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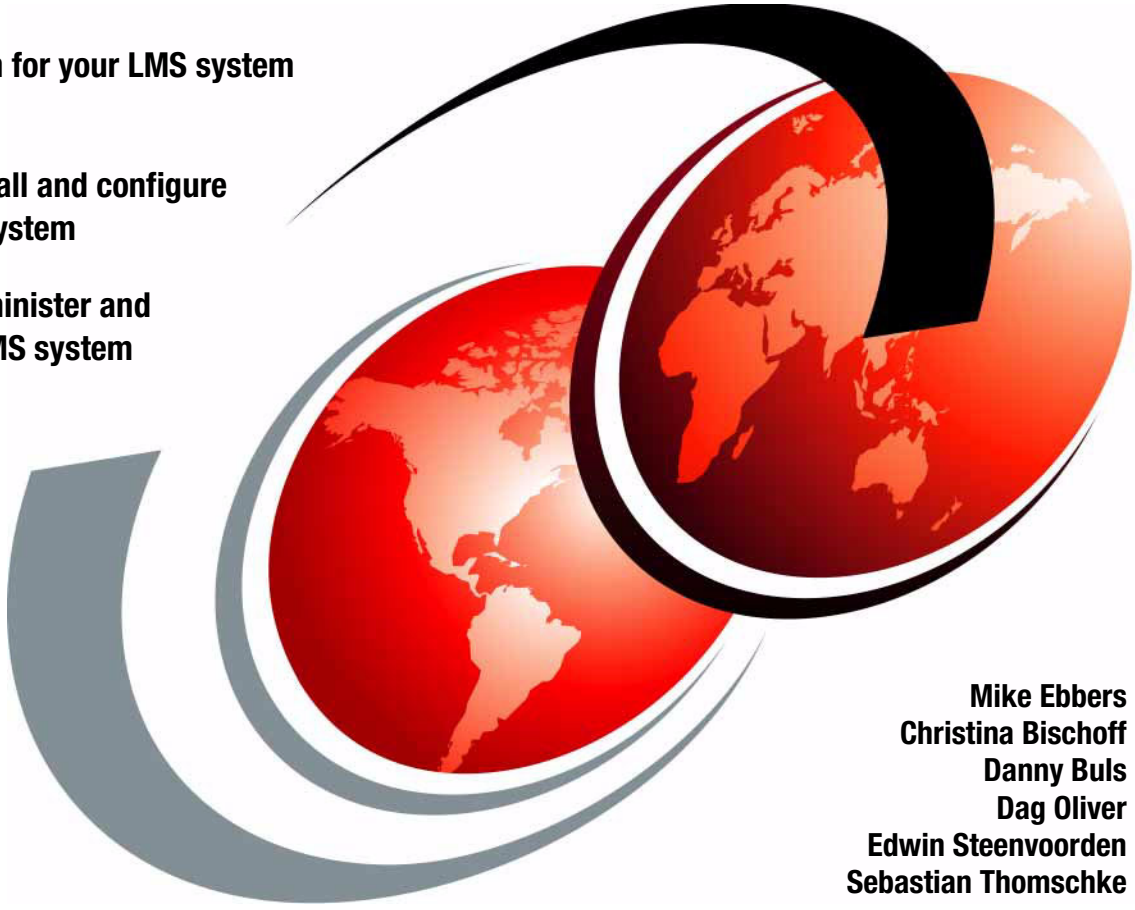
IBM Lotus Learning Management System Handbook

How to plan for your LMS system

How to install and configure your LMS system

How to administer and use your LMS system



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Preface

This IBM Redbook introduces the new IBM Lotus Learning Management System (LMS) into the growing world of e-Learning products and systems. We wrote it to help you plan for, install, configure, and use the LMS to meet your company's education requirements.

We begin with a discussion of what a learning management system is. We describe how this new LMS contains a WebSphere®-based architecture. We list the requirements and prerequisites for supporting this e-Learning environment. Then we tell you of our installation experiences, and show you how to configure and customize the system for your company. Lastly, we give you some tips on how to adminster and use the LMS. We end with a case study that illustrates these points.

Anyone who is reponsible for choosing and implementing a learning management system will want to read this publication.

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Part 1

Planning

In this part we introduce the IBM Lotus Learning Management System. Then we discuss ways to plan for its installation.

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1

Introduction to the IBM Lotus Learning Management System

In this chapter we describe the functions of a Learning Management System in general and the benefits of the IBM Lotus Learning Management System (LMS). We discuss the differences between the LMS and Lotus LearningSpace R5. At the end we give an overview of future product plans.

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1.1 Introduction

People do banking transactions on the Internet. They find catalogs and information on the Web. Online shopping is getting big. Plenty of companies, organizations, and educational institutions have established e-Learning offerings to make learning more flexible, efficient, and just-in-time.

Training is taken more seriously than ever before. Not only is it strategic and important, but also it links directly to the organization and business results. Training improves employee morale, ensuring that employees understand the business goals.

When companies focus on learning, they do not focus any more on getting people into traditional classes. Rather they:

- Embed learning in business processes and initiatives
- Increase overall productivity and competitiveness
- Leverage learning solutions as a way to solve problems
- Facilitate the transfer of knowledge

In this chapter we describe the functions of a Learning Management System in general and the benefits of the IBM Lotus Learning Management System (LMS). We discuss the differences between the LMS and Lotus LearningSpace R5. At the end we give an overview of future plans.

1.2 What a Learning Management System is

Are you seeking an easy way to manage blended learning solutions, resources, and courseware in your company only from one single platform? Do you need to manage student activities, user data, and tracking?

A Learning Management System supports the extension and optimization of the different learning offerings within a company. We are not talking about either an e-Learning solution or classroom training. Rather, an LMS combines different learning components in blended learning solutions. This helps you to get more effect out of what is invested in learning.

The Learning Management System manages all resources, curriculums, and catalogs owned by a company. You can track certification progress, schedule and enroll courses, and auto-generate reports on individual learning progress or the progress of a training initiative across the whole organization. An LMS supports requirements for compliance, certifications, accounting, and ERP integration.

1.3 What makes the IBM Lotus LMS special

There are many reasons that make the IBM Lotus Learning Management System (LMS) special. At the root of the LMS's flexibility is the ability to configure the system instead of customizing it. Another quality that makes the LMS distinctive is the way it easily scales from small through departmental to enterprise-wide needs. Benefits also include the robustness, flexibility, and extensibility of the architecture, and the ability to create custom reports. In addition, we look at several major areas below.

1.3.1 Blended learning

Blended learning is no longer just a buzzword; it is reality. It has been adopted by the corporate community and is changing the dynamics of online learning. Asynchronous courses launched and managed by the LMS are only one part of a good learning program. The LMS can also manage real time instruction, those face-to-face courses that need the traditional classroom approach as well as live virtual classroom sessions.

IBM Lotus recently introduced a live classroom product called IBM Lotus Virtual Classroom. This product integrates seamlessly with the IBM Lotus Learning Management System.

1.3.2 Authoring tool

Although it ships with the LMS, the LMS Authoring Tool (AT) is a standalone Windows application. It once was described like this: “It fills the sweet spot between Microsoft Powerpoint and a more complex tool like Macromedia Dreamweaver.”

The AT was built to enable subject matter experts to create their own courses without having to be Web developers or e-Learning experts. It supports blended learning. This means that one course can consist of physical classroom activities, self paced e-Learning, and virtual classrooms.

Since the LMS supports SCORM 1.2, the AT can also be used as a conversion tool. Content supporting earlier versions of AICC and SCORM can be imported into the AT and converted to SCORM 1.2 compliant content. When imported into the LMS, the LMS can then generate SCORM 1.2 tracking data to track student progress.

1.3.3 Offline client

The offline client lets you download courses onto your Windows32 desktop so that they can be taken anytime from anywhere. When you reconnect to the LMS server, all your activities in those courses will be updated.

1.3.4 The bottom line

With the IBM Lotus Learning Management System, you can manage the entire learning process, plus all forms of learning—a comprehensive system with great flexibility. An LMS helps you accomplish these goals:

- Build a corporate learning environment that integrates with the dynamic workplace and is part of your organizational portal strategy.
- Provide reporting and tracking for staff decision making and human capital management.
- Develop competency-based learning solutions to help increase worker productivity and reduce training costs.
- Design blended learning solutions.
- Streamline corporate learning programs, delivering valuable training resources to employees when needed.

We describe the components and architecture of the IBM Lotus Learning Management System in more detail in the next chapter, particularly in 2.1, “What is in the LMS” on page 10.

1.4 How the LMS is different from LearningSpace

Many people will ask about the differences between LMS and Lotus LearningSpace R5. The main difference is that the LMS covers more than just e-Learning offerings. The LMS also manages physical classroom and e-Learning resources. It builds a corporate learning environment in your company.

Table 1-1 Differences between Lotus LMS and LearningSpace 5.0

Learning Management System	LearningSpace 5.0
Manages physical classroom and e-Learning resources.	No support for physical classrooms. Designed as e-Learning delivery platform only.
Runs on Microsoft Windows, Sun Solaris, IBM AIX®, and Linux.	Runs on Microsoft Windows 2000 only.
J2EE Application-based on IBM WebSphere.	Based on Microsoft IIS.
Includes Authoring Tool for creation of custom content.	Supports third-party Authoring Tools only.
Customizable UI can be personalized for various user groups and profiles.	Same UI for all audiences, but customizable by customer.
Scalable to support large enterprises.	LOB solution.
Calendar and schedules.	No calendar and scheduling.
Wait list management.	No wait listing.
Powerful administration tools.	Limited administration tools.
Integrates with various LDAP directories: Domino, Active Directory, and IBM Directory Server.	Maintains its own user directory and can only be connected to a Lotus Domino Directory.
Supports offline learning via the LMS Offline Client.	No support for offline learning.
Supports ad-hoc and scheduled reports. Reports can be delivered in different formats, including html, csv, text, xml, and pdf.	Provides only ad-hoc HTML-based reports.

1.5 Lotus Workplace and the LMS

In the spring of 2003, IBM announced the creation of an innovative new platform for collaboration and human interaction called the Lotus Workplace. As part of the IBM On Demand strategy, Lotus Workplace will connect people with the information and business processes they need.

The LMS will be the application at the core of the learning component of Lotus Workplace. In the future versions of the Workplace, learning will still be available as a standalone product, similar in functionality to today's LMS. It will also

integrate with the other business components of the Workplace platform such as messaging, calendaring, document management, application integration, and awareness. All of these components will all use a common WebSphere-based infrastructure.

This flexibility allows LMS customers to first focus on the learning system to reap the benefits of e-Learning and then add additional features incrementally when needed.

The pervasive use of "learning" across the Workplace will make informal learning a reality while the collaborative components of Lotus Workplace will enrich the formal learning experience.

Lotus Workplace will also provide the foundation for service organizations, system integrators, and business partners to build specific solutions that add specific value to the Workplace.

2

Planning your LMS deployment

In this chapter we take a closer look at the considerations for deploying the IBM Lotus Learning Management System (LMS). We include technical aspects and, just as important, the organizational and political aspects of a deployment.

The LMS system will in many ways influence the whole infrastructure of an organization. Even the most basic installation will usually connect to a relational database (RDB) and Lightweight Directory Access Protocol (LDAP) catalog already in use. Connecting it to Domino, Sametime®, or the IBM Lotus Virtual Classroom are also options. Some customers want to take it even further and customize integration into their HR systems as well.

All of this makes for careful planning. Time invested in the planning phase is key to success and can avoid a lot of problems later.

When you finish reading this chapter, also see Chapter 16, “Corporate scenario” on page 327, for an example of how a company would plan for their deployment of LMS.

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2.1 What is in the LMS

Note: This section is an edited version of an article published in the Lotus Developer Domain written by Elizabeth Bowling. The original article can be found at:

http://www.lotus.com/ldd

The LMS is made up of several software components, dividing functionality among multiple applications and even incorporating products from other software companies. These varied components work together to provide a comprehensive solution to the problem of learning management.

Table 2-1 summarizes the LMS components, their source, and whether they are required for the LMS to function.

Table 2-1 LMS components

Component	Source	Purpose	Required
LDAP directory	Third-party	Maintains the centralized user accounts for an organization; may be used for authentication by multiple applications. If you don't already use an LDAP directory, one is provided on the LMS CD.	Yes
Relational DBMS	Third-party	Maintains three databases dedicated to the LMS; may additionally contain other databases not used by the LMS.	Yes
LMM Server	LMM	Acts as the focal point of the LMS; users access the LMS and its data through the LMM Server.	Yes

Component	Source	Purpose	Required
Delivery server	LMS	Displays course structures where students can navigate among activities, displays course content for each activity, and tracks progress data and transmits it to the LMM Server.	Yes
Content server	Third-party	Stores course content files for use with the LMS; files are accessed from course outlines using URLs.	Yes
SMTP server	Third-party	SMTP server third-party transfers help desk requests and all LMS-generated e-mail.	Yes
Web browsers	Third-party	Displays the LMS user interface on a client workstation.	Yes
FTP server	Third-party	Stores uploaded courses prior to importing them into the LMS.	No
Authoring Tool	LMS	Runs on a client workstation and enables course developers to create course outlines and content, including assessments. The Authoring Tool can also be used to import third-party courses into the LMS.	No
Offline Learning Client	LMS	Runs on a client workstation and enables a student to work on a course while disconnected from the network.	No

Component	Source	Purpose	Required
Collaboration servers	IBM Lotus products	Extends the LMS with other IBM Lotus products to add collaborative features: ► Domino: Discussion forums ► Sametime: Instant messaging ► Discovery server: Knowledge-search portlet ► IBM Lotus Virtual Classroom (LVC): Online (real-time) class sessions	No

Distributing product features among these various components gives you the flexibility to configure the LMS to suit your company's training needs. Figure 2-1 on page 13 shows a basic configuration for the LMS; your own installation may look very different.

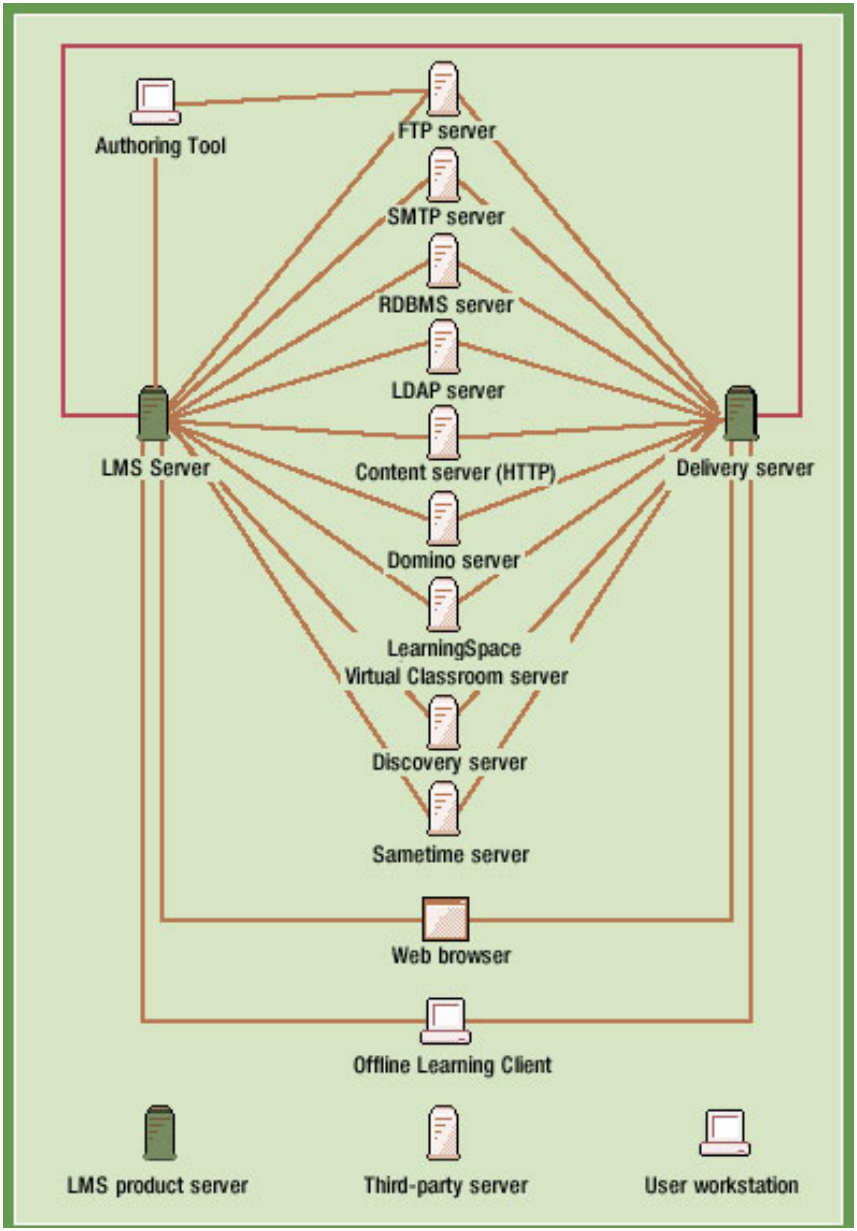

Figure 2-1 Configuration example

2.1.1 How these components interact

All users enter the LMS through the LMM Server. When the user specifies the appropriate URL in a Web browser, the LMS responds by displaying the Home module. At this point, the user is anonymous and has limited access to product features. When the user clicks **Log in**, the LMS prompts for a user name and password. This information is validated first against the database management system to determine whether the user is rostered in the LMS, and then against the LDAP user directory to authenticate that person's user name and password.

Once the user is successfully logged in, the LMS Server provides the client browser with an interface, allowing access only to the set of features associated with each user's defined permissions. Students use this interface to browse course lists, to enroll in and launch courses, and to view their progress. Other users can modify system settings, register users, deploy courses, define resources such as locations and instructors, schedule classes, and run reports detailing information on both the system and its users. When a user action triggers a system notification, the message is routed using the SMTP server.

Course developers use the Authoring Tool on their Windows workstations to create courses and to package third-party courses for use with the LMS. Courses are uploaded to the FTP server where they can be imported into the Lotus Learning Management System.

Course structures are stored within the LMS, while content files are stored on one or more content servers. To access a course, a student launches it from the Student Catalog, viewed on the LMS Server. The LMS Server then redirects the student to a Delivery Server, where the course outline is displayed, allowing the student to navigate within the outline and imposing a predefined sequence on course activities. When the student launches a particular course activity, the Delivery Server accesses the corresponding content files from the appropriate Content server and displays them in the LMS interface. As the student works through a course, progress data is captured on the Delivery Server and transmitted back to the LMS Server for processing.

Students wishing to work on a course off-line can download courses to their Windows workstations and use the Offline Learning Client to access the course when disconnected from the network. Upon reconnecting to the network, the student can upload tracking information to the LMS.

The Lotus Learning Management System supports a variety of IBM Lotus products designed to enable collaboration. Collaboration activities are built into the course design and are hosted on Collaboration servers that are integrated into the LMS.

2.1.2 A closer look at the LMS components

Let's take a closer look at the components of the Lotus Learning Management System and how they interact.

LDAP directory

Just as AICC and SCORM have been established as the leading specifications for e-Learning content, LDAP is the de facto standard regarding directory services. As an open, vendor-independent communication protocol for directory access with wide-spread acceptance, LDAP is a guarantor for interoperability of heterogeneous platforms, systems, and environments.

The LMS requires that user information is stored in an LDAP directory. The directory contains general user information that may be accessed by more than one application; it does not have to be specific to the LMS. If your company already uses an LDAP directory, you can use it with the Lotus Learning Management System. If your company uses Domino, you can configure the Domino Directory to function as an LDAP directory and use it with the LMS. Otherwise, you can set up the IBM Directory Server that is included on the LMS CD and use that for storing user information.

See “Supported LDAP directory servers” on page 374 for a list of the supported LDAP directory servers.

Relational database management system

The remainder of the data used by the LMS is stored in a third-party relational database management system (RDBMS). Although the RDBMS is a third-party product, it is a fundamental component of the Lotus Learning Management System. Data regarding user privileges, courses, and resources is stored in the database management system and accessed as needed.

The LMS uses three databases to store its data: The LMS Server database, the Delivery Server database, and the Audit database. The LMS Server database and the Delivery Server database store information related to users, courses, and resources, using the information in different ways. For example, the LMS Server requires user information to roster users and to track permissions; the Delivery Server uses the information to track user progress through course activities before sending that information back to the LMS Server. The Audit database stores system-generated information about LMS usage and is useful for system administration.

The LMS supports the following RDBMS products:

- DB2® UDB Release 7.2 or later
- Microsoft SQL Server 2000 for Windows 2000 Advanced Server

- Oracle 8i or later

The RDBMS can be hosted on the same machine as other LMS components, but in large organizations, it is typically stored on its own machine. The RDBMS does not have to be dedicated to the Lotus Learning Management System because the LMS usage is restricted to its own set of tables; however, in a large company, the LMS will use a great deal of the RDBMS resources.

LMS Server

The LMS Server is the central component in the Lotus Learning Management System, tying all of the other components together. Every LMS installation uses a single LMS Server, which may be hosted on one machine or on a server cluster.

The LMS Server can run on the following platforms:

- Windows 2000 Server or Advanced Server
- IBM AIX 5.1 or later
- Sun Solaris 8 or later
- Linux 2.4 or later

Users access the Lotus Learning Management System through the LMS Server, which provides the user interface. The interface provides for two general categories: Students and administrators. Students use the LMS Server to browse the course catalog, to enroll in courses, and to view their own progress data. Students are generally limited to two modules in the user interface: The Student Home module and the Student Catalog module. Student tasks include those listed in Table 2-2.

Table 2-2 Student tasks

Module	Typical tasks
Home	View announcements and messages.
	View progress towards completion of courses, certificates, and curriculums.
	View a calendar of scheduled activities.
Student Catalog	Browse through the list of available courses.
	Enroll in (or withdraw from) courses.

Administrators use the LMS Server to manage system settings, as well as users, resources, and courses. This category of user includes all non-students, such as system administrators, registrars, reporters, course developers, instructors, and resource managers. The LMS user interface categorizes administration tasks into a series of modules; you can assign access to those modules based on the

types of tasks for which each administrator is responsible. The range of administration tasks includes those listed in Table 2-3.

Table 2-3 Administrator tasks

Module	Typical tasks
Home	- View announcements and messages. - Approve/reject requests for enrollment in (or withdrawal from) courses. - View a calendar of scheduled activities.
Users	- Create and maintain LMS user accounts.
Course Catalog	- Register courses with the LMS. - Create offerings.
Course Management	- Enroll students in courses (or withdraw them from courses). - View class lists and student results.
Resources	- Define resources such as rooms and instructors. - Schedule resources for use with courses.
Reports	- Track student progress through one or more courses. - Create, schedule, and generate reports.
Settings	- Configure system settings. - Add components to the LMS. - Check logs.

Delivery Server

The Delivery Server is an LMS component that connects students to courses, performing tasks that support the sequencing, launching, and tracking of course content. An LMS installation can use one or more Delivery Servers to distribute courses. The Delivery Server supports the same set of platforms as the LMS Server.

When a student launches a course from the Course Catalog on the LMS server, the LMS server redirects the user interface to the Delivery Server designated for that course. The Delivery Server displays the course outline, which allows the student to navigate within the course and to select activities to launch. When the student launches an activity, the Delivery Server accesses a specified Content server where the content file for the activity is stored and displays that content to the student. As the student progresses through the course, the Delivery Server tracks progress data and routes it to the LMS Server.

Content server

Every course requires content—text, images, and multimedia—that users view as part of completing the course. Course content files are stored on content

servers, and are accessed from the course outline with URL links. Content servers are not intrinsic components of the LMS; they are third-party HTTP servers. If you are upgrading from LearningSpace, you probably already store course content on one or more HTTP servers, which can also be used with the Lotus Learning Management System. If you are not migrating from LearningSpace, you need to designate one or more HTTP servers to be used for hosting your LMS course content; these servers do not have to be dedicated to LMS content.

Course content cannot be developed or edited using the LMS Web interface; a special-purpose tool must be used for this. Your company can develop its own content using the LMS Authoring Tool component (see “Authoring Tool” on page 19), as well as commercially available Authoring Tools such as Macromedia DreamWeaver. Additionally, you can purchase ready-to-use content packages from vendors specializing in online training.

All content, including assessments, must be imported into the LMS before it can be made available to students. You can import content packages directly into the LMS using its command-line import utility (using SCORM 1.2 format only), or import packages into the LMS Authoring Tool, and send the packages to the LMS from there (the Authoring Tool accepts both SCORM 1.2 and AICC formats).

For organizations that migrate from LearningSpace Forum, the content files for migrated courses can optionally be stored in the LMS Repository, a Notes® (NSF) database where files are transferred during migration.

SMTP server

The LMS uses messaging to route automatic notifications to users and to send help requests to the Help Desk. This requires the use of an SMTP server, which routes the messages as needed within the system. The SMTP server does not have to be dedicated to the LMS; you can use an existing SMTP server that is already supporting other applications.

Web browsers

Users access the LMS from their client workstations using Web browsers. Users accessing Domino-based discussions see the database in its Web format through the browser, rather than using a Notes client.

The LMS supports the following client platforms and browsers:

- Microsoft Windows 95, 98, ME, XP, and 2000. Supported browsers: Microsoft Internet Explorer 5.0x, 5.5x, 6.0x and Netscape 6.2+ (for LMM, LVC, and Authoring modules).
- Linux Suse 7.2+ and RedHat 7.2+ only. Supported browser(s): Netscape 6.2+ (for LMM module).

- Apple Macintosh OS 9.x and OS X. Supported browser(s): Netscape 6.2+ (for LMM module).

Keep in mind the following information concerning client operating systems, browsers, and other related software:

- Internet Explorer 6.0 may require a one-time download of the JVM.
- The Authoring Tool and Offline Client only support Windows 2000 and XP.

Note: LMS does *not* support Netscape Release 4.7.

FTP server

When you upload courses to the LMS, you store them on an FTP server. The LMS copies the course package from the FTP server and processes it. When you create an offering based on that course, the LMS Server sends the course outline to the Delivery Server, and the course content to the content server. If you choose not to use FTP for transferring course files, they must be stored in a file server that is accessible to the LMS Server.

Authoring Tool

The LMS Authoring Tool is a content-creation application that allows you to create basic course structures and assessments or to format third-party courses for use with the LMS. Only native content can be edited in the Authoring Tool; content that was originally created elsewhere cannot be edited (you must return to the original editing tool for that purpose). The Authoring Tool lets you add sequencing information to a course to ensure that activities are completed in a specific order; you can also specify scoring requirements for activities.

The Authoring Tool is a stand-alone component of the LMS; it runs only on Windows platforms. During LMS installation, the Authoring Tool package should be placed on a server accessible to your company's content developers, who then download the package and install the tool on their own workstations.

Offline Learning Client

The Offline Learning Client is a package that enables students to complete course activities while disconnected from the network. Students download the package from the LMS server and install it on their Windows workstations. After the package is installed locally, a student can download one or more courses flagged as available for offline use, and then disconnect from the network. While the student is working offline, tracking information (progress and scores) for each downloaded course is stored on the workstation. When the user reconnects to the network, the course can be reset to online status and the corresponding tracking information uploaded to the LMS Server.

Collaboration servers

While taking a course online, a user may participate in a variety of collaborative sessions, hosted on a Collaboration server. Online discussions are hosted on a Domino server; instant chats are hosted on a Sametime server; live sessions are hosted on a LearningSpace - Virtual Classroom server, and Knowledge Management portals are hosted on a Discovery Server. Each of these servers is supported by another IBM Lotus offering, but can easily plug in to the Lotus Learning Management System. Table 2-4 lists the IBM Lotus products that provide the collaboration features.

Table 2-4 Collaborative features

Collaboration feature	IBM Lotus product	Description
Discussions	Domino R5 and later	Uses Notes databases that allow students and instructors to read and post documents discussing course-related topics.
Instant chats	Sametime 3	Uses Sametime instant messaging to allow a student to chat with one or more other students participating in the same course offering.
Live sessions	IBM Lotus Virtual Classroom 1.1	Provides a virtual classroom where instructors lead a class session in real-time. During the session, the instructor can display various types of files, mark up a whiteboard, lead students to one or more Web sites, and run additional applications that students can view from their own workstations.
Knowledge search	Discovery Server	Provides a portlet enabling a student to link to a Discovery Server and to search for information related to a specific topic under discussion in the course.

In summary

On the whole, the Lotus Learning Management System is a highly flexible and scalable product. By dividing features among multiple components and incorporating various third-party applications, the LMS enables a customer to configure the system in many different ways, as dictated by business needs. Smaller companies may choose to set up a simple configuration with one or two Delivery Servers to cover their online training needs. Larger corporations can expand the configuration at will, adding in additional Delivery Servers, and optionally plugging in one or more collaborative products.

One of the advantages of the IBM Lotus Learning Management System is that it lets you take advantage of existing applications, such as your LDAP directory and relational DBMS, as well as other IBM products you may already be using. The combination of all these different technologies makes the LMS appropriate for almost any training needs.

2.2 Making a project plan for deploying LMS

We recommend that you develop a project plan before deploying the LMS in your company. IBM Software Services for Lotus have developed a stepping-stone approach towards implementation of your learning management system so that your organization can make the most of this powerful learning system and take advantage of its many facets. The stepping stone approach leads you through three stages to full deployment followed by periodic health checks.

2.2.1 Stage 1: IBM Lotus LMS testbed launch

Stage one of the IBM Lotus LMS deployment addresses three key areas:

- Define Boundaries: A one-day workshop should be held for both the business and technical contacts within the team. During this session, you should familiarize your team with the full capabilities of the LMS and brainstorm how best they can be utilized within your organization to identify and agree on the scope of your learning management system.
- Building of the “Testbed system”: This should enable your technical team to install and configure a limited, non-production, testbed model of the LMS. Once the testbed has been built, it will be populated with a sample of your content consisting of both physical and virtual training data and materials.
- Skills transfer for both business and technical communities: The technical team will be hand held through configuration and administration tasks. The business team will be assisted to configure a sample of their live course data and will be mentored in the use of the content Authoring Tool to import existing Web content.

The testbed can subsequently be used for:

- Internal demonstrations and awareness
- Technical design validation
- Investigation of existing content assistance with feature implementation decisions
- Further skills development

This helps you to utilize the LMS to its full potential.

The next step for your team should be to hold a “Next Steps” workshop. Feedback on both technical and business aspects of the system should be discussed and documented. Recommendations of the tasks to be undertaken and the effort required for the scoping, planning, and architecture assessment will be outlined.

2.2.2 Stage 2: Scoping, planning, and architecture assessment

The scoping, planning, and architecture assessment addresses both the business and technical requirements of your solution and provide an understanding of the impact of the deployment of the LMS within your production environment. Your project team should review your environment and business needs and provide recommendations of what is required to deploy the LMS, its components, and courseware within your organization. The assessment contains the following two streams and activities:

- Business assessment
  - Assess learning and content delivery requirements.
  - Define course administration and management processes.
  - Design content migration and taxonomy standards.
  - Survey the market for learning content specific to the organization’s needs.
  - Skills gap analysis for business and technical individuals.
  - Create High-Level Business Transformation Plan.
- Technical assessment
  - Infrastructure scalability and readiness for hosting e-Learning activities.
  - Integration concept (for example, Workflow, ERP, and databases requiring change for the successful rollout of LMS).
  - Identify areas necessary for governance.
  - Perform capacity planning.
  - Define archiving strategy.

- LDAP Schema integration and design security policies.
- Create High-Level Implementation Plan.

At the conclusion of this assessment, your team should be able to provide an impact and gap analysis report for implementing the LMS, a blueprint design for the required architecture, and an outline deployment project plan.

2.2.3 Stage 3: LMS deployment

We recommend that you break down your LMS deployment into three key phases:

- Solution design
- Pilot
- Deploy

The solution design will take the results of the LMS scoping, planning, and architecture assessment to the next level and define a detailed design for your new LMS environment. It will define the complete enterprise-wide solution for your organization, covering such areas as Learning Management Module and Content Server Topology, security and LDAP integration, operational and support models, transactional activity, reporting and auditing, content migration, student profile design and administration, course taxonomy standards, access rights and system governance, and offline client deployment.

A key element of the deployment is a comprehensive pilot that will validate your learning requirements, prove the technical design, and identify early potential roadblocks. The pilot is delivered within your production environment using a Reference Build that can be fine tuned prior to full deployment and may cover single or multiple business units, depending on your requirements.

Once the Reference Build has been successfully implemented, your project team should complete the implementation of the solution and document deployment standards and operational procedures to empower you to replicate the phased deployment of the LMS throughout your organization. Skills transfer, training, and a communication plan have to be incorporated into the LMS Deployment Solution.

2.2.4 Stage 4: Health check

Periodically, as your organization's education function evolves, new opportunities will arise to further improve your LMS environment to increase learning efficiency and maintain technical optimization. To ensure that you continue to gain the maximum ROI and end user satisfaction, your team should develop a Health Check for LMS, which reviews the educational processes and the infrastructure

on a periodic basis. The Health Check will make recommendations for adjustments and improvements, ensuring that your organization's learning management system avoids future problems and that your education environment continues to run efficiently and effectively at all times.

Figure 2-2 shows a possible project approach.

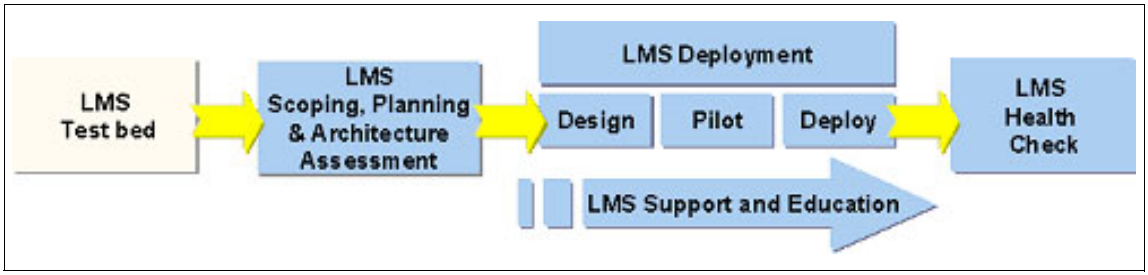

Figure 2-2 Project plan for LMS deployment

Note: This Solutions Overview of IBM Lotus Learning Management System is just one of the many advanced offerings available from IBM Software Group Services. They have a full portfolio of services designed to help you get the most out of your IBM Software. Further information can be found at:

`http://www.lotus.com/lotus/offering3.nsf`

3

Capacity planning for the LMS

In this section we provide guidelines on estimating concurrent usage based on the demographics of an organization. We look at some alternatives for topology. Finally we give some recommendations for hardware requirements based on the number of concurrent students logged onto the system.

The sizing estimates in this chapter are an approximation of the hardware resources required to support the LMS deployment. They are efforts to provide a starting point for understanding customers' hardware requirements. Actual customer experiences will vary from the sizing estimate for many reasons. The degree of variation can range from insignificant to very significant.

See Appendix A, “Sample sizing questionnaire” on page 359, for additional tips on capacity planning. Also see Chapter 16, “Corporate scenario” on page 327, for an example of how a company would plan for their deployment of LMS.

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3.1 Configuration options

The IBM LMS deployment is composed of these components:

- IBM HTTP Server
- IBM WebSphere Application Server (WAS)
- IBM LMS Learning Management Module (LMM)
- IBM LMS Delivery Server (DS)
- Database server
- Directory (LDAP) server

All these components can be installed on either a two-tier or a three-tier hardware configuration. The minimum hardware requirement is a two-tier configuration. The first tier contains:

- IBM HTTP Server
- WAS
- LMM
- DS

The second tier contains:

- LDAP server
- Database server

3.1.1 Tier configuration

How many tiers do you plan to implement? Figure 3-1 shows the IBM HTTP Server, WAS, LMM, and DS on the first tier, while the database server and LDAP servers are on the second tier. This configuration is sufficient with a small number of concurrent users.

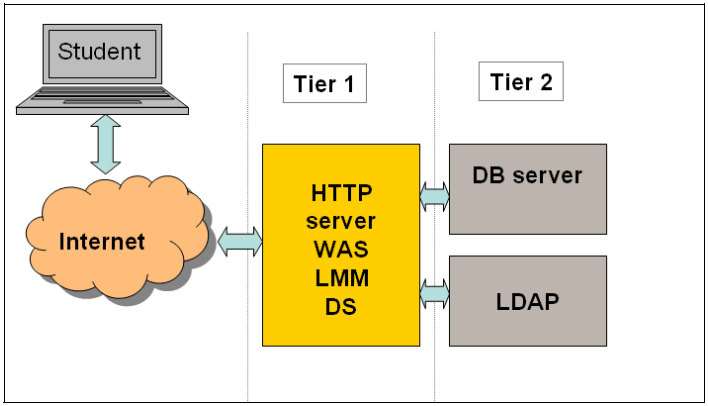

Figure 3-1 Two-tier configuration

The three-tier configuration, shown in Figure 3-2, places the IBM HTTP Server on the first tier. WAS, LMM, and DS are on the second tier. The database and LDAP servers are on the third tier. This supports a larger number of users.

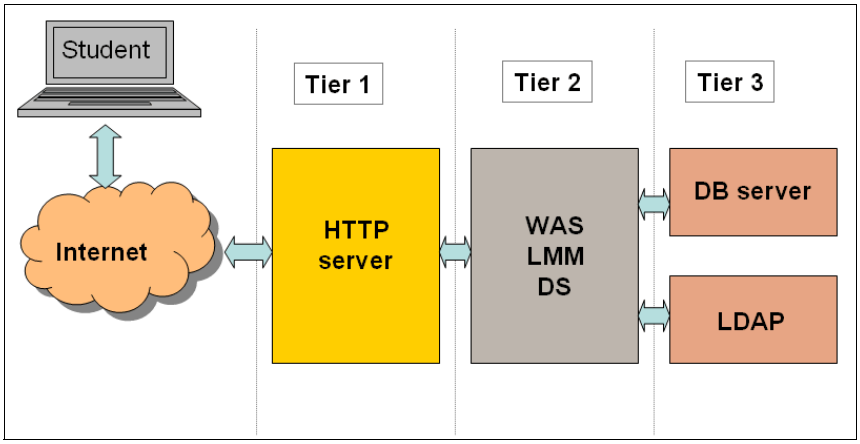

Figure 3-2 Three-tier configuration

3.2 The initial capacity sizing

What kind of server will we need? How many processors? Should you use Linux or Windows? What is a minimum recommended installation?

Capacity planning is a multi-stage process. It starts with the gathering of information and ends with a configuration for a particular customer. The methodology involved is as follows:

1. Define the size of the student population.
2. Define the workload pattern.
3. Define the performance objectives.
4. Work with your IBM specialist to define a configuration that meets your needs based on the items above.

You must provide enough information for each of the steps listed above in order to get the configuration that will best meet your needs. See a detailed questionaire for this purpose in Appendix A, “Sample sizing questionnaire” on page 359.

3.2.1 Defining student population

The size of the student population to support has a direct effect on the size of the hardware needed. A good estimate of the population is therefore necessary. There are four different levels of student population that are of interest when sizing for a learning management system. Figure 3-3 shows each level.

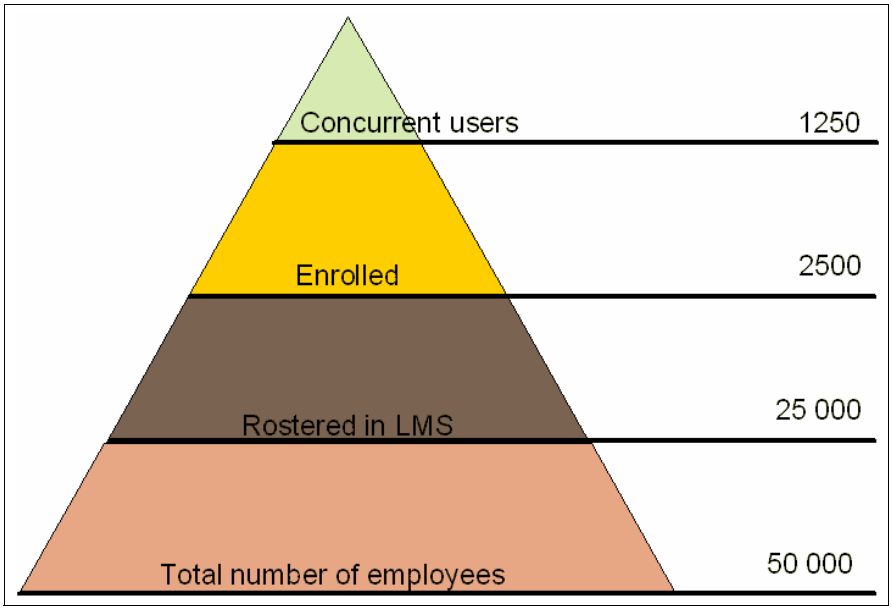

Figure 3-3 Student population

Total number of employees

Starting from the bottom of the pyramid, we see users who are listed inside the corporate directory. This user list usually includes the entire population of the corporation and it usually resides in the directory of a LDAP server.

Rostered students in the LMS

A portion of that student population may be rostered within the LMS. In some corporations, the entire population is eligible to take training (and therefore is rostered). In other corporations, only a percentage of the entire employee population is eligible to take training. Students from this population go into the LMS system to search the catalog and enroll in courses. You need to get a handle on how many of these eligible employees would access the system in any given day to search and enroll in courses.

Enrolled students

Only a portion of the rostered students can be logged onto courses at any time. Although many students could be enrolled in a course, not all of them would be actively attending their courses.

Concurrent users

Finally we come to the population that is of most interest to us. These are the students who are logged onto the system. These students who are actively and simultaneously logged onto the system form a large part of the requirement for performance on an LMS.

Figure 3-3 on page 28 shows a corporation with 50,000 employees. When estimating concurrency for a LMS installation, the concurrency rate will normally be in the range of 1 to 10 percent of the rostered students.

Table 3-1 Capacity planning example

Type	#	%
Total number of employees	50,000	
Rostered students in the LMS	25,000	100.0
Enrolled	2,500	10.0
Concurrent users	1,250	5.0

For capacity planning, the recommended configuration for this corporation needs to support 1250 concurrent logins, as shown in Table 3-1.

Note: Total number of employees affects the LDAP server only. Rostered students impact the size of the relational database.

3.2.2 Defining the workload pattern

A workload pattern (also referred to as usage pattern) involves the identification of the features most likely to be used by your user population. This process should be fairly easy, since the target application (the LMS) is known in advance. Therefore the number of possibilities that users have available to them are known.

For example, students could log onto the LMS, access the list of enrolled courses, and launch one of the courses. They can spend some time navigating through the different courses activities, then log out. In this case the usage pattern would be as shown in Figure 3-4 on page 30.

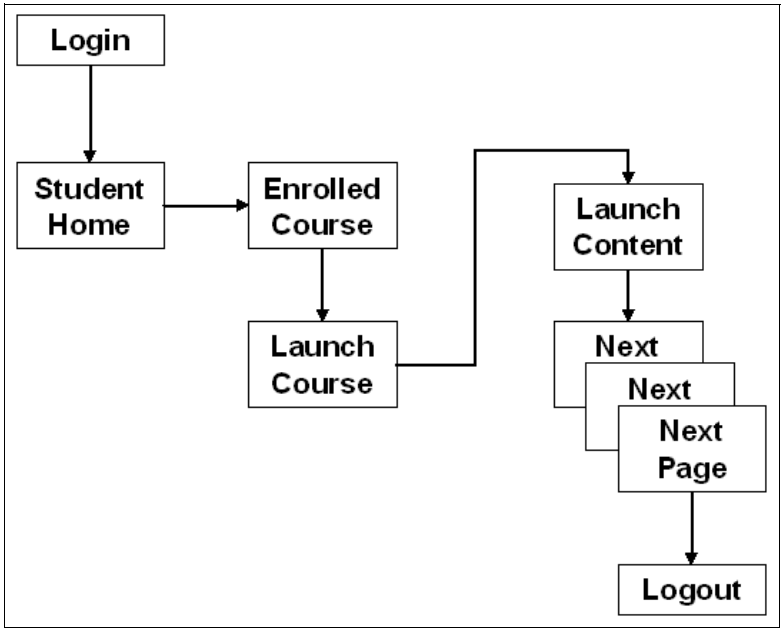

Figure 3-4 Workload pattern example

This usage pattern is specific to one class of students. Another pattern could include students who log into the system to search for courses in the catalog and self-enroll in them.

3.2.3 Performance objectives

Ask your customers to think about the different performance objectives and the metrics used to measure performance:

Response time 3–6 seconds is the standard response rate. If you need a faster response rate, a more powerful configuration may be needed.

Concurrent users This is the number of users that are actively logged onto the LMS system, as discussed in 3.2.1, “Defining student population” on page 28.

Specific log-in rate Log-in rate defines the arrival rates of users to the system. It is usually measured as number of logins per hour. You also need to specify whether the log-in rates are even throughout an 8-hour or 24-hour day or come in bursts (for example, morning rush or end of semester rush).

CPU utilization Although we recommend that you run your system at 80 percent CPU utilization for the LMS, you may decide to size your configuration so that the LMS server is running at a lower utilization. This might be a preferable option if you plan to run other applications at the same time (remote access applications such as VNC, anti-virus scanners, or backup, for example).

Contingency Planning for contingencies is also an important. For this we recommend that you add 30 percent to the expected CPU utilization on the busiest days.

Note: We have just described the input data that must be collected before any hardware configuration can be recommended for an LMS. See Appendix A, “Sample sizing questionnaire” on page 359, for a set of questions that can aid in your collection of the data.

3.2.4 Capacity planning

The final step in this process is conducted by an IBM LMS performance specialist. A configuration will be recommended based on the input and on performance characteristics of the LMS that have been measured on different hardware platforms.

For a given population size, there is a level of throughput required for each of the configuration components (IBM HTTP Server, LMM, DS, database, and LDAP server) to satisfy the concurrency and response time needed. Based on performance data that the e-Learning team has collected on the different platforms (xSeries®, pSeries™), the IBM LMS performance specialist can make recommendations on the hardware required.

3.3 Scalability options

The LMS application is a WebSphere application and should benefit from improvement in performance when the scalability options for WAS are followed. In this section, we show some typical configurations that have been developed for small, medium, and large deployments. The configurations are presented in an order of increasing size.

Note: The configurations described below are approximations. Your configurations will vary based on the exact number of concurrent users supported, your usage pattern, and your performance objectives.

3.3.1 A small deployment

First we discuss a typical small deployment that has a few hundred concurrent users. The configuration shown in Figure 3-5 consists of two tiers. In the first tier, we have combined both the IBM HTTP Server and the WAS. On that same machine resides both the LMM and the DS. In the second tier we have combined the database server with the LDAP server.

This configuration is considered to be the minimum configuration for the LMS.

The machine in both tiers would likely be an Intel platform running either the Microsoft Windows 2000 operating system or a Linux operating system. The minimum number of processors on these platforms needs to be at least two. The amount of RAM needs to be at least 2 GB.

This configuration could support several hundred users at a time (depending on the model of the servers). Both the LMM and DS reside on the same machine, along with WAS and the IBM HTTP Server. The database server and the LDAP server are installed on a second machine.

100 to 500 concurrent users

While maintaining the same number of boxes, this type of configuration could support more users if two more processors were added to the LMS server box, or if the processors were upgraded to faster models.

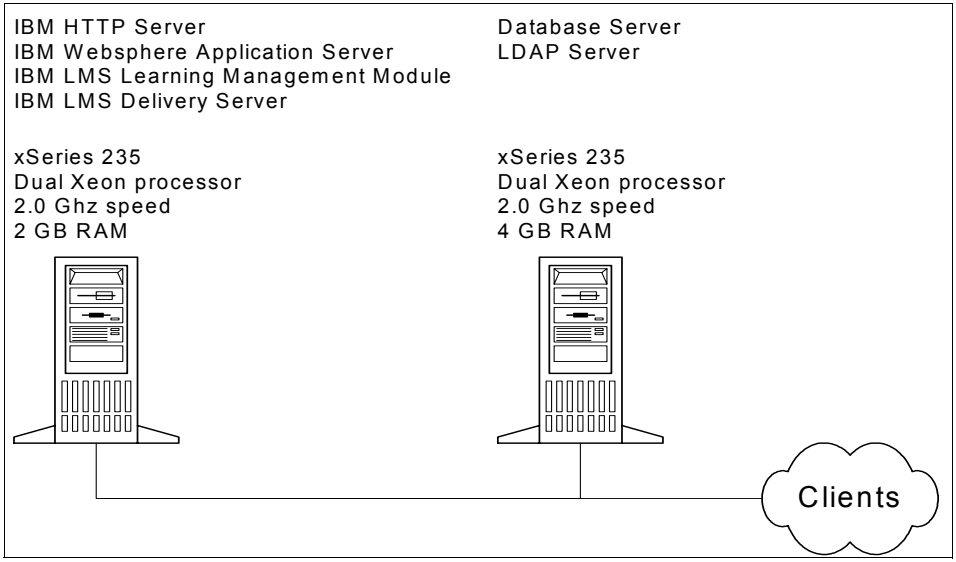

Figure 3-5 Small LMS deployment 1

3.3.2 Another small deployment

In this second configuration, the servers are still arranged in a two-tier configuration; however, the DS has been located on its own machine. This configuration will handle several hundred more students than the previous configuration.

Again, the LMM and DS can be running on either Microsoft Windows 2000 or Linux.

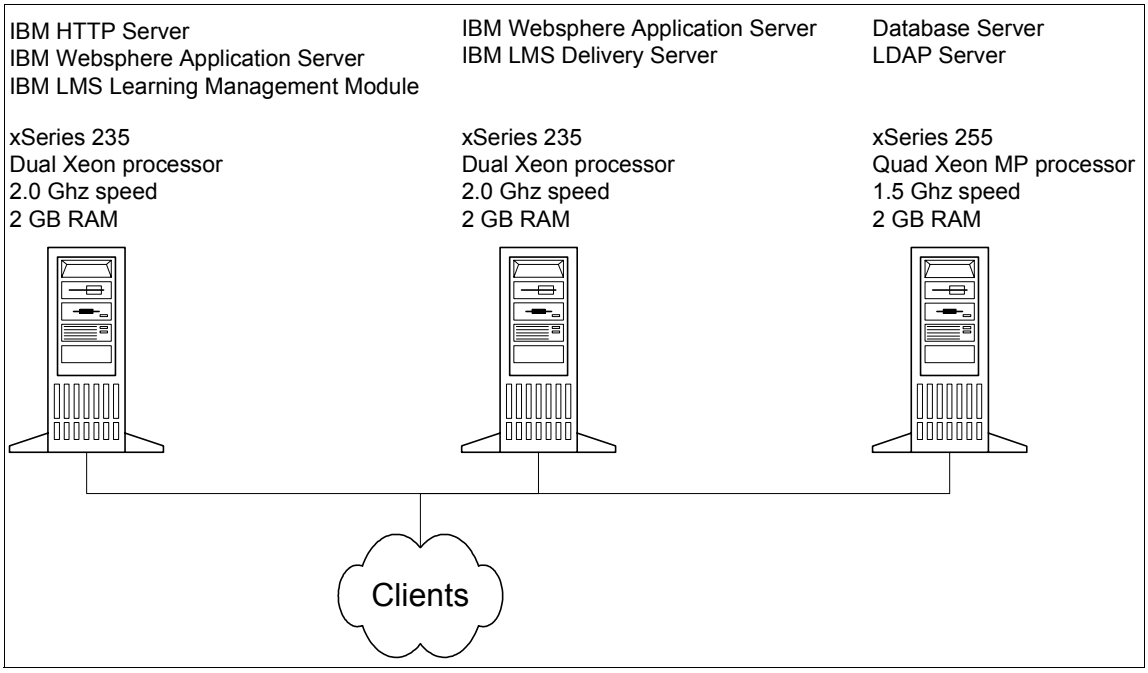

Figure 3-6 Small LMS deployment 2 - 500 to 1000 concurrent users

3.3.3 A medium deployment

In this configuration we switch to a three-tier configuration where the IBM HTTP Server is located in a separate machine. Due to the anticipated increase in demand on the database server, both the database server and the LDAP server are located on their own machines.

This configuration could support several thousand users, depending the model of the pSeries and depending on the number of processors in each of the boxes.

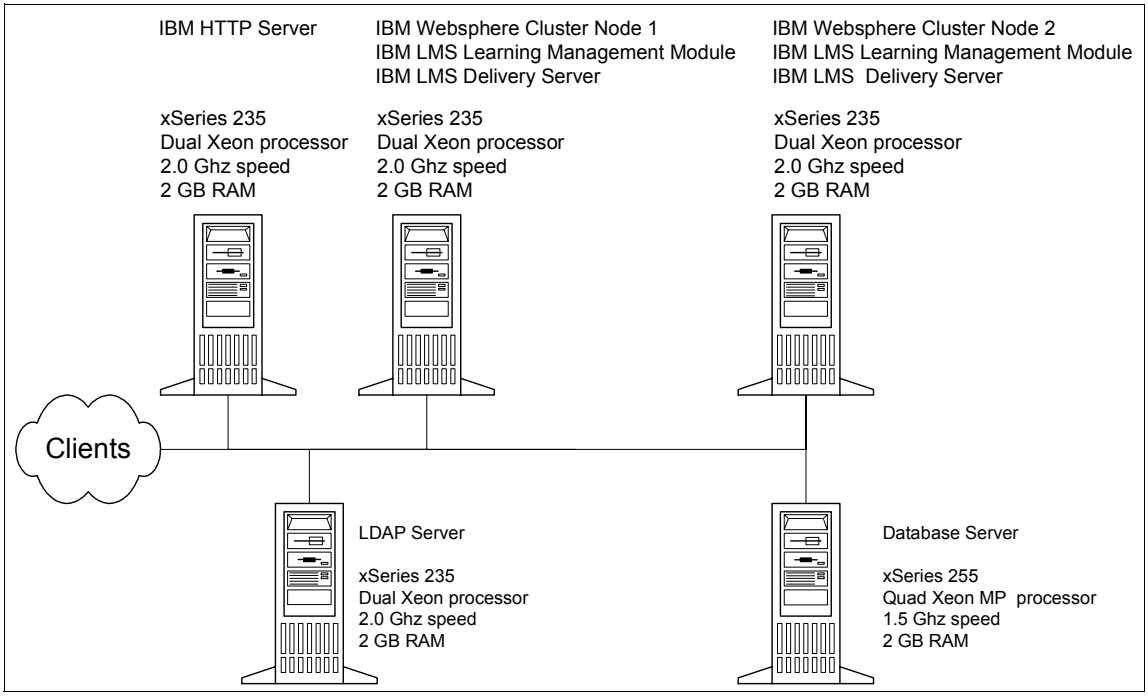

Figure 3-7 Medium LMS deployment - 1000 to 2500 concurrent users

3.3.4 A large deployment

In this example, we are still using a three-tier configuration, but we have multiplied the number of machines in each tier. The LMM and DS are now running in separate WebSphere clusters. The WebSphere Network Deployment Manager (for controlling the clusters) is running on a small desktop PC. We have also added three IBM HTTP Servers preceded by a load balancer.

