners (see Lesson Class), who are going to do the activities that are defined in a learning design. Therefore, data that is involved in the learning design instance of a particular lesson should not be shared across lessons. In terms of progress engine, the start of a lesson is the trigger of the progress engine. At this point, progress engine should initialise any resources of the learners.

Learner Progress

The learner progress is the data holder that records the progress status of runtime learning design instance. In other words, learner progress record where the learner is in a lesson. Therefore, learner progress has to be specific to a particular learner and a particular lesson.

Learner Progress Bar

The learner progress bar is a graphical representation of a user's progress. It appears in three forms - a vertical Flash component that sits on side of the LAMS learner GUI interface or a non-Flash tree structure that overlays the LAMS learner GUI interface, and the horizontal Flash layout used in the the LAMS monitoring GUI interface. These give a user friendly graphical representation of where a learner is in the learning design.

The relationships between the group tables looks a little confusing, as the grouping classes are used for both normal groups and the lesson class. A Lesson has a LessonClass, which is a subclass of Grouping (and hence is stored in the lams_grouping table). The staff_group_id column is only used for the LessonClass object. The LessonClass has a single group in its groups collection, and this group is all the learners in the LessonClass. Then there is a second group which is the staff group, and that group's id is stored in the staff_group_id column.

In the course of the lesson, there maybe "normal" groups set up, such using the Random Grouping. These will have a Grouping class and one or more Group classes, so one lams_grouping row and multiple lams_group rows.

- **ToolSession.** As you already know, learning design is a static aggregation of learning activities. Each activity refers to a tool session record that holds the runtime data for the activity. Moreover, the ToolSession is the means by which we assign a batch of learners to a particular instance of an activity. If the activity is being used for the whole class, then the ToolSession is associated with the LessonClass' group of learners. If the activity is grouped, then there is a separate ToolSession for each group, creating a separate instance of the ToolActivity.
- The **LearnerProgress** records the progress data for each learner. One lesson should have 0 or many learner progressions. Every learner should only have one learner progress record for a lesson.

The learner's progress object is represented as one class in Java, but the attempted and completed sets are implemented as separate tables in the database. So there are 5 direct and indirect links from the learner's progress to activity - current activity, previous activity, next activity, attempted set and completed set.

The completed and attempted sets are exclusive sets. When a learner starts an activity then the activity is recorded in the attempted set. When the activity is completed, it is removed from the attempted set and added to the completed set.

Lesson States

The lesson passes through a number of states. The states are defined in the Lesson class.

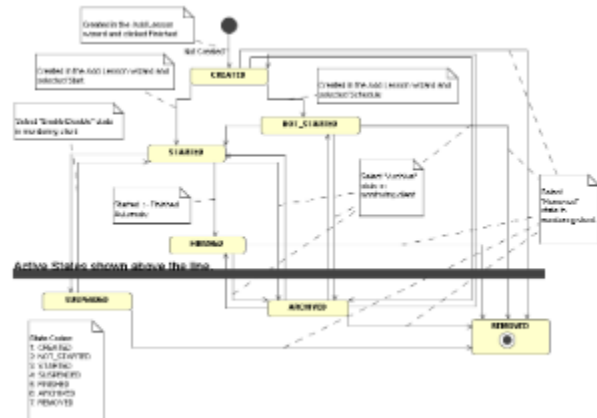


Figure 3 Normal Flow for Lesson States

As of LAMS 2.1, you will be able to move from any state to removed - you do not need to make it archived first.