The WebSphere clusters nodes are likely to be high-end pSeries running AIX. The database server and LDAP server are probably running on an existing infrastructure.

This configuration can support a large student population, depending on the model used for each of the servers.

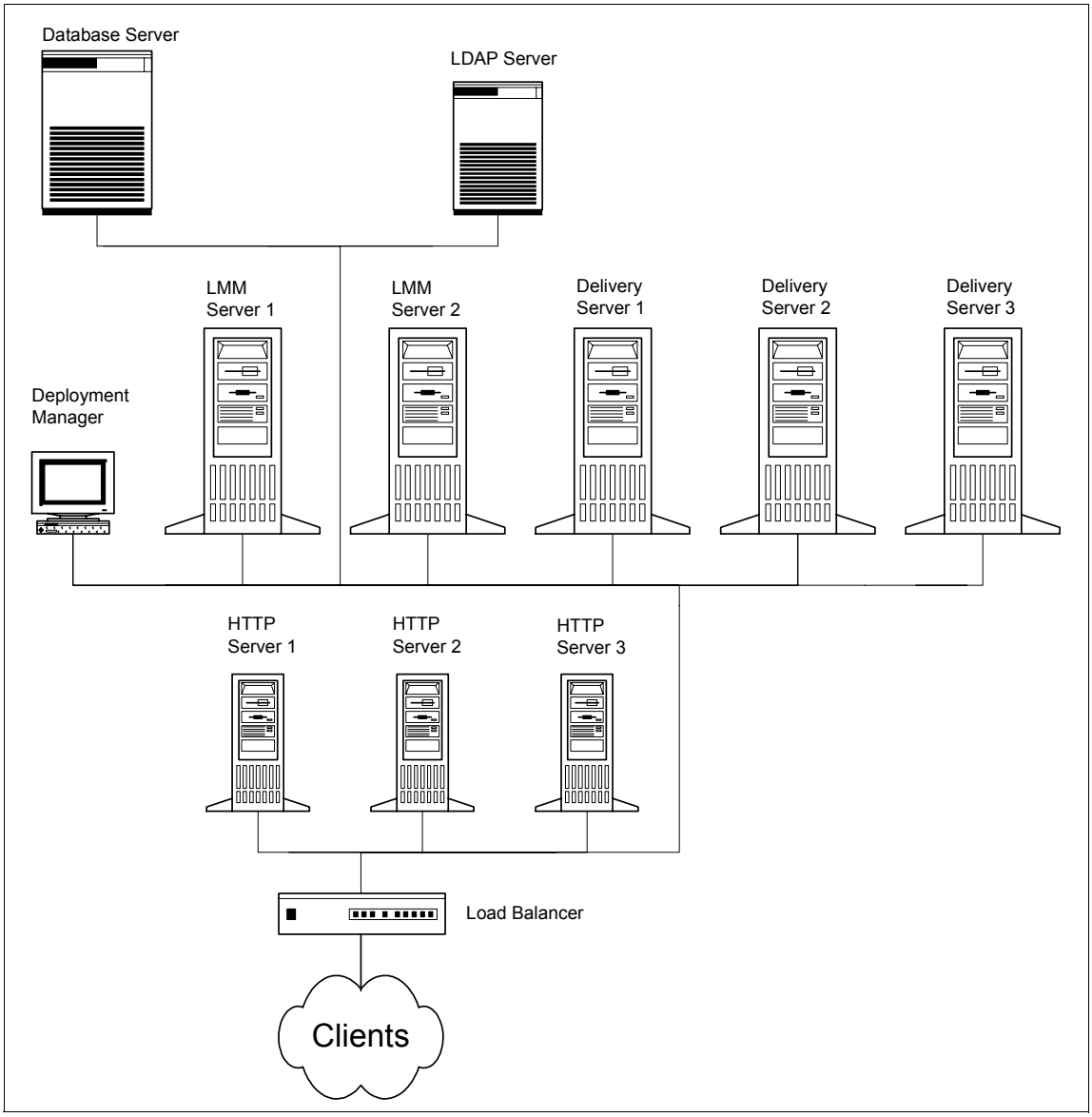

Figure 3-8 Large LMS deployment - 2500 to 10,000 concurrent users

3.3.5 Deployment on remote locations

While LMS is designed to be very scalable, it also supports remote locations through distributed Delivery Servers. For short response times and therefore a better learning experience, Delivery Servers can be placed close to the physical

locations of end users. Instead of attending courses on a far-off DS, students will work on a DS that is located on their fast LAN. Especially when courses contain multimedia elements such as audio, video, or animations, and the network connection speed between the locations is slow, having a DS onsite improves the access time to the content dramatically.

Figure 3-9 shows how a scenario with distributed Delivery Servers might look.

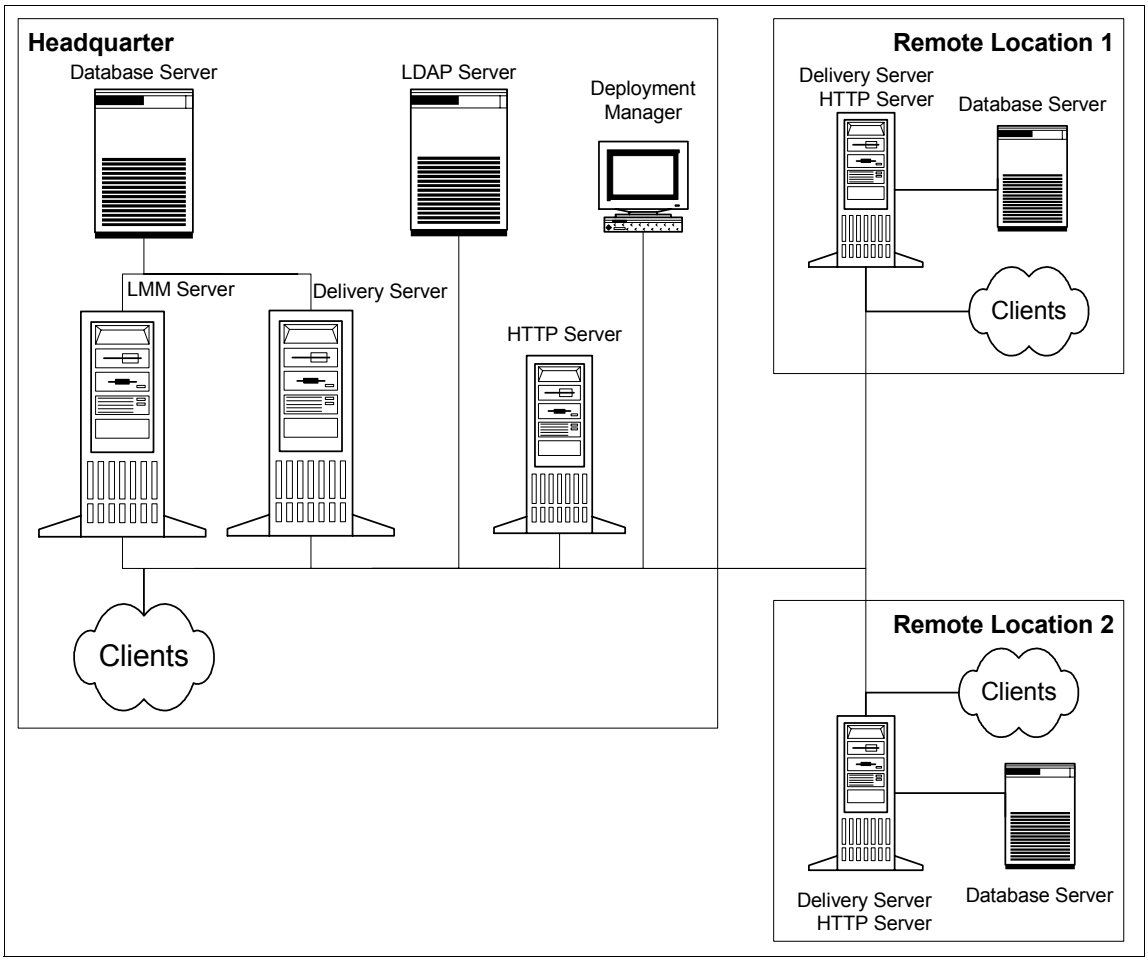

Figure 3-9 LMS deployment with remote locations

For faster access, a remote DS stores its data on a database server that is located in the same location. The DS does not need to be able to connect to the Database Server used by the LMM, and vice versa. The data exchange between LMM and the remote DS takes place using Web services/SOAP.

3.4 Database size estimation

Besides calculating the number of servers needed by LMS, it is also important that you get an idea of the amount of data stored in LMS. This depends mainly on the following factors:

- Number of courses
- Number of rostered users
- Average courses per user
- Average nodes (course elements) per course

Based on the LMS data model, the following formulas can be used to calculate the size of data and indexes of a LMS database in kilobytes. The LMM and the DS database will have about the same size; therefore you can use this formula for both. If LMM and DS are installed on the same database server, you just multiply the result by two to get the total database space usage.

```
dataSize = numberOfCourses * (57 + avgNodesPerCourse * 30.4) + numberOfUsers *
(10 + avgCoursesPerUser * (3.8 + avgNodesPerCourse * 1.1))

indexSize = numberOfCourses * (12.3 + avgNodesPerCourse * 1.4) + numberOfUsers
* (1.5 + avgCoursesPerUser * (1.6 + avgNodesPerCourse * 0.14))
```

Based on this formula, you can create a spreadsheet. Figure 3-10 shows an example, including some test values.

LMS Database Size Estimation

Input Parameters	500	**number of courses**
	10000	**number of users**
	2	**average courses per user**
	15	**average nodes per course**

	Data Size	Index Size
Summary	**762,500 kB**	**105,650 kB**
Summary	**745 MB**	**103 MB**

Total (LMM + DS)	**1.66 GB**

Figure 3-10 Example of database size estimation

Part 2

Installation

Now that you have created an implementation and capacity plan, this part of the Redbook prepares you to successfully undertake an LMS installation. Please note that it cannot be used as a replacement for the installation guide. Its intention is to give you a better understanding of the installation process and to discuss issues that you need to consider before installing the LMS.

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4

Pre-installation

After planning your LMS deployment, several pre-installation tasks must be completed before you run the LMS installer. These steps are covered in this chapter.

Appendix B, “LMS installation checklist” on page 363, provides a checklist you can use during the pre-installation. It ensures that you perform all necessary tasks and allows you to write down all essential information you will need for the installation of LMS. It also provides a table for you to record your parameters during the installation.

To help you plan, Appendix C, “Software requirements” on page 373, lists the prerequisite software.

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4.1 Roles and responsibilities

Before you start doing anything else, you should get a clear understanding of the roles and responsibilities of an LMS deployment.

For this reason we provide you with a list of the basic roles and responsibilities for deploying and maintaining LMS. Each role is not necessarily assigned to a separate individual; a single person may have responsibility for several roles. You will want document these assignments at the beginning of your deployment project.

4.1.1 Champion or sponsor

The champion is the person responsible for the deployment. Usually this person has banked their next career move on the success of the deployment. Usually this person has high visibility in the company.

4.1.2 System architect

The system architect is responsible for technical deployment in its entirety.

4.1.3 Network architect

The network architect is responsible for design, deployment, and security of the network infrastructure.

4.1.4 Database administrator

The database administrator is responsible for tuning, backup, and maintenance of the LMS database(s).

4.1.5 IT system administrator

The IT system administrator is responsible for the care and maintenance of server hardware, including failure management and course content backups.

4.1.6 Help desk

The help desk is responsible for handling student usage questions and to generate processes and procedures for problem resolution. The help desk is sometimes called upon to help subject matter experts (SMEs) create courses in LMS.

4.1.7 System IT specialist

The system IT specialist is responsible for the development of custom reports and programmatic development of the workflow process. The system IT specialist is sometimes called upon to manage utilities for recovery of forgotten passwords, and other IT-related tasks.

4.1.8 Corporate data integration specialist

The corporate data integration specialist is an IT specialist who is involved in integration with Human Resource (HR) systems, accounting systems, and other data sources.

4.1.9 Change management specialist

The change management specialist handles LMS software updates, course content rollouts, and course changes. The change management specialist is also responsible for scheduling server maintenance and providing approval for taking the system offline and bringing the system online.

4.1.10 Content developers

Content developers are experts in content tools (LMS Authoring Tool, HTML, Knowledge Producer, DreamWeaver, Authorware, Flash, and so on). Content developers usually have a mixture of instructional design, curriculum design, graphic arts, and content development experience.

4.2 Preconfiguring the LMS servers

Based on the deployment scenario you have chosen:

1. Assemble the machines to be used for the LMS.
2. Install the operating system.
3. Set up the correct TCP/IP settings (use fixed IP addresses and fully qualified hostnames).
4. Apply your company's security policies.
5. Connect the machines to your network.
6. Ensure that the DNS hostnames are correctly resolved in the network.

We recommended that you set up all LMS servers using the same time zone and date/time settings. This ensures, for example, that correct time stamps will be displayed on reports.

4.2.1 Installing XVFB on UNIX platforms to enable reporting

If you run the LMS on a UNIX platform, you must install Xserver Virtual Frame Buffer (XVFB) on your LMM Servers to enable the reporting feature. XVFB provides a virtual Xserver that runs without a head or graphics card, releasing you from the requirement of running a real Xserver.

XVFB installation and configuration differs between Linux and AIX.

Installing XVFB on Linux

XVFB for Linux is freeware and can be obtained from x.org's X11R6 distribution.

1. Check the directory /usr/X11R6/bin for a file named Xvfb.

   If you have this file, skip to step 4.

   If you do not have this file, proceed with step 2.

2. Download the XVFB file from the following link to a directory on the Linux machine:

   ftp://ftp.xfree86.org/pub/XFree86/4.2.0/binaries/Linux-ix86-glibc22/

3. Extract the file with the following commands:

```
chmod +x extract
mkdir /etc/X11
./extract -C /usr/X11R6 Xvfb
```

4. Generate a script file named /etc/init.d/xvfb containing the following lines, and make it executable:

```
#!/bin/sh
mode=$1
case "$mode" in
'start')
# start the X Virtual Framebuffer (Xvfb)
if [ -f /usr/X11R6/bin/Xvfb ]; then
echo "***Starting up the Virtual Frame Buffer on Screen 1***"
/usr/X11R6/bin/Xvfb :1 -screen 0 1152x900x8 &
fi
;;
*)
echo " Usage: "
echo " $0 start (start XVFB)"
echo " $0 stop (stop XVFB - not supported)"
exit 1
;;
esac
exit 0
chmod +x xvfb
```

5. Change the run-level to 3 by doing the following:

```
Edit etc/inittab
# Default run-level. The run-levels used by RHS are:
# 0 - halt (Do NOT set initdefault to this)
# 1 - Single user mode
# 2 - Multiuser, without NFS (The same as 3, if you do not have networking)
# 3 - Full multiuser mode
# 4 - unused
# 5 - X11
# 6 - reboot (Do NOT set initdefault to this)
#
id:5:initdefault:
```

6. Change id:5:initdefault: to id:3:initdefault:.

   Note: If you use a different run level, be sure to match it when you set up the soft link in the next step.

7. Create a soft link using the following command:

   ```
   ln -s /etc/init.d/xvfb /etc/rc3.d/S75xvfb
   ```

   This example uses run level 3. If you intend to use XVFB in a different run level, set up the soft link to the appropriate /etc/rcx.d directory. The run level of your Linux system is specified in your /etc/inittab file.

8. Restart the server.
9. Verify that XVFB is running with the following command:

   ```
   ps -ef | grep Xvfb
   ```

10. Set DISPLAY from the command line using:

    ```
    DISPLAY=hostname:1.0
    export DISPLAY
    ```

    The previous lines can be added to .bash_profile or whatever profile you are using.

11. Start the servers.

Installing XVFB on AIX

For complete instructions for XVFB, see *AIXwindows Programming Guide*, Appendix E, at

http://publib16.boulder.ibm.com/pseries/en_US/aixprggd/aixwnpgd/xvfb.htm#xvfb

1. Add the following line to /etc/initab:

```
xvfb:2:respawn:/usr/bin/X11/X -force -vfb -x abx -x dbe -x GLX :1 >
/dev/null
```

2. Set DISPLAY by adding the following line to .profile:

```
DISPLAY=`hostname`:1.0
export DISPLAY
```

3. Restart the server machine.
4. Disable JIT on application server(s).

4.3 LDAP server

For the LMS running under WAS, an LDAP directory is mandatory. It is used for multiple purposes:

- Authenticating the WebSphere administrator
- Authenticating the LMS users
- Retrieving additional information about LMS users and groups (such as a user's manager, e-mail address, or language preferences)

4.3.1 Tasks to complete

Here we list the tasks for providing an LDAP server to your LMS system.

Step 1: Install or identify an existing LDAP directory server

The number of LDAP directories supported by the LMS is actually limited by the underlying WAS. To support single sign-on (SSO, meaning single authentication against multiple servers), LMS does not authenticate users itself. Instead it uses the capabilities of WAS, which supports only certain LDAP servers. See “Supported LDAP directory servers” on page 374 for a list of supported LDAP servers.

For testing purposes, other LDAP V3 compliant LDAP directories may be used. For example, we successfully set up an LMS testing environment using an OpenLDAP directory.

Step 2: Gather LDAP access information

During the WAS configuration and the LMS installation, you will be asked to provide information regarding your LDAP directory. It is a good idea to collect this information before you run the installer.

- LDAP directory location

  You need to know the fully qualified hostname of the LDAP directory server and the port number that is used for the LDAP service. Usually this is port 389.

- Base distinguished name (DN)

  The base DN is something like a domain, a filter, or a scope specifying which part of the LDAP directory has to be used for authentication and search requests. It has a similar meaning as the starting folder for a search on your local file system. The base DN defines the starting point in an LDAP directory tree, and for any upcoming search request only entries below the specified branch will be considered for the result set.

  If a base DN looks like “ou=Detroit, o=YourCompany”, LDAP searches and authentications will be performed only on YourCompany’s employees in Detroit. ou stands for organizational unit and `o` is the abbreviation of organization. A good place to read about the different attributes used in LDAP is the LDAP Schema Viewer at:

  `http://ldap.akbkhome.com/attribute.html/`

- LDAP directory bind user

  The bind user is used by WAS and LMS to perform lookups on the LDAP directory. This user only needs to have read access to the directory. WAS and LMS will never attempt to write back to the directory.

- An attribute as user identifier in the LDAP directory

  Usually the attribute uid is used as the identifier for user entries in an LDAP directory. If for some reason this field is not provided in your LDAP directory and you have to use another attribute, such as common name (cn) or employeeNumber, you will later have to reflect this in the field user filter when configuring the WAS LDAP user registry connectivity.

Step 3: Test the LDAP directory connection

Here are two steps you can take to test the connection.

Ensure that all LMS servers can access the LDAP directory

You can check this by using the following **`telnet`** command directly in a command prompt on all LMS servers:

```
telnet <LDAP server hostname> <LDAP port number>
```

Figures 4-1 through 4-4 show the different results you may get when running the command.

Figure 4-1 Successful connection to an LDAP directory using telnet on MS Windows

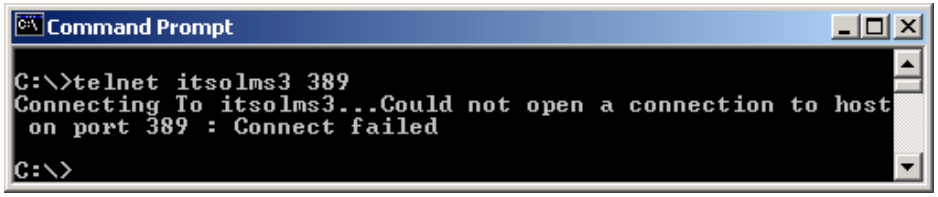

Figure 4-2 Failed connection to an LDAP directory from telnet on MS Windows

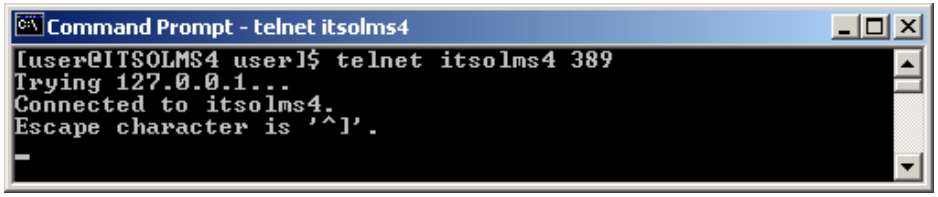

Figure 4-3 Successful connection to an LDAP directory using telnet on Linux

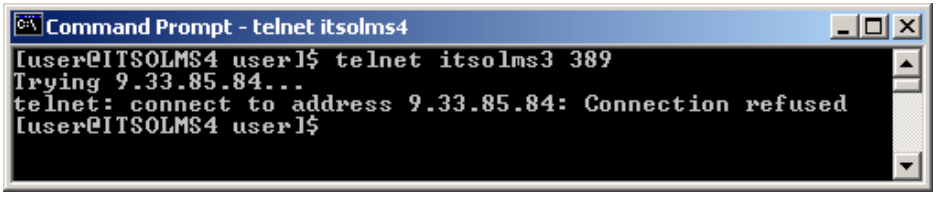

Figure 4-4 Failed connection to an LDAP directory from telnet on Linux

Tip: If you are using Microsoft Windows 2000 Server and you have the Microsoft Windows 2000 Resource Kit installed, you can also use ldp (ldp.exe) for testing the LDAP directory connections.

Verify the LDAP bind user

You have to ensure that the used LDAP bind user has the permission to see all other LMS users and their attributes in the LDAP directory. Users that are not visible to the bind user cannot be authenticated and therefore will not get access to the LMS.

Note: The “Test LDAP Connection” button of the LMS setup program does not ensure this. It only tests if the LDAP directory is reachable using TCP/IP and if the bind user itself can be authenticated. For this reason we recommend that you use a separate LDAP client and log on to your LDAP directory with the bind user. Check that the retrieved LDAP entries are the ones you expected.

See 4.3.2, “Additional information” on page 49, for an example usage of the LDAP Browser/Editor.

A list of freely available LDAP clients can be found in “Free LDAP viewers” on page 449.

Step 4: Create or select an LDAP group for LMS administrators

During LMS installation you will be asked if the LMS administrator role should be applied to a group or to a single person in the LDAP directory.

We recommend that you specify an LDAP group (for example, cn=LMSAdmins,ou=whatever) instead of a single person. This makes it easier to add administrators to the LMS since you only have to modify the group in the LDAP directory. Using this technique allows you to avoid having to explicitly grant the required permissions to each person you want to be an LMS administrator.

4.3.2 Additional information

Here are some additional issues that we have discovered.

Note: See Appendix F, “Default LDAP attribute mappings” on page 393, for additional information on relating your LDAP entries to your LMS system.

Using multiple LDAP directories

If you want to allow users registered in different LDAP directories to use the same LMS installation, you will have to connect WAS and LMS to a meta directory that references user entries in these directories.

Note: Use of a meta directory with LSM is not currently supported by IBM.

There are two different kinds of meta directories:

- “Virtual Directories”, “LDAP Proxy Servers”, or “LDAP Gateways,” which forward incoming query requests to the directory containing the desired information.

  Some examples of this kind are enQuire Virtual Directory, MaXware Virtual Directory, OctetString Directory Federator Express, Radiant Logic Virtual Directory Server, and Sun ONE Directory Proxy Server.

  Main advantages to a virtual directory include:

  - They provide real-time data from the backend directories.
  - The virtual directory does not have know the password encryption methods used by these directories, since authentication requests are forwarded to the backend directories also.

- “Synchronized Directories,” which import the information from the backend directories by using replication technologies. Incoming requests are served by the meta directory itself based on the imported data.

  Some examples of this kind are Critical Path Meta-Directory Server, IBM Directory Integrator, MaXware MetaCenter, Microsoft Metadirectory Services, NOVELL DirXML, Siemens DirXmetahub, and Sun ONE Meta-Directory.

  The main advantages to a syncronized directory include:

  - Synchronized directories do not require the backend directories to be online to serve queries.
  - Queries are usually processed faster, compared to virtual directories, because the requests are not forwarded to other directories.
  - During data synchronization, the imported data can be transformed and enriched to fit the actual needs.

Before you start using an meta directory with LMS, you should consider the following issues:

- The usage of meta directories with LMS is currently not officially supported by IBM.
- All data provided by the meta directory must use the same LDAP data schema. For directories using different schemas, meta directories usually provide mechanisms to map the attributes of those directories to a single data schema.
- The LDAP bind user must have the correct permission to query the required data on all connected directories.
- Ensure that the user authentication through the meta directory against all attached directories works.

However, by using the IBM Directory Integrator (IDI), you can create an IBM-supported scenario. IDI is not a typical meta directory. It is a data transformation engine that can retrieve information from a variety of input sources, transform it as required, and send it to several types of output sources.

Since IDI also has input/output connectors for LDAP, it can be configured to act as an synchronized directory in conjunction with an IBM Directory Server (IDS). In this case IDI retrieves the data from the backend directories, transforms it based on user-specified rules to a single LDAP schema, and pushes the adjusted data to the backend storage of the IBM Directory Server (IDS). WAS and LMS are then connected to the IDS, which is supported for use with LMS.

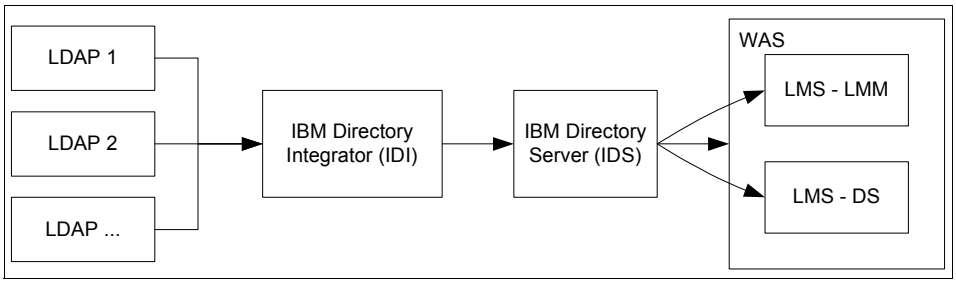

Figure 4-5 Integrating multiple LDAP directories with LMS using IBM Directory Integrator

Using LDAP browser/editor to verify LDAP directory access

To verify the LDAP directory access using the LDAP browser/editor:

1. Download and install the Sun Java Runtime Environment 1.2.2 or later from:

   `http://java.sun.com/j2se/1.4.1/download.html`

2. Download and unpack the LDAP Browser/Editor from:

   `http://www.iit.edu/~gawojar/ldap/`

3. To launch the client, go to the ldapbrowser folder and run the lbe.bat on Window Systems and the lbe.sh on Unix/Linux systems.

   Read the faq.html if you encounter problems.

4. After launching the client, you will be asked to select a predefined LDAP server connection to use. Click **New** to create a new LDAP connection. See Figure 4-6 on page 52.

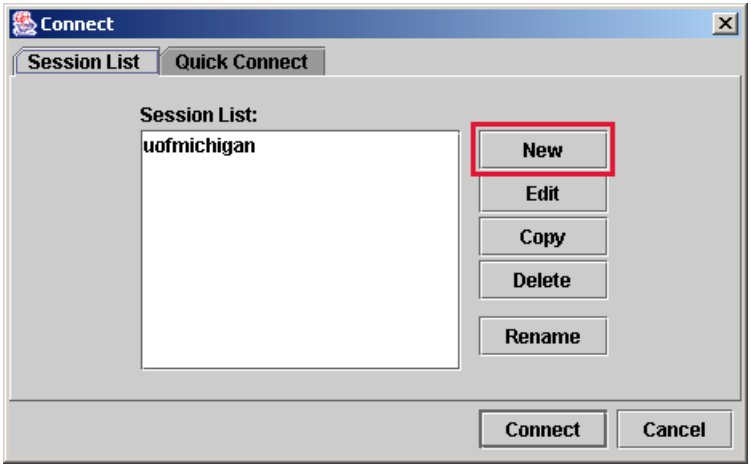

Figure 4-6 LDAP browser - Quick Connect dialog

5. Enter a label for the new connection (session name). See Figure 4-7.

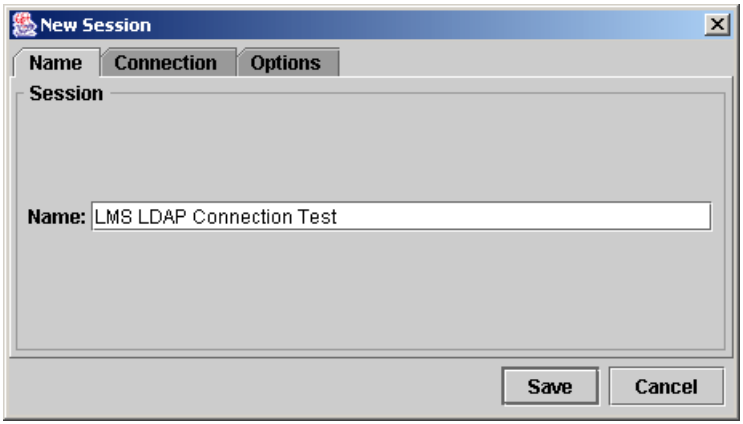

Figure 4-7 LDAP browser - New LDAP connection - Connection name

6. Go to the Connection tab, enter the LDAP directory connection details, and then click **Save**.

Note: To enter the bind user you have to clear the “Anonymous bind” check box first. See Figure 4-8.

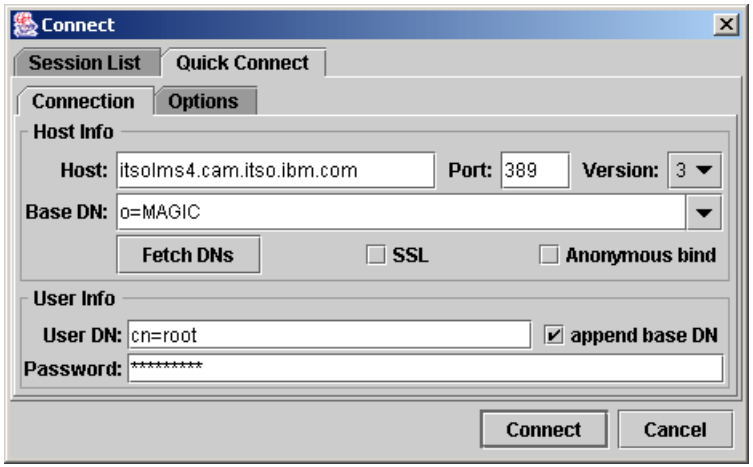

Figure 4-8 LDAP browser - New LDAP connection - Connection details

7. Select the newly created connection from the session list in the Connect dialog and click **Connect**. See Figure 4-9.

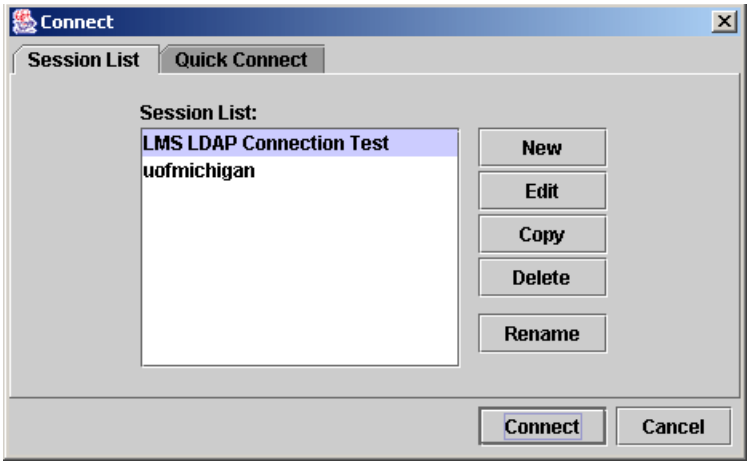

Figure 4-9 LDAP browser - Selecting an LDAP connection

8. You should see the LDAP tree with all users now. Check that their attributes are visible too, as shown in Figure 4-10 on page 54.

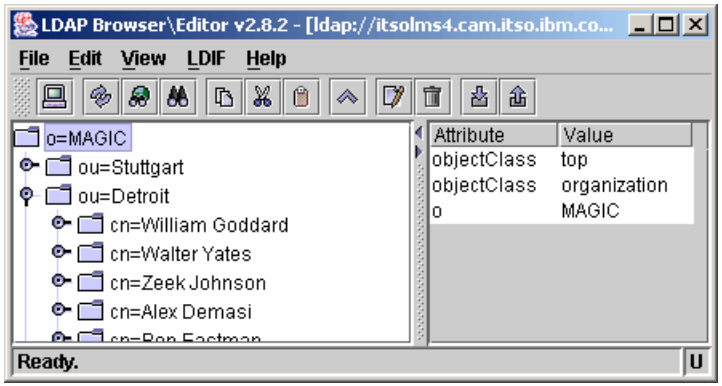

Figure 4-10 LDAP browser - Retrieved directory tree

If an error occurs, it is shown in the status bar at the bottom of the window, as seen in Figure 4-11. You can then view the error log from the menu item **View -> Display error log**. See Figure 4-12 on page 55.

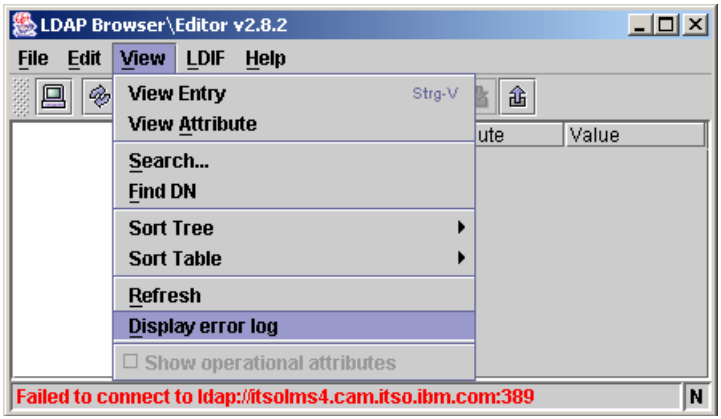

Figure 4-11 LDAP browser - Connection failed

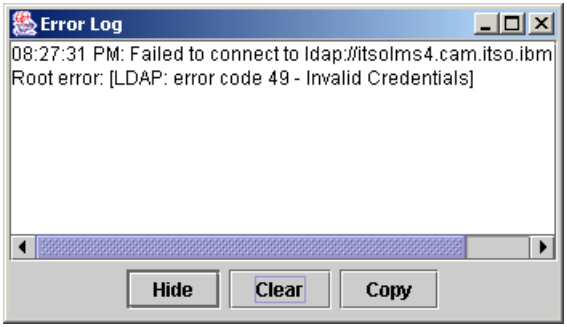

Figure 4-12 LDAP browser - Displaying error log

4.4 Database server

LMS uses relational databases to store all of its business data. During the LMS installation the following logical databases will be created:

LMM database This is the core database of the LMS. It stores all user, course, tracking, and resource information. It is only used by LMM.

Audit database This database is used as an activity log of administrative actions performed by users (system configuration, user enrollment, or course catalog administration). In case of misconfigurations, for example, it can be used to trace the activities that led to the current situation. LMM only writes to the Audit database and does not use or report on the written information itself.

DS database This contains the course structure data for offerings that have been deployed to a DS. It also contains the tracking data that is generated when a user attends a course. This data is then transferred by Web Services to the LMM and stored in its database as well.

One DS database is required to support each DS. It does not need to reside on the same database server as the LMM and Audit databases. In a distributed environment, for example, you might consider using a database server that is physically closer to the DS.

These databases are logically distinct and are accessed only by the applications. There is no direct communication between the logical databases.

4.4.1 Tasks to complete

Here are the tasks for installing the database server.

Step 1: Install or identify an existing database server

If you are not going to use an existing database server with LMS, then a database server must be installed and configured first. See “Supported database servers” on page 374.

You can use different database servers for LMM and DS. In this case, it is not required that LMM can access the database server used by DS and vice versa. Between LMM and DS all necessary information is exchanged using Web Services/SOAP.

Before installing DB2 on Linux

Running DB2 on a Linux 2.4 server requires changes to the Linux kernel parameters. Recompile the kernel source as explained here before you install DB2 on the server.

1. Change the msgmni parameter to 256 with the command:

   ```
   echo 256 > /proc/sys/kernel/msgmni
   ```

   This sets the maximum number of SYSV IPC message queues from the default of 16 to 256.

2. Increase SEMMNI from 128 to 2048. This sets the maximum number of semaphore IDs allowed in the kernel. The upper limit for this value is 32768.

3. Increase SEMMSL from 250 to 500. This sets the maximum number of semaphores per sem ID. The upper limit for this value is 8000.

4. Increase SEMOPM from 32 to 256. This sets the maximum number of operations allowed per semop() call. The upper limit for this value is 1000.

5. Increase the number of open files using the command:

   ```
   echo 32768 > /proc/sys/fs/file-max
   ```

   This sets the maximum number of open files system-wide to 32 KB.

Before installing DB2 on Sun Solaris

Before installing the DB2 for Sun Solaris product using the DB2Setup Utility or the DB2_install and PKGADD commands, you may have to update your system's kernel configuration parameters.

The following lines should be added to the file /etc/system. You must reboot your machine after updating any kernel configuration parameters:

```
set msgsys:msginfo_msgmax=0xFFFF
set msgsys:msginfo_msgmnb=0xFFFF
```

```
set msgsys:msginfo_msgmap=0x102
set msgsys:msginfo_msgmni=0xFF
set msgsys:msginfo_msgssz=0x10
set msgsys:msginfo_msgtql=0x400

set shmsys:shminfo_shmmax=0x20000000
set shmsys:shminfo_shmseg=0x32
set shmsys:shminfo_shmmni=0x12C

set semsys:seminfo_semmni=0x400
set semsys:seminfo_semmap=0x400
set semsys:seminfo_semmns=0x800
set semsys:seminfo_semmnu=0x800
set semsys:seminfo_semume=0x32
```

The settings can be verified with these commands:

```
# ipcs –a
# sysdef | egrep MSG\|SEM\|SHM
```

This information is also available in the DB2 knowledge base at:

```
http://www-3.ibm.com/cgi-bin/db2www/data/db2/udb/winos2unix/support/documen
t.d2w/report?fn=db2v7ixdb2ix31.htm#HDRUPDATE_SOLARIS_KERNEL
```

Step 2: Prepare database server for UTF-8

Because of multilingual support, the LMS databases must be in UTF-8 (Unicode) format.

IBM DB2

The LMM, DS, and Audit database require their own databases on a database server. The DB2 instance can have many other databases on the same instance, which use other codepages. In this way, the LMS databases can co-exist with other databases without affecting them.

Oracle

An Oracle instance has only one database, which must be UTF-8 for use with LMS. If this instance is being used for other purposes, all schemas on that instance will be UTF-8. If this is a problem for the other database users, a separate database instance must be created, which can be on the same server.

Microsoft SQL Server 2000

There are no specific database requirements that should affect other databases on the database server.

Step 3: Set up database client connectivity

Install the required database client software for your database server on the LMM and DS machines. If the database server is installed on the same machine as the LMS, no additional client software needs to be installed.

Tip: You can find the JDBC driver for Microsoft SQL Server 2000 here:

http://msdn.microsoft.com/library/default.asp?url=/downloads/list/sqlserver.asp

Ensure that the connection between your database server and your LMM and DS is not blocked by a firewall. As in the LDAP connectivity test, you can use the **telnet** command to test the connection to the specific port on your database server.

JDBC 2.0 driver setup for DB2 7.2

WebSphere requires JDBC 2.0 drivers for its JDBC data sources. DB2 7.2 uses JDBC 1.0 by default. Therefore you must configure the DB2 Connect™ Software on the WebSphere machine to use its supplied JDBC 2.0 drivers in order for WAS to connect to DB2 databases using JDBC.

If you are using DB2 8.1, no actions are required, since it uses JDBC 2.0 by default.

On Windows systems:

1. Stop any running DB2 processes.
2. Open a command prompt and navigate to the ...\sqllib\java12 directory.
3. Execute the file `jdbc2.bat`. This will copy the appropriate db2java.zip file to the directory ...\sqllib\java\.
4. You can now restart DB2 processes.

To see what JDBC level is in use on your system:

- If JDBC 2.0 is in use, the file SQLLIB\java12\inuse will exist.
- If JDBC 1.0 is in use, the file SQLLIB\java11\inuse will exist.

On UNIX systems:

1. Log in as the DB2 instance owner (for example, db2inst1).
2. Type:

```
cd $HOME/sqllib
```

3. Add the following line to the file userprofile:

```
. /$DB2_INSTALL_PATH/java12/usejdbc2
```

Where /$DB2_INSTALL_PATH is the actual path where DB2 is installed on the machine, *not* an environment variable.

Note: You should update each user account profile for your database system with the .$HOME/sqllib/java12/usejdbc2 command.

4. Save your changes to the file.
5. Stop any running DB2 processes.
6. Log out and log back in.
7. You can now restart DB2 processes.

4.5 SMTP server

In order for LMS to perform automatic notifications, it needs to have access to an SMTP server. Here are steps to provide SMTP server connectivity.

4.5.1 Tasks to complete

The following sections discuss the tasks to present.

Step 1: Install or identify an existing SMTP server

There are no specific requirements for the SMTP server software to be used with LMS.

Write down the fully qualified hostname of your SMTP server, since this information is needed for setting up the e-mail notification support in LMS.

Step 2: Ensure SMTP relaying for LMM is enabled

For security reasons, SMTP servers usually relay e-mails only to defined hosts; sometimes they completely disallow it. You have to ensure that LMM actually can send e-mails using the SMTP server.

First check and modify the settings of your SMTP server to allow SMTP relaying by LMM.

Then try to send an e-mail using the SMTP server directly from the LMM machine using telnet as shown in Figure 4-13 on page 60.

```
telnet lms-lmm.example.com smtp
220 lms-lmm.example.com ESMTP Service (Lotus Domino 5012HF16) ready at Wed, 25
Jun 2003 14:25:24 -0400
EHLO lmsadmin@example.com
250 example.com Hello lmsadmin@example.com ([10.0.0.1]), pleased to meet you
250-HELP
250-SIZE
250 PIPELINING
MAIL FROM: <lmsadmin@example.com>
250 lmsadmin@example.com... Sender OK
RCPT TO: <student123@somewhere.com>
250 student123@somewhere.com... Recipient OK
DATA
354 Enter message, end with "." on a line by itself
This is a test.
.
250 Message accepted for delivery
QUIT
221 lms-lmm.example.com SMTP Service closing transmission channel

Connection to host lost.
```

Figure 4-13 Testing SMTP connection using telnet

The bold text commands show what to enter in the console and the normal text are the responses of the server. These commands connect to the SMTP server and try to create and send a new e-mail. If you are running the **telnet** command on a MS Windows command prompt, you will have to type the commands blind, since they are not shown in the console.

4.5.2 SMTP commands

The following are SMTP commands:

- EHLO {sender's hostname}

  Initiates an SMTP session between the client machine and the SMTP server. The client machine identifies itself by providing its fully qualified hostname.

- MAIL FROM: <{sender's e-mail address}>

  Starts an e-mail transaction and specifies the e-mail address used for the "from" field.

- RCPT TO: <{recipient's e-mail address}>

  Defines the recipient of the e-mail.

- DATA

  Signals the beginning of the e-mail's main text message. All lines entered after this command will be recognized as part of the e-mail. To end the text message you have to enter a line containing only a dot (.). After this command, the mail will automatically be sent.

- QUIT

  Ends the session with the SMTP server.

4.6 HTTP servers

In an LMS environment, HTTP servers (that is, Web servers) provide the LMS user interface and the course contents to each student. You can use the same Web server for UI and content. However, for performance reasons, you will usually want to set up separate content servers in larger LMS deployments.

4.6.1 HTTP servers for LMS user interface access

As you will later see, the LMS modules (LMM, DS) will be installed on logical application servers that reside on a WebSphere Application Server (WAS). Every application server is bound to a unique TCP port on the machine on which it is installed. As WAS comes with a built-in HTTP server, you can access the applications hosted by an application server directly without the need of a separate HTTP server. That is, the applications in an application server can be accessed by:

```
http://<hostname>:<application_server_bind_port>/<application_context_root>
```

On a single server installation, for example, the LMM is accessible by:

```
http://lmsserver.com:9081/lms-lmm
```

And the DS by:

```
http://lmsserver.com:9081/lms-ds
```

These assume that LMM and DS are installed on an application server that is bound to port 9081.

Since your LMS is fully accessible using these URLs, you might ask why an additional Web server is necessary for accessing the LMS and how to set up this Web server to connect to WAS.

How to set up a separate Web server for LMS

For several Web servers, a WebSphere plug-in is provided by WAS. This plug-in and a plug-in configuration file (plugin-cfg.xml) have to be installed on the Web server. Incoming HTTP requests for the Web server will be intercepted by the plug-in and—based on the rules defined in the configuration file—either passed to WAS or back to the HTTP Server. The plug-in configuration file contains mapping descriptions for incoming URLs to URLs pointing to WebSphere applications. An incoming URL request for `http://lmsserver.com/lms-lmm` might be translated by the plug-in and then internally forwarded to `http://lmsserver.com:9081/lms-lmm`.

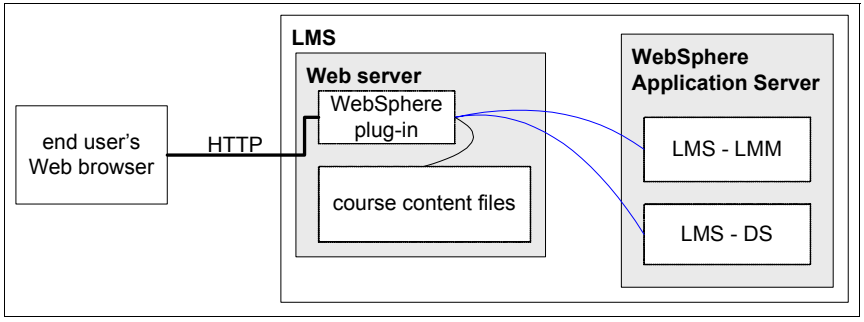

Figure 4-14 WebSphere plug-in intercepting HTTP requests

The Web server can also be located on a separate machine. In this case you have to ensure that the WebSphere applications are reachable through TCP/IP by the WebSphere plug-in installed on the Web server.

If you are deploying the LMS on multiple servers, you can use the same Web server to forward to LMM and DS. And of course, if the distance between LMM and DS is too big, you can set up separate Web servers for LMM and DS access.

Now you know how WAS and the HTTP server interact, so we can answer the other question.

The advantage of adding a Web server

Several advantages are discussed below.

Performance

HTTP servers are highly optimized to serve static contents like HTML and image files. Even though WAS comes with a built-in HTTP server task, we recommend that you provide a WebSphere application's static elements from an HTTP server. For LMS, this would mean unzipping the provided war files for LMM and DS in the document path of the HTTP server and modifying the plug-in

configuration file accordingly. This is explained in detail in 6.1, “Move static LMS elements to the Web server” on page 106.

Security

When the environment is secured by firewalls, using an HTTP server with WebSphere plug-in to access WebSphere applications reduces the number of ports required to be open.

Basically only port 80 and 443 (for SSL) on the machine hosting the HTTP server need to be opened to an untrusted network. One HTTP server can provide access to applications from different WebSphere Application Servers.

Usability

Since you can map WebSphere applications as virtual directories to an HTTP Server, URLs that are easy to remember can be created. Thus end users do not have to care about port numbers to access WebSphere applications.

Applications or Web components hosted on multiple servers can—when mapped to the same HTTP server—act virtually as a one-server application.

Now that you know several reasons to have a separate HTTP server, see Figure 4-15 on page 64. It shows an example of an LMS setup where the HTTP server is installed on a separate machine that is placed in a DMZ. The WebSphere servers are secured by two firewalls. The first only allows inbound HTTP connections from the untrusted network to the Web server on port 80 and 443. The second firewall is configured only to passthrough connections from the Web server to the application server’s http/https ports of the LMM and DS machines. In addition, the second firewall also allows HTTP connections from LMM and DS to port 80 of the Web server. This is needed because the LMM and DS are talking indirectly to each other by the Web server.

Beside course contents, the static UI elements of the LMS modules are also stored on the Web server and will not be requested from WAS.

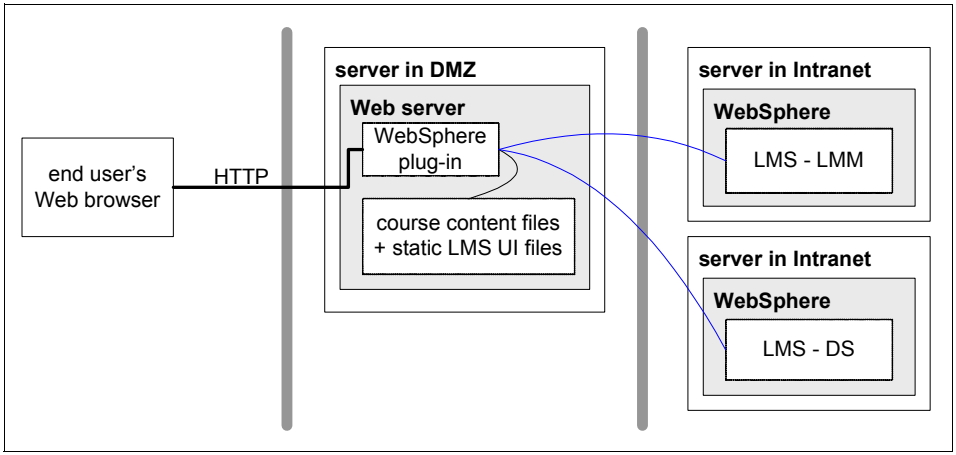

Figure 4-15 WebSphere plug-in located on a separate machine

4.6.2 HTTP servers for course contents

Beside HTTP servers for accessing the LMS modules, Web servers are required to host the actual course contents. The content for a deployed course is hosted on all Web servers that are dedicated to the DS on which this course is deployed. For any DS, multiple load-balanced Web servers can be used as content servers.

For small deployments, and if it suits your security policies, you might use the same HTTP server you are using for the DS as a content server.

In contrast to Web servers providing LMS user interface access, there are no specific requirements for Web servers used for serving course content. We recommend using Web servers that support HTTP/1.1. You can find information on the major differences between HTTP/1.0 and HTTP/1.1 at:

`http://www.research.att.com/~bala/papers/h0vh1.html`

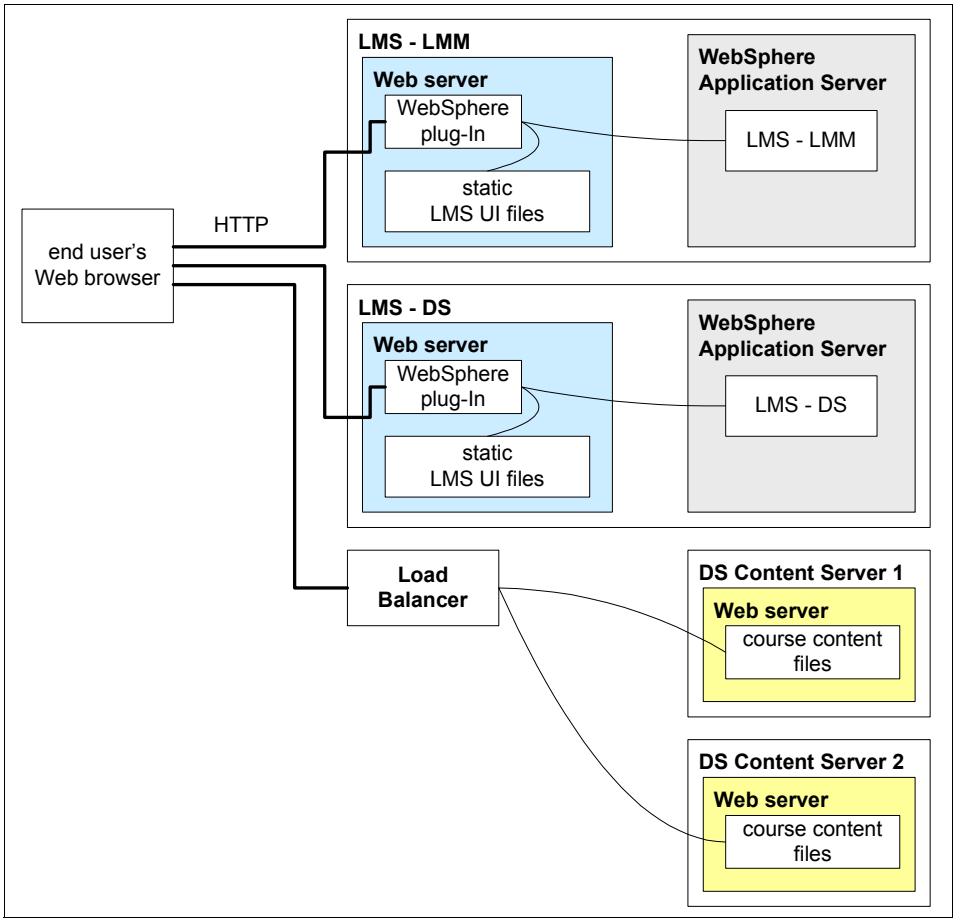

Figure 4-16 Using multiple content servers

4.6.3 Tasks to complete

Here is a list of tasks for setting up your HTTP (Web) servers.

Step 1: Plan your Web server scenario

As you read in the previous sections, you have flexibility in how you place and use the Web server(s). Based on your deployment planning (see Chapter 2, "Planning your LMS deployment" on page 9) you will have to decide the right scenario for your company.

Step 2: Select your Web server software

Keep in mind, only HTTP server(s) for which the WebSphere plug-in is provided can be used for LMS user interface access. See “Supported Web servers for use with WAS” on page 375 for a list of Web servers you can use.

This requirement does not exist for dedicated course content servers, as explained in Section 4.6.2, “HTTP servers for course contents” on page 64.

Step 3: Ensure that port 80 is available

Make sure that, on the machines you are going to install an HTTP server, no other server is running on port 80. To check this, you can use the command:

```
telnet <hostname> 80
```

Under Windows, you should get a response like:

```
Connecting To <hostname>...Could not open a connection to host on port 80 :
Connect failed.
```

Step 4: Install the Web server software for LMS access

If you want to use a Web server other than the bundled IBM HTTP Server 1.3.26 or if you want to install the IBM HTTP Server on a separate machine, install and configure your Web server according to its installation instructions *before* you install the WAS. During the installation of WAS, select the appropriate WebSphere plug-in to be installed.

If you decide to use the included IBM HTTP Server on the same machine as WAS, you need to select it, along with the correct WebSphere plug-in, as an installation option during the setup of WAS.

For further information read “Preparing to install and configure a Web server” at the WebSphere Application Server InfoCenter:

```
http://publib7b.boulder.ibm.com/wasinfo1/en/info/aes/ae/tins_webserver.html
```

Step 5: Install the Web server software for content access

If you are using separate content servers, install the Web server software according to its installation instructions on these machines.

Step 6: Prepare Web servers for content deployment

When a course is deployed to a DS, the LMM’s Content Manager (CM) copies the course files to all content servers attached to the specified DS. This file transfer can happen through a file system or over FTP.

We recommend that you use file system transfer only for single server installations, meaning that LMM, DS, and course contents are installed on the same server. For all other scenarios you should use FTP.

Create a course content directory

Create one directory on all content servers that are dedicated to hold the content files of deployed courses. You can create this directory directly under the document root of the Web server. Alternatively you can create this directory outside the document root and map it as a virtual directory to the Web server.

For Apache Web Server and IBM HTTP Server, this means you will have to add a section to the configuration file httpd.conf looking like this:

```
Alias /content/ "d:\deployed_course_content/"
<Directory "d:\deployed_course_content/">
Options None
AllowOverride None
Order allow,deny
Allow from all
</Directory>
```

This sets up a virtual directory, /content/, that points to the physical directory, d:\deployed_course_content. Files in this directory are then accessible through http://<hostname>/content/.

Preparing for content deployment through a file system

File system transfer means that the CM copies the course files to the previously created directory using file system access.

If you need to deploy content to a Web server that is not located on the same machine as the LMM (which is usually the case) through the file system, you have to *map* (Windows) resp. *mount* (Linux) this remote content directory to the LMM machine's file system and *not* to the DS machine's file system.

Preparing for content deployment using FTP

On *all* content servers used by LMS, you have to set up FTP accounts with the *same* FTP user name and password. Set up the FTP account(s) so that the content directory is accessible for read and write access.

Ensure that you can connect to the FTP server(s) from the LMM Server and that you can access the content directory. Try to create and delete a folder using FTP in the content directory to ensure that the FTP user has the required rights.

4.7 WebSphere Application Server

IBM WebSphere Application Server (WAS) Release 5 is a powerful J2EE application server and the base environment for LMS (LMM and DS).

WAS delivers flexible configuration and deployment options to meet the needs of the stand-alone or multiserver distributed and highly dynamic environments. As your e-business requirements change, you can migrate smoothly to the greater functionality and higher qualities of service offered by other configurations.

If multiple servers are used, you *must* install WAS Network Deployment. The Network Deployment (ND) module configures and controls multi-server WAS installations. Also if you intend to deploy LMS on a cluster of servers for performance or high availability reasons, ND must be installed to manage the cluster.

WAS ND can be installed on the same node where the WAS base product has been installed, but usually you avoid this additional overhead and install WAS ND on a separate desktop machine.

Note: You can also use an existing WAS environment for LMS, if single sign-on (SSO) is enabled and the previously installed LDAP directory is used as User Registry for the Global Security.

4.7.1 WAS terminology

Application Server is the primary runtime component. This is where the application actually executes. All WebSphere Application Server configurations can have one or more application servers. However, there is no workload distribution or common administration among application servers until you reach the Network Deployment level.

Node is a logical grouping of application server processes. A node often corresponds to a physical server machine with an IP address assigned to it. The application server processes located on one node are managed by a single node agent. On each node, there is a local copy of the cell configuration repository managed by a node agent. This repository may be modified through the deployment manager during publish/activate configuration processes. The node agent also has access to the configuration repository of each process running on a node.

Cell is a logical configuration concept that associates WebSphere server nodes with one another. Administrators may freely define the cell according to whatever

criteria they will take to group the servers (organizational aspects, application aspects, and so on). A cell is managed by one deployment manager process.

Node Agent is the administrative process that manages application server processes on a single node. The Node Agent routes administrative requests issued from the deployment manager to a particular application server. It is purely an administration process participating in the network deployment configuration and is not involved in serving applications.

Network Deployment Manager is an administrative process that controls processes and manages load balancing between the nodes connected to the cell. Administrative access to any node in a cell is governed by deployment manager processes. This means that the deployment manager hosts the administrative console for the entire cell. In the WebSphere Network Deployment configuration, one computer is designated to be the central Deployment Manager. This central machine controls other systems that work under its supervision.

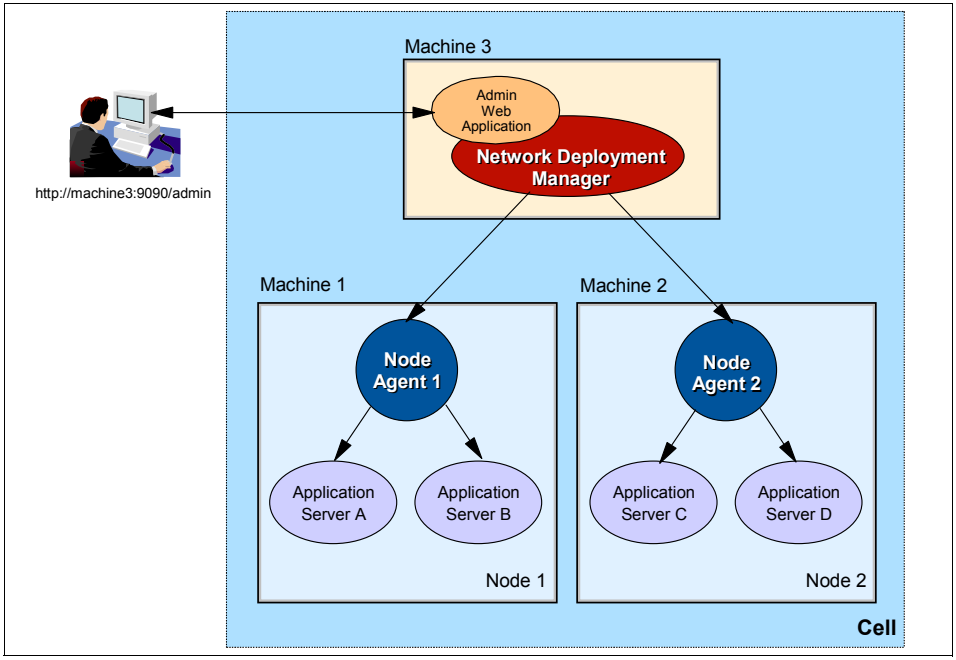

Figure 4-17 Interrelation between WebSphere components

4.7.2 Tasks to complete

Here are the tasks for installing the WebSphere Application Server.

Step 1: Read the platform-specific tips for WAS 5 installation

Read the “Platform-specific tips for installing and migrating” described at:

`http://publib7b.boulder.ibm.com/wasinfo1/en/info/aes/ae/rins_prereq.html`

Step 2: Install WAS base product

Install WAS as described in the LMS installation guide on all LMM and DS machines. In addition, here are some tips and additional information regarding the WAS installation:

- During the install, we recommend that you choose Custom as the installation method and then deselect the following options:
  - Embedded Messaging
  - Application Server Samples
  - Application Assembly and Development Tools
- Do not forget to select the correct WebSphere Web server plug-in to be installed.
- When you are asked by the installation program to enter the Node Name, do not enter the fully qualified hostname. You can use the short hostname or some other name. The node name is used as a reference name to distinguish between the different nodes of a WebSphere cell. In the field `Host name or IP address`, enter the fully qualified hostname.

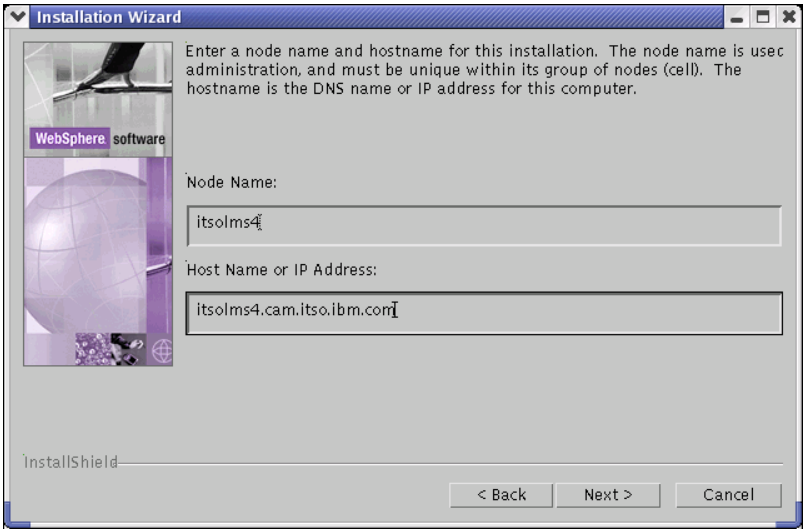

Figure 4-18 WAS installation - Entering node name and hostname

- After installation, the “First Steps” program is launched. Select **Start the server** from the displayed menu. When WAS is started, click **Verify**

Installation to validate the WAS installation. This process should end with the message `IVTL00801: Installation Verification is complete`.

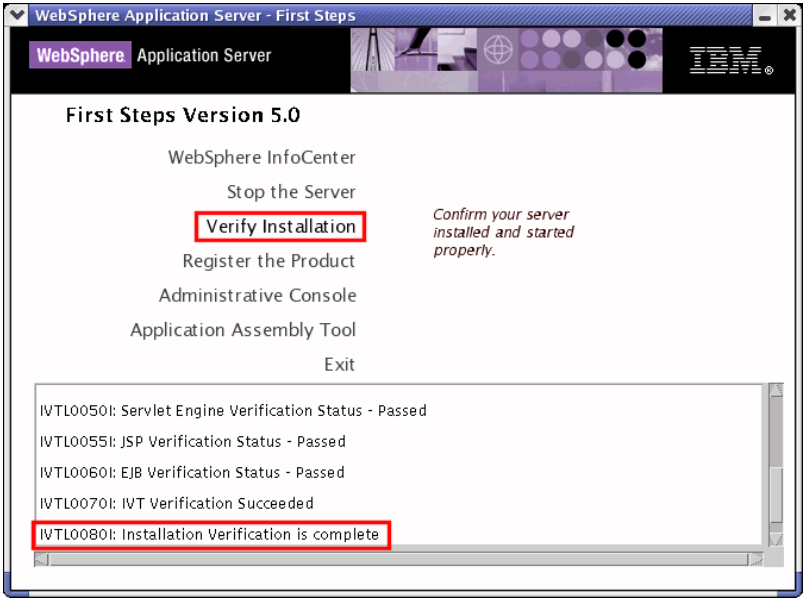

Figure 4-19 WAS installation verified

- During the WAS installation, an application server called server1 is automatically created. server1 hosts the WAS administration console, the DefaultApplication (contains the hello, snoop, and hitcount servlets), and the ivtApp (used by the installation verification process).

  You can access the WAS administration console using:

  ```
  http://<fully_qualified_hostname>:9090/admin
  ```

  The test servlets are accessible from:

  ```
  http://<fully_qualified_hostname>:9080/snoop
  http://<fully_qualified_hostname>:9080/hello
  http://<fully_qualified_hostname>:9080/hitcount
  ```

- Under Windows, you can start and stop server1 by using:
  - The start menu

    To start: **Start -> Programs -> IBM WebSphere -> Application Server V5.0 -> Start the Server**

    To stop: **Start->Programs -> IBM WebSphere -> Application Server V5.0 -> Stop the Server**

– The command line

To start: `<WAS_install_path>\bin\startServer.bat server1`

To stop: `<WAS_install_path>\bin\stopServer.bat server1`

When WebSphere Global Security is enabled, the stopServer command requires a user name and password:

```
<WAS_install_path>\bin\stopServer.bat server1 -username wasadmin
-password password
```

- Under UNIX, you can start and stop the server by using the command line.

  To start: `<WAS_install_path>/bin/startServer.sh server1`

  To stop: `<WAS_install_path>/bin/stopServer.sh server1`

  When WebSphere Global Security is enabled, the stopServer command requires a user name and password:

  To stop: `<WAS_install_path>/bin/stopServer.sh server1 -username wasadmin -password password`

Note: wasadmin is the server user ID you specify when enabling WAS Global Security. This user *must* exist in the LDAP directory.

Step 3: Enable WAS Global Security and SSO

As described in the LMS installation guide, enable WAS Global Security and SSO. Use the same LDAP directory as user registry you want to use for LMS.

See “How to set up security in WAS” on page 378 for additional information on the most important configuration parameters regarding WebSphere security.

Step 4: Install and configure the WebSphere plug-in

When you install WAS, you can decide which WebSphere Web server plug-ins you want to install. Based on the location of your Web server, you have to perform different steps to ensure a proper setup of the plug-in.

Note: There is a known issue with the WebSphere plug-in in ND environments. See “Unique application server names across a cell” on page 79.

If WAS and the Web server are on the same machine

When a WebSphere plug-in is selected and the Web server is installed on the same machine, the setup program will automatically do the following:

- Copy the plug-in binary to the <WAS_installation_path>/bin directory.

- Update the Web server's configuration file, such as the httpd.conf file on IBM HTTP Server/Apache Web Server, so that it loads the plug-in on start up.

After the WAS installation, you must perform the following steps manually:

1. Generate the required plug-in configuration file as described in "Generating the WebSphere plug-in configuration file" on page 75.
2. Check that the right settings have been applied to the Web server's configuration file.

   For the bundled IBM HTTP Server 1.3, this means, for example, that you must verify that the httpd.conf contains the required parameters:

   – The line `ServerName <fully_qualified_hostname>` (usually the first line of the file) should contain the fully qualified hostname of the server. If this line is missing or only shows the short hostname, change it manually.

   – Ensure that the following lines are added to the file, usually at the end:

   ```
   LoadModule ibm_app_server_http_module
   "<WAS_install_path>/bin/mod_ibm_app_server_http.dll"
   WebSpherePluginConfig
   "<WAS_install_path>/config/cells/plugin-cfg.xml"
   ```

   Also ensure that the path points to the right location.

   a. Restart the Web server.

   b. Check that the WebSphere plug-in is configured correctly by accessing the servlets of WebSphere's DefaultApplication in a Web browser:

```
http://<fully_qualified_hostname>/hello
http://<fully_qualified_hostname>/snoop
http://<fully_qualified_hostname>/hitcount
```

If WAS and the Web server are not on the same machine

If you installed the Web server on a separate machine, the WAS setup program will only copy the plug-in binary to the <WAS_installation_path>/bin directory.

You will then have to perform the following steps:

1. Generate the required plug-in configuration file as described in "Generating the WebSphere plug-in configuration file" on page 75.
2. Copy the plug-in binary and the plug-in configuration file to the Web server's file system.
3. Update the Web server's configuration file, so that the WebSphere plug-in is loaded.
4. Restart the Web server.

5. Check that the WebSphere plug-in is configured correctly by accessing the servlets of WebSphere's DefaultApplication in a Web browser:

```
http://<fully_qualified_hostname>/hello
http://<fully_qualified_hostname>/snoop
http://<fully_qualified_hostname>/hitcount
```

Note: This process is described in detail for all supported Web servers at the WebSphere Application Server InfoCenter in "Manually configuring supported Web servers":

http://publib7b.boulder.ibm.com/wasinfo1/en/info/aes/ae/tins_manualWebServer.html

See "Plug-in configuration on a separate IBM HTTP Server" on page 77 for an example.

Table 4-1 WebSphere plug-in binary filenames

Web server	OS	Plug-in file name
IBM HTTP Server 1.3.26		
	UNIX	mod_ibm_app_server_http.so
	Win2k	mod_ibm_app_server_http.dll
IBM HTTP Server 2.0		
	UNIX	mod_was_ap20_http.so
	Win2k	mod_was_ap20_http.dll
Apache HTTP Server 1.3 (without Extended API)		
	UNIX	mod_app_server_http.so
	Win2k	mod_app_server_http.dll
Apache HTTP Server 1.3 (with Extended API)		
	UNIX	mod_app_server_http_eapi.so
	Win2k	mod_app_server_http_eapi.dll
Sun ONE Web Server, Enterprise Edition 6		
	UNIX	libns41_http.so
	Win2k	libns41_http.so
Microsoft Internet Information Server 4.0, 5.0		
	Win2k	iisWASPlugin_http.dll
Lotus Domino Enterprise Server 5		
	UNIX	libdomino5_http.so
	Win2k	domino5_http.dll

Step 5: Create separate application servers for LMS modules

In order to later be able to apply specific tuning options to the LMS, you should create application servers on your WAS nodes that are dedicated to LMS.

On single server installations, we recommend that you create one separate application server, that hosts both LMM and DS. On multi-server installations, an application server will usually only host LMM or a DS.

For information about the performance impacts of one or many application servers per node, read “J2EE Application Deployment: One or Many Applications per Application Server?” at:

http://www7b.software.ibm.com/wsdd/techjournal/0211_alcott/alcott.html

Step 6: Set ConnectionIOTimeOut parameter

To ensure the successful deployment of both LMM and DS, you must set an additional WebSphere variable, ConnectionIOTimeOut.

Perform the following steps for each application server that will later host a LMM or DS module:

1. In the WebSphere Administrative Console, go to **Servers -> Application Servers -> <SERVER_NAME> -> Web Container -> HTTP Transports**.
2. In the HTTP Transports screen, click the asterisk (*) associated with the port for which “SSL enabled” is set to False.
3. In the port’s screen, click **Custom Properties**.
4. Click the **New** button.
5. Set the name to ConnectionIOTimeOut and the value to 1000.

Testing connectivity

See 8.7, “Test JDBC connections from within WebSphere” on page 140 for additional details on testing your connections.

4.7.3 Additional information

Now we share some additional information.

Generating the WebSphere plug-in configuration file

After the installation of WAS (and Network Deployment Manager), and before you can use the Web server plug-in, the Web server plug-in configuration must be generated. Any future changes that affect the way how HTTP requests to WAS are routed, require that this process will be repeated.

To generate the configuration file:

1. Open the administrative console (http://<WAS_hostname>:9090/admin) in a Web browser and log on.
2. Expand Environment and select **Update Web Server Plug-in**.
3. Click **OK** to generate the configuration file.
4. Verify that the generation was successful by looking at the messages that appear at the top in the administrative console.

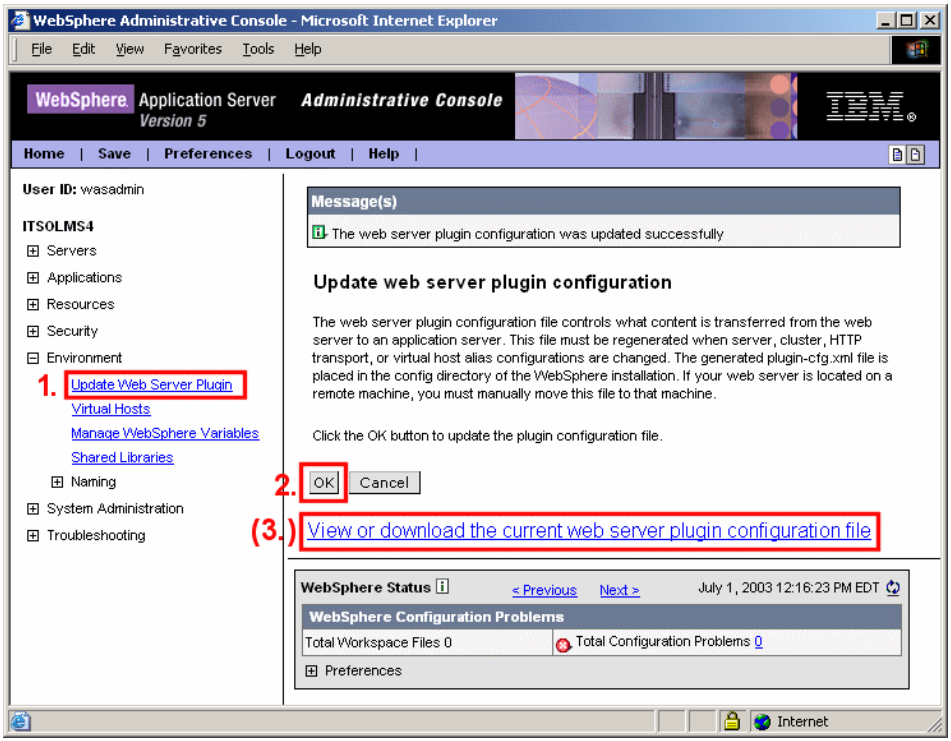

Figure 4-20 Generating WebSphere plug-in configuration file

5. Open the plugin-cfg.xml file and alter directory paths if necessary. These paths were generated with respect to that WAS system where the plug-in was generated and may not be correct for the server where you deploy the plug-in configuration file.

   The generated Web server plug-in is stored in one of the following places:

   – In a Network Deployment environment, it is stored in <WAS_ND_installation_path>/config/cells/plugin-cfg.xml.

– In a base WebSphere Application Server environment, it is stored in <WAS_installation_path>/config/cells/plugin-cfg.xml.

6. If you are in a Network Deployment environment, make sure that after the regeneration the plug-in configuration file is synchronized with the nodes. To ensure this, restart all nodes or copy the file manually to the separate WAS machines.

   Under Windows, you can restart a node by issuing the following commands in a command line on the WAS machines:

   ```
   cd <WAS_installation_root>
   stopServer.bat <server> -username <wasadmin> -password <password>
   stopNode.bat -username <wasadmin> -password <password>
   startNode.bat
   startServer.bat <server>
   ```

   Under Linux, you can restart a node by issuing the following commands in a command line on the WAS machines:

   ```
   cd <WAS_installation_root>
   .\stopServer.sh <server> -username <wasadmin> -password <password>
   .\stopNode.sh -username <wasadmin> -password <password>
   .\startNode.sh
   .\startServer.sh <server>
   ```

   Note: According to the WebSphere manual, you can also use the Full Resynchronize function in the WAS administration interface to synchronize the plug-in configuration file between ND and a WAS node. However, in our experience this does not always work.

7. If you are using separate Web servers, copy the plug-in configuration file to the appropriate location on these machines.

   The WebSphere plug-in checks for changes in the plug-in configuration file every 60 seconds. You can wait this time or you can enforce a rereading of the file by restarting the Web server.

Plug-in configuration on a separate IBM HTTP Server

For a separate IBM HTTP Server 1.3 on a Windows machine, you will have to do the following steps:

1. Copy the mod_ibm_app_server_http.dll to <IBMHTTPServer_installation_path>\modules\.
2. Add the following lines to <IBMHTTPServer_installation_path>\conf\httpd.conf.

   ```
   LoadModule ibm_app_server_http_module
   "modules/mod_ibm_app_server_http.dll"
   ```

```
WebSpherePluginConfig "conf/plugin-cfg.xml"
```

Note: If you have any old entries in the Web server configuration file, you have to remove them first.

3. Copy the plugin-cfg.xml to <IBMHTTPServer_installation_path>\conf\.

Note: This file must be recopied to the Web server whenever an application server configuration change requires it to be regenerated. You also have to reapply the changes described below.

4. Adjust the log path in the copied plugin-cfg.xml:

```
<Log LogLevel="Error" Name="logs/http_plugin.log"/>
```

Using a relative path like logs/http_plugin.log instead of a absolute path will create the log file in the logs directory located under the IBM HTTP Server installation path.

5. Since the plug-in configuration file is configured to support Secure Sockets Layer (SSL) operation, you must do the following steps if you want to use SSL with your applications:

   a. Copy the plugin-key.kdb and plugin-key.sth files from <WAS_installation_path>/etc/ on the WAS machine, to the Web server machine (for example, to <IBMHTTPServer_installation_path>/ssl/).

   b. Edit the plugin-cfg.xml file to point to the appropriate paths on the Web server machine. For example:

```
<Transport Hostname="<hostname>" Port="<port>" Protocol="https">
<Property name="keyring" value="ssl/plugin-key.kdb"/>
<Property name="stashfile" value="ssl/plugin-key.sth"/>
</Transport>
```

   c. The ssl/plugin-key.kdb and ssl/plugin-key.sth file specifications must be valid paths on the HTTP server machine and either relative to the IBM HTTP Server installation path or absolute.

If you do not want to use SSL you just need to remove all `<Transport .... Protocol=”https”> ... </Transport>` entries from the plugin-cfg.xml.

Note: If you do not do either of these two, your IBM HTTP Server will fail to start, and give you the following message:

```
[Mon Jun 30 19:18:57 2003] [notice] Initializing the WebSphere Plugin
ws_common: websphereUpdateConfig: Failed parsing the plugin config
file
Note the errors or messages above, and press the <ESC> key to exit.
30...
```

Unique application server names across a cell

For the WebSphere plug-in to work properly in an ND environment, all application servers of a cell must have unique server names. The plug-in configuration file contains information for all application servers of the cell. If two servers have the same name, the WebSphere plug-in does not load. This is a known problem and will probably be solved in future WebSphere versions.

By default, every WAS has a server1. If more than one WAS is added to a cell, you will automatically end up with multiple server1s. To solve this problem, you have the following two options:

- Delete multiple server1 servers.

  You cannot rename application servers.Therefore the only chance to solve the problem of multiple server1 servers is to delete them.

  Since the default server1 does not host the WebSphere administration application when the node is federated into a cell, you usually turn it off to free unused system resources. The ND environment is in no way affected if you remove the default servers. Nevertheless, the hello, snoop, or hitcount servlets that are part of server1 might be useful in certain situations.

- Modify the plug-in configuration file manually.

  You can change the server names manually in the plug-in configuration file. In the following example, two server1 servers are renamed to itsolms2_server1 and itsolms3_server1.

Example 4-1 Renaming two server1 servers

```
<ServerCluster Name="server1_itsolms2_Cluster">
   <Server Name="server1_lms2">
      <Transport
         Hostname="itsolms2.cam.itso.ibm.com" Port="9080" Protocol="http"
      />
      <Transport
         Hostname="itsolms2.cam.itso.ibm.com" Port="9443" Protocol="https"
      >
         <Property
            name="keyring"
```

```
            value="d:\WebSphere\AppServer\etc\plugin-key.kdb"
         />
         <Property
            name="stashfile"
            value="d:\WebSphere\AppServer\etc\plugin-key.sth"
         />
      </Transport>
   </Server>
   <PrimaryServers>
      <Server Name="server1_lms2"/>
   </PrimaryServers>
</ServerCluster>
<ServerCluster Name="server1_itsolms3_Cluster">
   <Server Name="server1_lms3">
      <Transport
         Hostname="itsolms3.cam.itso.ibm.com" Port="9080" Protocol="http"
      />
      <Transport
         Hostname="itsolms3.cam.itso.ibm.com" Port="9443" Protocol="https"
      >
         <Property
            name="keyring"
            value="d:\WebSphere\AppServer\etc\plugin-key.kdb"
         />
         <Property
            name="stashfile"
            value="d:\WebSphere\AppServer\etc\plugin-key.sth"
         />
      </Transport>
   </Server>
   <PrimaryServers>
      <Server Name="server1_lms3"/>
   </PrimaryServers>
</ServerCluster>
```

Manual modifications of a plug-in configuration file are automatically overwritten when the plug-in configuration is regenerated in the WebSphere administration interface. To avoid overwriting the file unintentionally, you should copy the file and save it with another name. After this, you should change the related Web server configuration variable to point to the new file.

5

Installation

This chapter prepares you to successfully proceed with an LMS installation. However, it cannot be used as a replacement for the installation guide. Its intention is to give you a better understanding of the installation process and to discuss issues that you should consider before installing the LMS.

Note: Take a look at the appendix section in the back of this publication. We have provided numerous appendices in order to give you more details on various aspects of installing LMS. These include:

- Appendix C, “Software requirements” on page 373
- Appendix D, “WebSphere Application Server security parameters” on page 377
- Appendix E, “WebSphere scope setting” on page 389
- Appendix F, “Default LDAP attribute mappings” on page 393

Also see Chapter 16, “Corporate scenario” on page 327, for an example of how a company would install LMS.

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5.1 Installation overview

Before starting the actual installation, make sure you have read Chapter 4, “Pre-installation” on page 41. In this chapter we will refer to several topics discussed in Chapter 4, such as WAS, LDAP, and HTTP server.

See also Appendix C, “Software requirements” on page 373, and the Release Notes for the level of LMS that you are installing.

5.2 Installing LMS

This section provides some useful tips for your LMS installation.

5.2.1 About the LMS installer

The LMS installer program prepares the LMS application files for installation. The LMS installer does not deploy the LMS enterprise applications to WAS. Instead, the LMS installer uses InstallShield and runs on all LMS platforms. Specifically, the LMS installer does the following:

- It unpacks a set of files including:
  - CLIMP
  - LMS Offline Client
  - LMS Authoring Tool (AT)
  - LMS settings updater
  - Three portlets for use with WebSphere Portal Server
  - WAR and EAR files for deploying LMM and DS to WAS
  - Database scripts for creating the required LMS databases
- It creates two customized SQL script files that contain the settings you specified while the install program was running:
  - settings_init.sql for the LMM database
  - settings_init_ds.sql for the DS database

The LMS installer only copies or creates files. It does not register the components anywhere on the operating system. For example, under Windows the LMS install does not perform changes to the registry, nor does it add an entry in the Add/Remove Programs section of the Control Panel’s Software dialog. This means that you can run the installation program on another machine, and afterwards simply copy the required files to the WAS and database server.

The LMS installation program is available for different operating systems. The installation program will provide the files required for that specific operating system.

5.2.2 Tasks to complete

This section discusses the installation parameters.

Running the LMS installer

When you run the installer, you will be prompted for some or all of the following information, depending upon which components are selected:

- LMS features
- LDAP settings
- LMM Server settings
- Delivery Server settings
- Administrator settings
- Course content management and deployment settings
- Installation directory

As described in the previous section, it is not necessary to run the installer program on the machine where you actually want to install LMS. This also means (if you deploy the LMM on a different server from the DS) that by using the LMS installer you can install both LMM and DS at once on one machine. After the installation you then simply move the files to the appropriate server(s). You can move the database script files to the database server, the lmm-lmm.ear file to the LMM Server, the lms-ds.ear file to the DS server, AT and LMS Offline Client to the file server, and so on.

Collecting the required installation parameters

To minimize problems, you should collect the parameters that are requested by the installation program *before* you start the installation. Here you will find some additional information about the parameters that the installer will ask you for.

In 5.2.3, “LMS installation example” on page 88, you will find an overview of all parameters to be provided during the LMS install with sample data of one specific setup of LMS.

LMS features

When you launch the installer, one of the first questions asked is which LMS features and components you want to install. You can select all or some of the following components:

- Learning Management System Server (LMM)
- Delivery Server application (DS)

- Authoring Tool (AT)
- Utilities (Import, Migration)

LDAP settings

As part of the pre-installation steps, you determined the appropriate LDAP settings to use. See 4.3, “LDAP server” on page 46.

The LDAP user ID is the LDAP bind user that LMS uses to connect to the LDAP directory. This user requires the ability to read the entries of all the users in the given base DN. It does not have to be the LDAP or WAS administrator.

Note: The Test LDAP Connection button does confirm the correctness of most of the LDAP settings. However, it does not ensure that the LDAP user name has access to all user names and attributes as required. To learn how to check if the user has the correct access level, see “Verify the LDAP bind user” on page 49.

LMS server settings

The LMS server settings input screens capture information for the LMM application.

The Base URL refers to the URL that should be used to access the LMM Server. This is the base URL of the LMM application. It includes the base URL of the LMM application server and a context root of “lms-lmm” for the LMM application. The context root will always be “lms-lmm” and cannot be changed.

After deploying LMM, you can check the context root at the WAS administration console by going to **Applications -> Enterprise Applications -> [LMM application name] -> Additional Properties/View Deployment Descriptor -> Web Modules -> Web Module URI -> Context-root**. This parameter has the value /lms-lmm.

Note: The example provided by the installer in LMS 1.0 and LMS 1.0a is incorrect. The correct context root is lms-lmm, as outlined above.

The user name and password used for authentication between LMS servers do not refer to an LDAP user. These credentials are stored in the LMM and DS database and are used for the communication between LMM and DS.

If you run the installer script separately for the DS server, or if you set up an additional DS server, make sure that the LMM user name and password have the same values as the ones you provided here.

Administrator settings (LMM installation only)

The Administrator settings capture information about which user or group should receive Administrator access to the LMM application upon installation.

Select the Administrator role type and specify a user or group that will receive administration access to the LMS. An LMS administrator has administrative rights to the LMS and can perform tasks such as User, Content, and Resource management or change global LMS settings. The user or group must exist in the LDAP directory and will have automatic access to LMS after deployment of the application in WAS.

We recommend that you specify an LDAP group instead of a name, because this makes it easier to add additional administrators later on.

Content Management settings (LMM installation only)

The Content Management settings screen requires information regarding the course content deployment.

The `Path to Imported Course Packages` refers to the directory where the course packages will be stored on the LMM as the source for later deployment to the DS. Enter a path to the local directory on the LMM Server where imported courses will be stored. This path may be absolute or relative.

A relative path (for example, “package”) would store course packages at:

```
<WAS_INSTALL_PATH>\InstalledApps\<NODE>\LMM.ear\lms-lmm-complete-23.war\pac
kages
```

An absolute path such as E:\lmspackages (on a Windows server) would point to the \lmspackages directory on the LMM Server E: partition.

We recommend that you use an absolute directory for a separate data partition, so the directory’s size can be easily monitored.

The requested FTP User Name and Password for Deploying Content are global values used for the content deployment from the LMM to any content server attached to a DS. This means that this FTP account has to be set up on all content servers providing course content for LMS.

These parameters are required by the installer, even if you do not use FTP to deploy content but use the file system. Content deployment using files ystem is defined later during the installation on the Content Deployment settings screen. See “Content Deployment settings (DS installation only)” on page 86.

If you do not use content deployment using FTP, we suggest that you enter dummy values, such as “not used,” for the FTP user name and password.

Delivery Server definition (DS installation only)

The Delivery Server settings screen captures information for the Delivery Server application.

Choose a server ID to distinguish between the different DS servers. This name will be used within the LMS application, so an administrator can choose to deploy a course to a specific Delivery Server.

Enter the base URL of the DS application. This includes the base URL of the DS application server and a context root of “lms-ds” for the DS application. The context root cannot be changed. Optionally enter a description for the DS.

Note: The example provided as part of the label of the Base URL field is incorrect in Versions 1.0 and 1.0a of LMS. The correct context root is lms-ds, as outlined above.

The delivery server user name and password that are requested are used for authentication between the DS application and the LMM application. This user name and password will be stored in the DS database and do not reflect a user in the LDAP directory.

This user name and password are related to this DS server only.

Web Server settings (DS installation only)

The Web Server settings screen captures information about the location of deployed content and the location of the LMS tracking servlet.

The `URL of Deployed Content` points to a Web location on the content server that will be used to access the content of a deployed course. The Delivery Server will redirect the student’s browser to this URL when launching a course’s activity. See “Step 6: Prepare Web servers for content deployment” on page 66 for detailed information.

To use multiple content servers, you must set them up with a load balancer to balance requests to this URL between the content servers. This is not done by LMS; therefore you cannot enter a separate URL for each content server.

The tracking URL is predetermined by the DS base URL and should not need to be changed. If this URL is incorrect, the user will get tracking errors when launching a course.

Content Deployment settings (DS installation only)

The Content Deployment settings screen allows you to specify a way of how to deploy the content to the DS’s content server(s).

On a course deployment, the Delivery Server sends this information to the LMM. The LMM uses this information to copy the content to all content servers attached to a DS.

There are two ways in which content is deployed to the content server through either FTP or a file system copy. If both LMM and DS are on the same server, the easiest is to choose file system. If LMM and DS are on different physical servers, you will normally choose FTP.

To use FTP, you select FTP as deployment type and enter the location relative to the FTP root where content will be placed and the FTP host. The location is a directory that has been set up under the FTP server's root directory (physically or virtually). The FTP user specified before in the Content Management settings must have write access to this location. This location must map to the URL of deployed content specified in the Web server settings. See “Step 6: Prepare Web servers for content deployment” on page 66 for how to achieve this.

For deployment using the file system, select **File System** as the deployment type and enter an absolute path to the content directory that is mapped to the URL for deployed content. Like with FTP, this location must map to the URL of deployed content specified in the Web Server settings. For example (with IBM HTTP Server on Windows):

```
c:\program files\IBM HTTP Server\htdocs\en_US\content
```

Note: The file system path is the path to the content directory, from the LMM (and not from the DS), since the LMM’s content manager copies the files to the content server.

System Administrator e-mail settings (DS installation only)

The System Administrator E-mail Settings screen allows you to specify an e-mail address that will receive notifications from the system and an e-mail address that appears as the From e-mail address on these notifications.

Installation directory

This parameter specifies the directory to where the installer will copy the LMS installation files.

The installer does not perform an actual installation of the LMS components. It only extracts and customizes the files for the actual deployment. You can choose any directory and afterwards rename or move around the directory without any implication.

5.2.3 LMS installation example

Here is an example of the parameters used during an installation, when all features are selected to be installed.

This example considers the following setup:

- One LMM Server on lms.ibm.com®, with the IBM HTTP Server on the same server.
- One DS Server on lmsds1.ibm.com, with the IBM HTTP Server on the same server. This HTTP Server also functions as the content server.
- One LDAP Server on ldap.ibm.com.

Parameter	Sample	Comments
LDAP settings		
Provider URL	ldap://ldap.ibm.com:389	
Base Distinguished Name	o=ibm	
LDAP User ID	wasadmin	The binding ID for LDAP
LDAP Password	password	
LDAP Provider	IBM Directory Server (dropdown)	
LMS server settings		
Base URL	http://lms.ibm.com/lms-lmm	
Description	LMS Server	
User Name	lmslmm	To authenticate LMM to DS servers
Password	password	
Administrator settings		
Administrator Role Type	User (checkbox)	
Administrator LDAP User ID	lmsadmin	The user ID of the LMS Administrator
Content Management settings		
Path to imported Course Packages	d:\lmspackages	
FTP User Name	ftpuser	
FTP Password	password	
Notification E-mail format	Plain (dropdown)	
Delivery Server settings		

Parameter	Sample	Comments
Server ID	ds1	
Base URL	http://lmsds1.ibm.com/lms-ds	
Description	Delivery Server	
Delivery Server User Name	lmsds	To authenticate DS to LMM Server
Delivery Server Password	password	
Web Server settings		
URL of Deployed Content	http://lmsds1.ibm.com/content	
Tracking URL	http://lmsds1.ibm.com/lms-ds/tracking	
Content Deployment settings Use “Add Server”-button to add content server to the Servers-list		
Deployment Type	FTP (dropdown)	
Location for Deployed Content	content	Create virtual ftp directory “content” that maps to the directory where the HTTP server serves from: “http://lmsds1.ibm.com/content”
FTP Host	lmsds1.ibm.com	
System Administrator e-mail settings		
E-mail to Address	lmsadmin@ibm.com	
E-mail from Address	lmsadmin@ibm.com	
Installation directory		
Directory Name	d:\lms	

5.2.4 Installation file structure

If you choose to install all components, the following directories will be created during the installation of LMS 1.0x:

bin Command line import (CLIMP) and rostering utilities.

discussion JAR files to be installed on Domino discussion database server.

distribute Offline Learning Client installer, Authoring Tool installer, content tracking frameset files. These files should be moved to the appropriate location by the administrator where required

java	Platform-specific IBM JDK used by the utilities in the bin directory.
lib	JAR files used by the utilities in the bin directory.
license	License text files in various languages.
portlet	Three sample LMS portlets (WAR files): MyCalendar, MyCourses, SearchCatalog.
prt	Product registration files.
scripts	Database scripts to create the LMS databases and tables and write setup values into the databases.
update	LMS updater component to change LMS settings at a later stage; for more details see Trouble shooting section.
web-apps	EAR files for the LMM and DS servers, help WAR file, and additional WAR files that contain only static resources from the LMM and DS.

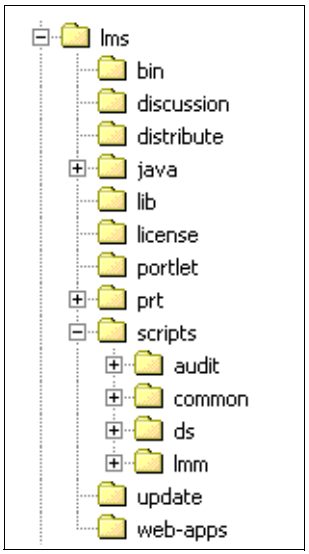

Figure 5-1 LMS file structure after installation

5.3 Creating and populating databases

As we described in 4.4, “Database server” on page 55, LMS uses three databases:

- LMM database (LMM Server only)

- Audit database (LMM Server only)
- DS database (one on each DS server)

The LMS installer generates database scripts for creating these databases, as well as scripts to create the database schema (tables, views, indices) and to populate the LMS settings. The scripts generated by the installer are grouped by database subdirectory in the directory <LMS_install_path>\scripts\.

The database administrator needs to create these databases by executing the scripts in Table 5-1.

Table 5-1 Database scripts

RDBMS	LMM db	Audit db	DS db
DB2 (UNIX)	lmm\cr_db2db_lmm.sh	audit\cr_db2db_audit.sh	ds\cr_db2db_ds.sh
DB2 (Windows)	lmm\cr_db2db_lmm.bat	audit\cr_db2db_audit.bat	ds\cr_db2db_ds.bat
MS SQL	lmm\cr_mssqldb_lmm.sql	audit\cr_mssqldb_audit.sql	ds\cr_mssqldb_ds.sql
Oracle	lmm\cr_oraown_lmm.sql	audit\cr_oraown_aud.sql	ds\cr_oraown_ds.sql

Important: For DB2, you have to run all the scripts under the user name that has set up the DB2 environment. This is because the database schema will be automatically set to the user's login name.

Next the database schema and seed data scripts need to be run against the three databases, as shown in Table 5-2.

Table 5-2 Schema

RDBMS	LMM db	Audit db	DS db
DB2	lmm\lmm_db2.sql lmm\permission_data.sql lmm\settings_init.sql	audit\audit_db2.sql audit\audit_data.sql	ds\ds_db2.sql ds\ settings_init_ds.sql
MS SQL	lmm\lmm_mssql.sql lmm\ permission_data.sql lmm\settings_init.sql	audit\audit_mssql.sql audit\audit_data.sql	ds\ds_mssql.sql ds\settings_init_ds.sql
Oracle	lmm\lmm_oracle.sql	audit\audit_oracle.sql	ds\ds_oracle.sql

The *LMS Installation Guide* provides some additional instructions if you are unfamiliar with how to issue the commands above.

Tip: The DB2 batch file (both for Windows and Unix) contains the additional sql statements that are required to create the schema and see data within the batch file. The statements are commented out by default, but can be easily activated by editing the script. This way the administrator will not have to run the sql statements separately.

For the Windows batch file, you can remove the “rem” statement from the last three lines.

For the Unix sh file, you can remove the “#” from the four db2 commands at the end of the file.

Later, if the user runs the LMS Updater to change any settings (see 8.6, “LMS Updater” on page 140), the Updater generates database scripts to update the settings. The user must run these to update the LMM and DS application databases (the Updater does not affect the audit database).

Important: After creating the databases using the script, test the connection to the databases from the WebSphere server.

For DB2, you will need to run the catalog commands on the WAS server if the databases are residing on a different server. The *Installation Guide* provides examples of this command.

Also make sure that you are using JDBC 2.0. The default for DB2 7.2 is JDBC 1.0. For how to change this, see Chapter 4, “Pre-installation” on page 41.

5.4 Configuring WebSphere

The WebSphere Application Server is an integral part of the IBM Lotus Learning Management System, and it must be configured in order for all LMS components to communicate.

5.4.1 Overview

The IBM LMS applications require various WAS resources and settings to be configured. The following actions are required, as described in the *LMS Installation Guide:*

1. Configure the JDBC provider, data sources, and J2C authentication entries for the three LMS databases.

Note: The user names specified in the J2C authentication entries must be the same ones that were used to execute the database creation and population scripts.

2. Define the value of the WAS environment variable that specifies the location of the JDBC driver. For Oracle and SQL Server, the JDBC driver information may need to be obtained from another source.
3. Define an LMS resource environment provider with entries that define the LMS log file path and SSL settings.

   For an example of the parameters mentioned in points 1, 2, and 3, see Section 5.4.3, “Example of WebSphere settings” on page 94.
4. Configure LDAP settings (unless this was already done during the steps in “Step 3: Enable WAS Global Security and SSO” on page 72.

   Note: The IBM LMS application and WAS must use the same LDAP directory.
5. Enable Global Security.
6. Configure SSO and LTPA settings. An LTPA token can either be generated by WAS or imported from elsewhere.

5.4.2 Defining the WAS parameters at the correct scope

Within WAS, parameters can be set at different levels. For LMS they can be set both at cell, node, or application server scope (level). Since a lot of installation problems occur by a misunderstanding of this concept or by accidently working on the wrong scope, we illustrate how to set the parameters at the correct level.

The following rules apply:

- Configurations at the cell level apply to all nodes and servers in the cell.
- Configurations at the node level apply to all application servers on the node.
- Configurations at the server level apply only to that application server.

The server scope has precedence over the node and cell scopes, and the node scope has precedence over the cell scope.

Although all parameters could be set at cell level, for LMS we suggest that you put all parameters on node level, to be able to handle differences in settings and directory setup between the different nodes. All parameters will have to be set at every node where the LMS application is deployed.

In Appendix E, “WebSphere scope setting” on page 389, additional information is provided to help you to make sure that you set the parameters at the correct level.

5.4.3 Example of WebSphere settings

Here is an example of the required WebSphere settings for LMS. This example assumes that LMS is using DB2 as the database server.

Configuring JDBC data sources

Table 5-3 shows how to set the path to the required JDBC driver.

Table 5-3 Path to JDBC driver

Parameter	Sample	Comments
Goto: Environment/manage WebSphere variables		
► DB2_JDBC_DRIVER_PATH (parameter exists already)	c:\program files\sqllib\java (windows) /home/db2inst1/sqllib/java (Unix)	Point to the java directory, and make sure that jdbc 2 has been set.

Table 5-4 shows how to create J2C Authentication Data entries for relational databases.

Table 5-4 J2C Authentication Data entries

Parameter	Sample	Comments
Goto: Security/JAAS Configuration/J2C Authentication data		
► Alias ► User ID ► Password	► lmm ► db2admin ► password	Alias: To refer to this entry when configuring JDBC datasources. On save the Alias name will change to <NODE>/lmm. User name/password that has read/write access to the databases. Note that for DB2, LMS will automatically expect that the db-schema is the same as the user ID.
► Alias ► User ID ► Password	► ds ► db2admin ► password	
► Alias ► User ID ► Password	► lsaudit ► db2admin ► password	

Table 5-5 on page 95 shows how to define the JDBC Provider.

Table 5-5 JDBC Provider parameters

Parameter	Sample	Comments
Goto: Resources/JDBC Providers		
► Name	► DB2 JDBC Provider	Dropdown list.
► Classpath	► ${DB2_JDBC_DRIVER_PATH}/db2java.zip	The default entry is correct. This now points to the db2java.zip for jdbc 2.0.
Goto: Resources/JDBC Providers/DB2 JDBC Provider/Datasources		
► Name	► lmm	
► JNDI Name	► jdbc/lmm	
► Statement Cache Size	► 0	Zero; default is 10.
► Component-managed Authentication Alias	► <NODE>/lmm	Dropdown list.
► Container-managed Authentication Alias	► <NODE>/lmm	Dropdown list.
Goto: ...DB2 JDBC Provider/Datasources/lmm/Connection Pools		
► Max Connections	► 30	Default is 10.
Goto: ...DB2 JDBC Provider/Datasources/lmm/Custom Properties/databaseName		
► Value	► lmm	lmm database name.
Goto: Resources/JDBC Providers/DB2 JDBC Provider/Datasources		
► Name	► ds	Repeat all settings for ds database.
► etc....	► etc....	
Goto: Resources/JDBC Providers/DB2 JDBC Provider/Datasources		
► Name	► lsaudit	Repeat all settings for lsaudit database.
► etc....	► etc....	

Table 5-6 shows how to configure environment entries.

Table 5-6 Environment entries

Parameter	Sample	Comments
Goto: Resources/Resource Environment Providers		
► Name	► LMS Provider	Any logical name will do
Goto: Resources/Resource Environment Providers/Referenceables		

Parameter	Sample	Comments
► Factory Classname	► com.lotus.elearn.naming.StringObjectFactory	
► Classname	► java.lang.String	
Goto: Resources/Resource Environment Providers/Resource Env Entries		
► Name	► LMS_FALSE	
► JNDI Name	► LMS_FALSE	
► Referenceable	► com.lotus.elearn.naming.StringObjectFactory	Dropdown list
Goto: ...Resource Env Entries/Custom Properties		
► Name	► value	
► Value	► false	
► Type	► java.lang.String	Dropdown list
Goto: Resources/Resource Environment Providers/Resource Env Entries		
► Name	► LMS_TRUE	
► JNDI Name	► LMS_TRUE	
► Referenceables	► com.lotus.elearn.naming.StringObjectFactory	Dropdown list
Goto: ...Resource Env Entries/Custom Properties		
► Name	► value	
► Value	► true	
► Type	► java.lang.String	Dropdown list
Goto: Resources/Resource Environment Providers/Resource Env Entries		
► Name	► LMS_LOG	
► JNDI Name	► LMS_LOG	
► Referenceable	► com.lotus.elearn.naming.StringObjectFactory	Dropdown list
Goto: ...Resource Env Entries/Custom Properties		
► Name	► LMS_LOG_PATH	
► Value	► d:\lmslog	Directory where the lms log files will reside
► Type	► java.lang.String	Dropdown list

5.4.4 Deploying the LMM and DS applications to WebSphere

Here are additional tasks to complete the installation.

Deploying applications

After the previous steps have been completed, the LMM and DS application EAR files can be deployed to WAS. From within the WAS administration console, select **Applications -> Install New Application**. The EAR files were generated by the LMS Installer and can be found in the webapps directory. The applications can be installed on an existing or a new application server.

The LMS Installation Guide provides clear instructions for installing the EAR files, and this should not cause any problems.

The only difference we recommend for production environments is that you enable the option “Pre-compile JSP” in Step 1: Provide options to perform the installation screen. When this option is enabled, all JSP files are compiled to servlets during the installation and not on the first Web access. The installation process will take a bit longer, but the LMS access for users will be fast from the beginning, with no delay for the compilation process.

Updating the WebSphere plug-in configuration

After deploying the application, you have to update the WebSphere plug-in configuration again, so that the LMM and the DS server can be accessed through the HTTP server. See “Generating the WebSphere plug-in configuration file” on page 75.

Starting the LMS application

After the preceding steps have been performed, the LMS is ready to be started. The Application Servers and Enterprise Applications can be started using the WAS administration console. Go to **Applications -> Enterprise Applications**, select the LMM or DS application, and click the **Start** button.

Now you are ready to test the application to make sure that LMS is working properly.

See 8.7, “Test JDBC connections from within WebSphere” on page 140 for additional details on connections.

WebSphere security

Refer to Appendix D, “WebSphere Application Server security parameters” on page 377, to ensure that you place the appropriate level of security into your WebSphere server.

5.5 System configuration

Here are steps to help you set up the DS server, help files, and e-mail.

5.5.1 Setting up the DS

Note: If you specified, during the LMS installation, to set up both LMM and DS, the DS server is already known to and configured with the LMM module. In that case, if you go to **Settings -> Delivery Servers**, you will find the DS server already there, so you will not have to do the following DS steps.

To add the Delivery Server (DS) to the LMS Server application, access the LMS Server start page at `http://xyz.acme.com/lms-lmm`, and log in as administrator.

Go to **Settings -> Delivery Servers** and click **Add**. Now use the settings shown in Table 5-7.

Table 5-7 Settings

Description	Value
Deliver Server Name	The name you used when you installed LMS.
User name/password	Use the user name/password used for the communication between lmm and ds.
Base URL for Delivery Server Deployment	Use the applicable URL, such as http://xyz.acme.com/lms-ds.

Click **Save**.

Note: The test button is not working in all versions of LMS and the results are not consistent. So if the test button gives `connection failed`, double-check that you entered the correct parameters, and then continue anyway.

5.5.2 Help files for the setup

The LMS online help is contained in a war file. To activate this, you have to unzip the war file and define the link to these files in LMS.

Unzipping help files

Locate the war file that contains the online help: lms-help.war in the web-apps subdirectory of the LMS install directory.

Create a directory for the help files in your HTTP server's document root (for example, ..\IBMHttpServer\htdocs\en_US\lmshelp) to store the help files. The directory should be created under the en_US directory for the English version to indicate the language. Do not use any spaces in the directory name. Unpack the lms-help.war file into this directory.