Lesson State	Description
CREATED	A newly created lesson. The learning design has been copied. The lesson class may or may not have been configured. The lesson is shown on the staff interface but not on the learning interface.
NOT_STARTED_STATE	A CREATED lesson may be scheduled to start at a particular date. When it is scheduled, state is set to NOT_STARTED_STATE for lessons that have been scheduled. The lesson is shown on the staff interface but not on the learning interface.
STARTED_STATE	The lesson has been started. The lesson is shown both the staff interface and learner interface. Whilst in this state, the learners can participate in the lesson.
SUSPENDED_STATE	A lesson that is in STARTED_STATE may be suspended. While suspended, the lesson can be seen on the staff interface but not on the learning interface. When the lesson is no longer suspended, it returns to STARTED_STATE.
FINISHED_STATE	The state for lessons that have been finished. Currently not used, as there is no definition of "Finished" as new learners could be added at any time.
ARCHIVED_STATE	The state for lessons which are shown as inactive on the staff interface but no longer visible to the learners.
REMOVED_STATE	The state for lessons that are removed and never can be accessed again. In reality, the records are still in the database and could be retrieved by setting the state back to STARTED_STATE directly in the database.

Teacher's Perspective Use Cases

Primary Actor	Use Cases
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Teacher	Create and Start Lesson
Teacher	Create Lesson
Teacher	Start Lesson
Teacher	Force Complete Learner
Teacher	Live Edit

Use Case Name:

Create and Start Lesson

Actors:

Teacher

Description:

The teacher creates a lesson for a learning session.

Preconditions:

The teacher loads up the "Add Lesson" interface.

Postconditions:

1. A lesson gets created.
2. A copy of learning design for lesson gets created.
3. A copy of tool content gets created.
4. A new lesson class is created.
5. Progress engine data such as the tool sessions is initialised.

Normal Flow:

1. Teacher clicks on the Add Lesson button. Each Add Lesson button is association with an organisation and this will become the organisation used to display the list of potential users, and be associated with the lesson.
2. Teacher selects the learning design he wants to run for the new lesson and clicks Next.
3. Teacher select the users who will be in the lesson and clicks Next.
4. Teacher types in the title and description for the lesson.
5. Teacher clicks on the Start Now to tell LAMS to create lesson.
6. LAMS initialises the lesson:
 - Creates a read only copy of the learning design, of type COPY_TYPE_LESSON
 - LAMS notifies all tools that involved in the learning design to create a copy of their content for lesson.
 - Creates a new lesson for the copied learning design (without a lesson class), associated with the selected organisation. Lesson status is set to Lesson.CREATED.
1. LAMS creates the LessonClass, based on the list of users supplied by the GUI, and associates it with the lesson.
2. LAMS starts the lesson
 - Goes through all the non-grouped tool activities and initialises the tool sessions.
 - Goes through all the scheduled based activities and start scheduler of each task if necessary.
 - Goes through all the branching activities and assigns it a grouping (if one doesn't exist) so that the users in the branch can be tracked.
 - Marks each activity as initialised. This is needed later for Live Edit.
 - Sets lesson status to Lesson.STARTED_STATE

Use Case Name:

Create Lesson

Actors:

Teacher

Description:

The teacher creates a lesson for a learning session and starts it ready for use.

Preconditions:

The teacher loads up the "Add Lesson" interface.

Postconditions:

1. A lesson gets created.
2. A copy of learning design for lesson gets created.
3. A copy of tool content gets created.
4. A new lesson class is created.

Normal Flow:

1. Teacher clicks on the Add Lesson button. Each Add Lesson button is association with an organisation and this will become the organisation used to display the list of potential users, and be associated with the lesson.
2. Teacher selects the learning design he wants to run for the new lesson and clicks Next.
3. Teacher select the users who will be in the lesson and clicks Next.
4. Teacher types in the title and description for the lesson.
5. Teacher selects on the Schedule or Start In Monitor to tell LAMS to create lesson but not start the lesson.
6. LAMS initialises the lesson:
 - Creates a read only copy of the learning design, of type COPY_TYPE_LESSON
 - LAMS notifies all tools that involved in the learning design to create a copy of their content for lesson.