If you have a problem while unpacking the war file on Windows, you can rename the file to lms-help.zip and then try to use your unzip utility.

Configuring LMS

Log into LMS as the administrator, and go to **Settings -> LMM Server Settings -> General Settings -> General**.

Complete the URL of the help system:

- In case the help files are on a different server from the LMM, use the full url:

  `http://myserver.com/lmshelp (for example)`

- In case the help files are on the same server as LMM, you can refer directly to the directory relative to the http-root directory.
  - For Windows, this would be ...\lmshelp.
  - For Linux, this would be /lmshelp.

The directory structure for the deployed help files is shown in Figure 5-2 on page 100.

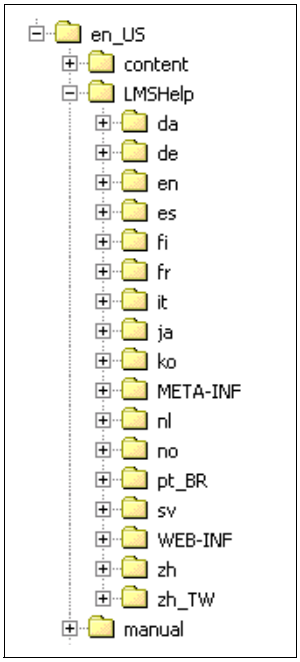

Figure 5-2 Structure of the LMS help files

To test the help after setting up the help setting, do the following:

1. Click another tab, such as Catalog (to allow LMS to refresh the screen and links).
2. Click the help link.

Note: UNIX and AIX users creating directories must have root privileges. Remember also, when creating directory names, do not use spaces.

5.5.3 Setting up e-mail

There are several types of e-mail available in the LMS system:

- Course e-mail
- Notifications of system or course events
- Error messages
- E-mail to the Help Desk

For all types of e-mail, you must complete the LMM e-mail settings as detailed below.

1. Click the **Settings** tab.

2. Under Deployment, click **LMM Server**.
3. Under LMM Server Settings, click **General Settings**.
4. Click **E-mail**.
5. Provide information in the fields shown in Table 5-8.

Table 5-8 Descriptions and values

Description	Value
Enable e-mail in the LMM	Select the check box to allow all types of e-mail. The box is selected by default.
SMTP server name	Enter the IP address or server name of the SMTP mail server.
Secondary SMTP server name	(Optional) Enter the IP address or server name of the SMTP server to which mail is sent when the primary mail server is unavailable.
Number of attempts to send an e-mail	Enter the maximum number of times the mail server will attempt to send a mail message. The default is 2.
Attempt time-out in seconds	Enter the number of seconds the mail server will wait for a response from the remote server before canceling communications. The default is 10.
Number of threads sending e-mails	Enter the number of threads the mail server will use for local mail delivery. Multiple threads are used to manage simultaneous processing of messages. The default is 5.

6. Click **Save**.

Important: If you do not save your work before navigating to another page, the Learning Management System discards the information you have entered.

Note: If you want to receive e-mail regarding imported courses, you must specify the e-mail settings before you do the import of any course packages.

5.6 Testing the LMS application

After finishing the LMS application, you should perform the following basic tests to make sure that the installation has completed successfully:

1. Test access to LMM and DS module using the following URLs on the Web server hosting the WebSphere plug-in:

   ```
   http://hostname/lms-lmm/about.do
   http://hostname/lms-ds/about.ds
   ```

   If a session time-out error appears, simply refresh the page.

2. Log in to LMM (`http://hostname/lms-lmm/`) with the LMS administrator user name and password. After login, you should see all tabs, which determines that you indeed have administrator rights.

3. Navigate to Reports on the Home tab and launch Progress Report.

   If an error comes up, you likely have a problem with the database schema. Even if no courses are deployed yet, you should not get an error.

   For more information on how to solve this, see “Database error” on page 138.

4. Upload a course. Run some tests by creating offerings to all DS servers and enroll some users.

   This will test that the LMM and DS server can communicate properly with each other. You will need to test this for all DS servers you installed.

   If you have multiple content servers per DS, you should check the content directory on all content servers to make sure they all received the course files.

5. Enroll a user in the course and launch the course. This will show if the tracking is activated properly.

6. Check course progress.

   This shows that the DS can communicate with the LMM, and it sends the tracking information back to the LMM.

If all the above areas are working properly, your LMS installation is successful.

5.7 Additional DS server

You can set up additional DS servers. In this section we outline the steps to set up an additional DS server called ds2.

To set up the DS2 server, you have to go through the same steps that were defined for pre-installation and installation, with the following exceptions:

1. LMS install.

   When you run the LMS installation program, you have to use a different name for the second DS server from the one used for the first DS server. For example, DS2.

   In addition, you will have to enter all the correct URLs related to ds2.

2. Create and populate databases.

   You will need to make changes to the created db-script files. By default, the script files create a database called ds for the DS. In our case, we already have a ds database for our first DS server. You will have to make changes manually to allow the creation of a separate database for ds2.

   In the case of DB2, edit the file cr_db2db_ds.bat in the directory <LMS_install_dir>\scripts\ds. Search for ds and make changes to the lines as follows:

   – Old: `db2 create database ds using codeset UTF-8 territory US`
   – New: `db2 create database ds2 using codeset UTF-8 territory US`
   – Also change all the other lines referring to this database name.

3. Post-installation tasks.

   Start the LMS administration interface, and add ds2 server as an additional DS-Server, as described in 5.5.1, “Setting up the DS” on page 98, for the first DS.

6

Post-installation tuning

This chapter describes several post-installation tasks. They are not necessary to get LMS running, but are recommended for system performance.

For the sections on TCP, Web server, and WAS tuning, some of the information was taken from the *WebSphere Application Server 5.0 - Tuning Guide*, which is worthwhile to read. It is an online document found at:

http://publib7b.boulder.ibm.com/wasinfo1/en/info/tuning/50TuneGuide.html

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6.1 Move static LMS elements to the Web server

In a three-tier configuration, you should consider moving static LMS user interface elements to the Web server. As discussed in 4.6.1, “HTTP servers for LMS user interface access” on page 61, for best performance the static elements of the LMS user interface should be located directly on the HTTP server where you installed the WebSphere plug-in.

For this purpose, the LMS installation comes with two Web archive (WAR) files containing the static elements of LMM and DS. After you extract the WAR files to the HTTP server, you modify the WebSphere plug-in configuration file so that it does not redirect requests for static elements to WAS.

Since WAR files are actually zip files, you can use any program that can handle zip files to extract the compressed files.

Tips: A very small (and free) Windows zip program with a graphical user interface is the 100 K Zipper, which can be found at:

http://www.quickzip.org/

A free command line tool for decompressing zip files, which is provided for a wide variety of operating systems, is Info-ZIP’s UnZip, located at:

http://www.info-zip.org/pub/infozip/UnZip.html

6.1.1 Installing static files for LMM user interface

Here are the steps to install the static elements on the LMM Server:

1. Copy the lms-lmm-http.war file to the HTTP server. The war file can be found in the web-apps directory of the LMS installation folder.
2. Install a program on the HTTP server for decompressing zip files.
3. Create a directory lms-lmm in the document root of the HTTP server, or create it somewhere else and configure it as virtual directory lms-lmm.
4. Extract the war file to the lms-lmm directory. If you installed the unzip command, you would use, for example:

   ```
   unzip lms-lmm-http.war -d d:\IBMHttpServer\htdocs\en_US\lms-lmm
   ```

5. Edit the WebSphere plug-in configuration file (plugin-config.xml) and search for the line:

   ```
   <Uri AffinityCookie="JSESSIONID" Name="/lms-lmm/*"/>
   ```

Replace this line by the following lines:

```
<Uri AffinityCookie="JSESSIONID" Name="/lms-lmm"/>
<Uri AffinityCookie="JSESSIONID" Name="/lms-lmm/"/>
<Uri AffinityCookie="JSESSIONID" Name="/lms-lmm/*.do"/>
<Uri AffinityCookie="JSESSIONID" Name="/lms-lmm/*.jsp"/>
<Uri AffinityCookie="JSESSIONID" Name="/lms-lmm/*.jsv"/>
<Uri AffinityCookie="JSESSIONID" Name="/lms-lmm/*.jsw"/>
<Uri AffinityCookie="JSESSIONID" Name="/lms-lmm/anon-api/*"/>
<Uri AffinityCookie="JSESSIONID" Name="/lms-lmm/auth-api/*"/>
<Uri AffinityCookie="JSESSIONID" Name="/lms-lmm/ContentServlet"/>
<Uri AffinityCookie="JSESSIONID" Name="/lms-lmm/import"/>
<Uri AffinityCookie="JSESSIONID" Name="/lms-lmm/j_security_check"/>
<Uri AffinityCookie="JSESSIONID" Name="/lms-lmm/services/*"/>
<Uri AffinityCookie="JSESSIONID" Name="/lms-lmm/servlet/AxisServlet"/>
<Uri AffinityCookie="JSESSIONID" Name="/lms-lmm/status"/>
```

These lines direct the WebSphere plug-in to forward requests for static elements to the local Web server. Static elements are recognized by the WebSphere plug-in based on URLs. URLs of requests that match any of the patterns defined by the Name parameter of the Uri tags are identified as requests for static elements.

6.1.2 Installing static files for DS user interface

Here are the steps to install the static elements on the DS server:

1. Copy the lms-ds-http.war file to the HTTP server. The war file can be found in the web-apps directory of the LMS installation folder.
2. Install a program on the HTTP server for decompressing zip files.
3. Create a directory lms-ds in the document root of the HTTP server or create it somewhere else and configure it as virtual directory lms-ds.
4. Extract the war file to the lms-lmm directory. If you installed the unzip command you would use, for example:

   ```
   unzip lms-ds-http.war -d d:\IBMHttpServer\htdocs\en_US\lms-ds
   ```

5. Edit the WebSphere plug-in configuration file (plugin-config.xml) and search for the line:

   ```
   <Uri AffinityCookie="JSESSIONID" Name="/lms-ds/*"/>
   ```

   Replace this line with the following lines:

   ```
   <Uri AffinityCookie="JSESSIONID" Name="/lms-ds"/>
   <Uri AffinityCookie="JSESSIONID" Name="/lms-ds/"/>
   <Uri AffinityCookie="JSESSIONID" Name="/lms-ds/*.ds"/>
   <Uri AffinityCookie="JSESSIONID" Name="/lms-ds/*.jsp"/>
   <Uri AffinityCookie="JSESSIONID" Name="/lms-ds/*.jsv"/>
   <Uri AffinityCookie="JSESSIONID" Name="/lms-ds/*.jsw"/>
   ```

```
<Uri AffinityCookie="JSESSIONID" Name="/lms-ds/j_security_check"/>
<Uri AffinityCookie="JSESSIONID" Name="/lms-ds/services/*"/>
<Uri AffinityCookie="JSESSIONID" Name="/lms-ds/servlet/AxisServlet"/>
<Uri AffinityCookie="JSESSIONID" Name="/lms-ds/track"/>
```

Note: When you are installing customization sets for the user interface, you will also have to copy all images and style sheets to the appropriate directories on the HTTP servers.

6.2 LDAP performance

The LMS user management functions assume an LDAP directory as the primary container of user and group information.

The LDAP directory contains the attributes that describe each user (for example, first name, last name, department number, organization, phone number, etc.), and it is used to authenticate each user that logs onto LMS.

When a user successfully authenticates (this process is actually handled by WAS), LMS searches the user's entry in the LDAP directory and retrieves the values of all required user attributes. These attribute values are cached by LMS by storing them in the USR table of the relational databases (LMM and DS) so that they may be reused during the session. This prevents repeated queries against the LDAP directory and improves overall performance of the application.

Every time a user logs in, LMS checks if the user's attributes have changed in the LDAP directory and updates the value stored in the USR table. If the LDAP attributes of a user changes while a user is logged in, LMS will not be aware of these changes during this session. The user will have to log in again. This is the trade-off to the cache mechanism, but not a very high price to pay for performance.

6.2.1 LDAP tuning

Each LDAP directory vendor supports some mechanism for performance tuning. Some allow you to control caching or buffering options. Some allow you to create indexes on the data in the directory.

Keep the following in mind when tuning your LDAP directory to increase the performance of LMS:

1. Make sure that the user attributes that are important to LMS are defined in the LDAP section of the settings files (settings.xml, ds-settings.xml). This section contains the mappings for each of these attributes to the corresponding LDAP attributes for each vendor and object class.

It is a good idea to ensure that each user's entry in the LDAP directory is populated with the critical attributes (such as the display name). This saves LMS from having to calculate those from other attributes.

2. LMS uses the user name specified in the login screen to look up a user's entry in the LDAP directory. You should make sure that the corresponding LDAP attribute (for example, uid) is indexed by the database that powers your LDAP directory.
3. When a user logs in, LMS attempts to determine whether the user is a manager (having other people reporting to the user). If the user's LDAP entry does not have an attribute that specifies this information (for example, isManager), LMS has to perform an additional query against the LDAP directory. This query determines if at least one other user has this user as manager. The user will only be presented with the first LMS screen after all lookups have been completed. Especially on large directories this search can be very time-consuming and significantly slow down the login process.

   To accelerate this you should ensure that the users' `manager` attribute is indexed in the database that powers the LDAP directory. If this is not possible or does not speed up the query enough, you can defer the IsManager lookup until after the login is complete (see details in "Deferring the IsManager lookup" below). Essentially, a separate thread performing the LDAP query is started that updates the user's entry afterwards.
4. There are several user attributes that are used quite often when searching for users (first name, last name, organization, etc.). For a faster response, you can index these attributes in the LDAP server's database.

6.2.2 Indexing LDAP attributes

Every vendor provides different ways on how to index the information in their LDAP directory.

In the case of Lotus Domino, for example, you just need to create a full text index on the address book (names.nsf) of the Domino server hosting the LDAP process. This can boost the performance significantly.

With IBM Directory Server 5.1, you can indicate which fields you want to index, using the Web administration interface.

IBM Directory Server 4.1 does not provide this feature in the administration interface. There you will have to create the index manually using DB2 utilities.

6.2.3 Deferring the IsManager lookup

As described above, in some cases you need to defer the IsManager lookup to speed up login and rostering processes. You can advise LMS to do so by setting the value of the deferIsManagerLookup field in the settings.xml and the ds-settings.xml from disabled to enabled. After the change you will need to restart the applications.

The settings.xml is located in the LMM installation directory at:

```
<WAS_install_path>\installedApps\<NODENAME>\LMSLMM.ear\lms-lmm-complete-23.
war\WEB-INF\classes\settings.xml
```

The ds-settings.xml is located in the DS installation directory at:

```
<WAS_install_path>\installedApps\<NODENAME>\LMSDS.ear\lms-ds-complete23.war
\WEB-INF\classes\ds-settings.xml
```

When the deferral is enabled, the IsManager attribute will not be updated during login and rostering processes. For newly rostered users, it will be set to zero (false). For users that logged on before, the value of the last IsManager lookup is used.

The server thread that performs the IsManager lookups in the background works with a FIFO queue (first-in, first-out). This means that the IsManager field of users that logged on first will be updated first.

Note: If the deferral of IsManager lookups is enabled and an LMS administrator rosters a huge list of users at once, the lookup thread's queue might overrun and could produce an error. In this case, you should not defer the IsManager lookup.

6.3 Database server performance

Tuning parameters vary according to the type of database and operating system you are using. There are no specific LMS-related performance tweaks that should be applied to the database server. Nevertheless, keep the following general advice in mind:

- Ensure that the database server is set up to support the maximum number of connections from the connection pool defined in WAS.
- If you are using the same database server for the LMM and the DS database, you can increase the performance by creating the databases on physically different hard disks on the database server.

There are several resources on the Internet that cover database performance tuning for the database servers supported by LMS. For your convenience, some of them are listed here:

- IBM DB2 Performance Problem Determination

  http://www-3.ibm.com/cgi-bin/db2www/data/db2/udb/winos2unix/support/tutorial_performance.d2w/toc

- IBM DB2 tuning parameters: WebSphere Application Server

  http://publib7b.boulder.ibm.com/wasinfo1/en/info/ae/ae/rprf_db2parameters.html

- IBM Redbook SG24-6417: *DB2 UDB/WebSphere Performance Tuning Guide*

  http://publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/SG246417.html

- IBM Redbook SG24-6012: *DB2 UDB V7.1 Performance Tuning Guide*

  http://publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/SG246012.html

- IBM Redbook SG24-5511: *Database Performance Tuning on AIX*

  http://publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/SG245511.html

- SQL Server Database Performance Tuning Tips

  http://www.sql-server-performance.com/

- Oracle Performance and Scalability

  http://www.oracle.com/appsnet/technology/performance/content.html

6.4 Tuning TCP settings on LMS servers

For each operating system, different parameters can be changed to optimize overall network performance. The following changes are recommended for the servers hosting the LMS application as well as the servers running the HTTP servers.

Regarding TCP tuning, additional information for a variety of operating systems can be found at:

http://www.psc.edu/networking/perf_tune.html

6.4.1 Microsoft Windows 2000

In Windows, all important TCP/IP parameters must be set using the registry editor (regedit.exe). Start the editor and go to:

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Tcpip\Parameters
```

Modify the parameters described below. If a parameter does not exist, you have to create it manually. After changing the settings, you need to reboot the machine.

Tip: A detailed description of Microsoft Windows 2000 TCP/IP implementation can be found at:

http://www.microsoft.com/technet/treeview/default.asp?url=/technet/itsolutions/network/deploy/depovg/tcpip2k.asp

TcpTimedWaitDelay

This parameter defines the time in seconds that needs to elapse before Windows can release a closed connection and make it available for re-use. This interval between closure and release is known as the TIME_WAIT state or 2MSL (twice the maximum segment lifetime) state. During this time, reopening the connection to the client and server costs less than establishing a new connection. Reducing the value of this entry allows TCP to release closed connections faster, providing more resources for new connections.

```
Recommended value: 30 (decimal) = 0x0000001e (hexadecimal)
```

After applying this change, you see fewer connections in TIME_WAIT. Display them with the **netstat** command.

MaxUserPort

This parameter determines the highest port number TCP can assign when an application requests an available user port from the system.

```
Recommended value: At least 32768 (decimal) = 0x00008000 (hexadecimal)
```

TcpNumConnections

This parameter defines the maximum number of simultaneous TCP connections and should be set higher than the expected number of simultaneous connections.

```
Recommended value: 150-200% of your expected number of concurrent users
```

Tip: Instead of using the registry editor, you can create a text file with the extension .reg using Notepad. The values have to be specified as hexadecimal values. It should look like this:

```
REGEDIT4

[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Tcpip\Parameters]
"TcpTimedWaitDelay"=dword:0000001e
"MaxUserPort"=dword:00008000
"TcpNumConnections"=dword:000007d0
```

After you save the file, you can copy it to all servers and add the values to the registry by simply double-clicking it in Windows Explorer.

6.4.2 Linux

Here we discuss Linux.

tcp_fin_timeout

This parameter defines how many seconds to wait for a final FIN packet (state of FIN_WAIT_2) before the socket is forcibly closed.

Under Linux, the TCP timeout can be set in /proc/sys/net/ipv4/tcp_fin_timeout.

This can be done by using the following command:

```
echo 30 > /proc/sys/net/ipv4/tcp_fin_timeout
```

A short description of this and other TCP parameters can be viewed in Linux by using the command **man tcp**. More detailed information is available in the Ipsysctl tutorial at:

http://ipsysctl-tutorial.frozentux.net/ipsysctl-tutorial.html#TCPVARIABLES

6.4.3 IBM AIX

Here we discuss AIX.

tcp_timewait

The tcp_timewait option is used to configure how long connections are kept in the timewait state. It is given in 15 second intervals, and the default is 1.

```
Recommended value: 2 (=30 seconds)
```

To see the current value, use this command:

```
no -o tcp_timewait=2
```

To change the value, use this command:

```
no -o tcp_timewait=2
```

A short description of this and other TCP parameters can be viewed in AIX by using the command **man no**.

6.4.4 Sun Solaris

Here we discuss Sun Solaris.

tcp_time_wait_interval

This parameter tells Solaris how long in milliseconds to keep a socket that was closed before releasing it for re-use.

```
Recommended value: 30000 (= 30 seconds)
```

To see the current value, use this command:

```
/usr/sbin/ndd -get /dev/tcp tcp_time_wait_interval
```

To change the value, use this command:

```
/usr/sbin/ndd -set /dev/tcp tcp_time_wait_interval 30000
```

tcp_fin_wait_2_flush_interval

This parameter defines how many milliseconds to wait for a final FIN packet (state of FIN_WAIT_2) before the socket is forcibly closed.

```
Recommended value: 67500 (=67,5 seconds)
```

To see the value, use this command:

```
/usr/bin/ndd -get /dev/tcp tcp_fin_wait_2_flush_interval
```

To change the value, use this command:

```
/usr/bin/ndd -set /dev/tcp tcp_fin_wait_2_flush_interval 67500
```

tcp_keepalive_interval

This parameter defines the timer interval in milliseconds prohibiting an active connection from staying established if one of the peers never responds.

```
Recommended value: 300000 (=300 seconds)
```

To see the value, use this command:

```
/usr/bin/ndd -get /dev/tcp tcp_keepalive_interval
```

To change the value, use this command:

```
/usr/bin/ndd -set /dev/tcp tcp_keepalive_interval 300000
```

6.5 Tuning HTTP servers

Depending on the expected number of concurrent users, you may have to change some settings in the configuration of the HTTP servers you are utilizing within your LMS.

6.5.1 Reload interval for WebSphere plug-in configuration file

Every 60 seconds, by default, the WebSphere plug-in reloads its configuration file (plug-in.xml) to check if any changes occurred. The dynamic regeneration of this configuration information is costly in terms of performance. Therefore, in production environments you should change the <RefreshInterval=xxxx> parameter defined in the configuration file itself to a higher value.

6.5.2 Sun ONE Web server, Enterprise Edition - Solaris

The default configuration of the Sun ONE Web server, Enterprise Edition provides a single-process, multi-threaded server.

Active threads

After the server reaches the limit set with this parameter, the server stops servicing new connections until it finishes with old connections. If this setting is too low, the server can become throttled, resulting in degraded response times. To tell if the Web server is being throttled, consult its perfdump statistics. Look at the following data:

- *WaitingThreads* count: If this gets close to zero, or is zero, the server is not accepting new connections.
- *BusyThreads* count: If this is close to zero, or is zero, BusyThreads is probably very close to its limit.
- *ActiveThreads* count: If this is close to its limit (default is 512), the server is probably limiting itself.

To view or set, use the maximum number of simultaneous requests parameter in the Enterprise Server Manager interface to control the number of active threads within Sun ONE Web server, Enterprise Edition. This setting corresponds to the RqThrottle parameter in the magnus.conf file.

6.5.3 Microsoft Internet Information Server (IIS)

Here we discuss the IIS.

IIS permission properties

IIS has several properties that dramatically affect the performance of the application server. The default settings are usually acceptable. However, because other products can change the default settings without user knowledge, make sure to check the IIS settings for the Home Directory permissions of the Web server. The permissions should be set to Script and *not* to Execute. If the permissions are set to Execute, no error messages are returned, but the performance of WAS is decreased.

To check or change these permissions, perform the following procedure in the Microsoft management console:

1. Select the Web site (usually default Web site).
2. Right-click and select the **Properties** option.
3. Click the **Home Directory** tab.

   To set the permissions of the home directory, in the application settings, ensure that the Script checkbox is selected in the Permissions list and that the Execute checkbox is cleared.

   It might also be necessary to check the permissions of the sePlugin. To do this, expand the Web server. Right-click the **sePlugin** and select **Properties**. Confirm that the Execute permissions are set to Execute.

Number of expected hits per day

This parameter controls the memory that IIS allocates for connections.

Using the performance window, set the parameter to more than 100000 in the Web site properties panel of the Microsoft Management Console.

ListenBackLog parameter

If you are using IIS, you are likely to encounter failed connections under heavy load conditions (typically more than 100+ clients). This condition commonly results from IIS rejecting connections. Alleviate the condition by using the ListenBackLog parameter to increase the number of requests IIS keeps in its queue.

Use the registry editor to set the ListenBackLog parameter located at:

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\InetInfo\Parameters\
ListenBackLog
Recommended value: 200
```

MaxPoolThreads and PoolThreadLimit

MaxPoolThreads controls the number of threads per CPU in the thread pool available for IIS to run Common Gateway Interface (CGI) processes (each process takes one thread). PoolThreadLimit specifies the upper limit for MaxPoolThreads.

The default thread limit that IIS can create on a machine is twice the number of MB in RAM on a machine (for example, a server with 512 MB of RAM is limited to 1024 threads).

Use the registry editor and adjust the following values:

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\InetInfo\Parameters\MaxPoolThreads

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\InetInfo\Parameters\PoolTheadLimit
```

6.5.4 IBM HTTP Server - UNIX

The IBM HTTP Server (IHS) is a multi-process, single-threaded server. For more information about tuning IHS, see the Hints on Running a high-performance Web server at:

```
http://www.software.ibm.com/webservers/httpservers/doc/v136/misc/perf.html
```

The configuration takes place in the IHS httpd.conf file located in the conf directory of the Web servers installation directory. After setting the described parameters, you have to restart IHS.

MinSpareServers, MaxSpareServers, StartServers, MaxClients

During heavy load, IHS can use a large amount of the server's processing time to create and destroy httpd child processes. Therefore for optimum performance even under heavy load, specify the same value for all four parameters. This avoids the time-costly recreation of sub-processes.

Ignore the appearing error message `[error] server reached MaxClients setting. Consider raising the MaxClient` when restarting IHS.

A too-low number of child processes is as bad as a too-high number, because more processes also means more memory usage and more processor time for managing the processes. You can use the Apache Benchmark (ab) program located in the IHS bin directory to test the impact of different parameter settings. To simulate 100 concurrent users performing 20 requests to LMS, for example, you can issue the following command:

```
ab -n 20 -c 100 http://<hostname>/lms-lmm/studentCatalog.do
```

In the **ab** command's summary, the most interesting fields are:

- Complete requests
- Failed requests
- Requests per second
- Time per request

When testing different parameter settings for the httpd.conf, use these values to compare and to find the best configuration setting for your system.

MaxRequestsPerChild

The MaxRequestsPerChild directive sets the limit on the number of requests that an individual child server process handles. After the number of requests reaches the value set for the MaxRequestsPerChild parameter, the child process dies. If there are no known memory leaks with the IHS version, set this value to zero (0), meaning unlimited.

LoadModule, AddModule

The more additional modules are loaded by IHS the more memory is consumed per process. Therefore, turn off the loading of all unnecessary modules. Consult http://httpd.apache.org/docs/mod/ for detailed descriptions on the different modules.

Timeout

The number of seconds before sends and receives time out.

```
Recommended value: 180
```

Listen

On servers configured with multiple network interface cards (NICs), use the Listen parameter to specify which IP addresses and ports IHS should serve.

```
Listen 127.0.0.1:80
Listen 127.0.0.1:8008
Listen 192.168.56.1:80
Listen 192.168.130.1:80
```

ServerTokens

This parameter controls which information about IHS is sent back to the client with the header of the HTTP response. For security reasons, we recommended that you set it to:

```
ServerTokens Prod
```

This will respond with the product name only and will not send information about the version number or the installed modules.

6.5.5 IBM HTTP Server - Windows 2000

Here we discuss the IBM HTTP Server for Windows 2000.

ThreadsPerChild

This parameter sets the number of concurrent threads running at any one time within the IBM HTTP Server. Set this value to prevent bottlenecks, allowing just enough traffic through to the application server.

How to change it:

1. Edit the IBM HTTP Server file httpd.conf located in the directory IBM_HTTP_Server_root_directory/conf.
2. Change the value of the parameter.
3. Save the changes and restart the IBM HTTP server.

The recommended value is to start with a size of 100, then increase as necessary. An HTTP error message of type 503, meaning a refused connection, should be a good indicator for the need to increase the value.

There are two ways to find how many threads are being used under load.

- Using the Windows 2000 Performance Monitor

  Select **Start -> Programs -> Administrative Tools -> Performance Monitor**. In Performance Monitor, click **Edit -> Add to chart**. Then set the following:

  - Object: IBM HTTP Server
  - Instance: Apache
  - Counter: Waiting for connection

  To calculate the number of busy threads, subtract the number waiting (Windows 2000 Performance Monitor) from the total available (ThreadsPerChild).

- Using IBM HTTP Server server-status

  Edit the IBM HTTP Server file httpd.conf as follows:

  - Remove the comment character "#" from the following lines:

    ```
    #LoadModule status_module modules/ApacheModuleStatus.dll
    #<Location /server-status>
    #SetHandler server-status
    #</Location>
    ```

  - Save the changes and restart the IBM HTTP server.

  In a Web browser, go to the following URL and click **Reload** to update status: `http://yourhost/server-status`. Alternatively, if the browser supports

refresh, go to `http://yourhost/server-status?refresh=5` to refresh every 5 seconds. You will see `5 requests currently being processed, 45 idle servers.`

6.6 Tuning the WebSphere Application Server

The adjustment of the parameters in this section takes place in the WebSphere Administrative Console and is performed on the application server hosting LMM and DS. After you change a parameter, you will have to re-start the application server.

6.6.1 JVM heap size

In general, increasing the size of the Java heap improves throughput until the heap no longer resides in physical memory. After the heap begins swapping to disk, Java performance drastically suffers. Therefore, the maximum heap size needs to be low enough to contain the heap within physical memory.

For small configurations, the maximum heap size of 256 MB that comes with the default WebSphere setting is acceptable. You should consider increasing the heap size under these conditions:

- If you have configured LMM and DS to run on two separate machines, and each machines has at least 2 GB of RAM, you should increase the maximum heap size to 512 MB. On the other hand, if your machine has only 2 GB of RAM and you are running both LMM and DS on the same machine, you should leave the setting of 256 MB unchanged.
- If LMM and DS are running on the same machine and the machine has more than 2 GB of RAM, you should increase the maximum heap size to 512 MB.
- If your machine has 4 GB or more, you may consider increasing the Java heap size to 1 GB. However, increasing Java heap size beyond 512 MB might cause garbage collection to take longer than normal and cause your system to be unusable while garbage collection is occurring.

How to view or change

In the WebSphere Administrative Console, go to **Application Servers -> <server_name> -> Process Definition -> Java Virtual Machine -> Additional Properties/General Properties**.

View or adjust the Maximum Heap Size and set the Initial Heap Size to one-fourth of this value.

6.6.2 JVM Just in Time Compiler

The Just In Time (JIT) compiler can significantly aid performance; therefore ensure that it is enabled.

How to view or change

In the WebSphere Administrative Console, go to **Application Servers -> <server_name> -> Process Definition -> Java Virtual Machine**.

View or adjust the Disable JIT option.

6.6.3 JVM - Avoiding class verification

This parameter skips the class verification stage during class loading, saving you overhead. When using this value with the JIT on, gains are between 10–15 percent in startup time.

How to view or change

In the WebSphere Administrative Console, go to **Application Servers -> <server_name> -> Process Definition -> Java Virtual Machine**.

Add the value -Xverify:none to the Generic JVM arguments field.

6.6.4 JVM - Number of garbage collection threads

You can have several garbage collection threads. If you machines have more than one processor, set the number of threads equal to the number of processors. This is only applicable for IBM JDK 1.3.

How to view or change

In the WebSphere Administrative Console go to **Application Servers -> <server_name> -> Process Definition -> Java Virtual Machine**.

Add the value -Xgcthreads=[number_of_processors] to the Generic JVM arguments field.

6.6.5 Web container thread pool

Use the maximum thread size parameter to specify the maximum number of threads that can be pooled to handle requests sent to the Web container. Requests are sent to the Web container through any of the HTTP transports.

You have two choices:

- Adjust the Minimum Size and Maximum Size for the thread pool.
- Turn on the Growable Thread Pool option to allow the thread pool to be increased by WAS as needed.

Although we recommend that you select the Growable Pool Size option, if you decide to set the minimum and maximum pool size, follow these instructions: The minimum size should be left to its default value of 10. The maximum size should be set to 100 and increased as necessary. How will you know if the maximum pool size needs to be increased? Observe the performance of the LMM or DS application servers. If you notice that the response time is increasing while the CPU utilization of the machine is still low, this could be a symptom of a starved system. The starvation could be caused by a bottleneck. A small thread pool size could be one of the bottlenecks.

How to view or change

In the WebSphere Administrative Console, go to **Application Servers -> <server_name> -> Web Container -> Thread Pool**.

View or adjust the Minimum Size, Maximum Size, and Growable thread pool.

6.6.6 Web Container MaxKeepAliveConnections

This parameter describes the maximum number of concurrent connections to the Web container that are allowed to be kept alive, that is, to be processed in multiple requests. If this value is too small, performance is negatively impacted.

How to view or change

In the WebSphere Administrative Console, go to **Application Servers -> <server_name> -> Web Container -> HTTP Transports -> <port_number> -> Custom Properties**.

Click **New** to create a new custom property and enter `MaxKeepAliveConnections` as Name.

Set the value to about 90 percent of the Maximum Size defined for the thread pool.

6.6.7 MaxKeepAliveRequests

This is the maximum number of requests allowed on a single keep-alive connection. This parameter can help prevent denial of service attacks when a client tries to hold onto a keep-alive connection.

How to view or change

In the WebSphere Administrative Console, go to **Application Servers -> <server_name> -> Web Container -> HTTP Transports -> <port_number> -> Custom Properties**.

Click **New** to create a new custom property and enter `MaxKeepAliveRequests` as Name.

At the beginning, set the value to 100. If the application server requests are received from the WebSphere plug-in only, increase this parameter's value.

6.6.8 JDBC Data Source - Connection Pool size

When accessing any database, the initial database connection is an expensive operation. Connection pooling and connection reuse reduces the number of these operations significantly.

Only two parameters should be changed here: Min connections and Max connections. All other parameters should be left untouched. The minimum connections should be set to 15. The maximum connections should be set to equal the number of the Web Container Thread Pool size.

Note: Whenever increases are made on the JDBC connection pool, equivalent changes need to be made by the database administrator on the database server.

How to view or change

The following changes should be made to all LMS data sources.

In the WebSphere Administrative Console, go to **JDBC Providers -> <JDBC_provider_name> -> Data Sources -> <database_source_name> -> AdditionalProperties/Connection Pool**.

Adjust Min Connections and Max Connections only; let the other parameters remain unchanged.

7

Maintenance

This chapter describes additional activities that may need to be performed after the installation of LMS. Topics include:

- Server maintenance plan
- Backup hints
- Updating LMS basic settings
- Recommended server restart sequence

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7.1 Server maintenance plan

To ensure proper LMS maintenance and reliability, you should have a server maintenance plan. It should include at least the following information about the maintenance and disaster recovery of the LMS machines:

- Architectural overview of the LMS installation including the connections to backend systems (database server, mail server, LDAP server, Content (FTP) Server, and other integrated IBM products such as Domino, LVC, and Sametime).
- Reinstallation plan: Written steps including installation parameters, the LMS CD, and a list of all other system software needed (including all system software, updates, and so on).
- Backup plan for the database(s), content, and customization sets.
- Database disk space growth plan.
- See 3.4, “Database size estimation” on page 37, for information on how to estimate the required database size for your LMS.
- Procedure for shutting down the system.
- Both technical and administrative (for notifying students).
- Listing of trusted individuals outside the IT Department who can make server changes or make requests of IT.
- Procedure for inspecting system, WAS, and LMS logs for problems on a per-server basis.
- Procedure for saving (for later error tracing) and clearing logs.

  Important: It is important that the LMS log files are cleared on a regular basis. Depending on the selected debugging level number of errors you receive, they can easily grow to a hundred megabytes and more.

- Data archival planning.
- Procedure for logging changes made to the server, including information about when a server was rebooted and a statement about the reason for changing the state of any server.
- Suggested LMS restart sequence.
- Definition of the roles and responsibilities of the players involved in the LMS deployment.

7.2 Backup hints

When you create your backup strategy consider backing up the following data:

- LMM, DS, and AUDIT database
- LMS installation directory
- Directory for imported packages, located on the LMM machine
- Directories containing the deployed content on the content servers
- Configuration files of Web servers
- WebSphere plug-in configuration file
- LDAP directory (if you are using an LDAP server dedicated to LMS only)
- LMS customization sets
- LMS, WAS, and operating system log files
- settings.xml and ds-settings.xml

Additionally, you should think about creating images of system and data partitions of all LMS machines after you successfully set up LMS. In case of system failures, this allows you to redeploy the whole system very quickly on similar machines. Partition images on Windows and Linux machines can be created using, for example, PowerQuest DeployCenter Library or Symantec Ghost Corporate Edition. The open source tool Partimage can be used for Linux (ext2fs, ext3fs, ReiserFS), AIX (JFS). Support for other file system types such as NTFS and UFS is currently in beta stage.

7.3 Updating LMS basic settings

When changes in infrastructure take place that affect LMS, you need to adjust the basic settings of LMS. You can do this with the LMS Updater. Perform the following steps to update your LMS basic settings.

1. You can find the LMS Updater in the LMS installation directory's /update folder. Under Windows, run updateSettings.bat, and under UNIX use updateSettings.sh to launch the LMS Updater. The input screens are similar to those of the LMS installer:

```
1. LDAP Settings
2. LMS Server Settings
3. Content Management Settings
4. Delivery Server Settings
5. Web Server Settings
6. Content Deployment Settings
7. System Administrator E-mail Settings
```

2. The LMS Updater uses the file settings.props to populate the install screens with the original values. You will be required to fill in all the passwords again, as they are not being kept in the properties file.

When you have finished adjusting the parameters, the LMS Updater creates two SQL scripts: updateLMM.sql for the LMM database and updateDS.sql for the DS database.

3. Copy these files to your database server or client.
4. Stop LMM and DS applications.
5. Execute the commands on the database server's (or client's) SQL command line. For example, on DB2 you will use the following commands in the DB2 command window:

```
db2 connect to <LMM_database_name>
db2 -tvf updateLMM.sql
db2 disconnect <LMM_database_name>
db2 connect to <DS_database_name>
db2 -tvf updateDS.sql
db2 disconnect <DS_database_name>
```

6. Start LMM and DS again.

7.4 Recommended server restart sequence

We recommend this stop and restart sequence if you do not have the Network Deployment Manager:

1. Stop the Enterprise Application Servers from the WAS Administration console.
2. Stop the WAS server using **Websphere\AppServer\bin\stopServer -username user -password pass**.
3. Start the WAS server using **Websphere\AppServer\bin\startServer**.
4. Start the Enterprise Application Servers from the WAS Admin console.

We recommend this stop and restart sequence if you have the Network Deployment Manager:

1. Stop Enterprise Application Servers from the WAS Admin console.
2. Stop the nodes using **Websphere\AppServer\bin\stopNode -username user -password pass**.
3. Stop the Network Deployment Manager using **Websphere\DeploymentManager\bin\stopManager -username user -password pass**.
4. Start the Network Deployment Manager using **Websphere\DeploymentManager\bin\startManager**.
5. Start the nodes using **Websphere\AppServer\bin\startNode**.

6. Start the Enterprise Application Servers from the WAS Admin console.

> **Tip:** Start the application server(s) hosting DS before you start the one hosting LMM. If you start LMM first, an end user may log onto LMM and access a course before the DS server is launched. If you launch the DS server first, it ensures that when the LMM Server is started then the DS is available too.

7.4.1 Batch files to stop and start LMS

Here we include some batch files that we used to stop and start LMS while writing this publication. Modify them to fit your needs.

Command files for Windows

The command files for Windows are:

- **start_manager.cmd** starts the deployment manager.

```
rem clear the logs
del d:\websphere\deploymentmanager\logs\*.log
del d:\websphere\deploymentmanager\logs\dmgr\*.log

d:\websphere\deploymentmanager\bin\startmanager
```

- **start_node.cmd** starts the node manager.

```
rem clear the logs
del d:\websphere\appserver\logs\*.log
del d:\websphere\appserver\logs\server1\*.log
del d:\websphere\lms-logs\*.log

d:\websphere\appserver\bin\startnode.bat
```

- **start_server1.cmd** starts the default application server.

```
d:\websphere\appserver\bin\startserver.bat server1
```

- **stop_server1.cmd** stops the default application server.

```
d:\websphere\appserver\bin\stopserver.bat server1 -username wasadmin
-password waspw
```

Shell scripts for UNIX

The following are shell scripts for UNIX.

- **start_manager.sh** starts the deployment manager.

```
#clear the logs
rm /opt/WebSphere/DeploymentManager/logs/*.log
rm /opt/WebSphere/DeploymentManager/logs/dmgr/*.log
```

```
/opt/WebSphere/DeploymentManager/bin/startManager.sh
```

- **start_node.sh** starts the node manager

```
# clear the logs
rm /opt/WebSphere/AppServer/logs/*.log
rm /opt/WebSphere/AppServer/logs/server1/*.log
rm /opt/WebSphere/lms-logs/*.log

/opt/WebSphere/AppServer/bin/startNode.sh
```

- **start_server1.bat** starts the default application server

```
/opt/WebSphere/AppServer/bin/startServer.sh server1
```

- **stop_server1.bat** stops the default application server

```
/opt/WebSphere/AppServer/bin/stopServer.bat server1 -username wasadmin
-password waspw
```

- To stop the Deployment manager:

```
/opt/WebSphere/DeploymentManager/bin/stopManager.sh -username [wasusername]
-password [waspassword]
```

- To stop the Node manager:

```
/opt/WebSphere/AppServer/bin/stopNode.sh -username [wasusername] -password
[waspassword]
```

The following script is useful if you have lost control over a running WAS instance. It searches for all running processes that were launched from inside the /opt/WebSphere/ directory and ends them.

```
killWebSphere.sh
   # kills all running websphere processes
   SEARCHFOR=/opt/WebSphere/
   ps -eaf | grep {$SEARCHFOR} | awk '{print $2}' | xargs kill -9
```

8

Troubleshooting

This chapter describes how to locate the source of problems and how to solve common errors.

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8.1 Introduction

In this chapter, we provide guidance for determining which part of the application is working (or not). In addition, we provide more information on this topic in 5.6, “Testing the LMS application” on page 102.

8.2 Locating the problem

If LMM and DS are not working properly, you can perform the following steps to determine the source of your problem.

Step 1: Check your client machine

Check the proxy settings of your browser to ensure that you can actually reach LMS. To receive meaningful error messages, you should turn off the option “Show friendly HTTP error messages” in the Advanced tab of Internet Explorer’s Internet Options.

Step 2: Validate the WAS installation

Start the First Steps program and use the Verify Installation option to check the WAS installation.

- Windows: **Start -> Program Files -> WebSphere Application Server 5.0 -> First Steps**
- UNIX: **<WAS_installation_path>/bin/firststeps.sh**

Step 3: Access WAS without WebSphere plug-in

Check if the problem is related to WAS or the HTTP Server. To determine this, instead of accessing the test servlets and the LMS application from the HTTP server, try to access them using the built-in HTTP task of WebSphere. To access the application this way, use the fully qualified hostname of WAS and the HTTP port of the default application server server1:

- Test your access to the WAS admin console:

```
http://<WAS_fully_qualified_hostname>:9090/admin
```

- Test your access to the test servlets:

```
http://<WAS_fully_qualified_hostname>:9080/snoop
http://<WAS_fully_qualified_hostname>:9080/hello
http://<WAS_fully_qualified_hostname>:9080/hitcount
```

If you can access any of these applications this way, WAS is running properly. If you cannot, it means that WAS itself is misconfigured. This can be because of

various reasons. Repairing a WAS installation is outside the scope of this publication.

Step 4: Check if problem is related to HTTP or WebSphere

Access the LMM and DS applications directly on the HTTP port of the application server(s) hosting the modules, instead of going through the HTTP Server, to make sure the problem is not related to the HTTP Server. For example:

```
LMM Server: http://<WAS_fully_qualified_hostname>:9081/lms-lmm/
DS Server: http://<WAS_fully_qualified_hostname>:9081/lms-ds/about.ds
```

If these URLs work, but the connection to LMS through the HTTP server is not working, it means that the problem is related to the HTTP server or the WebSphere plug-in. In this case refer to 8.3, “HTTP Server and plug-in problems” on page 135.

Step 5: Make sure all programs are running

Check if WAS, the HTTP server(s), the LDAP server, and the database server(s) are running. In the WebSphere Administrative Console, check if the LMM and DS applications are up and running.

Note: Access problems can occur if a firewall prevents access to certain services on the network.

In Chapter 4, “Pre-installation” on page 41, you will find more details about how you can check that the different software parts are working properly.

Step 6: Test database connection from WebSphere

When you prepared WAS for LMS, you created J2C Authentication Data entries and set up JDBC connections. If there is any problem with these settings, LMS cannot access the databases and will not run.

To verify these settings, we created a JSP file that tests the connection to the databases using the parameters configured in WAS. See 8.7, “Test JDBC connections from within WebSphere” on page 140, for how to set up this test. You will have to do this test from all servers where you have the LMM and DS application deployed.

Note: If you are using DB2 7.2, make sure that you have JDBC 2.0 activated; see “JDBC 2.0 driver setup for DB2 7.2” on page 58.

Step 7: Check the LMS logs

Within WAS you have defined where the LMS log files will be created. For example, in Windows, this can be:

```
d:\lmslogs
```

Remove the log files (to start with an empty log file), restart the application server(s), and view all files in this directory. Specifically, the file servernodename_LMS-LMM.log on the LMM Server and servernodename_LMS-DS.log on the DS server can provide you with more information.

Note: If you have not set the log path properly, no LMS log files will be created. Also, if WAS did not manage to start LMS, LMS log files might not be available.

If the log files are there, but they do not have enough information, you can change the log details from within LMS. Go to the **Settings** tab **-> LMM Server -> System Logging**.

For Application, Database, Trace, E-mail, and Tracking, you can make changes to the log details. Specifically, you can set the Logging level to debug temporarily while you are debugging.

Important: Remember to set the logging level back to normal after your tests, as the size of the log files will quickly grow using the debug option.

Step 8: Check the WebSphere logs

Look at the log files located in:

```
<WAS_install_path>/logs
<WAS_install_path>/logs/server1
<WAS_install_path>/logs/<servername>
```

Remove the log files, restart the application server(s), and view the log files again to see if there are already problems during the starting sequence. Specifically, the SystemOut.log file can be helpful.

Sometimes the log files will point directly to the problem area. In other cases though, such as if you are not familiar with the WebSphere logs, the log files might not be able to help you.

Step 9: Check pre-installation and installation requirements

Double-check all settings and requirements that are outlined in Chapter 4, “Pre-installation” on page 41, and Chapter 5, “Installation” on page 81.

From our experience, most problems are caused by incorrect spelling of parameters, either in WAS or LMS.

- Putting WebSphere parameters on the wrong node (for example, on the administration node instead of the server-node)
- LMS or WebSphere being unable to communicate properly with the LDAP or the database server
- HTTP server(s) not being able to load the WebSphere plug-in file properly

The easiest way to check the LMS parameters in use is to check the sql files that were used to create the settings in the database. For DB2, for example, the files are settings_init.sql and settings_init_ds.sql.

Alternatively you can access the database environment and check the tables directly.

In case you would like to make changes to the LMS settings that you have defined before, you do not need to re-install LMS. Instead you can use the LMS update utility; see “LMS Updater” on page 140.

Step 10: Additional resources

For additional information on solving specific errors, you can access the IBM Web site and use the technical support search:

`http://www.ibm.com/support/search/index.html`

You can also have a look at the Lotus e-Learning forum:

`http://www-10.lotus.com/ldd/lsforum.nsf?OpenDatabase`

8.3 HTTP Server and plug-in problems

If there are problems with the HTTP server, make sure that the server was running properly before the additional lines for the WebSphere plug-in were added to the HTTP server configuration file. See if you can access the root page or any other non-WAS related page on the Web server using a Web browser.

If you cannot access any other page, then the Web server itself is misconfigured; refer to the Web server’s troubleshooting documentation. If you can access other pages, the problem is related to the WebSphere plug-in.

8.3.1 Check plug-in settings

Most of the time, a plug-in problem is caused by one of the following reasons:

- The configuration lines within the Web server's configuration file loading the WebSphere plug-in are pointing to files that are not present at that location.
- The plug-in configuration file points to files and directories that do not exist on the server.

Locate the Web server configuration file and find the plug-in related lines. For the IBM HTTP Server for Windows, these lines look like this:

```
LoadModule ibm_app_server_http_module
"d:\WebSphere\AppServer/bin/mod_ibm_app_server_http.dll"

WebSpherePluginConfig "d:\WebSphere\AppServer/config/cells/plugin-cfg.xml"
```

If the lines are present, then:

- Check if the plugin-binary file (dll in windows) and the xml files exist in the directories that are specified in the HTTP Server config file.
- Check the content of the plugin-cfg file to check that all files and directories specified in here are correct and exist.

If the lines are not present, add them manually (following the steps in 4.4.1, "Tasks to complete" on page 56).

By default, the plug-in configuration file references files and directories that are available on the server where the plug-in configuration was generated. This means that these files and directories might not necessarily exist on the server where you use the plug-in configuration file. In some cases it will be necessary to modify the directories specified within this file by hand.

Note: If you make changes to the plug-in-configuration file, make sure they will not be overwritten by re-generation of the plug-in configuration, or by synchronizations between the Network Deployment Manager and the Nodes. If you have the HTTP server on a separate machine, you will not have this problem. If you have the HTTP server on the same server as WebSphere, consider renaming the plug-in-configuration file. For further information, see "Generating the WebSphere plug-in configuration file" on page 75.

8.3.2 HTTP server log

To get additional information regarding the Web server, check any errors that were encountered during the startup of the Web server.

For the IBM HTTP Server on Windows, you can disable the automatic startup in Services, and then start the Web server manually from the command line. In the command line, you are now more easily able to see if any error messages come up during the startup.

To start the IBM HTTP Server manually in Windows, use the command **apache.exe** in the base directory where the HTT server is installed, usually: C:\Program Files\IBMHTTPServer\apache.exe.

If the plug-in binary or configuration file cannot be accessed or there is a problem within the plug-in configuration file, the Web server might not start, and will show the appropriate errors during startup. You can also look into the server's log files.

8.3.3 Review WebSphere plug-in log file

Another location where you can find additional information is the http_plugin.log. You can determine the location of this file in the plug-in configuration file. If the plug-in configuration reference in the HTTP server is incorrect, or the plug-in configuration points to a log-directory that does not exist, the log file will not be created. By default the log file is:

```
<WAS_install_path>/logs/http_plugin.log
```

8.4 Problems with WebSphere security

In this section we discuss problems with WebSphere security.

8.4.1 Cannot activate Global Security

The issue: After changing the Global Security and clicking **OK** or **Apply**, the following error appears: `The Server User ID is not valid. Please enter a valid Server User ID`.

The solution: The normal reasons for this problem include:

- The user ID is not correct (LDAP settings).

  An example of a correct user ID could be wasadmin.

- The user filter is not correct (LDAP settings advanced).

  An example of a correct user filter for IBM HTTP Server includes:

  ```
  objectclass=inetOrgPerson
  ```

8.4.2 How to disable security

The issue: If you have a problem logging into the WebSphere admin console, you might have to disable security to get back into the admin console and solve the problem. How can you do this?

The solution: There are two ways to do this.

- Use the **wsadmin** command.

  From the bin directory of the Deployment Manager (or the Application Server if you do not have the manager installed), use the following command:

  ```
  wsadmin -conntype NONE
  ```

  The result should be a command-line prompt for wsadmin. Then issue the following **wsadmin** command to switch off security:

  ```
  securityoff
  ```

- Change the file security.xml.

  You can make changes directly in the file security.xml to disable security.

  - In a Network Deployment environment, change the file stored in <WAS_ND_HOME>/config/cells/security.xml.
  - In a base WebSphere Application Server environment, change the file stored in <WAS_HOME>/config/cells/security.xml.

  You will have to change the following lines in this file:

  ```
  <security:Security xmi:id="Security_1" useLocalSecurityServer="true"
  useDomainQualifiedUserNames="false" enabled="true" cacheTimeout="600"
  issuePermissionWarning="true" activeProtocol="BOTH"
  enforceJava2Security="true" activeAuthMechanism="LTPA_1"
  activeUserRegistry="LDAPUserRegistry_1"
  defaultSSLSettings="SSLConfig_1">
  ```

  Change enabled="true" to enabled="false".

  "enabled" specifies whether global security is enabled. When security is not enabled, all other security settings of this file are ignored.

8.5 Database error

A database error can appear when you navigate to the Home tab and launch specific items, for example, “Progress Report”. In that case, you are likely to have a problem with the database schema. Even if no courses are deployed yet, you should not get an error.

If you are using DB2, an error such as "DB2ADMIN.CATALOGENTRY_TEXT" is an undefined name' can be solved in one of the following ways:

- Make sure that the user used in the JDBC data source has SELECT, UPDATE, and DELETE rights to all LMS tables on the database.
- If the database scripts were running using one user name, but the WAS JDBC data sources are using a different user name, this error can occur. By default LMS uses:

  ```
  SELECT * FROM USR
  ```

  But in some cases it uses:

  ```
  SELECT * FROM DB2ADMIN.USR
  ```

  Where DB2ADMIN is the user name defined in WAS for the JDBC data source.

  This can be solved in the following ways:

  a. Change the data sources in WAS to use the same account that was used to run the scripts (probably db2admin). To check the user who ran the script, connect to the database, and check the current schema name.

  b. Remove the databases and run the database creation scripts again, but this time under the preferred login name.

  c. You can define which schema should be used in all cases. Go to <WAS_install_path>/InstalledApps/<NODE>/LMM.ear/lms-lmm-complete-23.war/WEB-INF/classes/persistencemanager.xml to see if all tables are defined with schema="%". If this is the case, you will need to replace schema="%" with the specific schema name of the LMS databases such as schema="DB2ADMIN".

- By default, LMS does not query a table by using the long format like:

  ```
  SELECT * FROM DB2ADMIN.USR
  ```

  Instead it uses the short form:

  ```
  SELECT * FROM USR
  ```

  This can be a problem if the database user has access rights to multiple schemas. In this case, check <WAS_install_path>/InstalledApps/<NODE>/LMM.ear/lms-lmm-complete-23.war/WEB-INF/classes/persistencemanager.xml. Replace schema="%" with the specific schema name of the LMS databases such as schema="DB2ADMIN".

8.6 LMS Updater

If you have a problem starting either the LMS or DS application, it may be because you entered one or more incorrect settings when you ran the LMS Installer. You can remedy this situation by running the LMS Updater.

See 7.3, “Updating LMS basic settings” on page 127, for details on how to use the LMS Updater.

8.7 Test JDBC connections from within WebSphere

In this section we discuss how to test JDBC connections from within WebSphere.

8.7.1 Test scenario

When you prepare WAS for LMS, you create J2C Authentication Data entries and JDBC connections. To verify these settings, we created a JSP file that tries to connect to the databases using the parameters configured in WAS.

If the test was successful a response such as that shown in Figure 8-1.

Figure 8-1 Successful LMS database connection test

8.7.2 Deploying the test tool

You must deploy the tool as an application to the same application server LMS is running on. To do so, first create a Web Archive (WAR) file containing the test JSP file and then install it using the WAS administration console.

Proceed with the following steps:

1. Ensure that the machine you are working on has the **jar** command installed. You can easily test this by opening a command line and enter **jar**. If the command is unknown, you will have to install a Java SDK, which you can download from:

   http://java.sun.com/

2. Create a new directory on your local hard disk, such as d:\lmsdbtest\.
3. Copy and paste the TestDbConnection.jsp shown at the end of this section into a new text file in Notepad.
4. If you set up LMS with other than the default JNDI names (lmm, lsaudit, and ds), change the following lines in the file accordingly:

```
jndis.add("jdbc/lmm");
jndis.add("jdbc/ds");
jndis.add("jdbc/lsaudit");
```

5. Save the file as TestJDbConnections.jsp to the newly created directory.
6. Create a sub directory called WEB-INF.
7. In the WEB-INF directory create a file called web.xml containing the following lines:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE web-app PUBLIC "-//Sun Microsystems, Inc.//DTD Web Application
2.3//EN" "http://java.sun.com/dtd/web-app_2_3.dtd">
<web-app id="WebApp">
   <display-name>LMS DB Connection Test</display-name>
</web-app>
```

8. Now run the following command to create a valid WAR file:

```
jar cvf d:\lmsdbtest.war -C d:\lmsdbtest\
```

   Note: It is very important that you do not miss the space and the dot at the end of the command. Otherwise it will not successfully create the WAR file.

9. Open the WAS administration console and go to **Applications -> Install New Application**.
10. In the first input screen, select **local path** and browse for the WAR file on your local disk. As context root use, for example, lmsdbtest.

11. Click **Next** until you reach Step 3: Map modules to application servers. Here make sure that the application server is selected on which you deployed LMS. Click **Next** and then **Finish** to install the WAR file.
12. After you save the changes to the master configuration file, start the application at **Applications -> Enterprise Applications**.
13. Now you can use the test by using an URL of the format:

    ```
    http://<WAS_servername>:<app_server_port>/<context_root>/TestDbConnectio
    ns.jsp
    ```

    For example:

    ```
    http://myWAS.ibm.com:9080/lmsdbtest/TestDbConnections.jsp
    ```

    Adjust the port number to the one used by the application server where you installed the WAR file.

> **Note:** The jsp-name that you refer to in the URL is case-sensitive.

8.7.3 Content of TestDbConnections.jsp

Below is the content of TestDbConnections.jsp.

```
<%@ page import="java.sql.*" %>
<%@ page import="java.util.*" %>
<%@ page import="javax.naming.*" %>
<%@ page import="javax.sql.*" %>

<%
    response.setContentType("text/html; charset=ISO-8859-1\"
pageEncoding=\"ISO-8859-1\"");
    response.setHeader("Pragma", "No-cache");
    response.setHeader("Cache-Control", "no-cache");
    response.setDateHeader("Expires", 0);
%>

<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">
<html>
<head><title>LMS DB Connection Test</title></head>
<body>
<h1>JDBC Connection Test</h1>
<%=new java.util.Date().toString()%><br/><br/>
<%
    ArrayList jndis = new ArrayList();
    jndis.add("jdbc/lmm");
    jndis.add("jdbc/ds");
    jndis.add("jdbc/lsaudit");
```

```
    try {
        Context ctx = new InitialContext();
        ctx.addToEnvironment(Context.INITIAL_CONTEXT_FACTORY,
"com.ibm.ejs.ns.jndi.CNInitialContextFactory");

        Iterator it = jndis.iterator();
        while (it.hasNext()) {
            String jndi = (String) it.next();
            %>Connecting to <%=jndi%>... <%
            try {
                DataSource ds = (DataSource) ctx.lookup(jndi);
                Connection conn = ds.getConnection();
                %>OK<br/><%
            }
            catch (NamingException e) {
                %>FAILED - JNDI not found</br><%
            }
            catch (SQLException e) {
                %>FAILED - cannot establish connection<br/><%
            }
        }
    }
    catch (NamingException e) {
        %>Getting InitialContext failed.<br/><%
    }
%>
<h2>Test finished.</h2>
<form>
    <input type="button" onClick="window.location.reload()" value="Retry">
</form>
</body>
</html>
```

9

Migration overview

This chapter provides an overview of the migration to LMS from LearningSpace Forum and LearningSpace 5.

More details on the migration can be found in the *Migration Guide* that is published on the IBM Web site.

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9.1 Introduction

Your company might want to migrate from its existing IBM e-Learning environment, such as LearningSpace Forum or LearningSpace 4 or 5, to the new IBM Lotus Learning Management System.

The Learning Management System is not just a software upgrade from LearningSpace Forum or LearningSpace 5. It is a new product, with a architecture loosely modeled on earlier LearningSpace systems, but with a richer feature set and a host of capabilities unavailable in earlier versions.

Moving a LearningSpace deployment, either Forum or LearningSpace 5, to the LMS involves proper planning. The system requirements for LMS are very different from LearningSpace Forum and LearningSpace 5, and in most cases not compatible.

Due to these differences, you usually will not be able to install the LMS on the same physical machines you used for LearningSpace or Forum. In addition, the migration process requires that the two systems run in parallel until all data has been transferred to the LMS.

Your LearningSpace installation must be migrated using a multi-stage process that involves planning, moving the data, then configuring and customizing the new system. Your LearningSpace installation should be assessed to determine how best to move user and course data to the LMS. Collaboration information must be updated and moved to the new system, and any custom changes to your LearningSpace installation must be recreated, as needed, in the LMS.

9.2 Planning your migration

The migration from LearningSpace requires some work to transfer data to the new system. You will also need to do some manual updates after the automated migration is complete. Depending on the version of LearningSpace or Forum that you migrate from, some of your data may not migrate at all, and may need to be recreated within the LMS.

Before you start a migration from either LearningSpace Forum or LearningSpace, you should have in mind these different aspects of planning:

- What release of LearningSpace Forum or LearningSpace are you currently using?
- Do you use an LDAP directory?
- Do you want to migrate the courses all at once or individually?

- Do you want to migrate course content and structure together or only course structure?
- Make sure that the systems are running at the same time.

The planning should cover both user migration and course migration.

The migration process involves the following steps:

1. Evaluate the existing system, and determine how and when data will be migrated to the Learning Management System.
2. Back-up data (including information on customizations made to the system), remove obsolete data, and prepare for migration.
3. Install and configure the LMS installation (both systems run in parallel during the migration process).
4. Migrate user information and import users into an LDAP directory.
5. Migrate courses.
6. Move discussion databases to a Domino server. Recreate live sessions using the Virtual Classroom server.
7. Complete any manual migration tasks, such as assigning user roles and recreating custom changes to the system.

The Learning Management System is different because additional features have changed the requirements for data, and a new database schema is being used.

Before you start with the migration, you should be aware of how much of your data will be preserved during the migration. In the following sections you will find tables with the amount of information that will be migrated from the different Learning Systems.

The amount of data that will migrate to the LMS may vary from one LearningSpace installation to another, depending on how that data is used and stored by LearningSpace, and how you choose to migrate it to the LMS.

9.3 Migrating data from Forum

Here is an overview of the data that is migrated from Forum to LMS.

Table 9-1 Migrating data from Forum databases

Forum Database	What data migrates	Comments
Schedule	Structure and documents	A course's structure is formatted as a series of files that use the SCORM 1.2 format. The migrated course structure does not include any sequencing; however, you can add sequencing by importing the SCORM package into the Authoring Tool and modifying the structure there before sending it to the LMS. By default, the course structure is packaged along with the content in the LMS Migration Tool, but you can choose to export the structure by itself by selecting the Manifest Only option.
MediaCenter	All documents	Documents must be linked to from the Schedule if users are to access them from the migrated course.
CourseRoom	None	Although CourseRoom discussions cannot be migrated to the LMS, if you use a Domino server you can create new Discussion databases for courses in the LMS.
Profiles	None	No user information is migrated.
Assessments	None (neither assessments nor individual questions migrate)	Assessments and questions are stored in Forum in a format that is not compatible with the LMS. After migrating the course data, you can create new assessments (and questions) in the LMS Authoring Tool.

Prerequisites

Before you install the LMS Migration Tool for Forum, make sure the following prerequisites are met:

- You must be using LearningSpace Forum 3.5 or 3.6.
- Your Forum server must be running Lotus Domino Release 5.0.10 or later (the Migration Tool does not run in Domino R6).

The migration process and tasks are described in detail in the *Migration Guide*. See "Additional resources" on page 152 for where to find the Migration Guide.

Note: You cannot migrate data from LearningSpace Forum releases earlier than 3.5 because they are based on earlier releases of Domino that are not supported by the LMS Migration Tool.

9.4 Migration from LearningSpace to LMS

Table 9-2 gives an overview of the data that can be migrated from LearningSpace to LMS.

Table 9-2 Migrating data from LearningSpace 4 and 5

Type of data	What data migrates	Comments
Assessments	LearningSpace 4: None LearningSpace 5: Some	LearningSpace 5: ► Published Assessment will migrate, using the old LearningSpace FTP setup, and used with the migrated versions of the courses in which they were used. ► AICC-formatted assessments will migrate as content only, but cannot be used for tracking anymore. ► Other types of assessments will not migrate.
Auto-enrollments	None	The auto-enrollment rules have to be recreated in LMS.
Course catalog entries	All	Unregistered course masters and entries will be created as appropriate in the LMS to present you with a course catalog after migration.
Course content	Some	With a database-to-database migration, content is transferred to the LMS along with course structures, and is subsequently managed within the LMS. Content migrated this way cannot be modified. If you choose, you can leave content on existing LearningSpace content servers and migrate only the course structures. In this case, you must place a copy of the LMS API Adapter on the content server to enable scoring and tracking. In addition, the course will not be available for use with the LMS Offline Learning Client, as that feature requires content to be stored within the LMS.
Course profiles	None	Course profiles are used differently in the LMS.
Course responsibilities	All	Users with Instructor responsibilities in LearningSpace will be added as instructors in the Resources module of the LMS, and will be automatically linked to the courses for which they are responsible.

Type of data	What data migrates	Comments
Course structure and properties	All	With a database-to-database migration, course structures and properties remain intact, along with LearningSpace extensions such as prerequisites, objectives, and auto-complete settings. If you migrate the structures using the Authoring Tool, and export them from LearningSpace using AICC format, the LearningSpace extensions to the AICC standard (includes prerequisites, objectives, auto-complete, and more) are not migrated because the Authoring Tool imports only standard AICC files.
Discussions	All	Connections to Discussions are migrated to the corresponding course masters, but the Discussion databases are not physically moved or updated. To use the Discussions with migrated courses, you must move them to another Domino server (R5.010 or later). Moving Discussions requires migrating the corresponding course with the Authoring Tool so you can update URLs pointing to the Discussion before importing the course into the LMS.
Enrollments	All	Users who were enrolled in a particular course in LearningSpace are automatically enrolled in the system-generated offering for that course.
Live sessions and associated materials	None	The definitions of live sessions must be recreated using the LMS Authoring Tool. Live sessions must now be hosted in the LearningSpace - Virtual Classroom product. The materials for live sessions (Whiteboards, Follow Me sets, and assessments) must be recreated for the new LVC session.
Permissions	None	Permissions will not migrate, as they are defined differently in the LMS and do not translate across products.
Progress data	Some	Course-level progress information is included in a direct database-to-database course migration. In-progress course information, such as activity-level progress, never migrates. If a student has not completed the course before migration, progress information is lost and the student's status is reset to Enrolled.

Type of data	What data migrates	Comments
Question pool	None	In the LMS, questions are no longer maintained independently of the assessments in which they are used. Now, you use the Authoring Tool to create assessments, and incorporate questions within them.
Reports	None	The LMS uses a new report engine, and a different database schema from LearningSpace. Reports cannot be migrated from LearningSpace; however, the LMS provides a similar set of predefined reports.
User profiles and profile categories	User profiles, but no profile categories	User profiles are exported as groups in the LDIF file, and once imported into an empty LDAP directory, can be used for assigning permissions to groups of users in the LMS through the use of “roles.”
User records (roster)	None	While LearningSpace users are added to the LMS database during migration, they receive the status Inactive, which means they are not actually rostered in the system. Users who are not set to Active status can use the LMS only as anonymous users with very restricted access. You can roster these users after migration by changing their status to Active in the Users module of the LMS.
User types	Student only	Users assigned the standard Student user type in LearningSpace are assigned that role in the LMS. Users assigned the Instructor user type in LearningSpace are migrated as Students to the LMS; when you migrate any courses that list that user as an Instructor, the user is then implicitly added to the Instructor role. Users assigned the standard LearningSpace Author and Administrator user types, as well as any custom user types you may have created, will default to the Student role in the LMS. You can manually assign users to the Administrator role in the LMS after migration is complete.

Please note that some specific conditions apply for courses that previously migrated from Forum into LearningSpace 4 or 5. See the *Migration Guide* for more details.

9.5 Additional resources

For more details on how to perform the migration and to get the migration tools, use the following IBM ftp site:

ftp://ftp.software.ibm.com/software/lotus/fixes/LearningSpace/LMS

On this FTP site, you will be able to find the following resources:

- *Migration Guide* from LearningSpace and Forum to LMS
- Latest migration utilities
- Migration Release Notes

10

Integration with other systems

This chapter describes some options for connecting the LMS with other systems.

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10.1 Options for system integration

Integrating LMS with other systems is usually done because of one of these reasons:

- To extend LMS with functions from other systems
- To provide LMS functions to other systems
- To exchange LMS business data with HR/ERP systems

For these three requirements, you have the following options:

- Extending LMS using other system functions
  - To provide discussion forums in courses, you can connect LMS to a Domino Server that hosts discussion databases.
  - To provide course chats, you can connect LMS to a Sametime Server.
  - To provide live sessions as activities in blended courses, you can connect to one or more LVC servers.
- Providing LMS functions to other systems
  - LMS provides three ready-to-use portlets that can be used to enhance your company's intranet portal. Based on WebSphere Portal Server, these portlets provide access to the course catalog, to "My Activities" and "My Courses".
  - You can use the LMS API to perform LMS related tasks from within other systems.
- Exchanging business data

  You can use the LMS API to perform LMS-related tasks from within other systems.

Figure 10-1 on page 155 gives you a graphical overview of these options for integration. For the IBM products to connect to LMS, it is important that they use the same LDAP server as LMS.

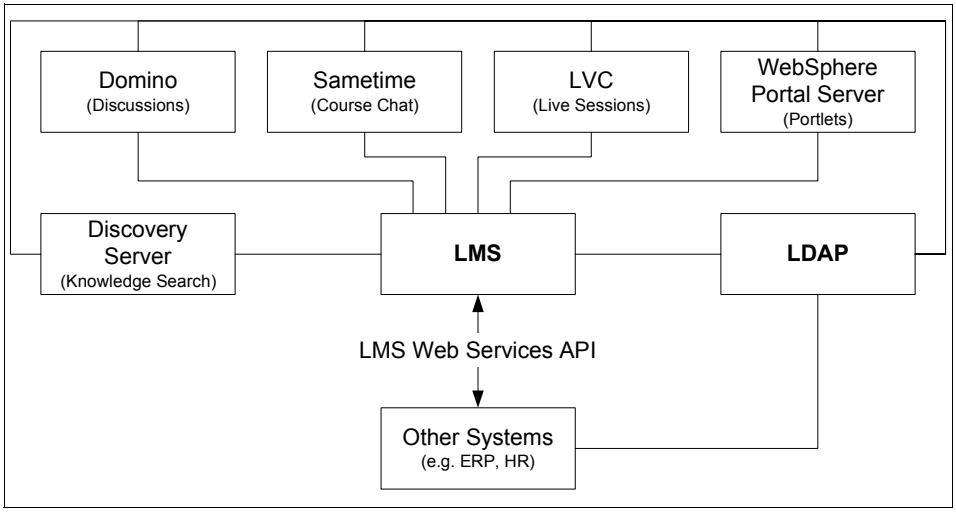

Figure 10-1 Available options for system integration

Detailed information about how to connect to Domino, Sametime, Discovery Server, and how to use the LMS portlets is described in detail in the *LMS Administration Guide*. Regarding the connection with LVC, we recommend that you perform the steps described in 10.2, “Connecting LMS with LVC” on page 155, of this publication.

Domino discussion database

In addition to being able to specify an existing Discussion database by specifying its URL, the LMS can be customized to allow for a different database template to be used when discussions are created. Basically, the LMS defaults to using the StdR5Disc (discsw5.ntf) template when creating a new discussion. There is a way to specify a custom template by updating a properties file. It is part of the LMSDiscussionServlet.jar.

10.2 Connecting LMS with LVC

If your company uses Lotus Virtual Classroom 1.1 (LVC) you can use its live session facility from within LMS. This means that you can set up blended courses that include live sessions (scheduled online classes) as course activities. Users enrolled in a course that includes a live session can join the session by going to their calendar, by launching the course, or by going to This Week’s Activities.

10.2.1 Installing the LVC-LMS connector

To connect LMS with LVC, you need a software package called the LVC-LMS Connector on the LVC Catalog server. This is a small Java Web application server that provides the required Web services used by LMS to communicate with LVC. Contact IBM to obtain a copy of the LVC-LMS connector.

To install the LVC-LMS connector, do the following:

1. On the LVC Catalog server, stop the Domino server by entering `quit` in the Domino server console.
2. Start the LVC-LMS connector Installation program (setup.exe) from the CD.
3. Choose **Setup Language**, select a language for your site, and click **OK**.
4. At the Software License Agreement screen, review the license agreement and click **Accept**.
5. At the Welcome screen, click **Next**.
6. At the Start-up Method screen, select the same mechanism for starting the LVC-LMS connector as you use for starting Domino services, and click **Next**.
7. At this point, the installation program copies a series of files from CD to server, displaying the Setup Complete screen when done.

   At the Setup Complete screen, click **Finish**.
8. If you have not set up the connector as a Windows service, restart the server machine now.

   If you have set up the connector as a Windows service, it defaults to the Manual setting (requiring you to start it manually). Change this setting to Automatic with the following procedure:

   a. Start the Services Manager.

      Windows 2000: **Start -> Programs -> Administrative Tools -> Services**

   b. Select **IBM WebSphere Application Server V5 - LVC Connector** by double-clicking it.

   c. Set the Startup Type to Automatic.

   d. Click **OK**.

   e. Close the Services window.

   f. Restart the server machine.

10.2.2 Enabling an LVC server in LMS

For live session capability to be available from within LMS, you must give LMS the information about each LVC server in your company that is providing the service.

1. Log onto LMS with an administration user and click **Settings**.
2. Click **Collaboration Servers**, and then click the **LVC** tab.
3. Click **Add**.
4. Enter a name for the LVC server that can be used to identify the server when the course offering is created. For example, enter `LVC1`.
5. Enter a description for the server.
6. Enter your LMS user name and password. This user name should have LMS administration privileges.
7. Enter the URL for the server; for example, `http://myLVCserver.com:9650/LVC`.

   Note: The LVC characters must be entered using uppercase.

   Port 9650 is a standard port of LVC that is used to connect LMS to LVC. You have to put the port number as part of the URL.

   To check if the port is accessible from LMS, you can use a telnet session ("telnet myLVCserver.com 9650") from the LMS Server machine. See “Ensure that all LMS servers can access the LDAP directory” on page 47.
8. Click **Save**.

   Note: You can update any of this information later on. Figure 10-2 on page 158 shows an Update server screenshot taken on a different LMS system.

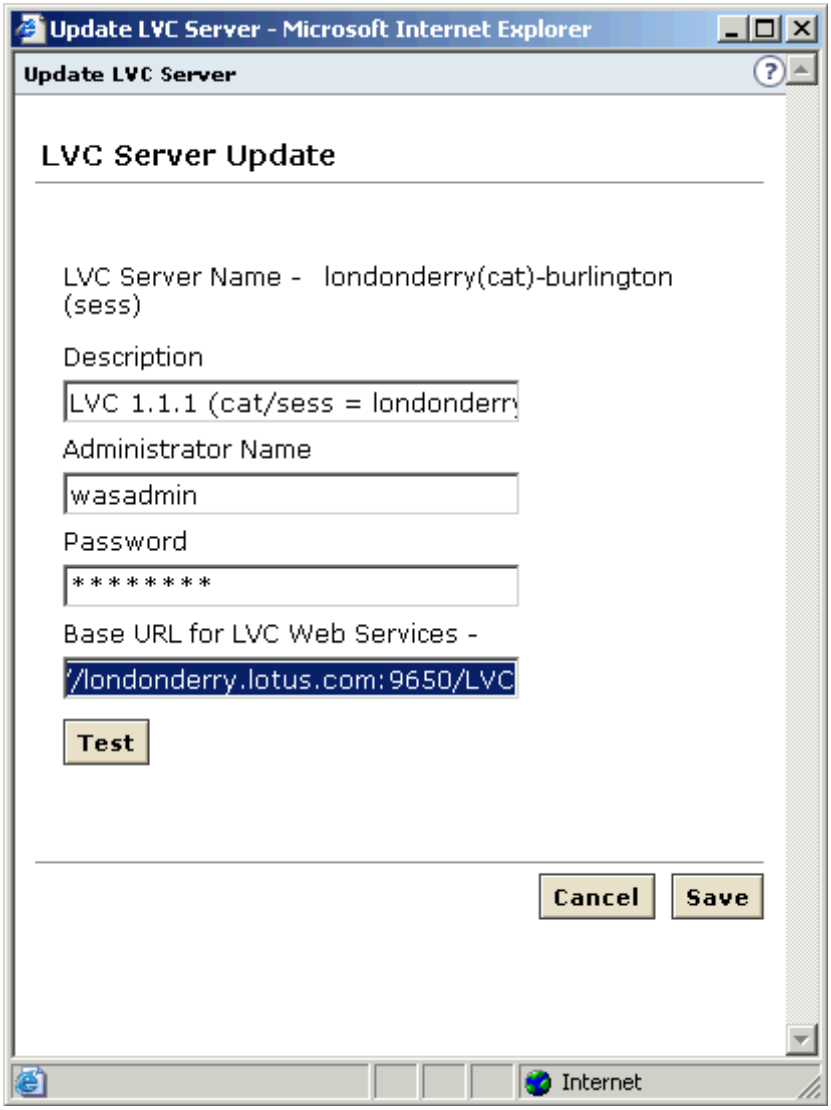

Figure 10-2 Update server screenshot

9. Repeat steps 3 to 8 for each LVC server.
10. Click **Done**.

10.2.3 Enabling SSO and importing the LTPA key on LVC servers

LMS and LVC both use Web single sign-on (SSO). To use the products together, you must merge the SSO solutions together, using the credentials from LMS.

Prerequisites

The prerequisites are:

- You successfully installed LMS.
- You successfully installed LVC.
- All computers are in the same DNS domain.
- All computers use the same LDAP directory server.
- You exported the WebSphere Lightweight Third Party Authentication (LTPA) key to a file.
- The LVC Catalog Server and LVC Session Server are running.

To merge single sign-on

In order to merge single sign-on:

1. Copy the WebSphere LTPA key to the LVC Catalog Server.
2. On the LVC Catalog Server, start Lotus Notes®.
3. Choose **File -> Database -> Open**.
4. In the Open Database dialog box, do the following:
   a. In the Server field, open the drop-down list and select the hierarchical name of the Catalog Server's Domino Server, for example, catalog/CertifierName.
   b. In the Database list, highlight the DomainName's Domino Directory (address book). When you select the correct database, the Filename field displays `NAMES.NSF`. Now click **Open**.
5. In the Domino Directory's navigator, click **Server** to open the list of subcategories.
6. Click **Web Config** (at the bottom) to open that view, and then double-click *** - All Servers -**.
7. Double-click **Web SSO Configuration for LtpaToken**.
8. On the action bar, click **Edit - Keys - Import WebSphere LTPA Keys**.
9. When the pop-up message appears, **"**`The Web SSO Configuration has already been initialized. Creating new keys will overwrite existing SSO keys. Continue?`**"**, click **OK**.
10. Enter the full path name of the WebSphere LTPA key, and click **OK**.

11. Enter the password for the WebSphere LTPA Import file, and click **OK**. Two new fields will display on the Web SSO Configuration document.
12. In the LDAP Realm field, add a backslash (\) between the hostname and the colon that precedes the LDAP port number. For example, change "ldap.example.com:389" to "ldap.example.com\:389".
13. On the action bar, click **Save** and **Close**.
14. Exit Notes.
15. Open the LVC Catalog Server's Domino Server console window and type:

```
replicate session/certifiername names.nsf
restart server
```

16. Open the LVC Session Server's Domino Server console window and type:

```
restart server
```

If SSO is configured correctly, the following message appears on the Domino server console:

```
HTTP: Successfully loaded Web SSO Configuration.
```

If a Domino server enabled for SSO cannot find a Web SSO Configuration document or is not included in the Domino Server Names field and therefore cannot decrypt the document, the following message appears on your server's console:

```
HTTP: Error Loading Web SSO configuration. Reverting to single-server
session authentication.
```

10.2.4 About generated courses

Generated courses are courses that are created in a program other than LVC (for example, the LMS), but are available in LVC. The content for generated courses—the outline and associated course materials—can be developed using:

- LVC. In this case, you click **Develop outline** in the Course Builder page in the Learning Home, just as you do to develop LVC course outlines and materials.
- If you are using the LMS, you access the Course Builder page from a link within that product.
- If you are using LVC with LMS, you can create the course outline and materials using the Authoring Tool in LMS.

Courses whose content is developed outside LVC do not appear in the LVC Learning Home.

The sessions for generated courses take place in LVC, regardless of where the course content is developed. However, with generated courses, most tasks are

carried out outside of LVC (for example, in LMS), including creating courses, scheduling sessions, and enrolling users.

How generated courses appear in LVC

Only LVC instructors and administrators can see generated courses. They never appear in the course catalog and thus students never see them.

In LVC, instructors see generated courses listed under the category Generated course on the Course Builder tab. Their status is always Generated.

How generated courses differ from LVC courses

Generated courses have some differences from courses created in the LVC. Specifically, you cannot do the following with generated courses:

- Include assessments with them.
- Publish them to the course catalog.
- View them in the My Sessions list (either as an instructor or a student).

The following tasks are performed outside LVC (for example, in LMS), rather than in the LVC Learning Home:

- Scheduling sessions (even though the schedule of sessions appears in the Learning Home)
- Enrolling students (for administrators)
- Starting sessions
- Changing catalog information, such as the course description or list of instructors

In addition, the LVC interface differs between generated courses and courses created in LVC. For example, when editing a generated course:

- The Edit catalog information and Schedule sessions buttons do not appear in the Course details page.
- The New Assessment button does not appear for the course on the Assessments and Questions page (since generated courses do not support assessments).

Any pre-session requirements must be set outside LVC, for example, in the LMS environment or other e-Learning product.

10.2.5 Creating and editing courses that include a live session

When course developers create course content in the LMS Authoring Tool, they can add materials for a live session as one of the activities that makes up the

course. This live session activity then becomes part of the course master. When you create a course offering from the master, LMS passes the materials to LVC so that it can deliver the live session. Returning to the Authoring Tool is the only means of editing these materials—an existing offering is updated only when the course is republished to LMS.

If the course developer prefers to store live session materials for a course in LVC, you can use the LMS master and offering creation process to create a new course in LVC. The resulting LVC course includes a Quickplace to store the course contents and profiles of instructors so that they can access the course materials from LVC. LMS instructors can also edit the Quickplace course materials directly from “Courses I’m Teaching” in LMS Home, provided they do so more than one hour before the session is scheduled to begin.

10.2.6 Managing courses that include a live session

After you specify a LVC server in LMS Settings, you can schedule the live session at the same time that you create the course offering. For information on creating and scheduling course offerings, see “Add course offerings” on page 428.

You can schedule a new live session up to one hour before you want the session to begin. Since you can also only enroll students up to one hour before the session begins, allow yourself or the students enough time to enroll.

The instructor for a live session can change the session’s schedule (up to one hour before the session begins) in the “Courses I’m Teaching” section of LMS Home.

You cancel or delete a live session by editing the LMS course offering or master.

Adding live session instructors

When you add a user as a course instructor in LMS for a course that includes a live session, LMS automatically adds the instructor as a full instructor in LVC.

The instructor can then both use LMS to modify LVC course materials for live sessions originating in LMS, and use LVC to create LVC-only courses and sessions.

Note: Removing a user from the LMS list of instructors removes only the ability for that user to edit the LVC course materials from LMS. All LVC instructor privileges remain unless an administrator removes them using LVC administrative tools.

10.2.7 Tips for working with live sessions

Working with live sessions can be tricky; use the following suggestions to avoid problems:

- Create your live session offering at least two hours before you actually want to start the session.

  This allows time for information about the session to be communicated between LVC and LMS. Attempting to start the session sooner may result in errors.

- After creating the live session offering, do not touch the keyboard for a couple of minutes.

- Immediately after session creation, information from the keyboard may still affect your session definition and cause errors. Wait a couple of minutes before proceeding to your next task.

- Make sure all dates for a live session are correct and in sync.

  For a live session created in the Authoring Tool, the LMS may display different start dates in the Virtual Classroom Details page and the Scheduled Offering page. The date on the Scheduled Offering page is the correct date; edit the date on the Virtual Classroom Details page to match it. If you do not, the session may fail.

- If a live session fails (for example, because you scheduled it to start too early), delete the session and create a new one.

  Attempting to correct the failed session may cause errors; you should just delete it and start again.

- If you import a live session definition from the LMS Authoring Tool, do not try to modify the materials within the LMS.

  Attempting to modify the materials from within the LMS will cause errors. If you need to modify the materials, you should delete the session, edit it from within the LMS Authoring Tool, and re-import it.

Note: The button that appears within the LMS is intended only for use with sessions that you actually create within the LMS.

When uninstalling LVC-LMS connector

The following files are inadvertently removed if you uninstall the LVC-LMS connector tool:

- LVC.JAR
- LVCStart.BAT
- LVCTerm.BAT

You can recover them by performing the following steps:

1. Download the Replace.zip located at:

   ftp://ftp.software.ibm.com/software/lotus/fixes/LearningSpace/Virtual_Classroom/Replace.zip

   Important: By downloading and using this code, you agree to these terms and conditions: The software samples, updates, and fixes (code) available in this archive or on this Web site for this program are copyrighted materials. By clicking the download link below, you agree that the code is provided under, and is subject to, the terms and conditions of the license agreement(s) that accompanied or were contained in the copy or copies of the program for which you are obtaining the code. You are not authorized to install or use the code except as part of a program for which you have a valid Proof of Entitlement or other authorization as specified in such license agreement(s). You further agree that you will comply with all applicable laws and export regulations.

2. Unzip the file.
3. Copy the file, LVC.JAR, into the \Lotus\lvc\lib directory (on the drive where LVC was installed).
4. Copy the two .BAT files into the \Lotus\lvc\bin directory (on the drive where LVC was installed).

Note: Here is additional information:

- If LVC was installed on any drive other than the C: drive, then the .BAT files must be edited using a text editor, such as Notepad, to enter the correct drive. The .BAT files contain the following two lines:

  ```
  C:
  cd "C:\Lotus\lvc\bin"
  ```

  Change the disk designation (C:) on both lines to reflect the location of the lvc\bin directory of your installation.

- If you tried to start LVC after uninstalling the LVC - LMS Connector tool, the Start menu shortcut may now point to a file other than the LVCStart.BAT. To check what file the shortcut is pointing to, do one the following: In Windows 2000, right-click the **Start Lotus Virtual Classroom** menu item and choose **Properties**.

Edit the shortcut target to point to \Lotus\lvc\bin\LVCStart.BAT, if necessary.

10.3 Using the LMS API

The LMS API is a Web Services API. This means that it uses the Simple Object Access Protocol (SOAP) to allow you to call the API from any system that supports HTTP, as well as from many different programming languages.

SOAP (http://www.w3.org/TR/SOAP/) is an XML-based communication protocol and encoding format for inter-application communication. It leverages HTTP or SMTP as its transport layer and XML as its data layer, to execute remote methods known as SOAP services. SOAP provides the foundation for a host of cross-platform cross-language distributed computing applications, termed Web Services.

A variety of Web Services client libraries are available, including Apache SOAP, Apache AXIS, IBM WebSphere Web Services, Microsoft .NET, and others. See the following links for more information about Web Services:

- Apache SOAP

  http://ws.apache.org/soap/

- Apache AXIS (Apache SOAP follow-on project)

  http://ws.apache.org/axis/

- Apache Web Services Invocation Framework

  http://ws.apache.org/wsif/

- IBM WebSphere Web Services

  http://www7b.software.ibm.com/wsdd/zones/webservices/

- Microsoft .NET Web Services

  http://msdn.microsoft.com/webservices

The functions provided by the LMS API are defined using the Web Services Description Language (WSDL), an XML format used for describing Web Services. The WSDL definition files are provided with your LMS server in the /api resource and can be used with the Web Services client libraries mentioned above. The WSDL for the LMSVersionAPI, for example, is accessible from:

```
http://<lms_server_name>/lms-lmm/api/LMSVersionAPI.wsdl
```

Web Services clients can use anonymous or basic authentication to access the different services from:

```
http://<lms_server_name>/lms-lmm/anon-api/<service_name>
```

Or, clients can use single-sign-on (SSO) to access the different services from:

```
http://<lms_server_name>/lms-lmm/auth-api/<service_name>
```

See the LMS API documentation for details on using either of the above access methods. You can download the official LMS API documentation from here:

http://www-1.ibm.com/support/docview.wss?uid=swg21104843

10.3.1 Features

The LMS API gives you programmatic access to many of the LMS features. For example, your program can do any of the following:

- Register users in the Learning System roster.
- Enroll users in courses and determine course rosters.
- Access the systems announcements.
- Find user and course calendars.
- Obtain course results.
- Search the course catalog.
- Find user preferences and settings.

You can use the LMS API to create a variety of applications, including the following:

- Applications that transfer information between other applications and LMS
- Applications that create alternate interfaces, such as portals, to the Learning Management System
- Programs that integrate LMS with other applications

10.3.2 A Java-based example

In this section we describe how to create a simple Web Services client to query the version of LMS using the LMS API.

Step 1: Prerequisites

Step 1 is getting all of the prerequisites.

1. Download the required software.

   For this example, you need the following software:

   – The freely available Java IDE Eclipse

     http://www.eclipse.org/

   – The WSDL2Java Eclipse plug-in

     http://www.myspotter.com/wsdl2java.shtml

   – The Apache Axis Web Services library

     http://ws.apache.org/axis/

- The LMSVersionAPI.wsdl file

  `http://<lms_server_name>/lms-lmm/api/LMSVersionAPI.wsdl`

2. Install Eclipse.
3. Install the WSDL2Java Eclipse plug-in.

Step 2: Set up a new Java project

To set up a new Java project:

1. Launch Eclipse.
2. Create a new Java Project by clicking **Fi**le -> New -> Pr**oject**.
3. Open Windows Explorer and go to the new project's folder in the Eclipse workspace directory (usually c:\Program Files\Eclipse\workspace\<project_name>).
4. Create a folder called lib and extract the .JAR files provided with the Apache Axis binary distribution to this directory (axis-ant.jar, axis.jar, commons-discovery.jar, commons-logging.jar, jaxrpc.jar, log4j-1.2.8.jar, saaj.jar, and wsdl4j.jar).
5. In the project folder, create a second folder called WSDLs, and move the file LMSVersionAPI.wsdl to this folder.
6. Go back to Eclipse and switch to the Java Perspective.
7. In the Package Explorer, right-click the new project and select **Refresh** from the pop-up menu. The lib directory, including the Axis .JAR files and the WSDLs directory, should now appear. See Figure 10-3 on page 168.

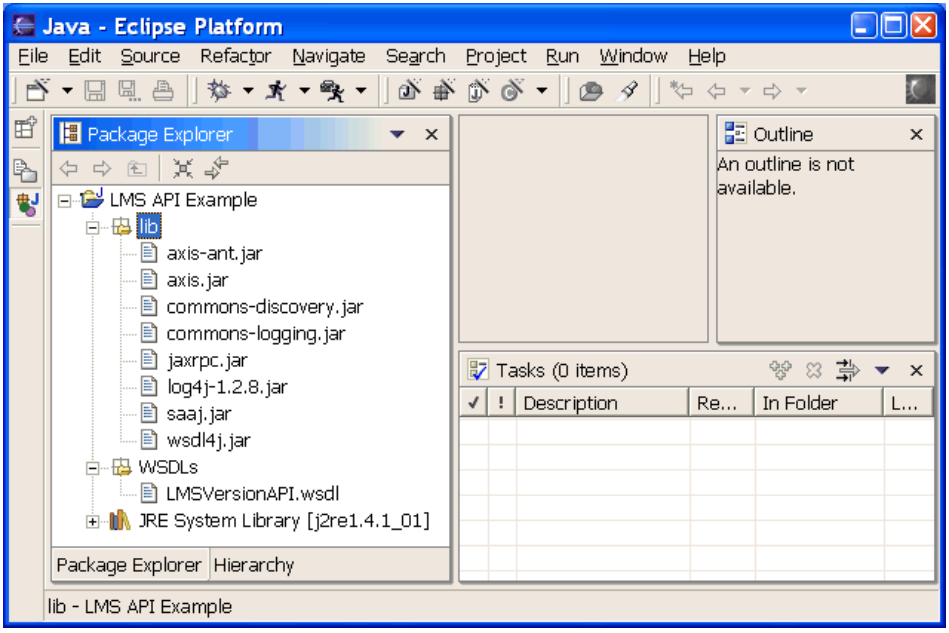

Figure 10-3 New LMS API example project in Eclipse

8. In the Package Explorer, right-click the project again and select **Properties**.
9. In the Properties window, select **Java Build Path** and open the **Libraries** tab.
10. Use the **Add JARs** button to add all Axis .LIB files to the project's build path.
11. After you added the .LIB files, click **OK** to close the Properties window.

See Figure 10-4 on page 169.

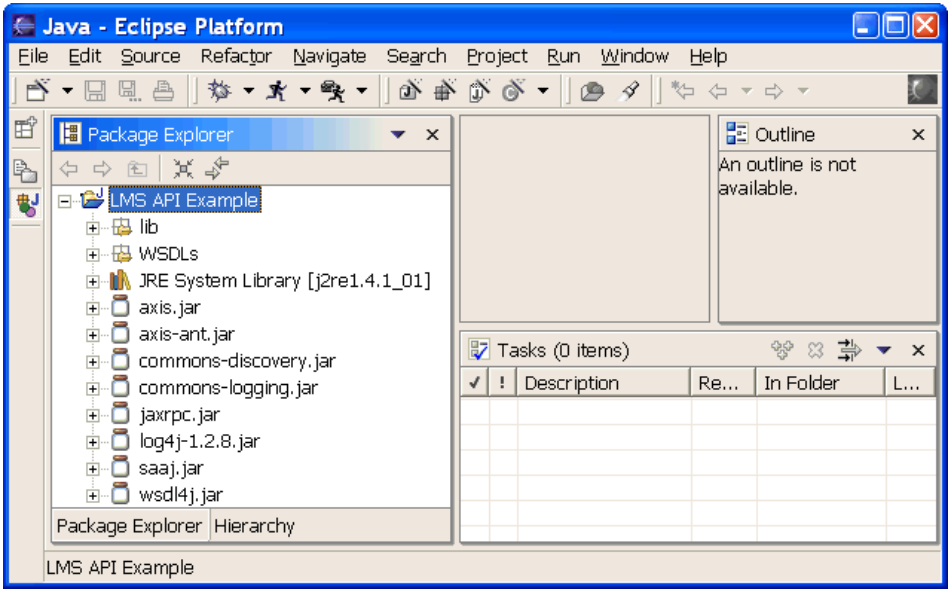

Figure 10-4 LMS API example project - Build path set up

Create stub classes

To access the properties of a Web Service you need to create so-called stub classes (a Java interface), which define the methods and properties of a Web service. The required stub classes can be created using the WSDL2Java Eclipse plug-in, which is a graphical front-end to the WSDL2Java.class provided within the Axis package.

To create the stub classes, right-click the **LMSVersionAPI.wsdl** file in the Package Explorer and select **WSDL2JAVA -> Generate**, as shown in Figure 10-5 on page 170.

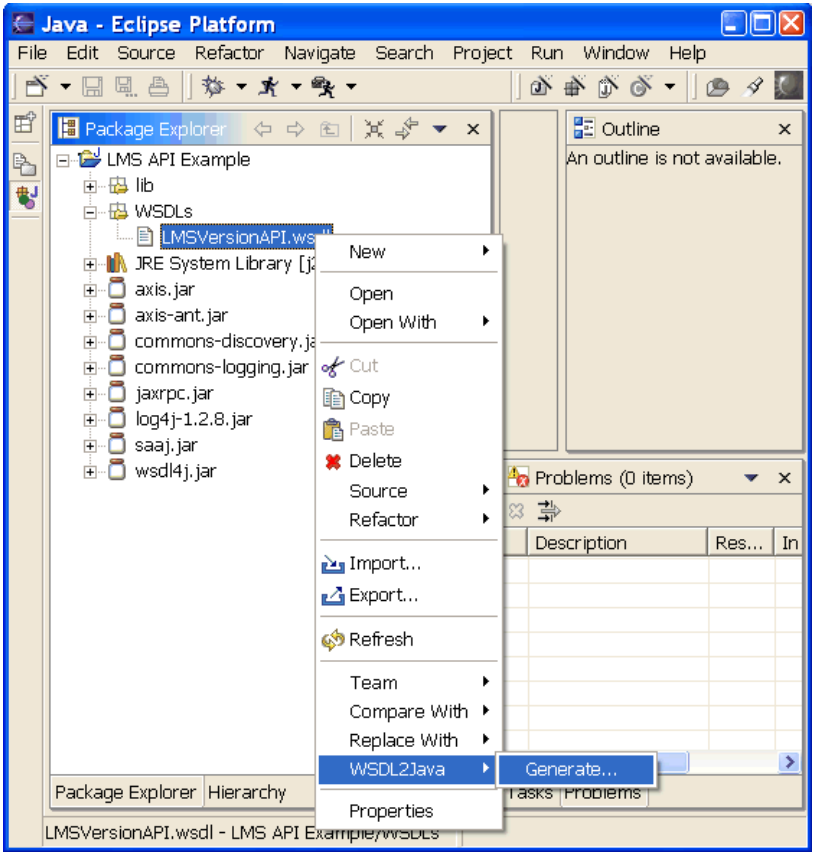

Figure 10-5 Generating the stub classes

Creating the example class

Now that the required libraries are added to the project and the needed stub classes are generated, we can create the class that actually acts as the Web Services client.

1. Right click the project in the Package Explorer and select **New -> Class**.
2. In the New Java Class dialog enter a class name, for example, `Add`, and click **Finish**.
3. Add the following method to the class:

```
public static void main(String[] args) throws Exception {
   try {
      String service = "http://<myserver>/lms-lmm/anon-api/LMSVersionAPI";
```

```
            LMSVersionAPI_ServiceLocator sl = new LMSVersionAPI_ServiceLocator();
            LMSVersionAPI_Port lmsVersionAPI =
               sl.getLMSVersionAPI(new java.net.URL(service));

            System.out.println("LMS Build Date: " + lmsVersionAPI.getBuild());
            System.out.println("LMS Version: " + lmsVersionAPI.getVersion());
         } catch (Exception e) {
            System.err.println(e.toString());
         }
      }
```

4. Replace <myserver> with the fully qualified hostname of the machine running the Web server that serves access to LMS.
5. Still in the class editor, press Ctrl + O to create the required import statements.
6. Press Ctrl + S to save the changes.

Launching the example class

To launch the example class:

1. From the menu select **Run -> Run ...**.
2. In the Run dialog, select **Java Application** and click **New**.
3. Change the Name to `LMS API Example`.
4. Click the **Browse** button to the right of the Project field and select the **LMS API Example** project.
5. For Main class, enter the name of the class you just created, for example, `LmsApiExample`.
6. Click **Apply** to save the changes.

See Figure 10-6 on page 172.

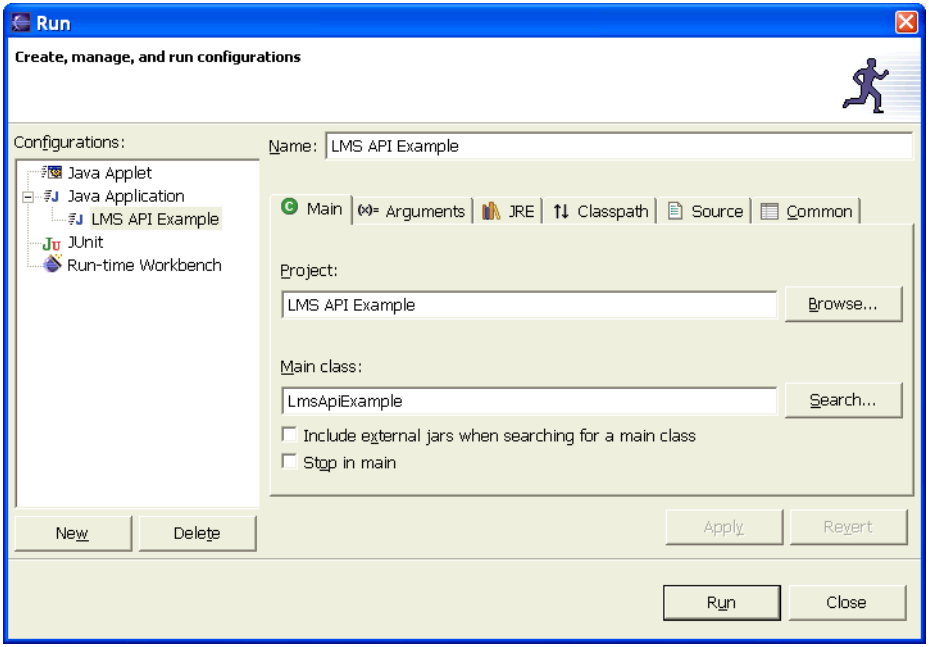

Figure 10-6 Eclipse run dialog

7. Click the **Run** button to launch the example. The console window should now show the build date and the version number of your LMS installation, as shown in Figure 10-7.

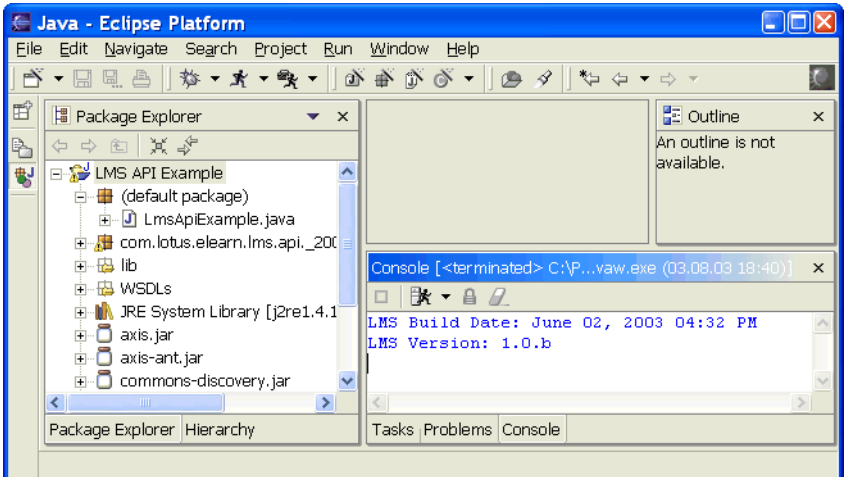

Figure 10-7 The LMS API example's console output

8. You can rerun the example by using the Run button menu in the Eclipse toolbar. See Figure 10-8.

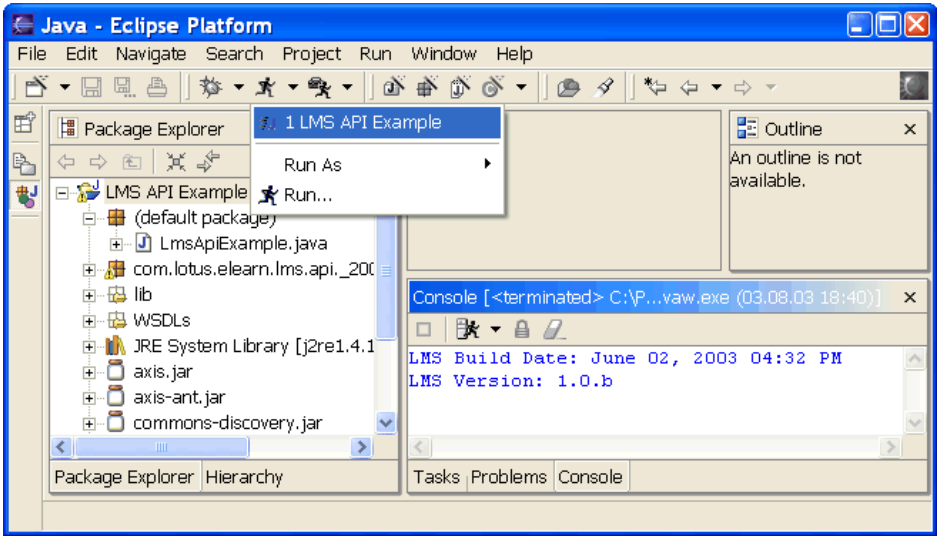

Figure 10-8 Run button menu

Part 3

Configuration, customization, and reports

In this part we provide guidance and techniques to those who work with and support the LMS.

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11

Configuring LMS

This chapter describes the steps to configure the LMS after it has been installed. The previous chapters have covered what needs to be planned in advance. Now we put it into practice.

For a detailed step-by-step scenario on how a company might configure LMS for its educational offerings, see Appendix G, “Configuring LMS for the MAGIC company” on page 397. That appendix takes the situation of the fictional MAGIC company described in Chapter 16, “Corporate scenario” on page 327, and steps you through the configuration setup for that company.

Another appendix with additional configuration information is Appendix H, “Default LMS user roles” on page 433.

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11.1 Getting started

The key to a successful configuration of the LMS is the planning you have done ahead of time. The LMS has a lot of capabilities for adapting to the users. Once the thought process has been completed and appropriate documentation has been collected and reviewed, the configuration process can begin. Areas that need to be covered are listed in Table 11-1.

Table 11-1 Areas to configure

Area	Action
Users	► Roster users. ► Map automatic role assignments. ► Configure roles. ► Configure profiles. ► Assign roles.
Course Catalog	► Configure course master folders. ► Configure course offerings folders. ► Add course masters. ► Add course offerings.
Enrollment	► Enroll students. ► Auto enrollment.
Resources	► Configure locations. ► Configure rooms. ► Configure skills. ► Configure zones.
Reports	
Customization	► Configure customization sets. ► Assign customization sets.
LDAP	► What fields will be required in LMS.
Access Control Lists	► Who will administer. ► Who will manage users. ► Will self-enrollment be allowed. ► Security as it effects courses.

11.2 LDAP, the key to the LMS

The LDAP directory plays a role in a number of LMS activities. It is used for user authentication and retrieving of user details. Besides this, user and group attributes stored in the LDAP directory are also used by administrators to create rules that:

- Control access to course catalog folders.
- Automatically assign roles to users.
- Authorize users or groups to administer resources.
- Display announcements to certain users and groups.
- Apply customization sets to users.

Figure 11-1 illustrates the different areas that depend on information from the LDAP directory.

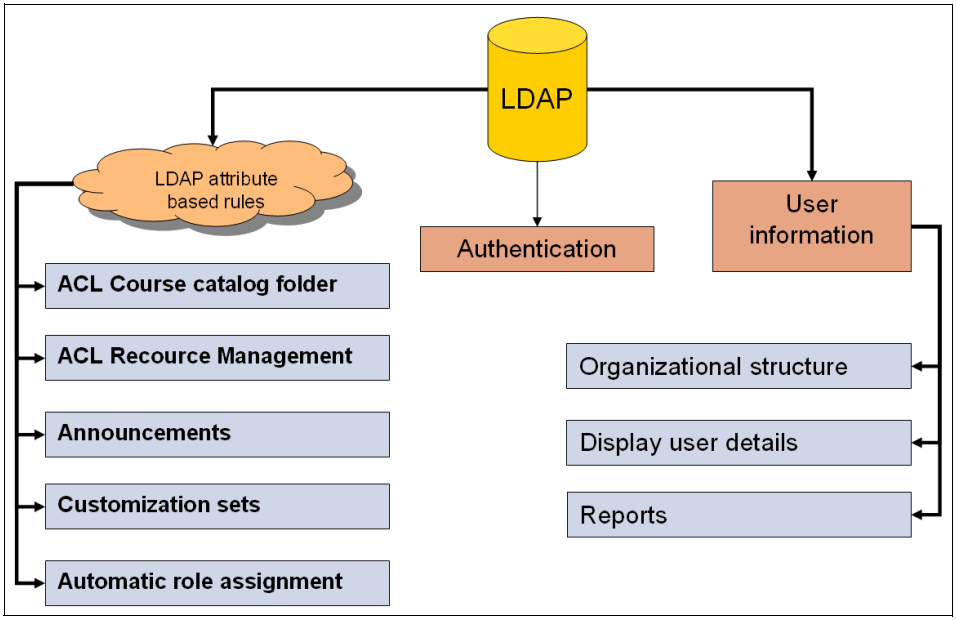

Figure 11-1 LDAP dependencies in LMS

11.2.1 Matching strings

As described above, at several places rules have to be created to control LMS. These rules are applied to users that are selected in the LDAP directory based on matching strings (patterns).