- Creates a new lesson for the copied learning design (without a lesson class), associated with the selected organisation. Lesson status is set to Lesson.CREATED.
1. LAMS creates the LessonClass, based on the list of users supplied by the GUI, and associates it with the lesson.
 2. If the teacher selected Start In Monitor, the lesson is left as Lesson.CREATED. If the teacher scheduled the lesson, then a scheduler task is set up to start the lesson automatically and the lesson status is Lesson.NOT_STARTED.

Use Case Name:

Start Lesson in Monitoring

Actors:

Teacher

Description:

The teacher starts a lesson that was created previously.

Preconditions:

The teacher loads up the "Monitor" interface.

Postconditions:

1. Progress engine data such as the tool sessions is initialised.

Normal Flow:

1. Teacher clicks on the Start Now button.
2. LAMS starts the lesson
 - Goes through all the non-grouped tool activities and initialises the tool sessions.
 - Goes through all the scheduled based activities and start scheduler of each task if necessary.
 - Goes through all the branching activities and assigns it a grouping (if one doesn't exist) so that the users in the branch can be tracked.
 - Marks each activity as initialised. This is needed later for Live Edit.
 - Sets lesson status to Lesson.STARTED_STATE

Similarly to the previous test case, if the lesson is scheduled, LAMS will do the same "start the lesson" process automatically at the correct time. The teacher may also go into the Monitoring interface and do "Start Now" on a scheduled lesson, or set up scheduling on a non-started lesson.

Use Case Name:

Force Complete

Actors:

Teacher

Description:

The teacher moves a learner from one part of the lesson to another part of the lesson.

Preconditions:

The teacher loads up the "Monitor" interface and brings up the sequence tab. The learner is partway through the lesson.

Postconditions:

1. Learner's progress is updated

Normal Flow:

1. Teacher finds the learner's icon on the learning design diagram, then clicks and drags the learner's icon to a later activity, or to the "finished" bar at the end of the screen.
2. If the teacher dragged to the icon to a later activity, the call to the server passes the activity id of the activity just proceeding the selected activity (ie the "last" activity to be marked as completed"). LAMS then processes the learner's path through the design to the nominated activity using the progress engine to determine the next task. Along the way, LAMS will create tool sessions and do branching calculations as required. Once the "last" activity is reached, the learner is started on the next activity. This gives the affect of moving the user to the nominated activity.
3. If the teacher dragged the icon to the finished bar, the call to the server does not pass any activity id. LAMS will process the learner's path to the end of the learning design.
4. In either case, LAMS obeys the normal "stop" mechanisms. For example if the user reaches a permission gate that is shut, or a chosen grouping but has not been grouped, then the processing will stop and LAMS will return the current activity id of the activity where the user is stopped. Also, LAMS only marks the user's progress as completed - it does not call the tool and tell the tool that this user has completed the activity. Therefore if the learner returns to the activity later they will complete the activity the same as normal (e.g. in MCQ they will get to answer the questions).

Use Case Name:

Live Edit

Actors:

Teacher

Description:

The teacher makes a small change to the learning design of an existing lesson. Note: this is only designed for quick changes to the learning design structure, not large scale changes. If only the content of an activity is to be changed, it should be changed via the activity's screen in monitoring.

Preconditions:

The teacher loads up the "Monitor" interface and brings up the sequence tab.

Postconditions:

1. The learning design attached to the lesson is updated.

Normal Flow:

1. Teacher clicks Live Edit, and confirms that they wish to edit the learning design.

- LAMS system JSP activity - A single framed JSP is also used for system activities. The difference between this category and single framed JSP activity is that the actually activity content won't be displayed directly. Instead, a LAMS page will be loaded to represent activity's content. Options activity is a good example - LAMS option page will be shown with all the sub-activities outlines and instructions rather than the contents of all optional activities.

Why did we make this classification? We want all activities contents are loaded by LAMS loading page rather than shown directly from Struts action forward. Why LAMS loading page is important? LAMS loading page has to exist because of two major reasons. Firstly, the loading page is a clean solution to add extra frame and clean unnecessary frame whenever required. Without using an intermediate loading JSP, we could not find a solution to achieve the same functionality.

Secondly, the loading page is a good place to send update progress bar message to the Flash client. In LAMS 1.0 we had the entry JSP page of each tool doing updates of the Flash progress bar. This resulted in a tight dependency between tool and the Flash progress bar, duplicate code and consequently a maintainability nightmare.

Isn't the loading page is extra overhead and makes LAMS very "chatty" (ie a lot of calls to the server)? Yes, but for the benefits it has brought use, it was worth the overhead. If usage and/or profiling show an issue in this area then we will optimise the code however the overall methodology appears sound at this stage and there are other areas we can look at for performance improvements.

Move to next activity

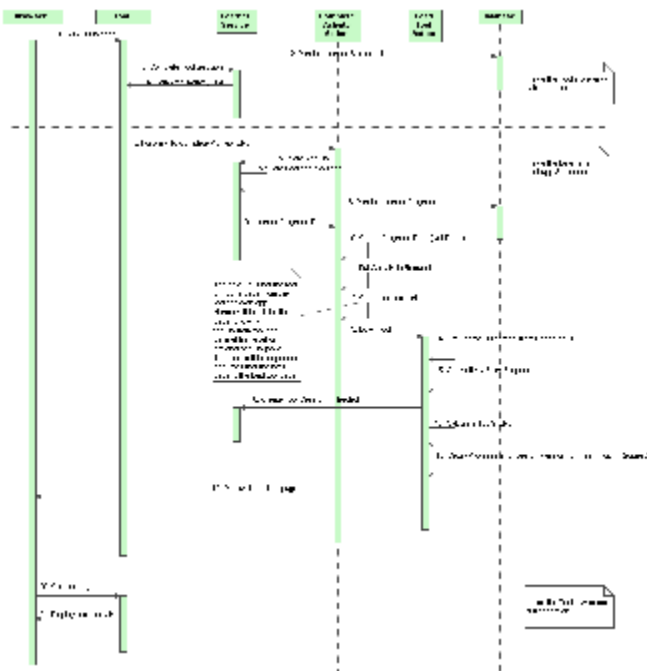


Figure 5 Move to Next Activity - Sequence Diagram

Above diagram shows the overall algorithm used to complete the moving from one activity to the other. This process usually triggered by clicking on the "Finished" button of a particular tool page. Originally we did Step 2 to Step 8 in one transaction so as to ensure there is no inconsistent state between tool and LAMS server. However when we implemented Live Edit, there was an increased chance that calculating the learner progress would fail due to some case we hadn't considered (setting up Live Edit while allowing the learners to proceed and not putting in synchronisation points which may slow down the progress engine wasn't easy). So we split the update into two transactions, so that the tool is always able to persist their data, and then it forwards to a URL in the learning web app to do all of the progress updates.

It is important to notice that LAMS travel from tool web application to lams_learning web application via http URL calls. This means that any calls to the core services that are NOT in the tool's Spring contexts are available to the learning logic. The tool's do not include all the context.xml files for the core, so some of the service beans are not available.

The lams_learning is responsible for calculating the URL for next activity and forward to it. Two major algorithms, Calculate the next activity at service layer and Mapping the Activity to the URL, are hidden in above diagram, which will be explained in following sections.

In the diagram above, many of the calls such as Calculate Learner Progress, Put Activity in Request, etc, are really calls to other classes, but the other classes have to be hidden or the diagram would be impossible to read.

Calculate the next activity at service layer



Figure 7 Calculate the URL from Learner Progress- Activity Diagram

Once the service layer progress engine calculated the next activity to move on to and returned the learner progress, the web layer progress engine needs to figure out what is the proper URL for the next activity. Figure 7 illustrates the algorithm to fulfill this functionality.