Using matching strings, users are identified in several ways:

- By Attribute: Can be any attribute name (for example, departmentNumber) or an attribute name and its value (for example, departmentNumber=123).
- By Group: The name of a group defined in the LDAP directory.
- By User: The user's hierarchical name (for example, John Doe/Springfield/Acme) or distinguished name (for example, cn=John Doe,ou=Springfield,o=Acme).

Note: In the Announcement settings, the screen By User is called By Name.

When you match by attribute, you can specify either an LMS attribute name (such as FirstName) or an LDAP attribute (such as givenName). LMS attribute names are mapped to LDAP attribute names as defined in the LMM's settings.xml file.

When LMS evaluates a By Attribute match, it first looks for the attribute in the mapping table in settings.xml. If there is an entry in the mapping table, LMS uses the mapped LDAP name to search the LDAP directory for the match. If there is no entry, LMS assumes that the attribute name is an LDAP attribute name and uses it directly to search the directory for a match.

Tip: See Appendix F, "Default LDAP attribute mappings" on page 393, for a list of the LDAP attribute mappings that are defined by default and a description on how you can determine the effective mapping in your LMS.

You can test attribute values for equality (=) or inequality (!=). You can also use one or more wild cards to do pattern matching on a set of attribute values.

By Group and By User matching strings can be specified in either of two forms:

- As a qualified LDAP distinguished name, such as cn=John Doe,ou=Springfield,o=Acme
- As a hierarchical form, such as John Doe/Springfield/Acme, which the LMS converts internally to an LDAP distinguished name

  By default, LMS converts the hierarchical form by adding a "cn=" qualifier to the first part of the name, an "ou=" qualifier to all other parts of the name except the last, and an "o=" qualifier to the last part, removing the slashes ("/"). You can specify different qualifiers to be used for this conversion by changing the dnQualifiers statement in the LDAP section of the settings.xml file (<dnQualifiers first="cn" middle="ou" last="o" />), where the value for first

is applied to the leftmost section of the name, the value for last is applied to the rightmost section of the name, and middle applies to everything in between.

Note: The asterisk wildcard (*) can be used at the beginning of a By User matching string instead of the common name to match all users in a portion of the directory. You *cannot* use a wildcard together with portions of a common name. For example, the following matching strings would not work:

- *Doe/Cambridge/IBM
- John*/Cambridge/IBM
- Jo*Doe/Cambridge/IBM

You also CANNOT use it for a By Group match.

In Figure 11-2 on page 182, the examples of matching strings assume the default mappings in settings.xml (for example, the LMS attribute LastName maps to the LDAP attribute sn).

Type	Example	Matches LDAP entries
By Attribute	LastName=García	All users with the LDAP sn attribute with the value García.
	sn=García	ditto
	sn=Gar*a	All users whose LDAP sn attribute begins with Gar and ends with a
	sn=*arc*	All users whose LDAP sn attribute begins, starts or contains arc
	DepartmentNumber =*	All users with the departmentNumber attribute regardless of its value (if any)
	DepartmentNumber	ditto
	DepartmentNumber=	All users with the departmentNumber attribute for which no values or an empty value has been assigned
	DepartmentNumber!=*	All users who do not have the departmentNumber attribute
	DepartmentNumber!=	All users who do not have the departmentNumber attribute or have a non-empty value assigned to it
	DepartmentNumber!=123	All users who do not have the departmentNumber attribute or do not have the value 123 assigned to it
	PostalCode=021*	All users whose LDAP postalCode attribute value begins with 021
	Description=*Java*	All users whose LDAP description attribute contains the word Java
By Group	Sales/Springfield/Acme	All users in this group
	cn=Sales,ou=Springfield, o=Acme	ditto
By User	John Doe/Springfield/Acme	A person (John Doe) at Acme in Springfield
	cn=John Doe,ou=Springfield, o=Acme	ditto
	*/Springfield/Acme	All users at Acme in Springfield
	*,ou=Springfield,o=Acme	ditto
	*	Anyone at all
	cn=anonymous	Anonymous users only (that is, users who have not logged in to the LMS)

Figure 11-2 Example of valid matching strings

11.2.2 Controlling access

In LMS, permissions can be granted to users by assigning them roles or by adding them to access control lists (ACLs) for specific objects (for example, to a Master Catalog folder, a location, or a room).

Tip: You can find detailed information about role assignment, permission granting, and managing access control in Chapter 5, “Managing Users” in the *LMS Administration Guide.*

LMS uses configurable roles to control which functions are available to users in the user interface. A user may have more than one role, and roles may be assigned either automatically by using matching strings, or assigned manually through the LMS administration interface. Newly rostered users by default get the Student role. See Appendix H, “Default LMS user roles” on page 433, for a list of the default permissions for the different standard roles.

When setting up ACLs, keep the following in mind:

- Users who do not have a role granting the permission to see the Masters Catalog cannot see any course masters, even if they have been granted access to one of the Master Catalog’s folders in ACL settings.
- Applying the Administrator role to users does not imply the permission to create new locations. This right has to be granted separately via the ACL in the LMM General Settings/Location Access Control tab, as shown in Figure 11-3.

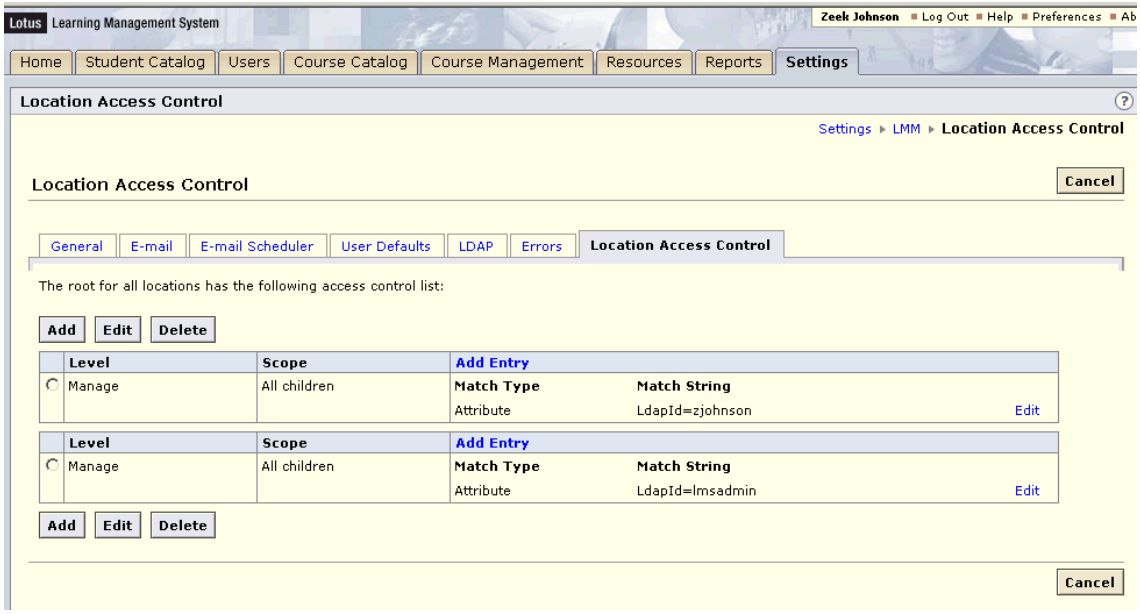

Figure 11-3 Settings Location Access Control in LMM

11.3 Scaling down the LMS

Even though the LMS is an enterprise product, there are plenty of opportunities to scale it down. In fact, one of the first things you should consider when starting to use the LMS is turning off the functions that are not needed.

Out of the box, the LMS has a default set of features. Switching off unwanted features is easy. Should the need for these features come at a later point, you can always turn them back on. An advantage of this is that it gives you the opportunity to set up interfaces with different complexity for different groups of users.

Figure 11-4 shows the default LMS home page for a student.

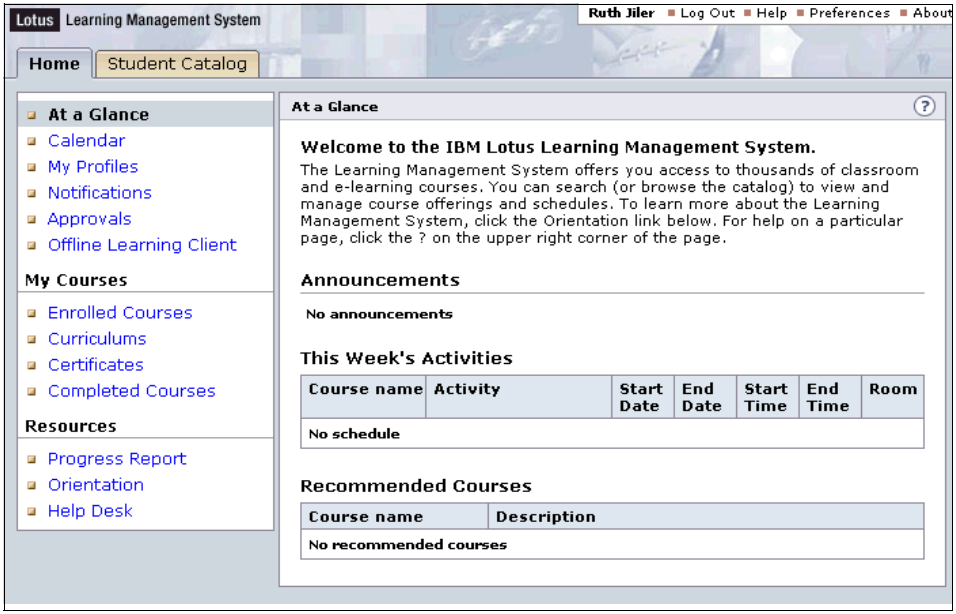

Figure 11-4 Default student home page

By editing the details of a certain role and turning off some of the features available, you can simplify what the user sees. In Figure 11-4, we turned off the display of most of the line items in the left-hand (navigator) column. Thus we easily made a very uncomplex interface for a student, as shown in Figure 11-5 on page 185.

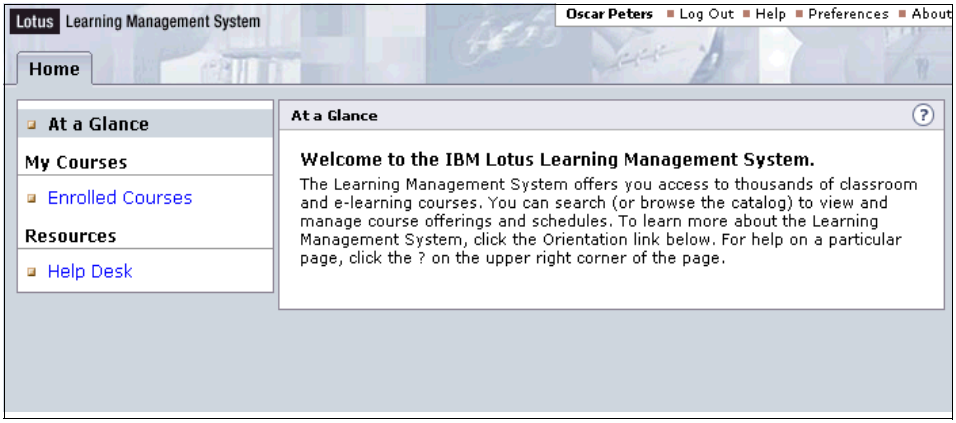

Figure 11-5 A basic home page

11.4 Managing users in LMS

Before rostering users for the LMS, you should have created roles and profiles in the system. This section will describe where to start to configure the system and what to consider. It is important to understand how the different components are connected to each other and which components affect others.

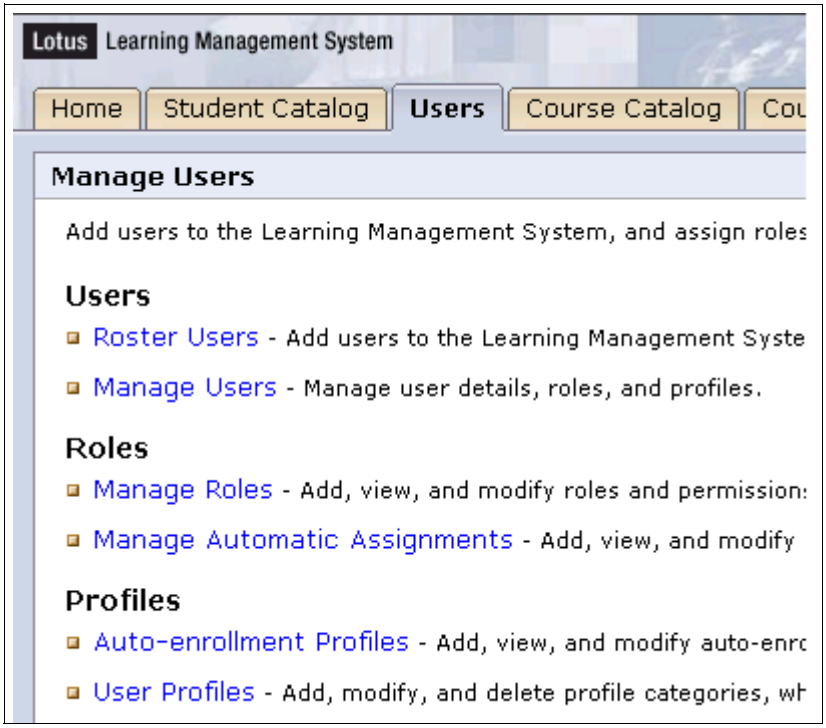

Figure 11-6 User management

11.4.1 Creating roles

Before you add users to the system, you will want to plan and create the roles your organization needs. LMS comes with five default roles that correspond to the types of users who work in the system: Administrator, Manager, Instructor, Student, and Anonymous. If these roles work for your organization, you can keep them and either leave the permissions intact or edit them. If these roles do not fit in your company, you can create new ones with all permissions you need in the roles.

When you add users to the system, you match them to a role that represents the tasks and functions they can perform in the system. Users with multiple roles receive the total of all permissions allowed by those roles.

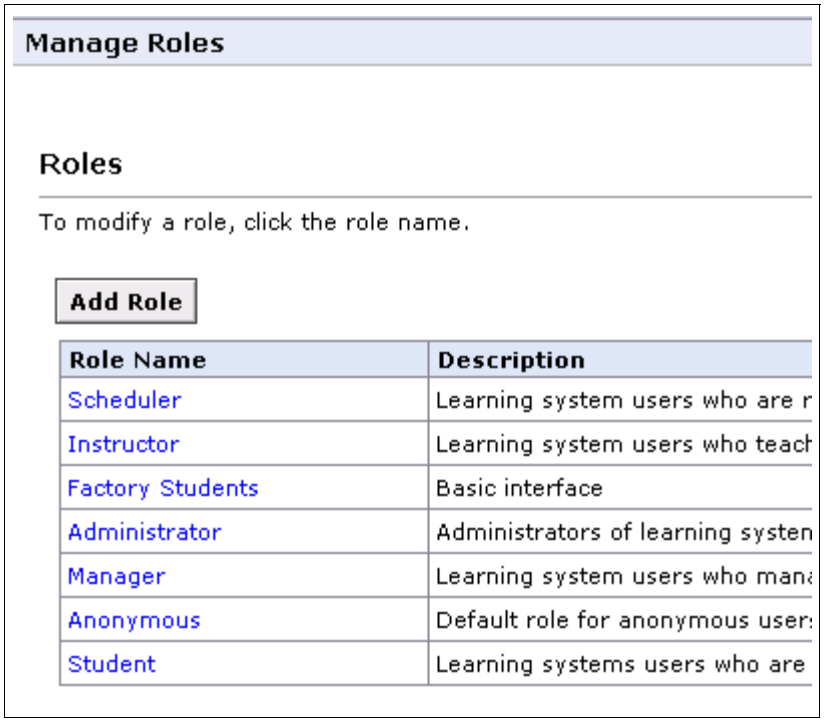

Figure 11-7 Roles

Each role is defined by a set of permissions in the LMS and its different tabs. Permissions determine which parts of the user interface a user can see. You can also add as many additional roles that make sense for your organization.

To review or add to the list of roles, open the Manage Roles section of the Users module. From here, you can either add a role to the list or click a role name to view or set its permissions.

You can assign multiple roles to a user. The user will have all permissions you have defined in those different roles before. When the user logs into the system, the LMS performs the assignment of those permissions to that user.

11.4.2 Explicit and automatic roles

You have to distinguish between explicit and automatic roles in the system. The difference between explicit and automatic roles is simply the way in which a role is assigned to a user.

- Explicit role: An explicit role is defined by a set of permissions that you associate with one or more users whom you select by searching in the LMS.

- Automatic role: An automatic role is defined by a set of permissions that you associate with a set of users who are identified in the LDAP directory by matching strings.

Every role assignment has its advantages.

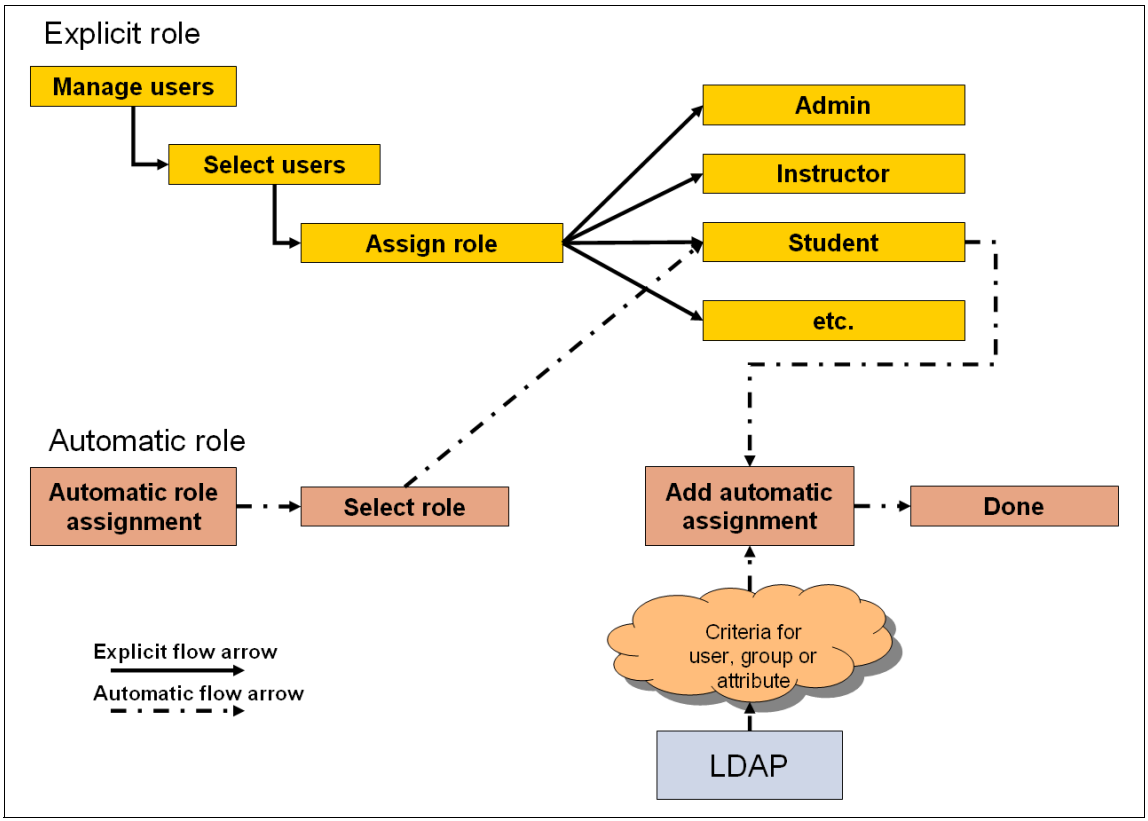

Figure 11-8 The flow in explicit and automatic roles

Assigning explicit roles

The advantage of assigning explicit roles is that you can assign multiple roles to a user in one step. Only users that have been assigned explicit roles show up in the user searches performed by Role. See Figure 11-9 on page 189.

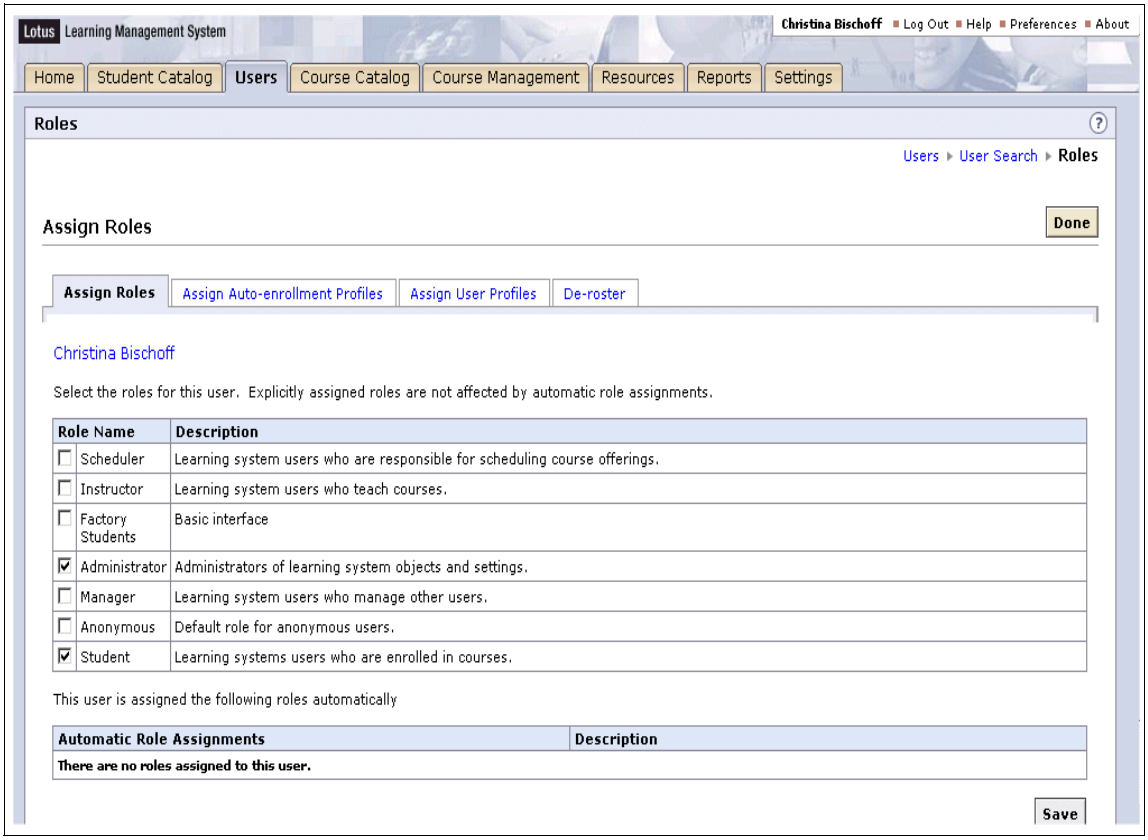

Figure 11-9 Role assignment

Note: How to apply roles to users manually is explained in the *LMS Administration Guide.*

Assigning automatic roles

Automatic role assignments are assigned by matching strings. Users who are identified in the LDAP directory can be assigned to specific roles you have specified with matching strings. See Figure 11-10 on page 190.

The advantage of automatic role assignment is that you can assign a role to multiple users in an LDAP directory.

Automatic assignments apply to users (present and future) identified by the matching string. Thus a future user identified by matching string specified for an automatically assigned role gets that role by default.

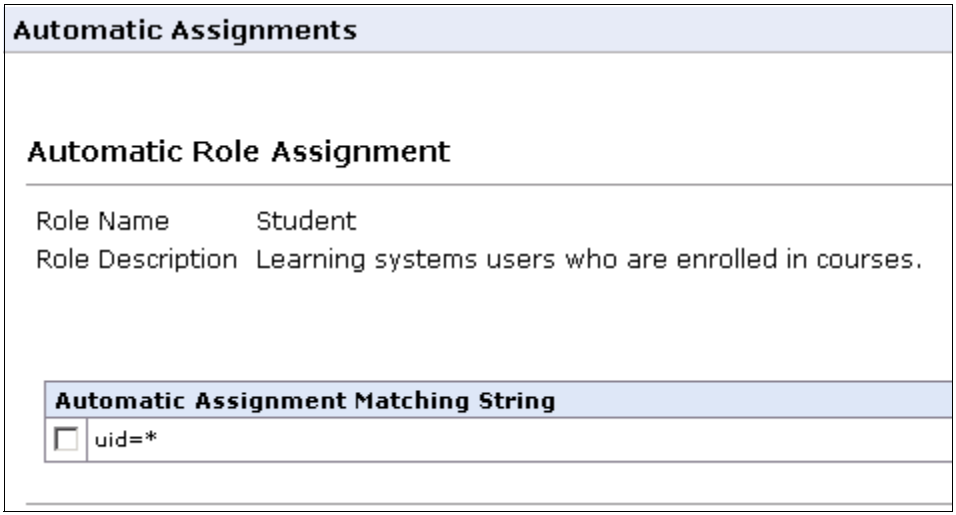

Figure 11-10 Automatic assignment

For automatic role assignments, the following types are used:

- Attribute: Can be DepartmentNumber. The matching string can be defined as DepartmentNumber=333. That would mean that any rostered user in this department is automatically assigned this role.
- Group: If you define a group as matching string, everyone from this group in the LDAP directory is assigned a specific role.
- Name: If you use names as the matching strings, all rostered users in this part of the LDAP directory tree are assigned the role.

See Figure 11-11 on page 191.

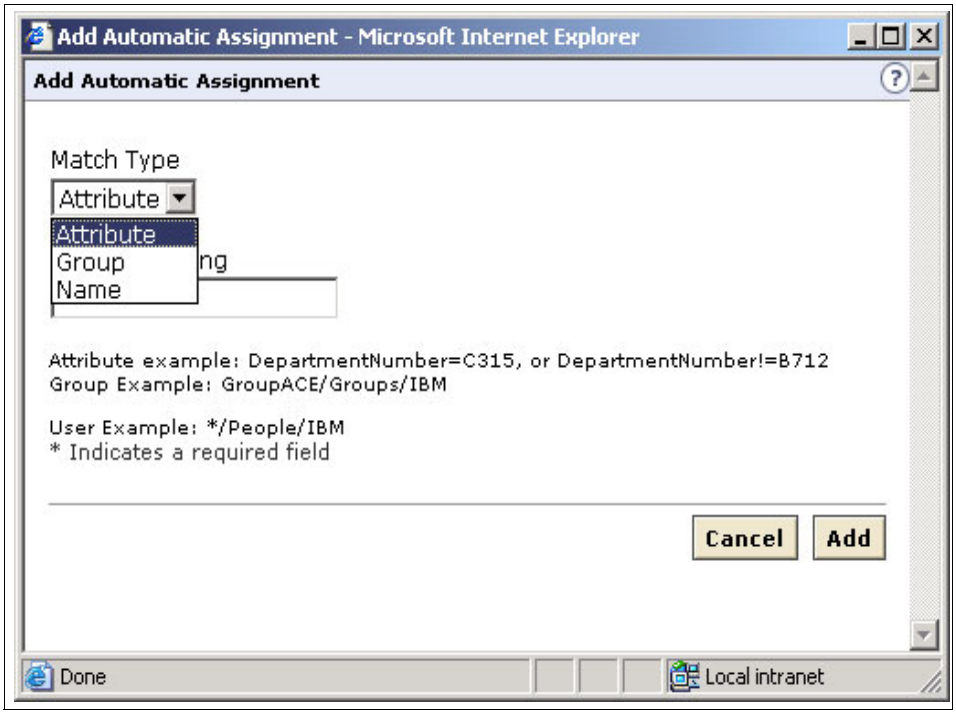

Figure 11-11 Adding automatic assignments

11.4.3 Permissions

Permissions are not assigned to individuals, but to the roles you have created before. You need to set permissions to allow users to view the Learning Management Module (LMM) user interface screens and to perform tasks.

Note: Roles and permissions work in conjunction with the access control lists (ACLs) to allow users access to course masters, course offerings, and locations.

The LMS provides default settings for all permissions for the five default roles that come with the system (Administrator, Instructor, Manager, Student, and Anonymous). You can leave the default settings or change them, or you can create new roles with a set of permissions you have defined.

For every tab in the system, there is a set of permissions you can specify.

- The Home permissions control the management and use of the features under the Home tab. See Figure 11-12 on page 193.
- The Student Catalog permissions control the use of the features under the Student Catalog.
- The Course Catalog permissions control the management and use of the features under the Course Catalog.
- The User Management permissions control the management and use of the features under the Users tab.
- The Course Management permissions control the management and use of the features under the Course Management tab.
- The Resource Management permissions control the management and the use of the features under the Resources tab.
- The Reports permissions control the management and use of the features under the Reports tab in the Administrator user interface.
- The Settings permissions control the management and use of the features under the Settings.

Note: More information on permissions can be found in the *LMS Administration Guide.*

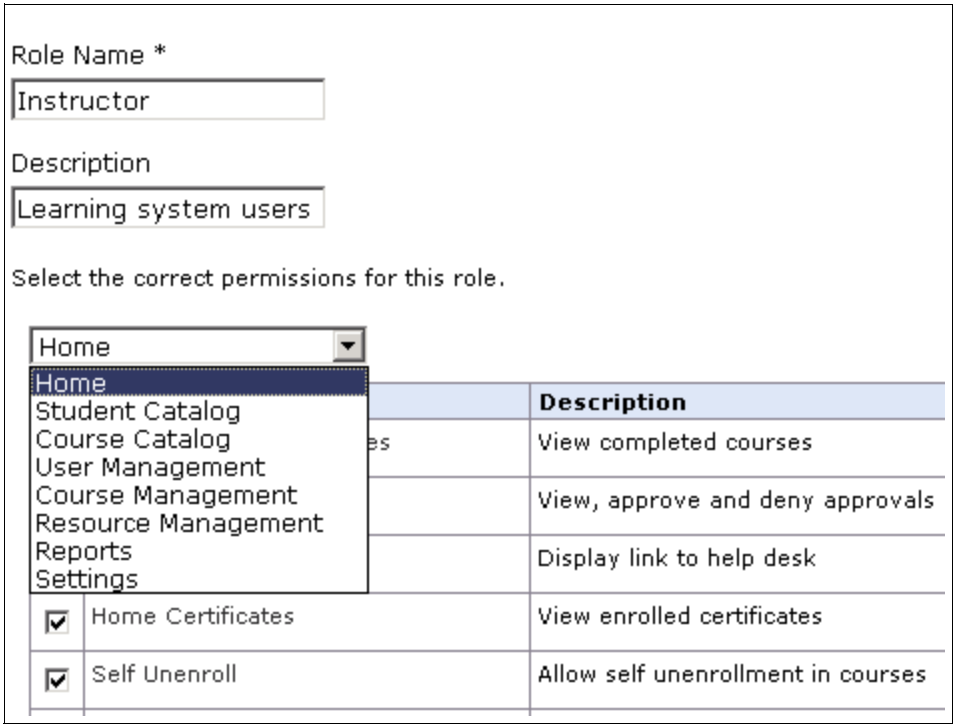

Figure 11-12 Permissions

You can assign a user to more than one role, even roles with very different permissions. Selecting a permission for one role overrides an unselected setting for that permission in another role.

Note: Newly rostered users cannot actually log in until assigned, at a minimum, permission to access the Home module.

11.5 Create profiles

The LMS does not come with default profiles, but it is a good idea to plan and set up profiles before you add users and courses to the system. Start by planning which types of profiles you need and then decide how to group them by category. We recommend that you start with the section of profiles.

Profiles are a descriptive label that can be used in various administrative functions. Profiles are needed for quick enrollment or are used from the

administrative point of view to perform tasks on a group of users rather than one user a time.

We differentiate between two kinds of profiles:

- Auto-enrollment profile: The administrator creates and assigns profiles to the users or groups. It is used to automatically enroll users in courses.
- User Profiles: Profiles created by the administrator. This profile can be used and selected by each user in the section My Profiles.

The procedure for setting up each one is outlined in Figure 11-13.

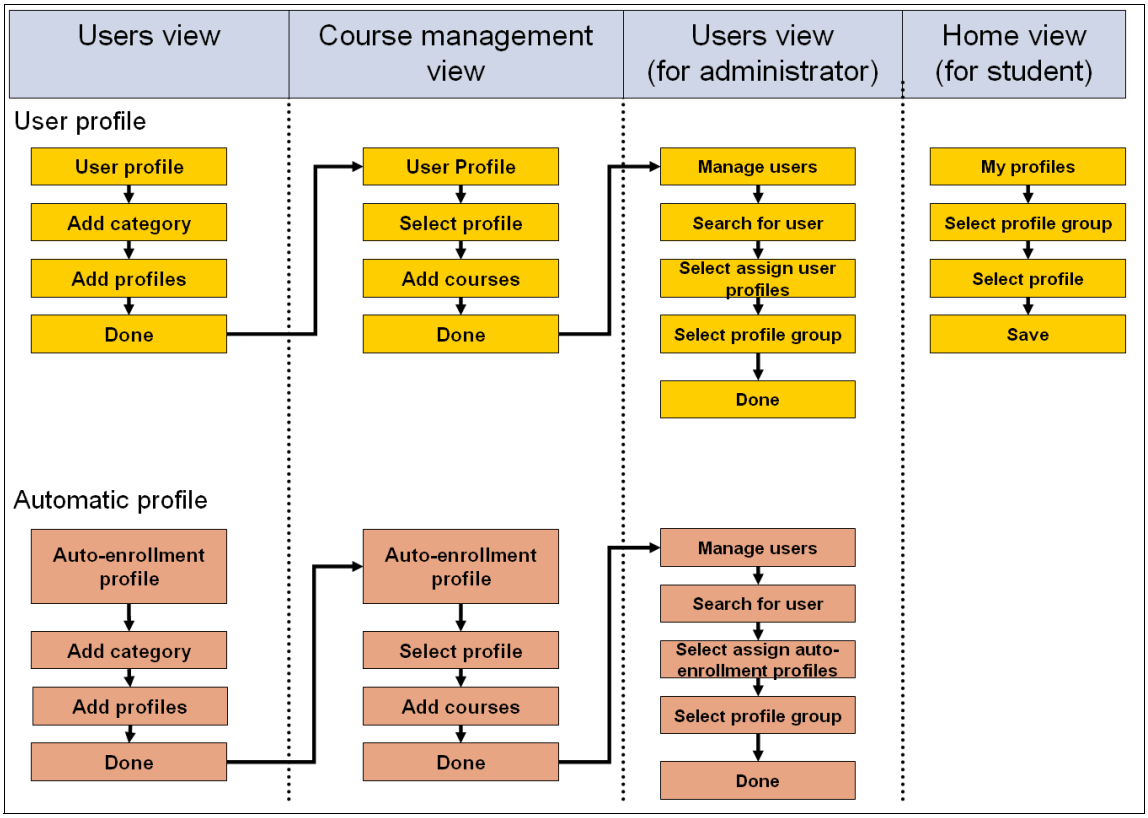

Figure 11-13 Workflow for setting up profiles

Create auto-enrollment profiles

Each profile, either auto-enrollment or user, is part of a category, so create categories before you create the profiles. In the User tab in the section Profiles, click **Auto-enrollment Profiles**. See Figure 11-14 on page 195.

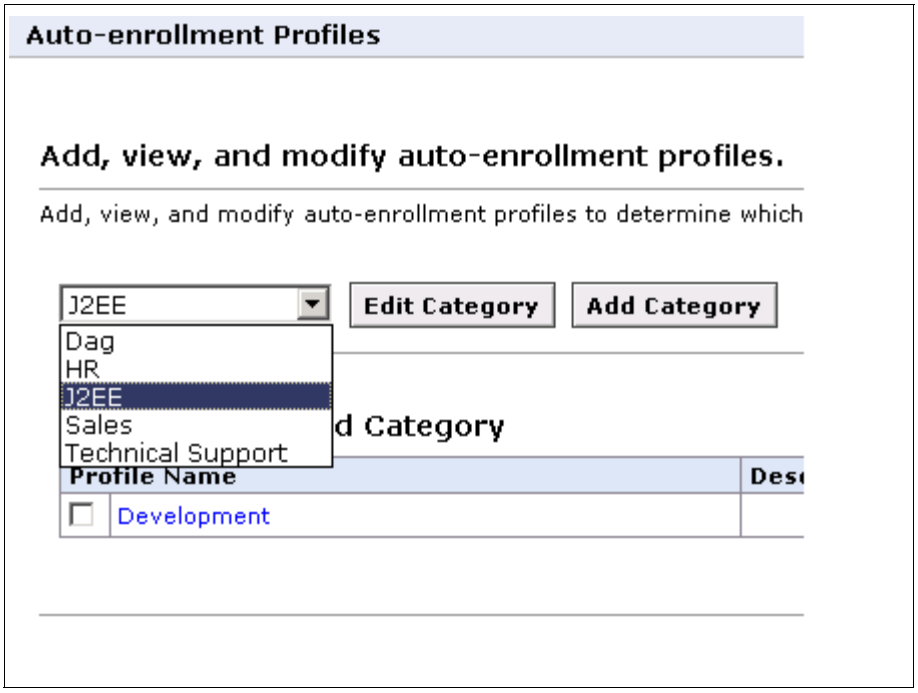

Figure 11-14 Auto-enrollment

When you start rostering and managing users, you can assign them auto-enrollment profiles. This will affect the course enrollment process in your system. Users who are assigned to different kinds of auto-enrollment profiles are automatically enrolled in courses that belong to their profiles. See Figure 11-15 on page 196.

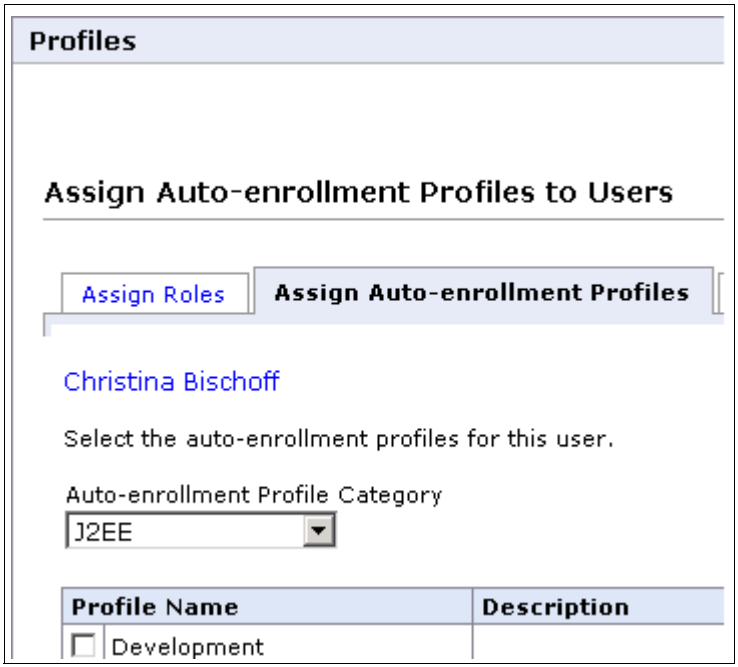

Figure 11-15 Assigning auto-enrollment profiles to users

Note: The *LMS Administration Guide* describes how to create profiles.

Figure 11-16 on page 197 shows how you can add, view, and modify user profiles.

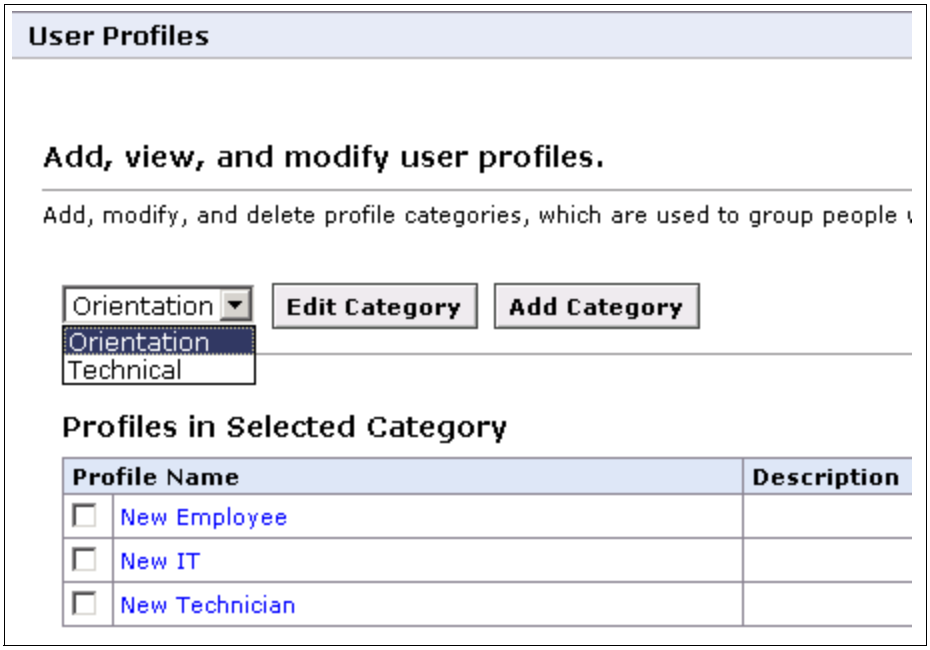

Figure 11-16 User profiles

11.5.1 Rostering users

Adding users to the LMS is called rostering. You can roster and de-roster users in the Users module. See Figure 11-17.

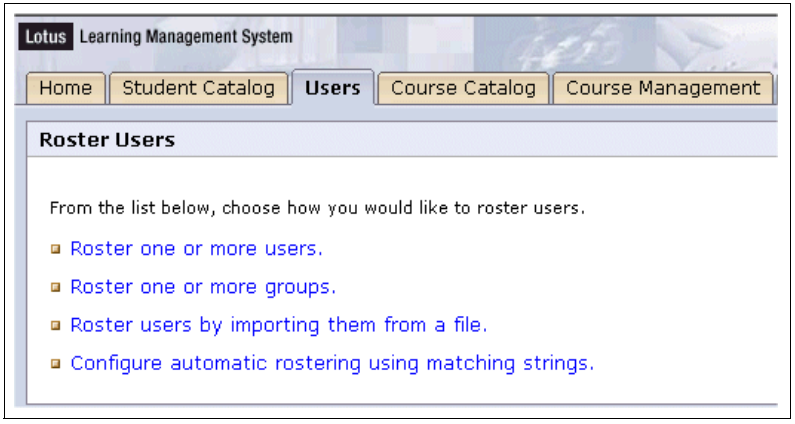

Figure 11-17 Rostering users

The LMS requires a functional LDAP directory. Any user who wants to use the LMS has to be defined in the LDAP directory of its company. The process of adding users to the LMS is called rostering. Rostered users can then log into the LMS and perform whatever tasks you give them permission to.

The LMS assumes that the installed LDAP directory of your company contains all information that describes the users of the system. The LDAP contains an entry for each user that describes the attributes of that user or the group the user belongs to.

The one exception is the anonymous user access. Any user that launches the LMS can access it as an anonymous user as well as users that log in but are not rostered.

You can roster users manually in one of the following ways:

- By selecting individual users from the LDAP directory
- By selecting groups of users from the LDAP directory
- By importing a file that contains a list of users

The first time a user tries to log in, the LMS checks if that user has an entry in the LDAP directory. If the user was previously rostered, his status can be inactive or active.

If the status for a previously rostered user is active, he can continue working in the LMS with all permissions and privileges of the assigned roles he has.

If the status is inactive, the user receives an error message and remains anonymous. That is, the user retains the limited access granted to anonymous users.

If a user has not been previously rostered, the LMS attempts to do so at this time. An administrator can subsequently modify the user´s attributes in the database.

Note: For more information on this topic, see the *LMS Administration Guide.*

11.6 Course catalog

The LMS is very flexible when it comes to setting up the structure of course masters and course offerings folders. In this section, we will look at some of the key features.

11.6.1 Master and course offering folders

There is no limit to the number of levels you can make on a folder tree. On the other hand, a clean, easy-to-understand structure will always pay off. This applies to both the master and course offering folders. You create the folders in the following ways.

Creating a masters catalog

To create a masters catalog:

1. Select the **Course Catalog** tab.
2. Click **Manage Masters Catalog**.
3. If no folders have been added previously, select **Masters Catalog**.
4. If a folder structure is already in place, drill down to the folder where you want to add content.
5. Click **Create Folder**.
6. Add a name and description, then click **Create**.

Creating a course offering catalog

To create a course offering catalog:

1. Select the **Course Catalog** tab.
2. Click **Manage Offerings Catalog**.
3. If no folders have been added previously. select **Offerings Catalog**.
4. If a folder structure is already in place, drill down to the folder where you want to add content.
5. Click **Create Folder**.
6. Add a name and description, then click **Create**.

Figure 11-18 on page 200 shows what it looks like when you roll down from level to level in a catalog.

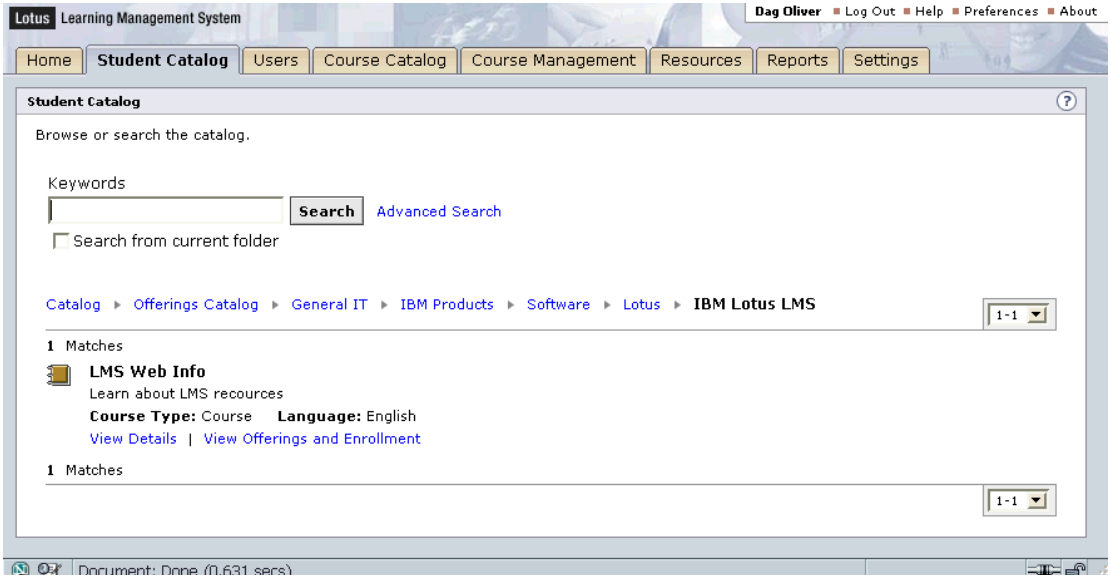

Figure 11-18 Access to all folders

Note: The text string between the search function and the course description will show you exactly where you are in the catalog tree.

Catalog -> Offerings Catalog -> General IT -> IBM Products -> Software -> Lotus -> IBM Lotus LMS

Access control to folders

You must set up access control lists (ACLs) for course folders to allow specified users to read, edit, and manage them and the masters they contain. First define the ACL for the catalog folder, which is the root folder, and then define ACLs for its child folders, all of which inherit its ACL. For example, you may allow all administrators to manage the catalog folder and then specify different access levels for other groups of users on a folder-by-folder basis.

You can find more information on ACLs for the catalogs in the *Learning Management System Administrator's Guide*, Chapter 5, “Assigning access control course offerings folders.”

Having set up the ACLs, the catalog view will vary from user to user. In Figure 11-18 you could see the course catalog with access to all folders. In Figure 11-19 on page 201 you can see the same course, but the user only has access to the Lotus folder.

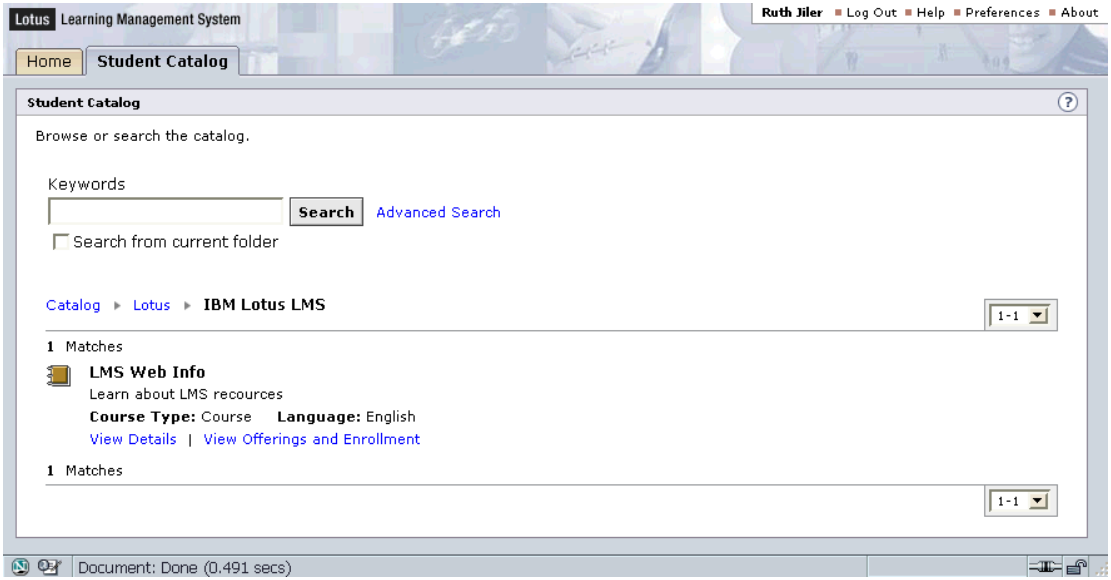

Figure 11-19 Access to limited folders

11.6.2 Creating course entries

There are two main steps to create a course entry. Number one is the master entry and the second is the course entry itself. One course master can be distributed to several course entries. This allows you to set the LMS up so that offerings can be delivered with different properties, such as:

- Different delivery servers
- Different dates
- Different audiences
- Different added tools, like mail, chat, etc.

Add course masters

A course offering must be based on a master, so at least one master must exist in the Masters Catalog before you can create an offering in the Offerings Catalog. To register or create a master, you must be assigned a role with the Manage Masters Catalog permission. Details for setting this up can be found in the *Learning Management System Administrator's Guide*, Chapter 5, “Managing Courses.”

The workflow in Figure 11-20 on page 202 illustrates the process of registering a new course master from an unregistered master. The unregistered master has been uploaded to the LMS either from the Authoring Tool or through CLIMP.

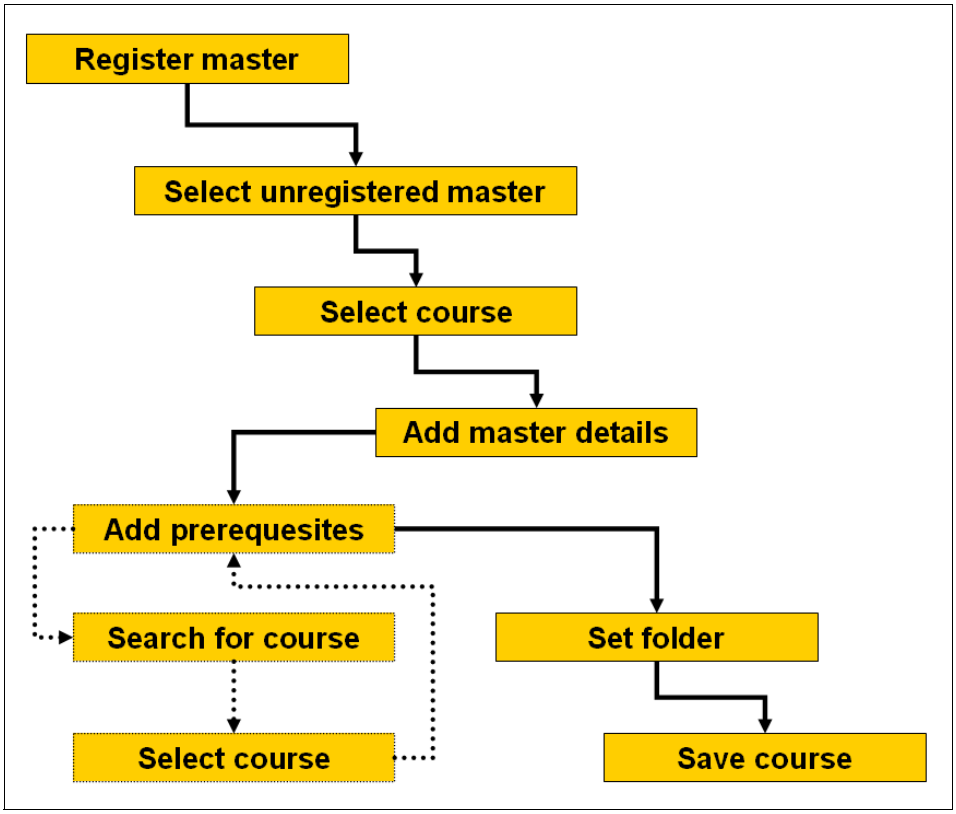

Figure 11-20 Registering a unregistered course master

The process for creating a new master from scratch is very similar. New masters are typically used for setting up physical activities, like training in classrooms or labs. As you see in Figure 11-21 on page 203, the main difference between the two processes is the capability to add booking requirements.