Some calls do redirects, some do forwards. The intention is that in moving to the next activity, something should redirect to ensure that we don't accidentally go back to the last screen. Normally the redirect is done via the displayTool.jsp but in other cases it is handled by the Struts "forward", which can be setup to be either a forward or a redirect. One day it would be nice to document exact at which point in the processed a redirect is done, so that we can ensure all "next activity" calls do a redirect but don't do a whole pile of redirects.

Join a lesson with Retrieving Progress Data - Needs Updating

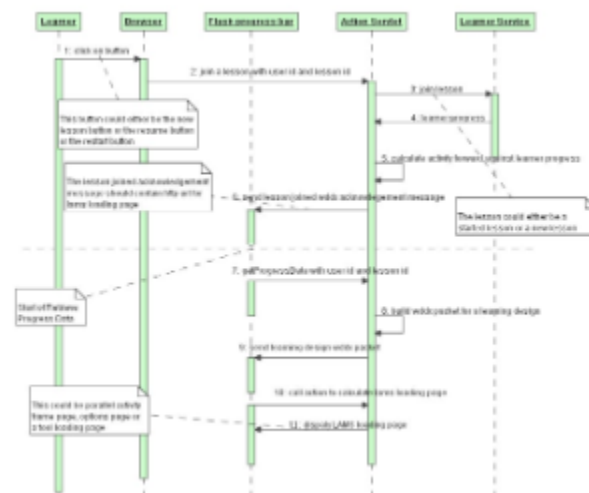


Figure 8 Join lesson with retrieving progress data - Sequence Diagram

Based on the understanding of major progress engine algorithm and page loading mechanism, we can further the explanation of the joining lesson algorithm. The explanations of join lesson and retrieving progress data are combined because these two use cases usually happen consecutively. Once LAMS finishes joining the learner to the lesson and send the wddx acknowledgement message with the URL of loading page calculation struts action back to Flash, Flash sends the request to the LAMS server to grab entire learner progress structure to build up learner progress bar. The progress data request from Flash has to be sent after the Flash client receives the "Joined Lesson" message from LAMS because it needs to load the latest progress data.

Communication between Server progress engine and Flash Progress bar

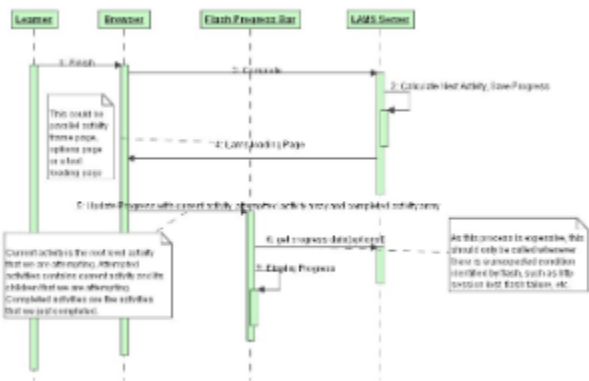


Figure 9 Server and Flash Communication - Move to next activity

We have already explained the algorithm of moving to next task on the LAMS server side. How do we achieve the visual indication of the movement on the Flash progress bar? Figure 9 explains the detail logic behind the scene. A Flash movie update script is embedded on the LAMS loading page (and the parallel and optional pages) and this movie opens a Flash pipe which passes the IDs for the current, attempted and completed activities. The code for the Flash swf is in the lams:Passon tag, so inclusion in a few jsps is easy.

Flash then updates the progress bar with the activity data, based on the design details that it received when the learner window was first opened. All the data has been calculated on the server side as part of the "move to next task". The data sent back to Flash is only small, which minimises the Flash - Java communication cost. As a safe guard, Flash can send the request to server to restore the whole progress bar structure if there is an issue on the Flash side.

One of the parameters passed to Flash is the design version. This is updated whenever a Live Edit is done, triggering Flash to get a new copy of the design when the version changes. This allows learners to see an updated design without having to exit/restart learner.

The code that actually moves to the next activity (on the "Loading Next Activity screen") is embedded in Javascript. If we are using the Flash progress bar then Flash calls the javascript method to advance to the next activity. This was done to eliminate timing issues we were getting between Flash updates and the JSP advancing. For this reason, the Flash progress bar had to be used in LAMS 2.0.

Non-Flash Progress Bar

In LAMS 2.1 we have introduced the Flashless learner interface (apart from Chat). If the learner is not using the Flash progress bar then the jsp calls the javascript to do the page redirect when the page is loaded. There is no need to update the non-Flash progress bar as that is generated only when the learner requests the progress display.

The non-Flash progress bar is generated using the ProgressBuilder class, which is based on the LearningDesignProcessor. During the parsing of the design, it builds a set of URLs to show completed activities. The data is then passed to a JSP for rendering. This is done every time, so we will have to watch that it doesn't become a performance issue - the code was done quickly rather than being coded to be quick. Having the work done on the server does increase the server load - normally the calculation of what should appear green, blue, etc is done in Flash and hence is done in the client. But it isn't done on every progress (as it in Flash) so hopefully it won't be a big issue.

Authoring Preview

When an author runs a preview, it actually runs a complete lesson, with a single learner in the class. There is no monitoring client. Apart from the differences mentioned for Gates and Grouping below, the following differences apply to Preview.

- The LearningDesign is set up with COPY_TYPE_PREVIEW.
- The LearningDesigns are hidden in the Workspace tree.
- Any activities that are set to Define Later are run with their default content (after warning the user).
- When a Branching Activity is reached, the author is able to select any branch rather than being forced to do the branch that would normally be selected.
- The user is able to "jump ahead" to an unstarted activity using the Flash progress bar. This triggers a force complete of the activities in between the current activity and the activity selected.

System Activities

Parallel Activities

The URLs for handling Parallel Activities are hardcoded. As it is a "structural" screen, there isn't a lot of point making this a pluggable activity, so no point moving the URLs to the SystemTool table. A Parallel Activity is defined to be completed when both of its children are completed.

Parallel activities are one of the hardest activities to get right in the web layer of the progress engine, as their behaviour varies when they are completed and appear in a popup, compared to in the normal window. So when you make changes to them, make sure you test the parallel activities on normal completion, in the popup window and as part of a complex sequence, such as an optional activity.

Optional Activities and Optional Sequences

Optional Activities and Optional Sequences are the same thing on the server. They have different Activity types for the purposes of authoring (to make life easier for Flash) but they are handled in the identical manner. An Optional Activity contains a set of Activity objects, which are displayed on the screen in orderId order and the learner selects which activity to choose. Optional Sequences just happen to be a special case where all contained Activity objects are SequenceActivity objects. The progress engine could cope with a single type of Optional Activity that mixed single normal activities with sequences, but it would be too confusing in the authoring client.

The URLs for handling Optional Activities are hardcoded. As it is a "structural" screen, there isn't a lot of point making this a pluggable activity, so no point moving the URLs to the SystemTool table. An Optional Activity is defined to be completed when the user selects "Finish" on the activity when the minimum number of child activities have been completed, or when the maximum number of activities have been completed.

Grouping

Grouping current supports two sorts of grouping - Random and Teacher Chosen. Random Grouping supports both "Group Learners by Number of Groups" and "Group Learners By Number of Learners Per Group" are marked as extension rather than inclusion because only one of these two conditions can be

applied when the teacher tries to create a random grouping activity. Applying both conditions will implicitly set the limit of the number of total learners in a class, which might make it difficult for a teacher to assign learners into the class when the lesson gets started but the authoring user interface only allows one condition to be set.

Teacher Chosen grouping allows the teacher to create groups and assign users to groups on the fly.