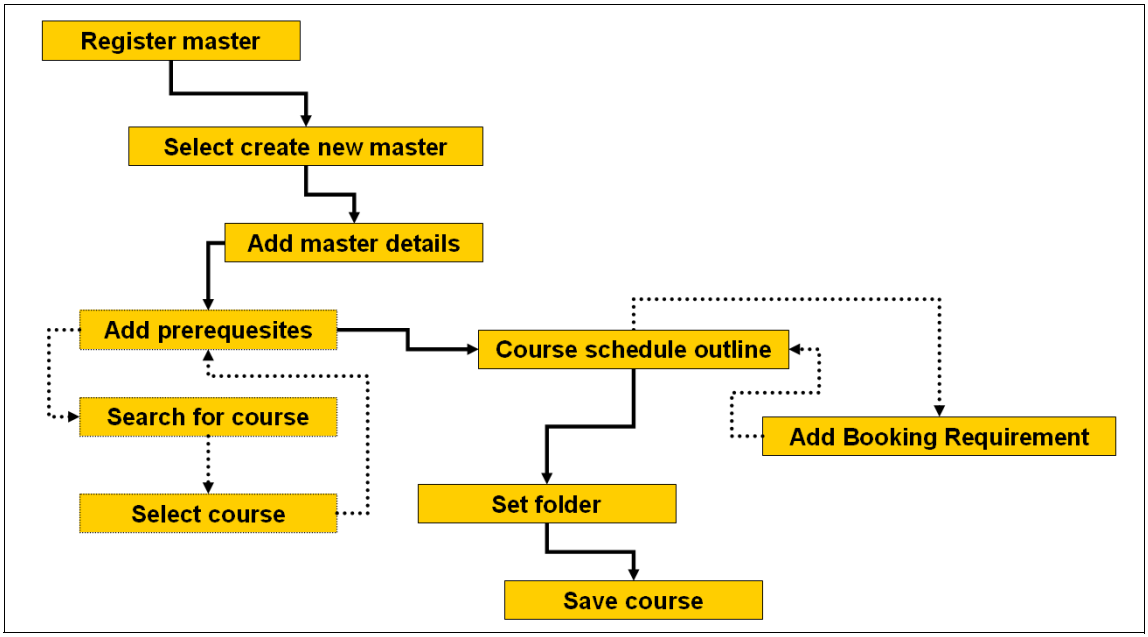

Figure 11-21 Creating a new course master

Registering course offering

The next step is to make the course entries. The process is very similar to creating masters. A course offering is a specific instance of a course created from a master. Course offerings are available to students through the Student Catalog.

When looking at Figure 11-22 on page 204, the workflow to the left illustrates the course offering being set up. If it is a physical course being set up you will then move on to the scheduling of the course. This is illustrated at the right of the figure.

Important: If you delete an active course offering, all students enrolled in the offerings are automatically unenrolled.

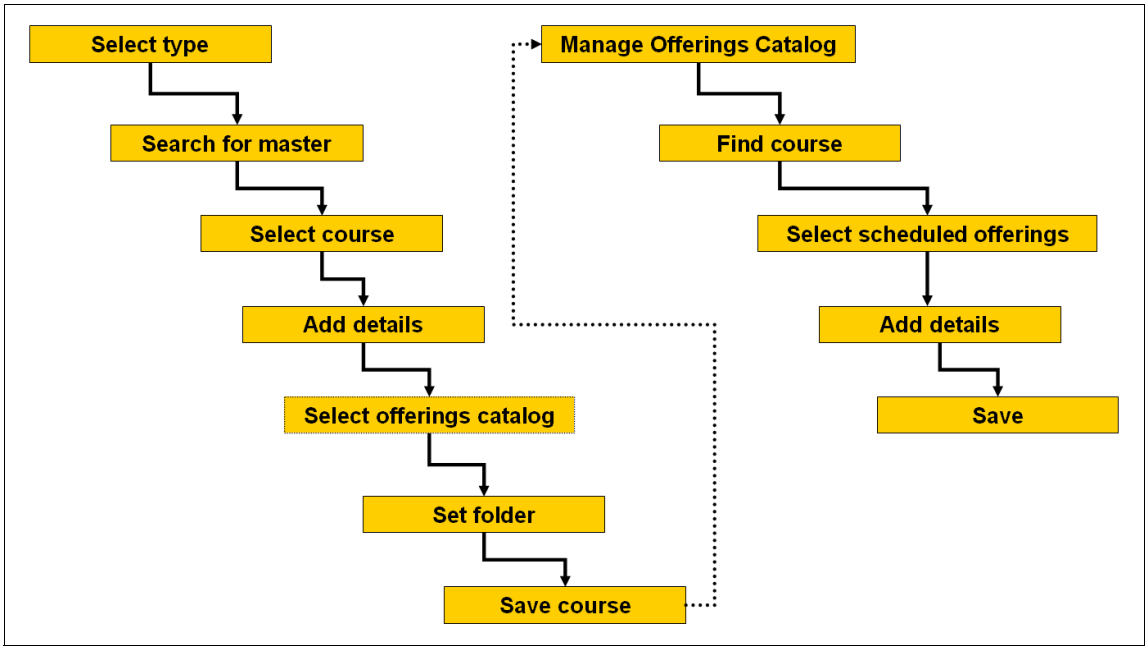

Figure 11-22 Register course offering with scheduling

Scheduled offerings

When scheduling a course you add information to the physical aspects of the offering. A room is a classroom, a conference room, an auditorium, a lab, or other room where instruction will occur. Equipment associated with a room is considered an attribute of the room and can include computer workstations, monitors, overhead projectors, VCRs, and other teaching aids.

Vendors provide instructors and rooms. A vendor may be a department within your company or another company, such as an educational agency.

Instructors are also considered resources. The Learning Management System has the capability to add and manage information concerning instructors, including name and location, skills, schedules, vendor information, instructor group information, and zone information.

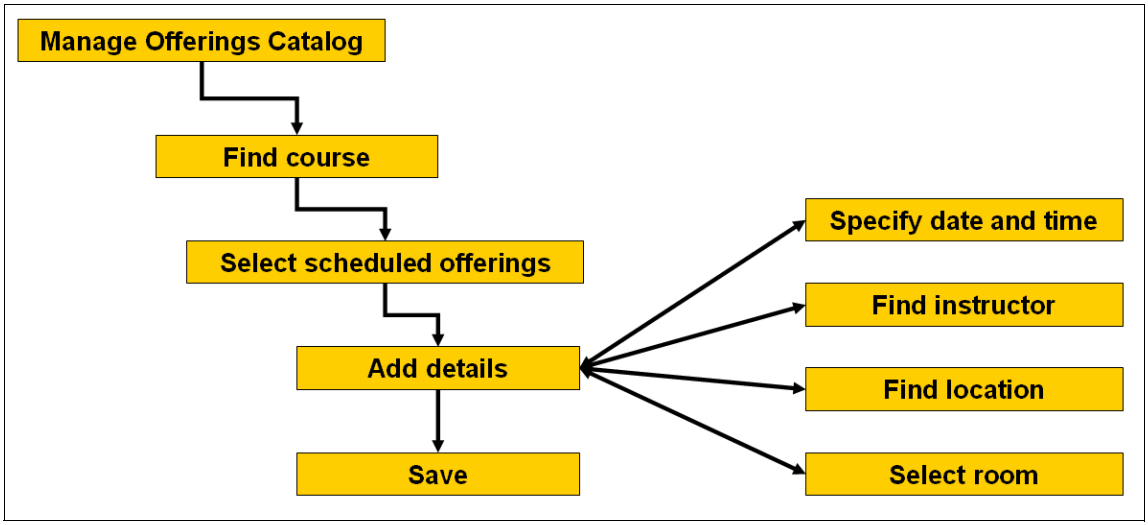

Figure 11-23 Scheduled offering

11.6.3 Curriculums and certificates

Curricula and certificates offer two different ways to group related course offerings for more convenient enrollment and management:

- A curriculum contains courses that are related by subject area or course of learning.
- A certificates contains courses that, when completed successfully, deem a student certified in an area of expertise.

Certificates also carry optional expiration dates to force students to repeat the requisite courses after a certain amount of time. You build curricula and certificates by creating curriculum or certificate masters in the Course Catalog with the "Register a Master" command. Then use the "Register Course Entry" command to add prerequisites and course offerings that are to be included. The Curriculum or Certificate course entry becomes part of the Offerings Catalog and appears in the Student Catalog. When students enroll in a curriculum or certificate, they enroll in all its associated course offerings.

Notice that the only difference between the curricula in Figure 11-24 on page 206 and the certifications in Figure 11-25 on page 207 is the capability to add dates to the process.

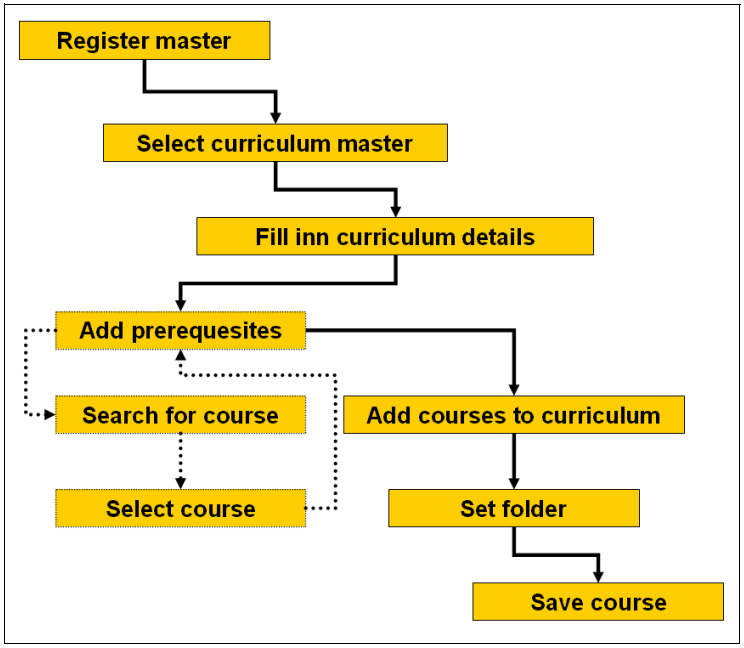

Figure 11-24 Registering a curriculum master

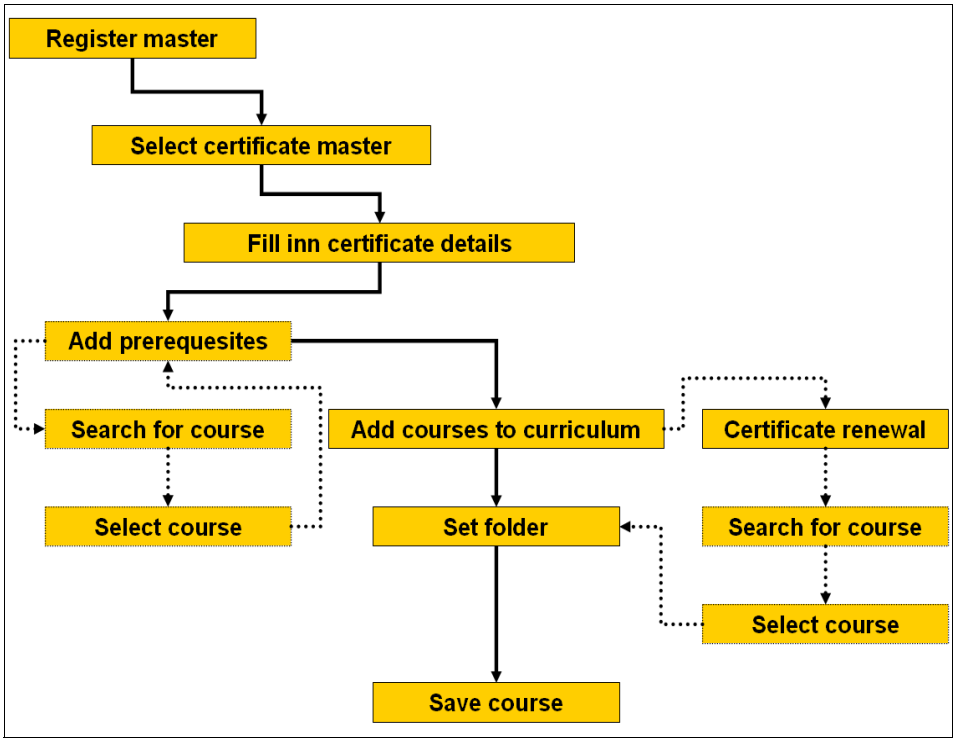

Figure 11-25 Registering a certificate master

12

Customization

This chapter provides examples of customization possibilities within your LMS. The information supplements the *LMS Customization Guide* that comes with LMS.

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12.1 Introduction

The main source of information regarding customization of LMS is the *LMS Customization Guide* that is delivered with the product. Check for the latest version of this guide on the following Web site (under Documentation Library):

http://www.lotus.com/ldd/

This guide requires a basic knowledge of Cascading Style Sheets, Java Server Pages, and HTML.

This chapter describes some additional examples of customizations. An example of a customization set is also provided on the ITSO Web site, as additional material to this publication on the following Web site (as additional material):

http://www.ibm.com/redbooks/abstracts/sg247028.html

In this chapter, we explain how to set up this customization set. Regarding additional customizations, the following topics are covered:

- How to change LMS logo text
- How to add a user count functionality to the LMS welcome page
- How to add a payment option during course enrollment

12.2 Introduction to customization sets

You can create alternate versions of the application and send selected users to one of these rather than to the default interface when they log in. To do this:

1. Copy the directories containing the files you want to change (or replace) into a directory structure that mimics your original.
2. Make your changes.
3. In the Administrator interface, specify the location of the customized files and the users to whom the interface that they define is applicable.

These alternate sets of files, along with the information concerning their location and use, are called customization sets.

The advantage of customization sets is that you can tailor the application's look, feel, and functionality for different sets of users rather than having to make global changes that affect all users. For example, you might want to create customization sets for different users based on their membership in one or the other of two different LDAP groups, providing one user interface and feature set for, say, users belonging to the Sales group and another for users in the Development group.

Further information regarding customization sets can be found in the *LMS Customization Guide*.

12.2.1 Define customization sets

It is important to plan which groups of users will be affected by customization sets, as only a single customization set can be in effect for a particular user. For example, you can choose to align the customization sets with departments and LDAP attributes used to identify the groups of users.

You can use several LDAP attributes for the matching string that belongs to a customization set.

If you would like to use a different logo before and after login, you can specify for the set before using the matching string:

```
Name - cn=anonymous
```

This will match any user not authenticated to the system.

For the other logos, you can use as a matching string the company or department name:

```
Attribute - CompanyName="Magic"
```

If users log into the LMS and do not match the company, they will see the default branding logo.

To keep the logo available for all parts of the application, you will have to copy the customization set both to the LMM and DS WebSphere servers.

12.2.2 Test customization sets

If you are planning a JSP customization set change, be careful. Since the JSPs you are modifying are the basis of the application, it is very easy to create a customization set with faulty JSPs and therefore render the LMS unusable for that subset of users.

Once the customization sets have been created, the WebSphere servers must be restarted. Once they are restarted, the customization sets will be cached by the LMS. Any changes made to the customization set at this point will be active after 60 seconds, as the LMS updates its customization set cache every 60 seconds.

Once everything is complete, log in as a user to verify that the customization is working correctly.

Also, it is a good idea to test launching a course for users affected by customization sets, since customization sets can affect delivery servers as well. If a customization set works when a user logs in, but the launch of the course fails, there is a problem with the location of the files on the delivery server.

12.3 Replacing the application logo and text

A simple but effective customization technique is to change the logo and text that you display to your users. This is done with a branding logo customization set.

12.3.1 Replacing the logo

LMS displays, in the header of the application pages, the standard IBM Lotus Learning Management System logo. On both the LMM and DS server, the logo can be changed to your requirements.

In the *LMS Customization Guide*, a specific section called “Replacing the application logo” provides all details of how you can make this change.

Here is the original branding logo:

Figure 12-1 Original branding logo

To replace the branding logo, you need a GIF logo to display in the place of the default logo. This new logo should be the same size (209 x 22) as the original graphic and should support transparency. The logo can be of a different size, but this is not recommended as it may throw off the design of some of the LMS pages.

There are many methods that can be used to create the GIF files required with transparency. For a tutorial when using Paint Shop Pro, see:

`http://www.jasc.com/tutorials/tgif.asp`

Image customization set and logo customization

It should be noted there are two ways in which a branding logo customization could be implemented. The LMS supports image customization sets as well as branding logo customizations. The difference is that an image customization set is a larger, more comprehensive change to the LMS.

An image customization set requires that all graphics used within the LMS be copied into the customization sets’ images directory. These image files can then

be modified at will. You can in effect create a new “skin” for the LMS using this method. In this case you are required to copy *all* images, not just the ones you wish to modify and use. This is because once the LMS determines a user matches a certain customization set upon login, the HTML pages generated during that session will refer to the customization set image directory, not the default image directory.

A branding logo customization set only requires a single file, the new branding logo. This is appropriate if you only want to perform simple branding. Besides, this method takes the least amount of disk space and effort. To use this option, while defining the customization within the LMS administrative screens, define the specific logo file within the field for the logo URL.

Therefore, if you only want to change the branding logo displayed in the upper left corner of LMS pages, use a branding logo customization set. If, however, you want to change every image, or images other than just the branding logo, you must use an image customization set.

12.3.2 Replacing the text

The help text that displays when a user moves the mouse over the branding logo is by default “IBM Lotus Learning Management System”.

If you change the logo, you probably also want to change the text for the users to match the text to the new logo.

The help text for images is kept within the properties files. Since the LMS supports multiple languages, there is a properties file for each language. If multiple languages are used, each of these language properties files must be edited in order for the help text to match the branding logo.

As an example, the file below is the English properties file:

```
..\resources\lmm\test\ApplicationResources.properties
```

Note: Test is the name of the customization set.

Within the properties file, find the line:

```
image.alt.logo = IBM Lotus Learning Management System
```

This can be changed to the required text.

12.4 Install the ITSO sample customization set

An example of a customization is provided on the ITSO Web site, as additional material to this publication (under additional material):

http://www.ibm.com/redbooks/abstracts/sg247028.html

In this section we explain how you can deploy and test this customization set.

12.4.1 Introduction

This specific customization set has been created for Microsoft Internet Explorer (IE) and the English language. When you test it out, use the IE. The user interface may not appear similarly in the Netscape Navigator. In addition, change the language preferences to English. Otherwise the UI will not be displayed in the correct manner. These requirements are necessary because only the CSS-files for IE and the English language have been modified.

To deploy the customization set, take the following steps:

1. Extract the customization set and copy the customization set to the appropriate directories.
2. Register the new customization set.

During this example, we will call this customization “test”.

12.4.2 Extract the customization set

The customization set file is LMSCustomizationSet.zip. This zip file consists of two files:

- lmmwebd.zip
- lmmresourced.zip

These files are typical for a customization set. The set consists of two main directories, the LMM Web Directory and the LMM Resource Directory. The LMM Web Directory contains JSP-files, CSS-Files, Javascript-Files, and the graphic collection and is structured as shown in Figure 12-1 on page 212.

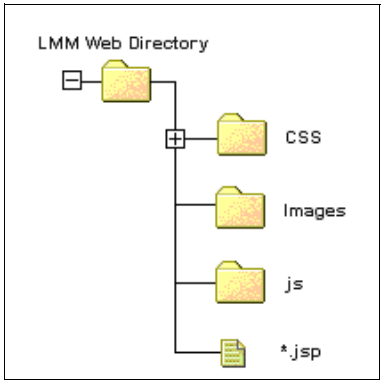

Figure 12-2 LMM Web directory structure

In the LMM Resource Directory, you can find the properties and templates. It is structured as shown in Figure 12-3.

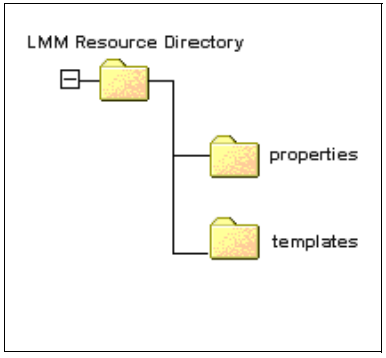

Figure 12-3 LMM Resource directory structure

To deploy the customization set, extract the lmmwebd.zip-file and copy the contents to:

```
<WAS_install_path>\installedApps\<NODE>\<LMM_App_Name>.ear\lms-lmm-complete
-23.war\test
```

Also extract the lmmresourced.zip file and copy the contents to:

```
<WAS_install_path>\installedApps\<NODE>\<LMM_App_Name>.ear\lms-lmm-complete
-23.war\WEB-INF\classes\resources\lmm\test
```

These steps install your LMM Web Directory and your LMM Resource Directory.

Your directory structure should match the structure shown in Figure 12-4 on page 216.

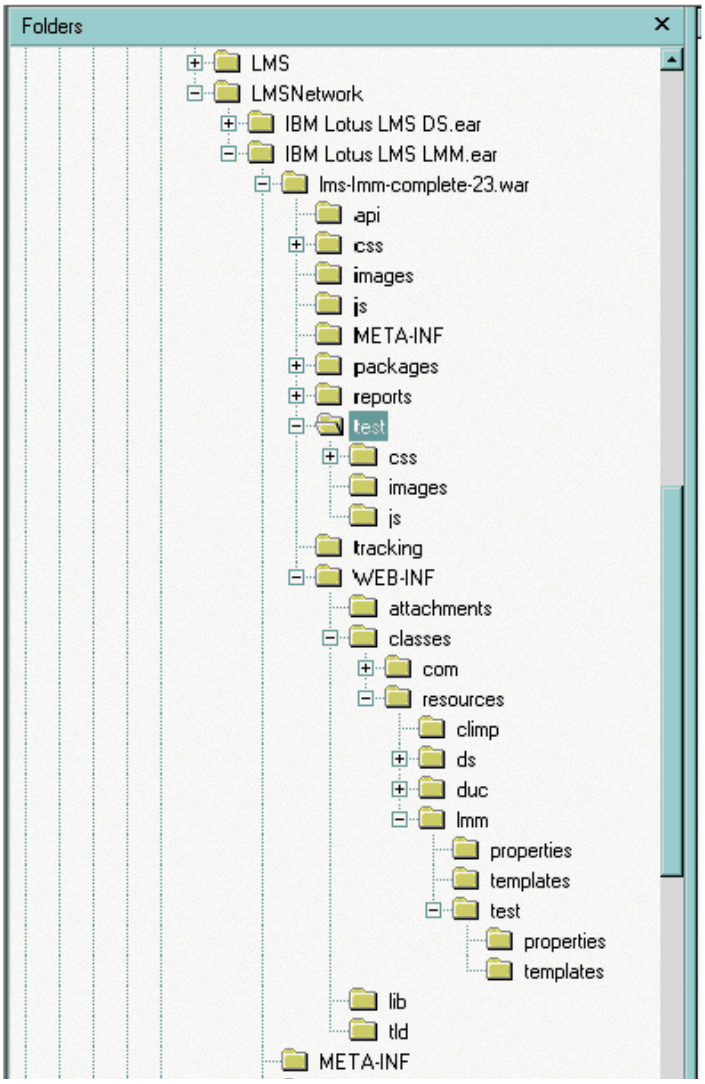

Figure 12-4 Directory structure of the deployed customization set

12.4.3 Register the new customization set

Register the customization set “test” and define which users or user group should take part in the new UI. To do this, log into LMS as an administrator and register the customization set as follows: Click **Settings**, open the link named Manage

Customization Sets (see Figure 12-5), and use the button **Add** to open the Menu for adding the new customization set (see Figure 12-6 on page 218).

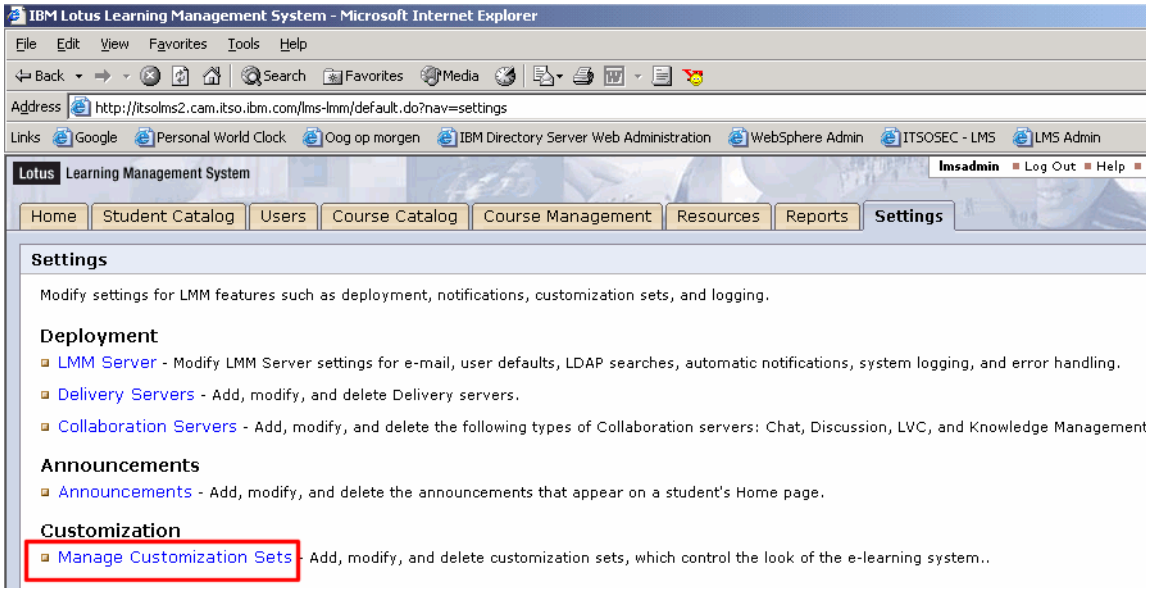

Figure 12-5 Manage customization sets

To define the new customization set, define the following fields (in Figure 12-6 on page 218):

- Title: The LMS internal name, which gives you the opportunity to manage the sets afterwards.
- LMM Resource Directory: The name of the LMM Resource Directory (test for our set).
- LMM Web Directory: The name of the LMM Web Directory (test for our set).
- Delivery Server Settings: Keep blank; only used if customization of the DS has been performed.
- Matching String and String Type: Define the matching string to allocate the users who should benefit from the new UI.

  You can choose a name, attribute, or the membership in a special group.

  For example:

  - Matching String Type: Name
  - Matching String: uid=lmsadmin
- Logo and Logout screen: To define customized logo and logout screen.

- Checkboxes: Activate the checkboxes of the features you want to adopt from the customization set.

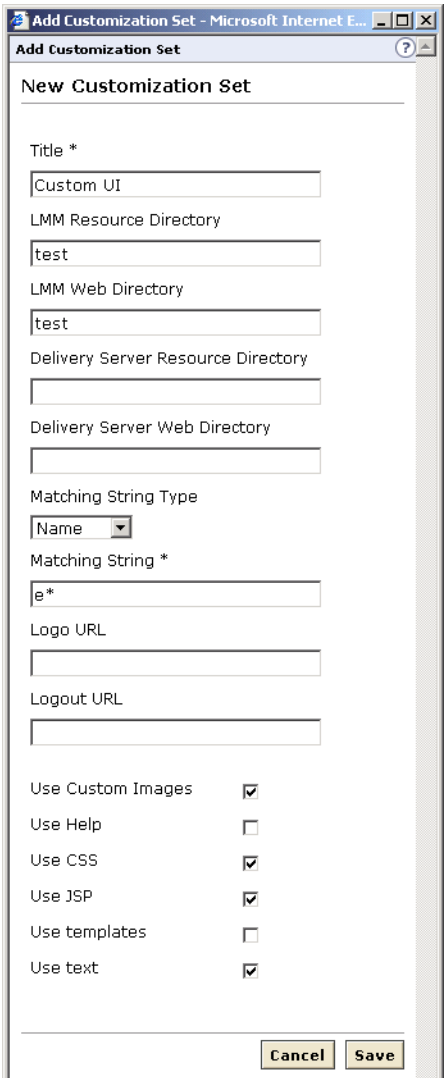

Figure 12-6 New Customization Set window

For this test customization set, activate the following checkboxes:

- Use CSS
- Use text
- Use Custom Images
- Use JSP

Save the changes and click **Done**. This will activate the customization set.

12.4.4 Deployed customization set

After the changes, your UI should have a look and feel similar to Figure 12-7.

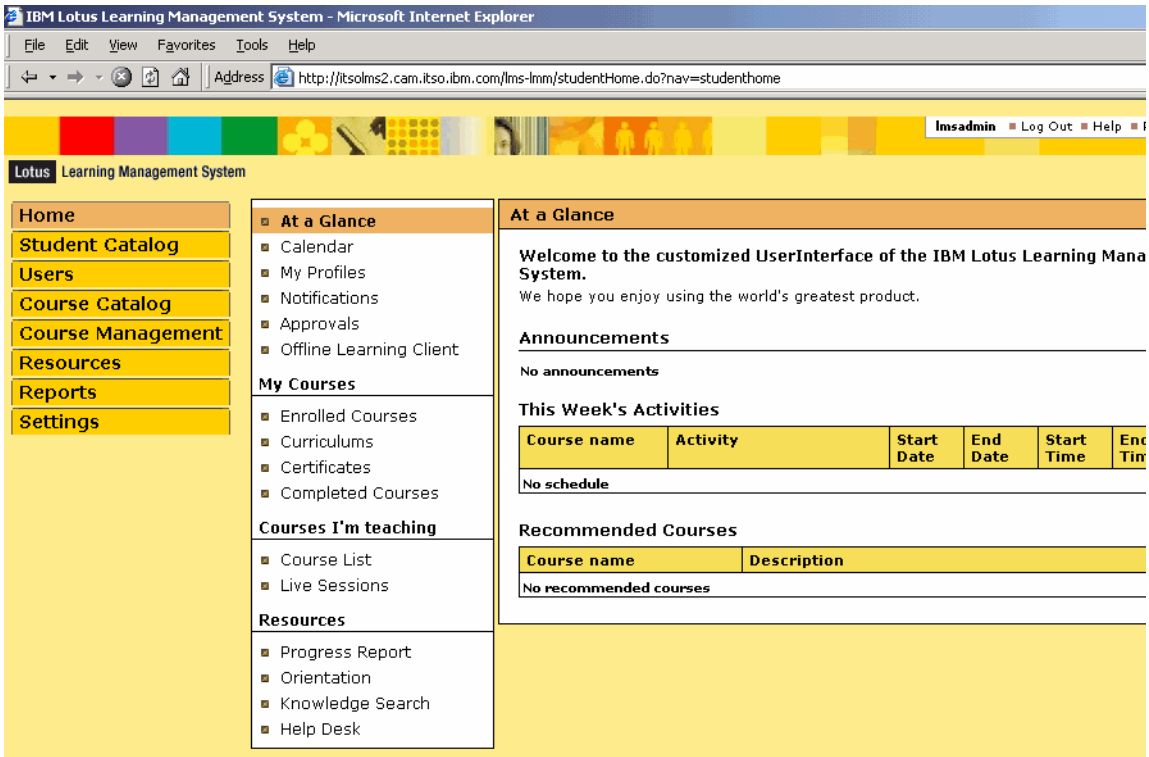

Figure 12-7 Result of the new customized UI

12.5 Displaying an online users counter

In this section we describe how you can display the number of currently logged-on users to the LMS on the user's welcome page. To do this, we create a separate JSP file that actually counts the users and then we embed this one at the right place in the welcome screen JSP file.

Note: Using this online counter might decrease the performance of your LMS system. If you experience a noticeable performance decrease, remove the counter.

Perform the following steps:

1. In the directory containing the JSP files for the customized set (that is, <WAS_install_path>\installedApps\<NODE>\<LMM_App_Name>.ear\test), create a JSP file called usersOnline.jsp with the following content:

```
<%@ page import="java.util.*" %>
<%@ page import="javax.servlet.*" %>
<%@ page import="javax.servlet.http.*" %>
<%@ page import="java.lang.reflect.*" %>
<%@ page import="com.ibm.ws.webcontainer.httpsession.*" %>
<%
try {
Field f;
int lmsUserCount = 0;

SessionData currSessData = (SessionData)request.getSession();
f = currSessData.getClass().getSuperclass().getDeclaredField("mManager");
f.setAccessible(true);
SessionContext sessContext = (SessionContext)f.get(currSessData);
f = sessContext.getClass().getSuperclass().getDeclaredField("mSessions");
f.setAccessible(true);
SessionSimpleHashMap sessions = (SessionSimpleHashMap)f.get(sessContext);

Iterator it = sessions.keySet().iterator();
while(it.hasNext()) {
  SessionData sess = (SessionData) sessions.get((String) it.next());
  Object sessUser = sess.getValue("user");
  if(sessUser instanceof com.lotus.elearn.user.User) {
    if(!((com.lotus.elearn.user.User) sessUser).isAnonymous()) {
      lmsUserCount++;
    }
  }
}
%><div style="background-color:#FE0000;font-size:10pt;font-weight:bold">
<%=(lmsUserCount>1 ? ""+lmsUserCount+" users are online." :
(lmsUserCount==1 ? "One user is online." : "Nobody is online."))%>
</div><%
} catch (Exception e) {}
%>
```

2. In the same directory, open the studentWelcome.jsp with Notepad and locate the following text block:

```
  <lms:spacer width="1" height="10" /><br>

<%--
Announcement header
--%>
```

3. Directly before <%-- Announcement header --%> insert the following line, which will embed response text from the usersOnline.jsp at this position.

   ```
   <jsp:include page="usersOnline.jsp" />
   ```

4. Test the counter by logging onto LMS.

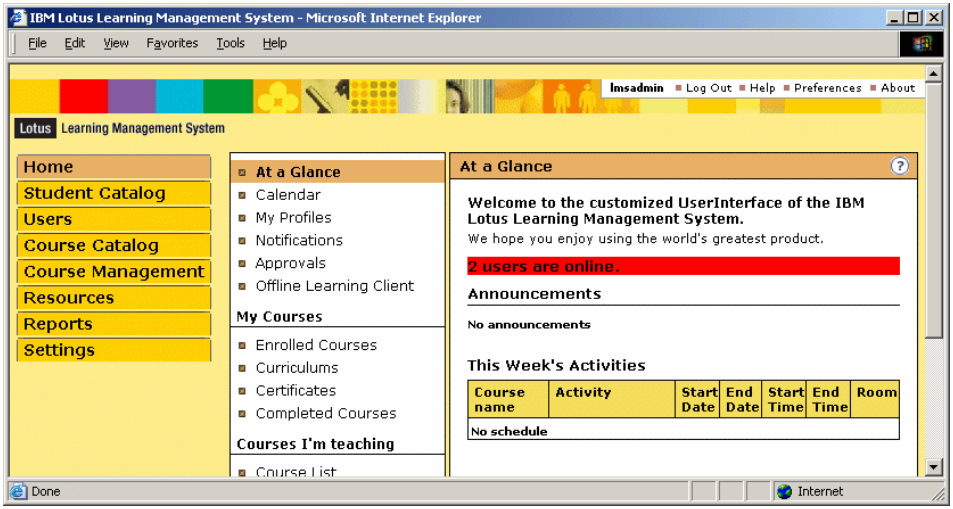

Figure 12-8 Welcome page with user's online counter

12.6 Payment method capturing

In this section we describe how you can intercept the course enrollment to capture payment information from each of their users as they enroll in a course. No details of the payment gateway and the connection to it are provided as this is outside the scope of the publication.

12.6.1 JSP modifications

For the payment method capture modification, we need to modify the Enroll button. This is the button that the users see when self-enrollment is activated for a course.

Modifying this enroll button allows us to direct the users to a new screen to collect and store the payment information and then complete the enrollment.

To do this, we first need to find the JSP that contains the Enroll button. Here are some steps to follow to find this JSP:

1. Open up the page with the Enroll button in the browser.

2. Move your mouse over the Enroll button.
3. Make note of the text that is written to the status bar (such as `Enroll in course`).
4. Open up Windows Explorer on the LMM Server, or an equivalent file browser on other operating systems.
5. Search for the `Enroll in course` text string in *.properties files. In our case you will find ApplicationResources.properties, under the resources\lmm\properties directory.
6. Find the text `Enroll in course` in the .properties file that you just found.

   ```
   <identifier> = "Enroll in course"
   ```

   You will find StudentCatalog.enrollButton = “Enroll in course”.
7. Search for the identifier text from step 7 in the JSPs for the customization set and this will give you the JSP you need to modify.

   You should find four StudentCatalog-jsps. We will change studentCatalogEntryOfferings.jsp.

We suggest that you create a custom set for the web-directory, so you change the jsps as part of the customization set (see Figure 12-1), instead.

We can now create our first custom code to capture the payment information. In our case we will use a Lotus Domino form to do this.

Once the payment database with the form is ready for users, we will need to change the current Enroll button. We want it to send the user to our payment form. We will comment out the current Enroll button code, and put in our new "Proceed to payment" button.

The buttons in the LMS are not actually buttons, but tables with images made to look like buttons with a link. They are generated from JSP tags defined in a Tag Library Descriptor (TLD). We will not generate our new button with a tag. So instead, we view the html source of the page where the Enroll button is shown to the user and search for the code for the Enroll button. This way we can copy and paste the actual html that the tag generates and make the required changes.

Example 12-2 on page 223 is an example of the adjusted studentCatalogEntryOfferings.jsp. At the part that is commented out, replace it by the code in Example 12-1. In this part, a connection to a Lotus Domino form is being called to handle the payment.

Example 12-1 Code to add new button

```
<!--  Code commented out for payment customizations
```

```
      <div class="btnStudentCatalogEnroll">
         <lms:studentEnrollButton offering="<%=currentOffering%>"
permissionName="Self_Enroll" captionKey="button.enroll"
tooltipKey="studentCatalog.enrollButton" />
      </div>
```

Example 12-2 Sample from studentCatalogEntryOfferings.jsp

```
-->

      <div class="btnStudentCatalogEnroll">
      <table border=0 cellspacing=0 cellpadding=0>
      <tr valign="bottom">
      <td class="btnSecCornerTopLeft" width=1 height=1><img
src="/lms-lmm/images/btnPrimAction_UpperLeft.gif" width=2 height=2
alt=''/></td>
      <td class="btnPrimBorderTop"
background="/lms-lmm/images/btnPrimAction_TopBorder.gif" height=1
colspan=3><img src='/lms-lmm/images/px.gif' width='2' height='2' alt=''
border='0'></td>
      <td class="btnSecCornerTopRight" width=1 height=1><img
src="/lms-lmm/images/btnPrimAction_UpperRight.gif" width=2 height=2
alt=''/></td>
      </tr>
      <tr>
      <td class="btnPrimBorderLeft"
background="/lms-lmm/images/btnPrimAction_LeftBorder.gif" align="left"
width=1><img src='/lms-lmm/images/px.gif' width='2' height='2' alt=''
border='0'></td>
      <td class="btnGeneralLable" id="btnPrimAction" colspan=3 nowrap><span
class="btnGeneralLable" id="btnPrimAction"><img src='/lms-lmm/images/px.gif'
width='5' height='2' alt='' border='0'><a class="btnGeneral" id="btnActive"
onMouseOver="window.status='Proceed to payment options';return true;"
onMouseOut="window.status=''; return true;" title="Enroll"
href="javascript:document.forms['studentCatalogForm'].userEvent.value='navigati
on';document.forms['studentCatalogForm'].subMode.value='courseOfferings&Oid=<%=
currentOffering.getOid()%>&Otitle=<%=currentOffering.getTitle()%>';document.for
ms['studentCatalogForm'].action='/studentreg.nsf/payment?OpenForm';submitForm('
studentCatalogForm');">Proceed to payment</a><img src='/lms-lmm/images/px.gif'
width='5' height='2' alt='' border='0'></span></td>
      <td class="btnPrimBorderRight"
background="/lms-lmm/images/btnPrimAction_RightBorder.gif"  align="right"
width=1><img src='/lms-lmm/images/px.gif' width='2' height='2' alt=''
border='0'></td>
      </tr>
      <tr valign="top">
      <td class="btnSecCornerBottomRight" width=1 height=1><img
src="/lms-lmm/images/btnPrimAction_BottomLeft.gif" width=2 height=2
alt=''/></td>
```

```
      <td class="btnPrimBorderBottom"
background="/lms-lmm/images/btnPrimAction_BottomBorder.gif" height=1
colspan=3><img src='/lms-lmm/images/px.gif' width='2' height='2' alt=''
border='0'></td>
      <td class="btnSecCornerBottomLeft" width=1 height=1><img
src="/lms-lmm/images/btnPrimAction_BottomRight.gif" width=2 height=2
alt=''/></td>
      </tr>
      </table>

      </div>
```

Now we are at a point where certain users will no longer see the normal enroll button from the LMS. Instead they will see our “Proceed to payment” button, and when they click this button, the users will be redirected to a Lotus Domino form where they can provide the payment details.

After the users have completed the Domino form, we need to enroll the user using the LMS API, then redirect the user to the initial LMS Web page.

12.6.2 Domino Agent

Example 12-3 contains sample code to enroll the user once the payment form is submitted into Domino.

This is only a framework for developers to use as a starting point. For example, not all the return pages are defined yet in the code below.

Example 12-3 Code

```
import lotus.domino.*;
import org.apache.axis.client.*;
import javax.xml.namespace.QName;
import javax.xml.rpc.ParameterMode;
import java.net.URL;

public class LMSEnroll extends AgentBase {

   public void NotesMain() {

      try {

         // Set up the notes session, and context
         Session session = getSession();
         AgentContext agentContext = session.getAgentContext();

         // Current database
         Database db = agentContext.getCurrentDatabase();
```

```
          // Document that was submitted
          Document doc = agentContext.getDocumentContext();

          // Values we need from the document
          String uid = doc.getItemValueString("uid");// user id
          String oid = doc.getItemValueString("OfferingID");// offering id

          // We can not continue if the offering id is blank
          if ( oid.equals("") ) {
             doc.replaceItemValue("IsTemp", "1");// mark this doc as temp
                    getAgentOutput().println("<h1>Validation
Error</h1><br>No offering selected.  You must select an offering to enroll in.
");
                getAgentOutput().println("<a
href='javascript:history.back(1)'>Click here to try again</a>");
             return;
          }

          // Payment method they selected
          String payType = doc.getItemValueString("paymentMethod");

                // Convert that to an integer for the switch below
                int i = Integer.valueOf(payType).intValue();

                // determine what to do based on payment selection
                switch (i) {

                case 0:// No payment type was selected ( should not be possible
)
                   doc.replaceItemValue("IsTemp", "1");// mark this doc as
temp
                getAgentOutput().println("<h1>Validation Error</h1><br>No
payment type selected.  ");
                getAgentOutput().println("<a
href='javascript:history.back(1)'>Click here to try again</a>");
          return;

                case 3:// We need to get approval, redirect to the approval
page.
                   doc.replaceItemValue("Status", "Pending");// set the status
to pending
          getAgentOutput().println("[[" + db.getFilePath() +
"/startNotice?ReadForm]]");
                return;

                default:// Enroll the user in the course
                if (enrollUser(uid,oid)) {
```

```
                        doc.replaceItemValue("Status", "Enrolled");// set the
status to enrolled
            getAgentOutput().println("[[" + db.getFilePath() +
"/successEnroll?ReadForm]]");
//                getAgentOutput().println(uid + " successfully enrolled in
offering " + oid + ".");
                } else {
                        doc.replaceItemValue("IsTemp", "1");// mark this doc as
temp
                        doc.replaceItemValue("Status", "Error");// set the
status to error
             getAgentOutput().println("[[" + db.getFilePath() +
"/unsuccessEnroll?ReadForm]]");
//                getAgentOutput().println("Error enrolling user " + uid + " in
offering " + oid + ".");
              }
                return;

                }

      } catch(Exception e) {
         e.printStackTrace();
      }

   }

   private boolean enrollUser(String uid, String oid) {

      // Enroll the user in the course

      try {

         URL url = new URL("http://<<DOMAIN_NAME_HERE>>/lms-lmm/anon-api");

              //System.out.println("LMS Server: "+ url.getHost());

         // Set up call
         Service service = new Service();
         Call call = (Call) service.createCall();
         call.setTargetEndpointAddress(url);
         call.setUsername("lmsadmin");
         call.setPassword("password");

         String NS_XSD = "http://www.w3.org/2001/XMLSchema";
         QName QNAME_TYPE_STRING = new QName(NS_XSD, "string");

         call.addParameter("user_id", QNAME_TYPE_STRING, ParameterMode.IN);
         call.addParameter("offering_id", QNAME_TYPE_STRING,
ParameterMode.IN);
```

```
          String [] params = { uid, oid };

          call.setReturnType(QNAME_TYPE_STRING);

          call.setOperationName(new QName("LMSEnrollmentAPI",
"enrollOfferingForUser") );
          call.invoke(params);

          return true;

       } catch(Exception e) {
          e.printStackTrace();
          return false;
       }

   }

}
```

13

Custom reports

You can add your own custom reports to the Learning Management System, using JReport Designer™, a client application that is external to the Learning Management System. In this chapter we provide information about JReport Designer and how to create custom reports.

As of the writing of the publication, no details were available regarding the data model of the LMS, so this chapter focuses on customizing existing reports. The data model will be made available at a later stage as part of the documentation set for the LMS.

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13.1 Introduction

The Learning Management System is delivered with pre-defined reports that can be used by the users that have the appropriate permissions. Using roles and permissions, you can determine who can run a report. For more information, see Chapter 11, “Configuring LMS” on page 177.

Reports are created by the JReport reporting engine from Jinfonet that is embedded in LMM. The administrator interfaces with JReport by using the JReport Designer client.

LMS includes the ability to download and use up to three copies of JReport Designer by Jinfonet Software, Inc. However, these copies of JReport Designer are solely for your use with LMS, and are not for standalone use.

In this chapter we install and use the JReport Designer to create a custom report for LMS.

13.2 JReport overview

To create custom reports you will need the following:

- JReport Designer software and the install key
- LMM database
- LMS-supported database client (such as DB2 Connect) that provides you with a connection to your LMM database
- Working knowledge of SQL for your LMM database

You can add your own custom reports to the Learning Management System by performing the following tasks:

1. Create the new report in JReport Designer, a client application that is external to the Learning Management System.
2. Create a new catalog for your custom reports. This should be done, as LMS product updates will overwrite the shipped catalogs. After you have done this for your first custom report, subsequent custom reports can share the new created catalog.
3. Create a custom report template. The predefined reports can also be used as starting points for creating additional custom reports, by editing a copy of the original template.
4. Manually enter information about each report in the Learning Management System file, called reports.xml.

5. If you have a clustered server environment, copy the report catalog, template files, and the updated reports.xml file to each server in the cluster.
6. Restart the Learning Management System server. If running a cluster of servers, you must restart each one.

The data source for LMS reports is the LMM database. The DS database and LDAP cannot be used.

13.3 JReport installation

Here is a summary of the steps to follow to enable reporting.

13.3.1 JReport system requirements

The System Requirements for JReport Designer 5.1 are as follows:

- Windows 9x, Windows 2000, or above
- Minimum of 32 M memory is required; 64 M or more is recommended
- Pentium 100 or above
- Minimum of 20 M free space on the harddrive

Additional requirement to create LMS reports: Connection to LMM-database.

Tip: You can install JReport on Macintosh (and UNIX) as well, by doing a manual installation. See the help files from http://www.jinfonet.com. We did not test this.

13.3.2 JReport Designer download

The Designer software and license are obtained by following these steps:

1. Download the JReport install program jrpsetup.exe from the Jinfonet Web site:

   http://www.jinfonet.com/download.htm/

2. Obtain a JReport Designer install key by following the instructions in your LMS Readme file.

   You can also obtain a 30-day temporary license from http://www.jinfonet.com.

Note: If you use a JReport Designer client with an evaluation key instead of the proper install key, the actual report results on the server will show `Evaluation Copy` as a watermark to the users.

13.3.3 JReport installation

Here are the installation steps.

1. Install JReport Designer 5.1.

   Run jrpsetup.exe and following the prompts to install.

   JReport requires Java Runtime Environment (JRE) 1.1.6 or higher installed on your client workstation. If you do not have this, the install program will give the message `no suitable VMs were found`. So first you have to download and install the JRE (for example, V1.4.1_03) from `http://www.javasoft.com/`.

   If the install program does not find your JRE by itself, you will prompted. Select **run installation with the VM from this location**, and browse to the java.exe file of your jre-install. For our workstation, it was:

   ```
   C:\Program Files\Java\j2re1.4.1_03\bin\java.exe
   ```

2. Provide the install directory (“destination location”). See Figure 13-1 on page 233.

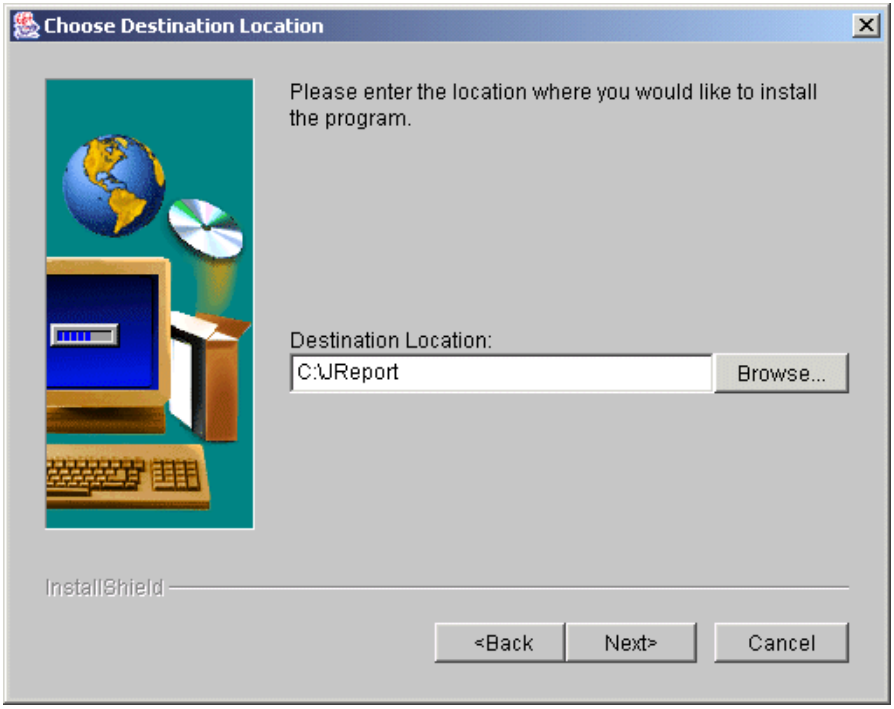


Figure 13-1 Destination location

> **Important:** Install JReporter in a directory name without spaces. For example, instead of using the default “c:\program files\jreport”, use c:\jreport. The space (between program and files) causes problems in some parts of the software. In our case, it was links to the help files.

3. Provide user ID and install key.
4. Accept the License Agreement.
5. Do not select “Add additional classpaths to locate external system components”. In our case we will do this manually. See “Adding the database driver to the JReport classpath manually” on page 236.

> **Tip:** If you do not have a DB2 client installed yet, you can do this later by editing the JReport.bat manually.

6. Choose whether to "Access the Internet using a proxy server" or not, as some of the help items are pointing to the Jinfonet Web site.

7. Create a JReport shortcut, since the installation does not create a shortcut on the desktop or within the Programs directory. Use this path and the following steps:

   ```
   C:\Program Files\JReport\bin\JReport.bat
   ```

   a. After the installation is complete, you can create a shortcut to the batch file created by the setup program. On the desktop, double-click **My Computer** and then go to C:\JReport\bin\JReport.bat. Right-click **JReport.bat** and select **Create Shortcut Here**.

   b. To create the shortcut on the desktop, drag and drop the shortcut to the desktop.

   c. To add the shortcut into the Start menu (for Windows 9x), double-click **My Computer** and then go to C:\Windows\Start Menu\Programs. Drag and drop the shortcut to this folder.

8. Start JReport. For details on starting the reporting process and checking your connection to the LMS database, see “Connecting JReport Designer to your database” on page 236.

13.3.4 Install JReport help files

To install the help files, use the following steps:

1. Download from JReport Designer help document jrphelp.exe from the Web site:

   http://www.jinfonet.com/download.htm/

2. Install the help by running jrphelp.exe.

In some cases you might have to install MDAC first.

Remember to install the help-files in a directory whose name contains no spaces.

13.4 Steps to create a custom report

Now that you have JReport Designer installed and connected to the JReport engine in the LMS, we show you how to create a custom report. A report consists of the following components:

- A catalog (.cat and .fml file) containing:
  - Queries that return result sets from the database that are then displayed by a report. Queries are edited outside of the catalog and are then imported into the catalog.

- Formulas that return results that are used by a report. Formulas are created using the JReport Designer formula editor.
- Parameters that pass data into the report at runtime from the LMS. Parameters are created by the JReport Designer.

The cat/fml is a pair of files that represents the catalog. Most of the updates will be done in the .cat file. The .fml file will be updated when you make changes to formulas in the report.

- Report templates (.cls file) for each report containing:
  - Graphical display elements such as lines
  - Fields that can display data and images

Custom reports are created using JReport Designer. The report file, which has a .cls extension, uses the resources in your custom report catalog. Once you create the report, you must ensure that it resides in the <WEB-ROOT>\reports\template directory. The custom catalog goes also in this directory.

You can create the report file either directly in that directory or copy it manually at a later stage.

Note: <WEB-ROOT> is used to identify the application directory within the WebSphere directory. For example: D:\WebSphere\AppServer\installedApps\lms\IBMLotusLMSLMM.ear\lms-lmm-complete-23.war\

If required, you can temporarily copy the catalog and template files to your local machine and work with them there. After finalizing the report, you can then copy the files back to the appropriate directory on the server.

To modify an existing report, we will perform the following steps to create a custom catalog:

- Modify an existing report.
- Make LMS aware of the new report by changing the reports.xml.

  A new report is not available to the LMM until you update reports.xml.

13.5 Set up a new report

Setting up a new report is currently somewhat complex. Here we show you how.

13.5.1 Creating a custom catalog

This section explains how to make a copy of the LMS report catalog. You do this so that an upgrade installation of LMS will not overwrite your catalog.

Creating a copy of the existing catalog

To create a custom catalog, you create a copy of your existing predefined report catalog that comes with the LMS, set up the JReport connection to your database, and then use the new custom catalog to create custom reports.

The catalogs used for the LMS predefined reports are contained in <WEB-ROOT>\reports\template. The catalog files are:

```
rpt_oracle.cat and rpt_oracle.fml (for Oracle)
rpt_db2.cat and rpt_db2.fml (for DB2)
rpt_mssql.cat and rpt_mssql.fml (for SQLServer)
```

These catalogs could be edited to add custom reports, but it is not recommended because updates of the predefined reports would overwrite your custom reports.