Grouping is a system tool and the logic for grouping is spread throughout the core. As such, we can't "plug in" someone else's grouping algorithm. However it is a SimpleActivity that implements the ISystemTool interface and the URLs for Grouping screens are defined in the lams_system_tool table, so there is the potential for calling a grouping algorithm in another web-app if authoring could be made to support it and we added calls to allow the external web-app to create Group objects.

Object and Database Models

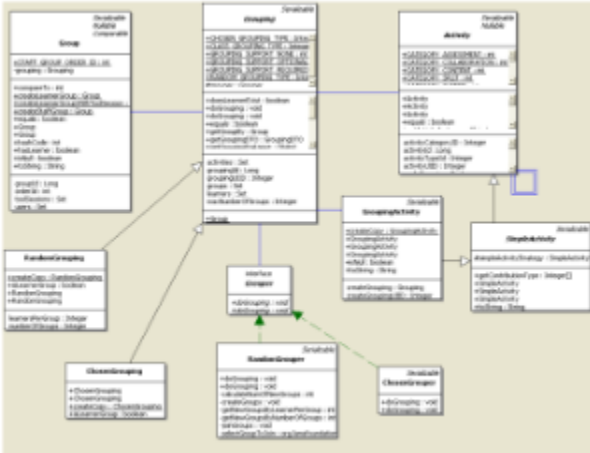


Figure 10 Grouping Domain Object Model

The above diagram shows the object model fragment for grouping implementation. Instead of having two different grouping activities, we delegate the grouping specific operations to the class "Grouping", which is extended by two sub-classes - RandomGrouping and ChosenGrouping. These two classes act as the data holder for two types of groupings. Furthermore, the strategy interface "Grouper" is created purely for calculation purpose. doGrouping method within grouper performs the grouping algorithm in a polymorphic way. The end result of this algorithm is to create a number of groups inside the grouping object.

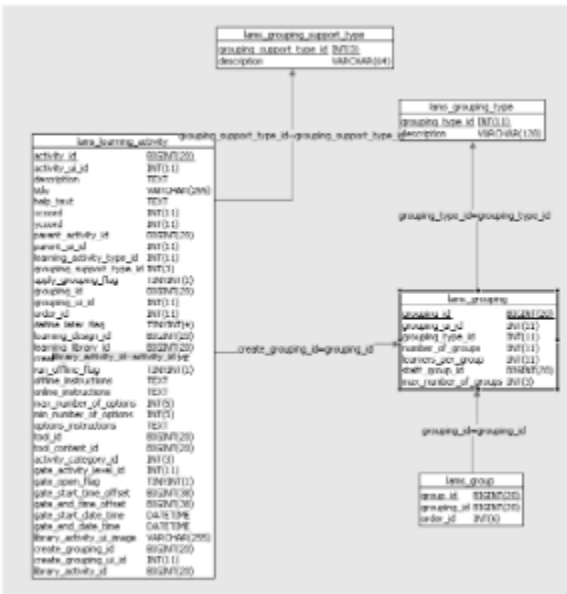


Figure 11 Database Model

Compared to the domain object model, the database design is much simpler. Most of the inheritance relationships you have seen are mapped using "Table per class hierarchy" to improve efficiency.

Ultimately, LAMS should be able to cope with tool having a non-grouped mode and grouped mode, hence the **GroupingSupportType**. Although LAMS 2.0 tools are not able to freely switch between grouped and non-grouped mode this database design will allow more flexibility in this area in the future. There was a debate over what levels of grouping would mean to a tool and as all our tools only care about getting "some group of users", we implemented a very simple version of the grouping support until we have an actual case where we want to do something more complex.

At present the three modes are used to control the users associated with the tool session, so the tools don't have to do anything with respect to the grouping type. The three basic supported types are:

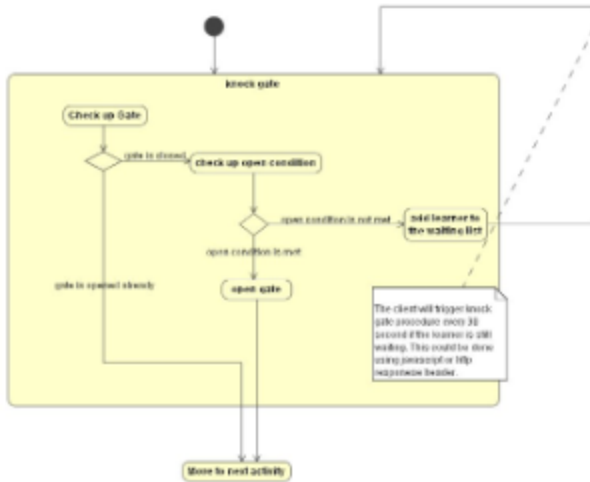


Figure 13 Open Synch Gate Activity Diagram

The knock gate procedure will firstly triggered by the completion of the activity before the gate activity in a learning design. As we have shown in the note, waiting learner will knock gate every 30 seconds. This is achieved via a META HTTP-EQUIV="Refresh" statement, and knocking on the gate will open it when enough learners are waiting.

Similarly, the Permission Gate and Schedule Gate will do a refresh to check if the Gate is open. Once the gate is open, the learner is taken onto the next activity automatically, saving the user clicking refresh constantly.

Preview

When running a lesson in preview, there is permission gates and schedule gates would be a problem. In preview, when these gates are reached, the author sees a screen indicating that a gate would normally apply here, but that the gate will be opened immediately so that the preview will proceed. LAMS then opens the gate and preview continues.

Branching

See [Branching](#)

Future Improvements

Lesson and Progress Data Caching

At present, the lesson and progress data are not cached, although the core User objects are cached. These are obvious candidates for caching, as they are complex structures and are required on every calculation of the next activity. Just putting the objects straight into the user's normal HttpSession or even the SharedSession doesn't work well. The HttpSession varies from web-app to web-app and some of the code to execute the "next" functionality is run within the tool's web-app, although the code itself lives in the lams-learning.jar. Putting it in the SharedSession would avoid this, but then we have to have two different entries for the lesson and progress data for the preview screen and the learner screen as both can be running simultaneously. Also, putting the lesson in the SharedSession is not a good idea as the Lesson is the same for all the users in the Lesson and potentially we could be caching a Learning Design (attached to the Lesson) which is now out of date due to a Live Edit. So the Lesson and the LearningDesign will probably need to be cached using the JBoss cache, which interacts with Hibernate so that the object in the cache is up to date.

In general, there is a lot of "put activity in the request", "get learner progress somehow", "put activity id/learning design id in the request parameters", etc in the progress engine. Originally it was carefully tuned so that each system screen got only what it needed, but then we'd change the screen to do more and we'd need more parameters, etc so it grew higgledy-piggledy. When we look at caching the progress data then we need to clean up where we put the activity in the request.

Making System Tools More Pluggable

At present, the system tools cannot be easily replaced with other versions of the tool. For most of the system tools this is not an issue, but we already have people wanting to use different grouping algorithms (say to access the groups already configured in their LMS) and potentially people may wish to open gates based on external systems. The lams_system_tool table has been set up to try to make a way to do this in the future and to make it easier to set up new sorts of branching (as you can tweak URLs in a table rather than hardcoding them). But before we can have pluggable groupings we need to address how this is done in authoring, as the grouping choices are hardcoded into the Flash interface and into the Activity class hierarchy.

Separate Instances for System Tools

Every tool activity will be associated with a set of tool sessions to hold its learning time data for a different group. However, system tools (e.g. gates, grouping, branching and sequence activities) do not have the equivalent of a tool session. Therefore it is not possible to easily assign a grouping to a gate, or restrict a gate to the users currently doing a branch. To do this, we would need to make the gate logic know about the pseudo-groupings used for branching. It also means that we have no way of creating subgroups (groups of groups), which I think we could in LAMS 1.0.