Copy and rename the catalog files for the database that you are using. We will use a DB2 catalog, but the process will be similar for the catalogs using either of the other databases. We copy and rename the files rpt_db2.cat and rpt_db2.fml to rpt_custom_db2.cat and rpt_custom_db2.fml. These new files can remain in the <WEB-ROOT>\reports\template directory or be copied into a different directory.

We rename the pre-existing catalog rather than loading and saving it under a new name in JReport Designer because Save As for a catalog is not permitted in a directory that already contains a catalog.

Connecting JReport Designer to your database

JReport Designer connects to your database to validate your SQL queries that return the report data. To enable JReport Designer to connect to your database, add your database driver to the JReport classpath and configure your JReport connection.

Adding the database driver to the JReport classpath manually

If you have not adjusted the classpath during the installation, you can do it manually. Open up the JReport.bat file for editing (by default this is in c:\JReport\bin). The file should have a line that begins similar to this:
`"C:\jdk1.3.1\jre\bin\java.exe" "-Dinstall.root=C:\JReport" -classpath`.

Add the following file(s) to the classpath. Be sure to include the full path of each of the files. The appropriate files should be installed with your database client.

```
If you are using db2:              db2java.zip
If you are using SQLServer:        msbase.jar, msutil.jar, mssqlserver.jar
If you are using Oracle:           classes12.zip
```

For example for db2, add:

```
C:\Program Files\IBM\SQLLIB\java\db2java.zip
```

Configuring the JReport Database Connection

To configure:

1. Launch JReport Designer by running JReport.bat.
2. Go to **File -> Options -> Advanced**. Make sure all of the “Forbid XYZ” options are unchecked (there are four total).
3. Go to **File -> Options -> Editor**. Uncheck “Insert field name with field” and “Insert group name with group.”
4. Go to **File -> Open Catalog**. Select **rpt_custom_db2.cat**.
5. If you cannot see the Catalog Browser, open it by selecting **View -> Catalog Browser**.
6. In the Catalog Browser window, under the Data tab, expand the item Connection. Expand the sub-item JDBC Connection for DB2.
7. Right-click **JDBC Connection for DB2** and select **Properties**. The sub-item name and properties will differ for different databases.
8. Make sure the following parameters are set:

   ```
   user: <your db2 user name>
   password: <your db2 user password>
   url: jdbc:db2:<your db2 database name>
   ```

9. In the Catalog Browser window, expand the *parameters* item. Find the parameter p_schema_com and make sure that the Value property has the name of your db schema. Note that for SQL Server, Value should be left blank.
10. Test the connection:
    a. Go to the Catalog Browser (or activate by **View -> Catalog Browser**).
    b. In Data\Connection\JDBC Connection for DB2\Tables, right-click **Tables**, and select **New Table**. Verify that you see the tables available on the server.

JReporter will provide you with appropriate error messages in case you have misspelled the user name/password or database name.

If you get a `communication error` message, there is likely a problem with the connectivity. Check that you can connect to the database from the PC, and that no firewall is blocking the access from JReporter to the database.

13.5.2 Locating an existing report

To be able to modify an existing report in your custom catalog, we will locate an existing predefined report first.

The predefined report attributes are contained in <WEB-ROOT>/reports.xml file. By finding the existing predefined report in reports.xml (specified by the template attribute), we can find the report file. By opening the report file in JReport Designer we can find the query that fetches the report data from the database. We use this information to find the files we need to be able to edit the look of the report and the information that the report displays.

Open reports.xml in a text editor and search for the report that you are interested in. Use a search string that concatenates the report name. For example, to find the User Transcript report attributes, search for “UserTranscript” to find:

```
<report
         id = "userTranscript"
         name = "userTranscript.name"
         description = "userTranscript.description"
         category = "progress"
         template = "UserTranscript.cls"
         permission = "User_Transcript_Report"
         localize = "true" >
        <select type = "singleUser" parameter = "p_tx_user_oid" />
        <select type="label" parameter="p_label_in_progress"
key="catalog.attrib.offering.status.inProgress"/>
        <select type="label" parameter="p_label_completed"
key="courseManagement.results.shared.progress.completed"/>
        <select type="label" parameter="p_label_not_started"
key="courseManagement.results.shared.progress.notStarted"/>
        <select type="label" parameter="p_label_passed"
key="courseManagement.results.shared.progress.passed"/>
        <select type="label" parameter="p_label_failed"
key="courseManagement.results.shared.progress.failed"/>
       </report>
```

For a list of existing reports, see *LMS Administration Guide*, Chapter 7, “Managing Reports/Predefined Reports.”

The attribute template = "UserTranscript.cls" tells us that the User Transcript report file is "UserTranscript.cls". We create a custom report by loading the

original report file, UserTranscript.cls, into JReport Designer and then saving it as UserCustomTranscript.cls.

13.5.3 Create a custom template

To edit the User Custom Transcript report, launch the JReport Designer, open the custom report catalog, open the User Transcript report, and then save the User Transcript report under a different name.

1. Launch JReport.bat.
2. Press Continue to enter the JReport Designer.
3. Click **Cancel** in the Chose Report dialog.
4. Open the custom report catalog from File/Open Catalog/rpt_custom_db2.cat.
5. Open the UserTranscript.cls from File -> Open/.
6. Save the UserTranscript.cls as UserCustomTranscript.cls.

From now on, you can edit UserCustomTranscript.cls directly without having to access UserTranscript.cls.

The UserCustomTranscript report template work area will look like Figure 13-2.

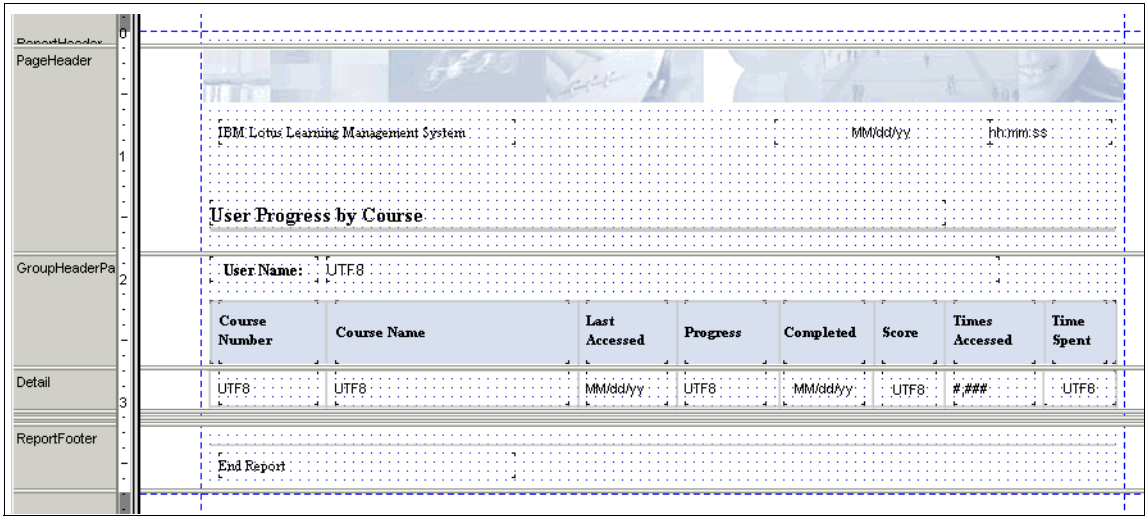


Figure 13-2 Template work area

Now you can start making changes to this report. This is outlined in the next section.

13.6 Changing the report

Here we describe how to customize a report.

13.6.1 Catalog browser and Report Inspector

There are two main tools used to view information about the reports. The Catalog Browser (**View -> Catalog Browser**) and the Report Inspector (**View -> Report Inspector**).

The Catalog Browser deals with the SQL used to generate the report, formulas used to process the results of the report, and parameters passed by the LMM into the report. See Figure 13-3.

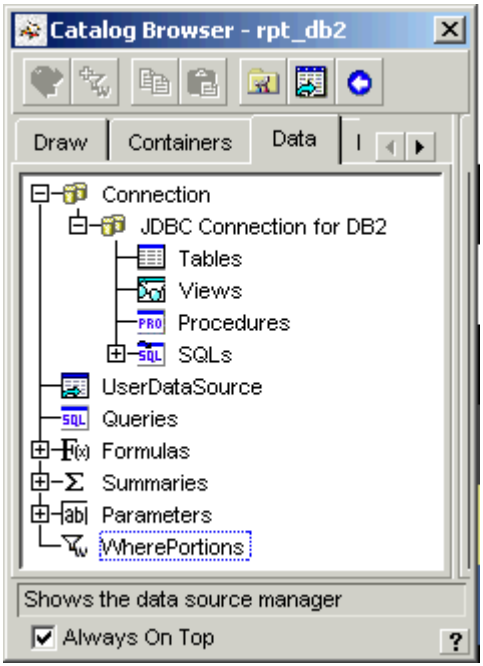


Figure 13-3 Catalog Browser

The Report Inspector deals with the visual layout of the report: Lines, text, etc. If you select an item in the main view, you can see information about it in the Report Inspector. See Figure 13-4 on page 241.

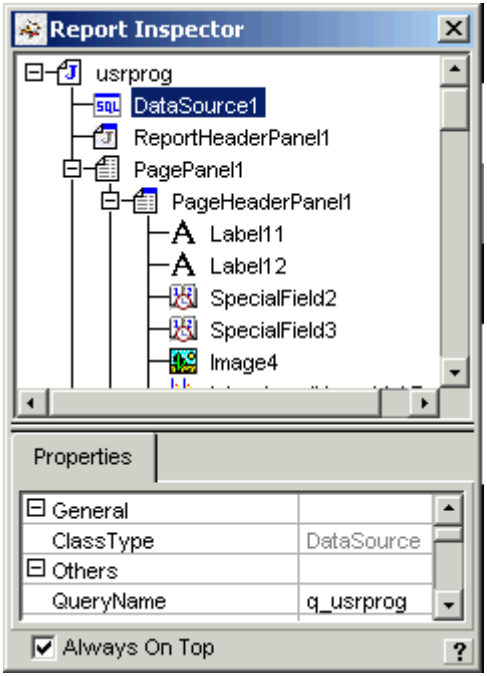


Figure 13-4 Report Inspector

The main view is divided up into several rows. Each row has a row header along the left side of the window. Note that in this example some of the rows are collapsed to a very small size.

ReportHeader Anything in this row will appear once at the top of the report

PageHeader Anything in this row will appear once at the top of each page of the report.

GroupHeaderPage Anything in this row will appear once at the top of each group in the report.

Detail Anything in this row will appear once for each row in each group.

GroupFooterPage Anything in this row will appear once at the bottom of each group.

PageFooter/ReportFooter Like PageHeader and ReportHeader, but at the bottom of the page/report.

Images

Select the graphic at the top of the report (in the page header area) and look at the Report Inspector, as shown in Figure 13-5.

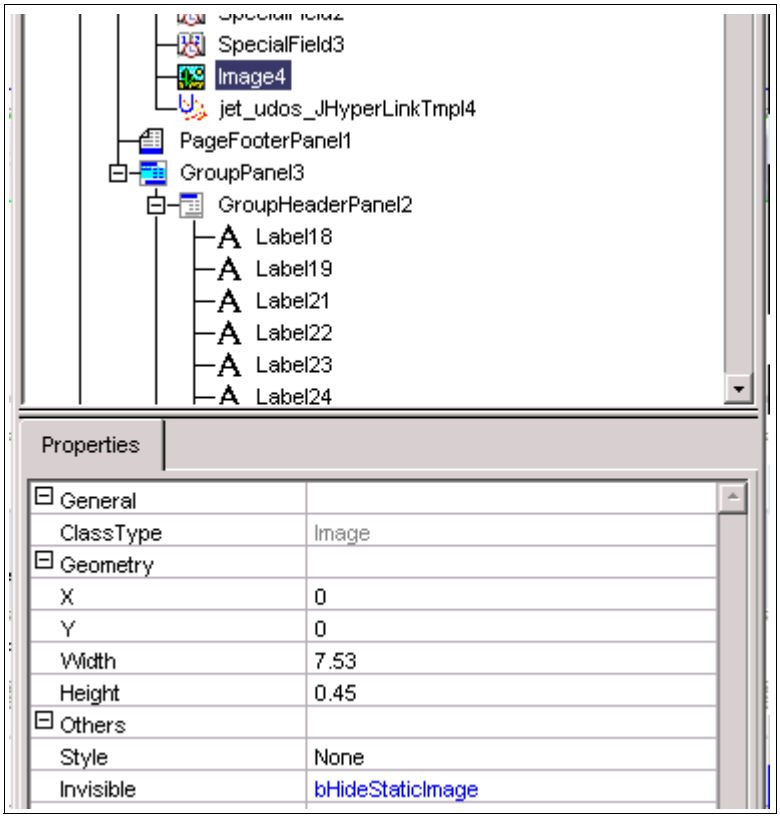


Figure 13-5 Image properties in the Report Inspector

Each image has an associated jet_udos_JHyperLink. The JHyperLink is used to display images when the report is viewed as HTML. When the report is viewed in a PDF, the GIF file specified in the “Image” item is displayed. Scroll all the way down in the Report Inspector to view the image displayed by each item.

Each Image/HyperLink has an attribute called “Invisible.” This attribute controls when the item can be seen. bHideStaticImage is a formula built into JReportDesigner that returns true when the report is displayed in HTML mode. Thus, the image item will not display in HTML mode. the HyperLink uses a similar formula called bHideDynamicImage so that it does not display when the report is viewed as a PDF.

13.6.2 Managing report layout

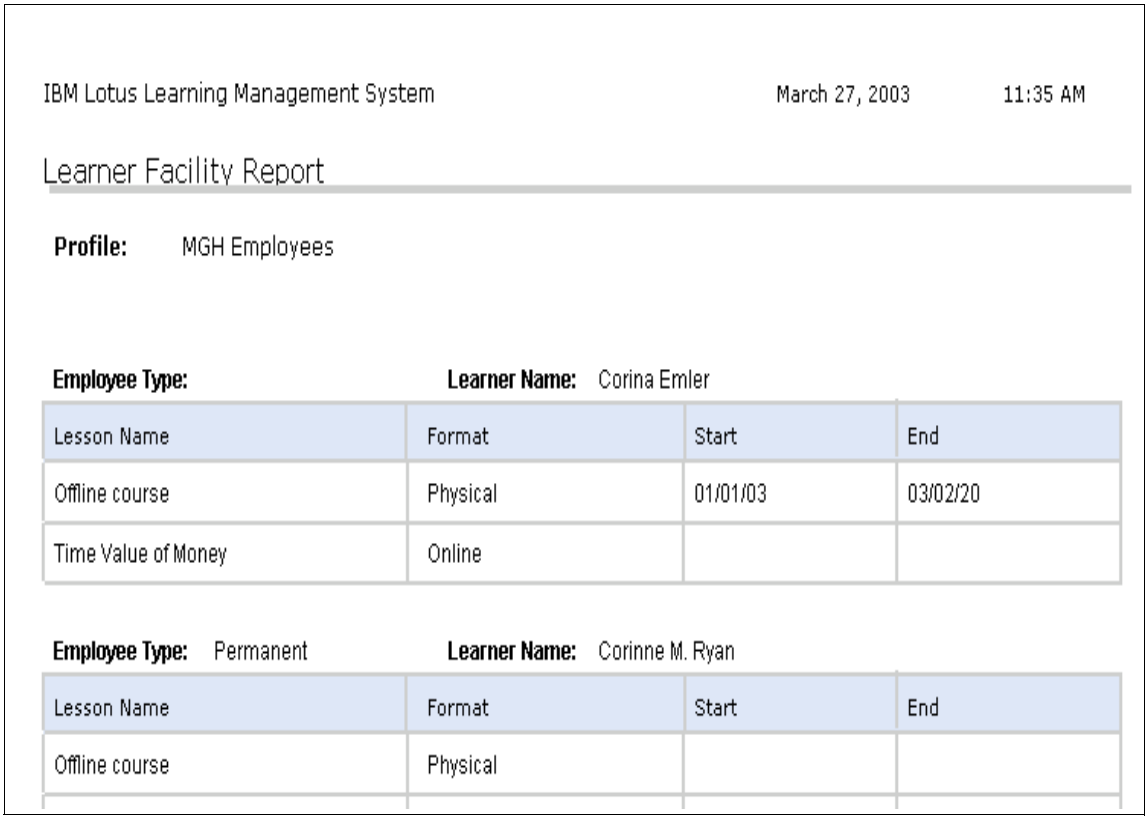
You can add lines or text to the report by selecting the appropriate item under the view menu. If you double-click a text label, you can edit the text of the label. If you select an item, you can view and edit it in the Report Inspector. Among other things, this is useful for formatting text (font style and size) and setting the exact position of lines.

Keep in mind that the blue header box in the GroupHeader area in LMS reports occasionally obscured text and lines. If you place text over the blue box and it seems to disappear you can select the blue box, right-click it, and select **Move to Back**. This should make your text visible again.

For further details on the JReport Designer, see *JReport Users' Guide*, “Previewing a Report/Design Mode.”

13.6.3 Working with groups

The SQL statement used in each report returns a set of rows. These rows can be divided up into groups for use by JReport. For example, each row in an SQL query might return the user name of a person and a class that she is enrolled in. You could divide up these rows into groups based on the user name, as shown in Figure 13-6 on page 244.



IBM Lotus Learning Management System March 27, 2003 11:35 AM

Learner Facility Report

Profile: MGH Employees

Employee Type: **Learner Name:** Corina Emler

Lesson Name	Format	Start	End
Offline course	Physical	01/01/03	03/02/20
Time Value of Money	Online		

Employee Type: Permanent **Learner Name:** Corinne M. Ryan

Lesson Name	Format	Start	End
Offline course	Physical		

Figure 13-6 Dividing rows into groups

In Figure 13-6, all of the rows that include the user Corina Emler would be in one group. To edit the grouping criteria for a report, select **Insert**, then **Group/Sort** from the menu. You should see the Group Wizard, as shown in Figure 13-7 on page 245.

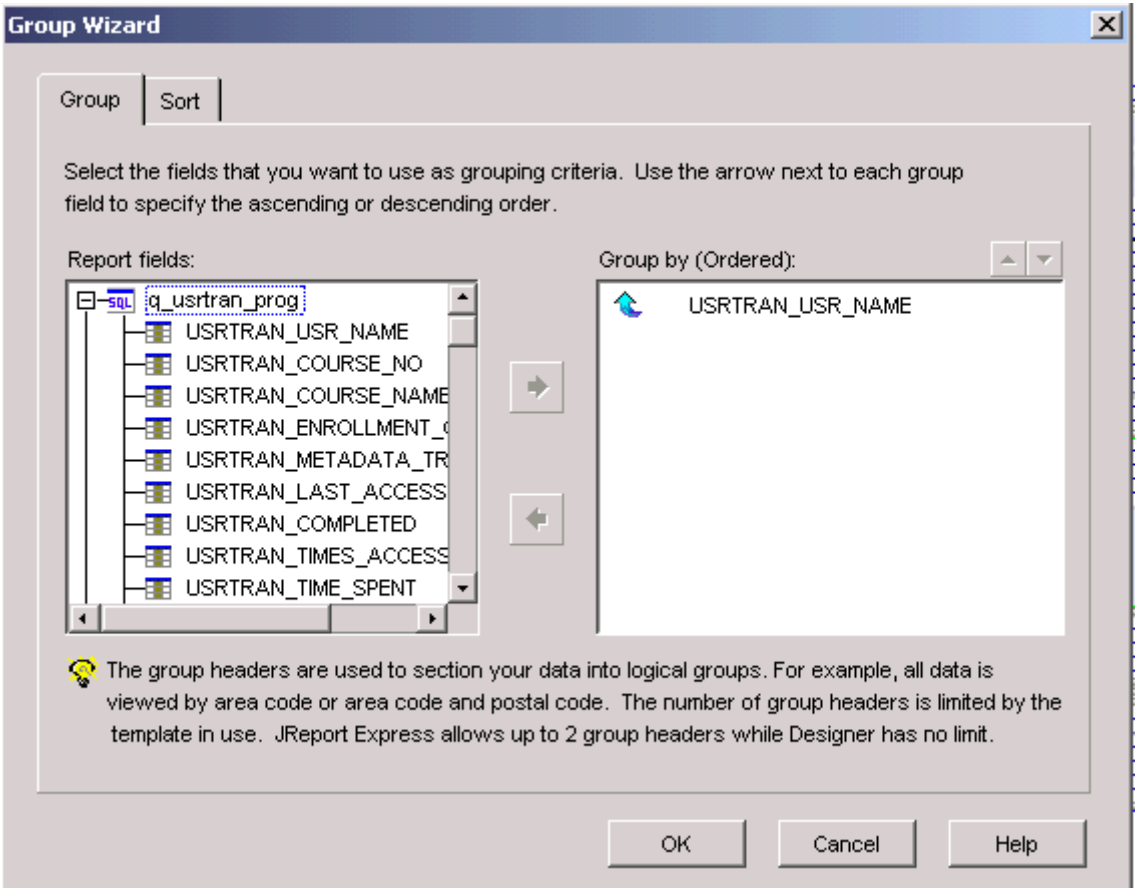


Figure 13-7 Group wizard

13.6.4 Working with formulas

To work with formulas:

1. Open the Catalog Browser.
2. Under the Data tab, expand the item Formulas.
3. To edit a formula, select the formula, right-click, and choose **Edit**. Alternatively, you can select the formula in a report and double click it.
4. To create a new formula, select any formula, right-click, and choose **New**.
5. In both cases, you should see the formula editor, shown in Figure 13-8 on page 246.

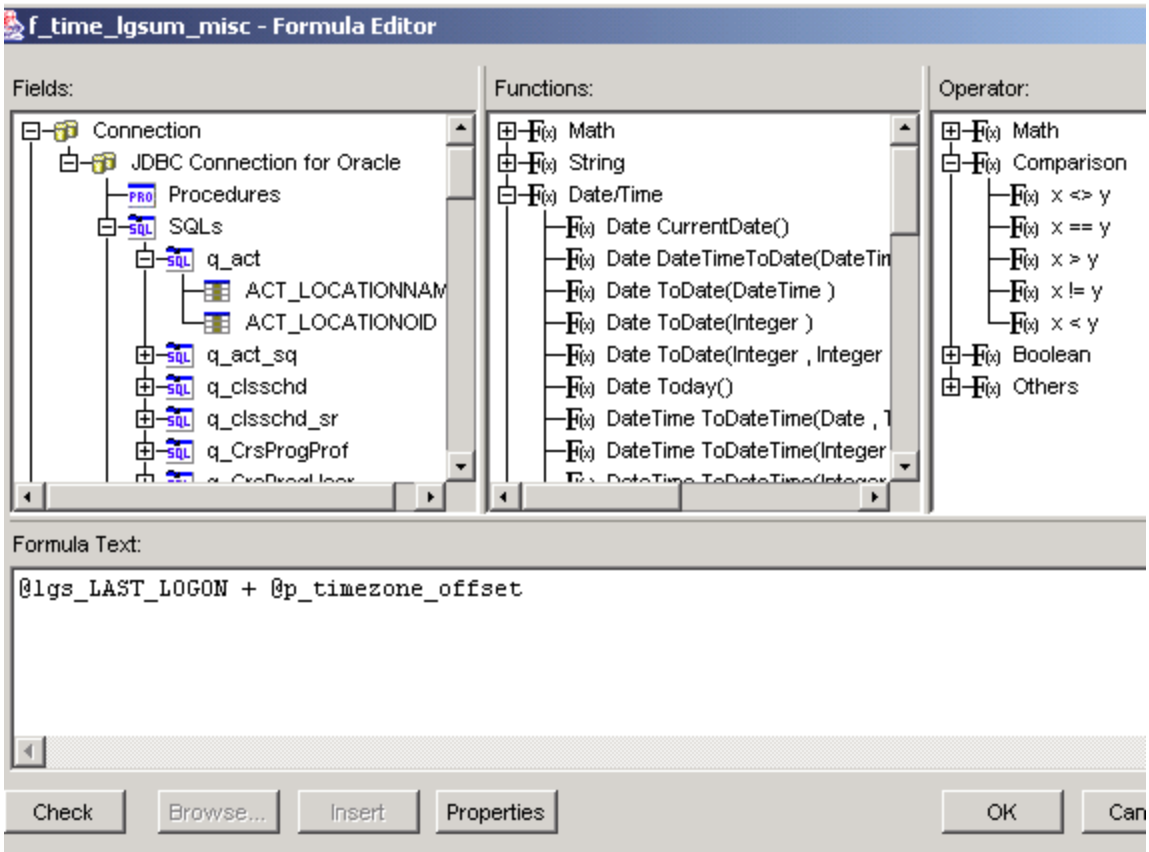


Figure 13-8 Formula editor

There are four windows:

- The Fields window contains all of the SQL columns available (for example, ACT_LOCATIONOID). You can use these columns in your formula by selecting the column and double clicking it.
- The Functions window contains a list of functions that are built into JReport. Select a function by double clicking it. You can also just type it into the Formula window.
- The Operator window displays a list of operations supported by JReport. Select an operator by double clicking it or typing it in.
- The Formula Text window displays the formula as you build or type it.

When you are finished editing your formula, you can check it for errors by clicking **Check**. If you select any function or operator and then press Help you will get help on that item.

13.6.5 Adding a data field to the report

To add a data field to the report, do the following:

1. Open the Report Inspector and select **Data Source**. Note the QueryName attribute.
2. Open the Catalog Browser. Expand **Connections -> JDBC Connection for DB2 -> SQLs**. Find the SQL query (in this case q_usrtran_prog) and expand it. See Figure 13-9.
3. The red arrows next to some of the columns indicate that these columns are used somewhere in the report. The red arrows are shown only when the report is open.
4. To place one of the columns in the report, double click the column you would like to insert, move your cursor to the place in the report where you want it, and place it in the report with a click.

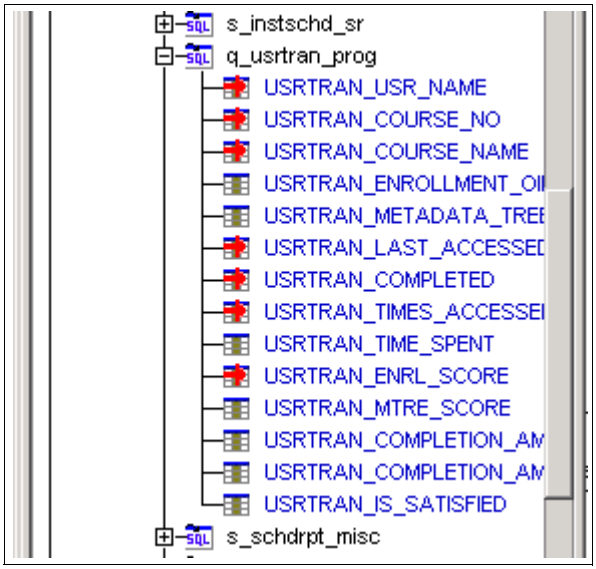


Figure 13-9 Show all columns of a query

13.6.6 Using parameters

Parameters are variables whose values are input when the report is run. Parameters are used in LMS reports to pass the database schema name and to pass selector values that have been set by user runtime selections in the LMM, and to pass standard values defined for the LMS such as fonts.

To view the parameters, expand the Parameters node in the Catalog Browser, as shown in Figure 13-10.

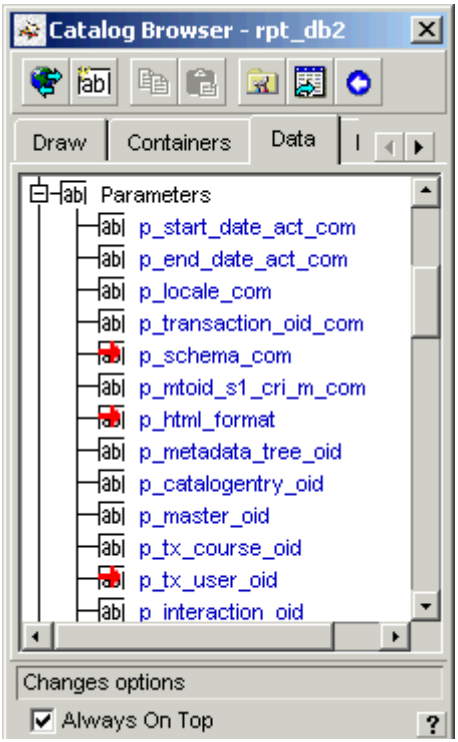


Figure 13-10 Parameter list in Catalog Browser

Red arrows are shown for parameters used in the report that is displayed. If no report is displayed, no arrows are shown.

To display the parameter properties, right click a parameter and select **Properties**.

To edit an existing parameter, select the parameter and edit the properties.

To create a new parameter, right click a parameter node, select **New Parameter**, and complete the attribute dialog. See *JReport Designer User Reference*, “Report Objects, Parameter”, for a description of the attribute fields.

See also *JReport User's Guide,* “Editing a Report by Inserting/Editing Objects/Parameter, Drawing Objects.”

13.6.7 Creating and editing SQL

With JReporter you can write SQL queries using the interactive query designer, or by uploading SQL statements from a file. For the reports in LMS, the SQL statements are uploaded from a file.

The format used by the query designer does not support the dynamic setting of the schema name at runtime (using the p_schema_com parameter) that LMS requires.

The data fields that are available for using in a report are created by an SQL query and can be viewed in the SQL tree under the JDBC Connection for DB2 node. See 13.6.5, “Adding a data field to the report” on page 247. The fields shown for each query are mapped from the query result set. (These are generally raw database columns, but they can also be computed columns or aliases.)

Queries for the LMS are File Queries that you create and edit in a text editor. You can view a current SQL command by selecting it in the Catalog Browser, right clicking, and selecting **Show SQL**. The SQL cannot be edited directly in the Show SQL window, but can be cut and pasted into a text editor.

To edit an existing SQL command, select the SQL query name in the Catalog Browser, select **update SQL**, and then enter your text file.

To create a new SQL query, select any SQL query name, right-click, select **New SQL**, and select your text file.

To change the SQL query that a report uses, select **Data Source** in the Report Inspector and change the QueryName to the SQL you want.

13.6.8 Basic SQL query structure

The mapped database columns shown by the Catalog Browser for the q_usrtran_prog SQL can be seen in Figure 13-11 on page 250.

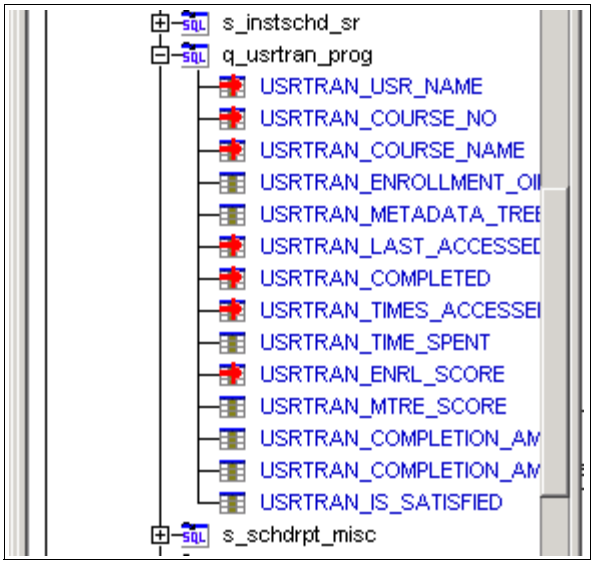


Figure 13-11 List of database columns of a query

Portions of the SQL that generated the mapped database columns for the q_usrtran_prog have been formatted and are shown in Example 13-1.

Example 13-1 SQL to generate the mapped database columns

```
SELECT
       usr.display_name usrtran_usr_name,
       cata.code usrtran_course_no,
       ctxt.title usrtran_course_name,
       enrl.oid     usrtran_enrollment_oid,
       mtre.oid  usrtran_metadata_tree_oid,
       (SELECT starttime
          FROM :p_schema_com.progress
          WHERE enrollment_oid = enrl.oid
          AND metadata_tree_oid = mtre.oid)   usrtran_last_accessed,

       ... (section omitted)

FROM
       :p_schema_com.usr,
       :p_schema_com.enrollment enrl,
       :p_schema_com.catalogentry cata,
       :p_schema_com.catalogentry_text ctxt,
       :p_schema_com.master mast,
       :p_schema_com.metadata_tree mtre,
       :p_schema_com.reportselection_item rpsi_usr
```

```
WHERE
      rpsi_usr.reportselection_oid = @p_tx_user_oid
      AND usr.oid = rpsi_usr.ptr_oid
      AND enrl.user_oid = usr.oid
      AND cata.oid = enrl.catalogentry_oid
      AND cata.oid = ctxt.catalogentry_oid
      AND cata.lang = ctxt.lang
      AND mast.oid = cata.master_oid
      AND mtre.oid = mast.metadata_tree_oid
```

For this query, table aliases (which are optional) have been defined in the FROM clause. The mapped database column names used by JReport are shown in the SELECT clause. For example, the database column USR.DISPLAY_NAME is mapped to USRTRAN_USR_NAME, which is displayed in the Catalog Browser. The mapped column names have catalog scope and must be unique. JReport will prefix the mapped names with the query name if it finds a duplicate name in the catalog.

The parameter p_schema_com, proceeded by a colon, is set to the LMM database schema name at runtime. It is also used to identify the schema name to use for verification when a query is created or updated. Set the Value attribute of p_schema_com to your schema name.

The parameter p_tx_user_oid is a selection parameter defined in the report.xml file that is passed to the query at runtime from the user's selection. See "Selection types" on page 255 for details.

13.6.9 Inserting a subreport

You can insert a subreport into any report. The subreport itself can be used as a standalone report or inserted into more than one report. See *JReport Designer User Reference /6. JReport Windows and Dialogs/ Insert SubReport* for instructions on inserting the subreport and for creating the sublinks between the parent and child report.

13.6.10 Using the view mode

The view mode of JReport can be used to preview the report. However, many of the reports in LMS use parameters that are generated at runtime and so they do not exist when using the View mode. The result is that no records will be shown in the view mode. This is also true of the examples that we use in this chapter.

Here is an example of using the View Mode to see data in JReport.Query:

```
SELECT
          location.name q_loctest_locname
```

```
FROM
          :p_schema_com.location
```

Figure 13-12 shows design mode and Figure 13-13 shows view mode.

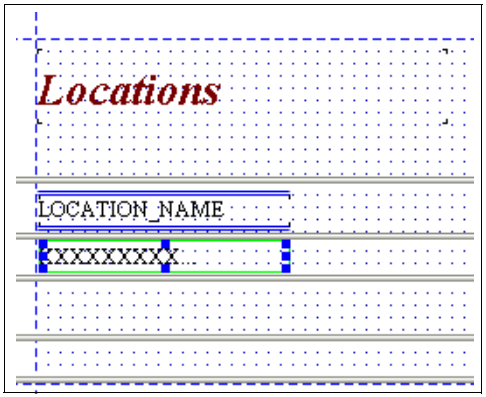


Figure 13-12 Example report in design mode

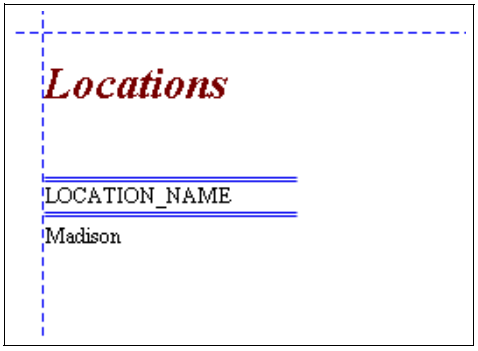


Figure 13-13 Example report in view mode

13.7 Deploying a report

Once you have created the custom report and copied the report file and the custom catalog files to the <WEB-ROOT>\reports\template directory, you must make an entry in the Learning Management System reports.xml file so that the LMM can identify the report. The reports.xml file contains the attributes of all reports, including name, description, name of the report file, and selection criteria and order.

Reports.xml stores the definition of every report category and pre-defined and custom report in the Learning Management System. The data contained in reports.xml is cached on the LMM Servers. If you make an entry in reports.xml on one LMM Server, every server in a cluster must be updated. The location of the reports.xml file is specified in the settings.xml file. Generally, xml files are located in the <WEB-ROOT>\WEB-INF\classes directory.

If you update your LMS, be sure to save a copy of reports.xml so that you can copy your custom report attributes into the new reports.xml.

Each report in reports.xml has its attributes defined by the <report> tag. (The <report> tags are listed after the initial DTD information in reports.xml.) Within this tag, there are five required attributes:

- ID: An arbitrary ID that you assign to the report; the ID must be unique.
- Name: The name you assign to the report.
- Description: The report's description.
- Category: The ID of the category to which the report belongs.
- Template: The new report template file name.

The values assigned to the name and description attributes appear in the LMM user interface.

There are also three other attributes, which are optional:

- Permission: A specific permission that you could require for anyone to run this report. It can usually be left blank.
- Localize: A true/false field that indicates whether the report name and description will be localized at runtime. The default value is false.
- Catalog: The catalog on which to base custom reports.

Pre-defined reports do not use this attribute as long as the default catalog is used. Customized reports will use another catalog file, so you will have to use the catalog attribute to indicate this.

The name and description attributes can optionally be keys into the ApplicationResources.properties file in order to localize the text strings in the user interface (all pre-defined reports do this). This happens when the localize attribute is set to true. If the localize attribute is set to false, then the text string assigned to the name and description attributes appear in the user interface without any language localization.

If you have a selection list for a given report, use the <select> tag, which is only valid when embedded in the <report> tag. If you do not offer a selection, you do not use <select>.

The attributes for <select> (both are required) are:

- Type: One of 27 selection types (see the list of all selection types below). An example would be the selection step for an Instructor Details report that shows the details of a selected set of instructors. The selection step would be of the type “multipleInstructor”: <select type="multipleInstructor" parameter="INSTRUCTORS" />
- Parameter: The value of the parameter attribute is the name of the parameter used in the SQL query defined for the report.

Continuing with the above example, the Instructor Details report uses a query like this:

```
select *
   from instructor, reportselection_item
   where instructor.oid = reportselection_item.ptr_oid and
reportselection_item.oid = @INSTRUCTORS
```

INSTRUCTORS is the name of the parameter for this query. The table called reportselection_item is used in every query for any report that has a selection step.

13.7.1 Special parameters

There are two special parameters that are used in an SQL query. The first one is always required and the second one is only required for the dateRange selection type.

The first is for the database schema name and is used by every report. It only appears in the SQL select for the report and not in reports.xml. The name of the parameter *must* be p_schema_com. It is used in the SQL select statement like in the following example:

```
select *
   from :p_schema_com.instructor, :p_schema_com.reportselection_item
   where instructor.oid = reportselection_item.ptr_oid and
reportselection_item.oid = @INSTRUCTORS
```

The second is for the dateRange selection type. All date range parameters must follow this naming convention:

- The parameter name for the start of the range must begin with “p_start_” and end with some text like “xyz”.
- The parameter name for the end of the range must begin with “p_end_” and end with the same text as the start date (“xyz” in the example in the previous bullet).

- In reports.xml, the <select> tag for the date range parameter will have a name that is the same text as the suffix from the parameters.

Thus, for our example, the tag would look like this:

```
<select type=”dateRange” parameter=”xyz” />
```

13.7.2 Selection types

The following selection types are available for the "type" attribute:

- singleActivity: Allows selection of a single activity for a given course. This type must be preceded by a singleCourse selection step.
- multipleCertificate: Allows the selection of multiple certificates.
- singleCertificate: Allows the selection of a single certificate.
- multipleCourse: Allows the selection of multiple courses.
- singleCourse: Allows the selection of a single course.
- multipleCurriculum: Allows the selection of multiple curriculums.
- singleCurriculum: Allows the selection of a single curriculum.
- dateRange: Allows range of dates. Date ranges can be:
  - Absolute: An actual start date and end date are entered.
    - Possible values: Any two dates
    - Example: Start Date: 02/01/2003, End Date: 02/20/2003
  - Relative: A length of time relative to today.
    - Possible values: A positive integer value and one of the following units: Day, month, week year
    - Example: Use data for last 10 days. At runtime this would be translated to a range from 10 days ago until today.
  - Range: A specific unit of time.
    - Possible values: Current week, current month, current year.
    - Example: Use data for this month. At runtime this would be from the first of the month until the last day of the month.
- singleEnrollable: Allows the selection of a single enrollable entity (either a catalog entry or an offering).
- multipleEnrollable: Allows the selection of a single enrollable entity (either a catalog entry or an offering).
- multipleEnrolledCourse: Allows the selection of multiple enrolled courses. Must be preceded by a singleUser step.

- singleEnrolledCourse: Allows the selection of a single enrolled course. Must be preceded by a singleUser step.
- multipleEnrolledUser: Allows the selection of multiple enrolled users. Must be preceded by a singleEnrollable step.
- singleEnrolledUser: Allows the selection of a single enrolled user. Must be preceded by a singleEnrollable step.
- multipleInstructor: Allows the selection of multiple instructors.
- singleInstructor: Allows the selection of a single instructor.
- multipleInstrGroup: Allows the selection of multiple instructor groups.
- singleInstrGroup; Allows the selection of a single instructor group.
- multipleLocation: Allows the selection of multiple locations.
- singleLocation: Allows the selection of a single location.
- multipleProfile: Allows the selection of multiple profiles.
- singleProfile: Allows the selection of a single profile.
- multipleRoom: Allows the selection of multiple rooms.
- singleRoom: Allows the selection of a single room.
- multipleUser: Allows the selection of multiple users.
- singleUser: Allows the selection of a single user.
- multipleVendor: Allows the selection of multiple vendors.
- singleVendor: Allows the selection of a single vendor.
- locale: Sets the locale; implied by the locale selected on the presentation/format step.

All types are case-sensitive and must begin with a lower-case letter.

13.7.3 Categories

Categories are defined with the <category> tag, which stands alone outside the <report> tag. The two attributes for <category> (both are required) are:

- ID: Unique identifier for this category
- key: The key into the ApplicationResources.properties file, used to localize the name of the category in the user interface

13.7.4 Example of attributes for reports

The following example lists the attributes of the <report> tag for a given report, with no localization (localize="false"):

```
<report
id = "swvnd"
name = "Software Training Vendors"
description = "This reports lists all the software training vendors."
category = "resource"
template = "swvendors.cls"
permission = ""
localize = "false"
catalog = "myCustomCatalog.cat" >
</report>
```

The text strings assigned to the name and description attributes will appear in the user interface exactly as they appear above. The following example lists the attributes of the <report> and <category> tags for a given report, with localization (localize="true"):

```
<report
id = "rpt01"
name = "r01.name"
description = "r01.description"
category = "enrollment"
template = "someReport.cls"
86 IBM Lotus LMS Release 1 Administrator's Guide
permission = ""
localize = "true"
catalog = "myCustomCatalog.cat" >
</report>
```

The values of the name and description attributes, r01.name and r01.description, respectively, point to keys stored in the file ApplicationResources.properties (in directory <WEB-ROOt>\WEB-INF\classes\resources\lmm\properties). The entries in this file can look like the following:

```
#####
# System Report Names & Descriptions
#####
r01.name = New Test Report
r01.description = A simple prototype report
```

Note that if you modify the ApplicationResources.properties file, an upgrade of LMS will overwrite the changes made.

13.7.5 Enabling custom reports

Before you make the new custom reports available to users, make sure that you test your reports to ensure that they work properly. To make a custom report available to users, the final steps you need to take include:

1. Copy all related files to each server, if you are running a clustered environment. These files include:
   - reports.xml
   - The .cls report template file
   - The catalog files (a .cat and a .fml file)
   - ApplicationResources.properties
   - The JReport language properties files (for example, someReport_fr.properties)

   When a report file is opened in JReport for editing, a .paramdesc file is created. This file is a scratch file and is not a part of the deployment. This file can be removed and does not have to be copied to the server(s).
2. Restart each server in the cluster.
3. If necessary, assign the Run Reports permission to any user who will run the new report (users with the Administrator role can run any report).

You can run the new custom report in the LMM user interface in the Report module by taking the following steps:

1. Click **Run reports**.
2. In the Category drop-down box, select the category in which you placed the report with the "category" attribute for the <report> tag.
3. Select the report and run or schedule it.

13.8 Example of editing an existing report

This example shows the workflow steps when you edit an existing report. In this example, we add the user's distinguished name to the User Progress by Course report. For this example, we assume that:

- JReport is installed and licensed.
- A database client is installed on the system with JReport and a connection to the LMM database has been configured. A DB2 database is used for this example.
- An LMM deployment is available.

Now here are the steps to follow.

1. Find the name of the User Progress by Course report file in the reports.xml. By searching on “userprogress” we find:

```
      <report
        id = "userProgressCourse"
        name = "userProgressCourse.name"
        description = "userProgressCourse.description"
        category = "progress"
        template = "usrprog.cls"
        permission = "User_Progress_Course_Report"
        localize = "true" >
       <select type = "singleUser" parameter = "p_transaction_oid_com" />
       <select type = "multipleEnrolledCourse" parameter =
"p_tx_course_oid" />
       <select type="label" parameter="p_label_in_progress"
key="catalog.attrib.offering.status.inProgress"/>
       <select type="label" parameter="p_label_completed"
key="courseManagement.results.shared.progress.completed"/>
       <select type="label" parameter="p_label_not_started"
key="courseManagement.results.shared.progress.notStarted"/>
       <select type="label" parameter="p_label_passed"
key="courseManagement.results.shared.progress.passed"/>
       <select type="label" parameter="p_label_failed"
key="courseManagement.results.shared.progress.failed"/>
      </report>
```

   This tells us that the report file is “usrprog.cls”.

2. Copy the catalog and report files into a work directory and rename the catalog files. In this case, we copy rpt_db2.cat, rpt_db2.fml, and userprog.cls to /Custom. We rename rpt_db2.cat to rpt_db2_custom.cat and rpt_db2.fml to rpt_db2_custom.fml.

3. Set up the database connection in the catalog. Open the rpt_db2_custom.cat catalog and the Catalog Browser. Expand the Connection node, right-click **JDBC Connection for DB2**, and select **Properties**. Set the properties for Driver, User, URL, and password. Figure 13-14 on page 260 shows an example connection.

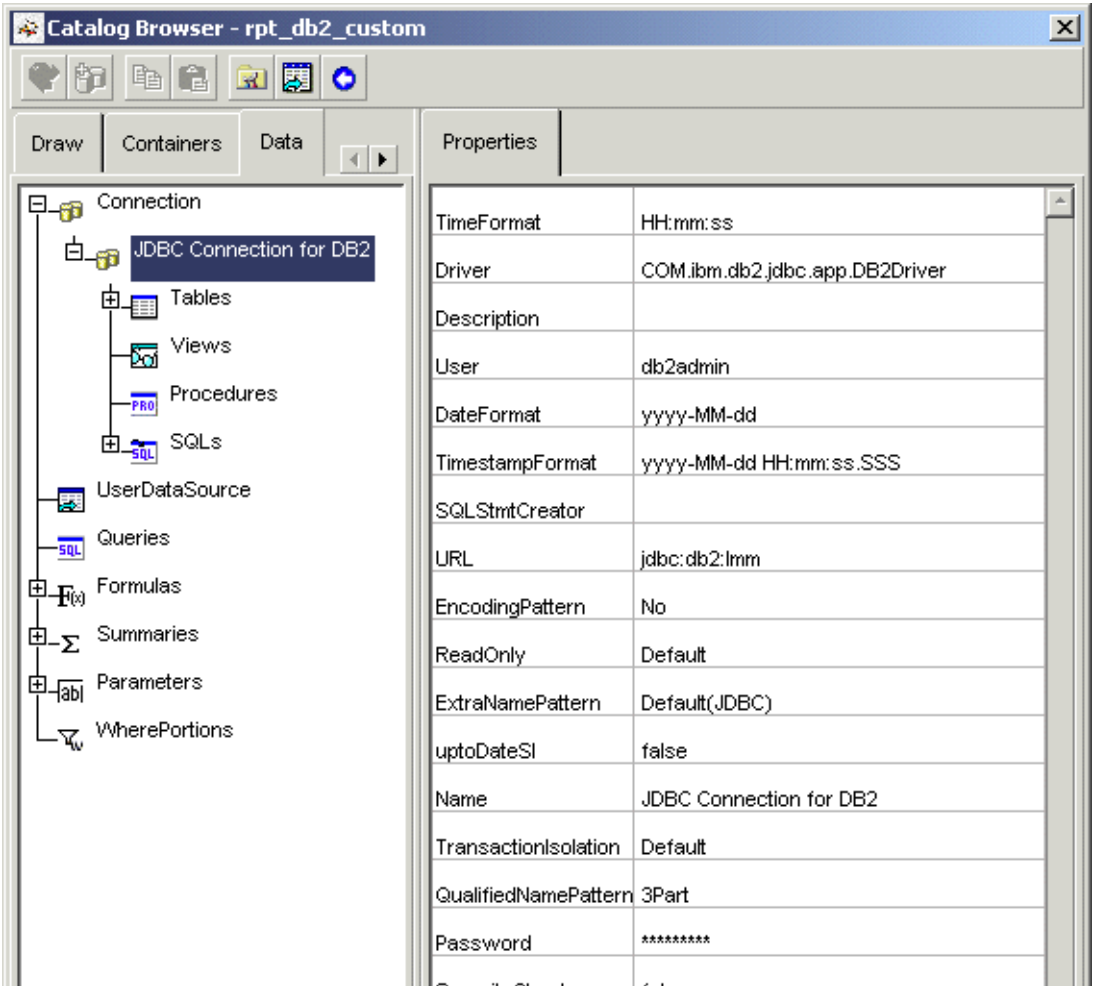


Figure 13-14 Connection properties to connect to the LMS database

4. Verify the connection. Expand the JDBC Connection for DB2 node, right-click **Tables**, and select **New Table**. Verify that you are presented with a table list and that there are no error messages. Click **Done**.
5. Set the Value of the p_schema_com parameter. Expand the Parameters node, click **p_schema_com**, and set the Value to your database schema name. Figure 13-15 on page 261 shows an example.

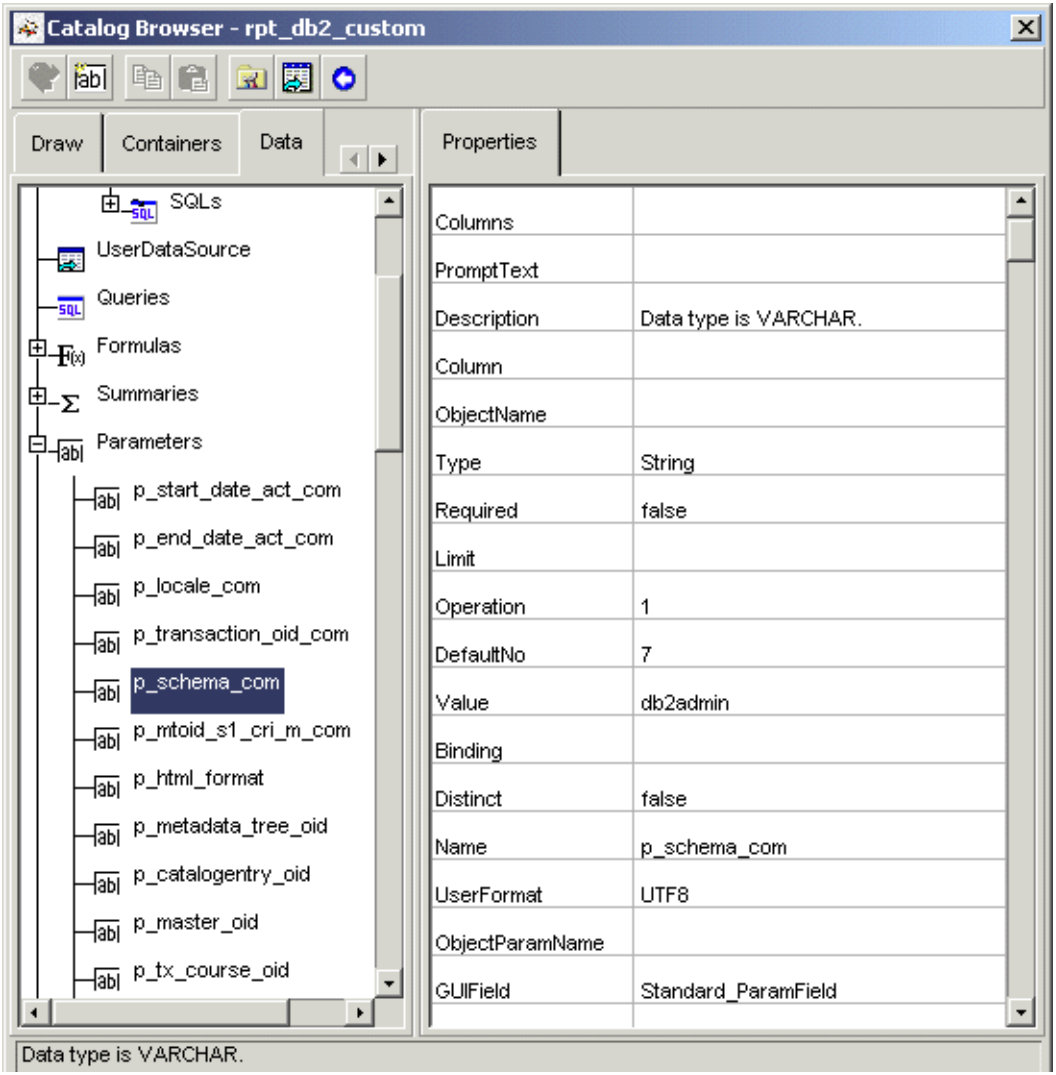


Figure 13-15 Setting the value of p_schema_com

6. Open the User Progress by Course report userprog.cls and save as a custom report, userprogcustom.cls. Click **File -> Open** and select **userprog.cls**. The report will open in the Design window. Click **File -> Save As** userprogcustom.cls.
7. Find the query that supplies the data for this report. Open the Report Inspector, expand the userprogcustom node and click **datasource1**. The query for this report is listed as q_userprog, as shown in Figure 13-16 on page 262.

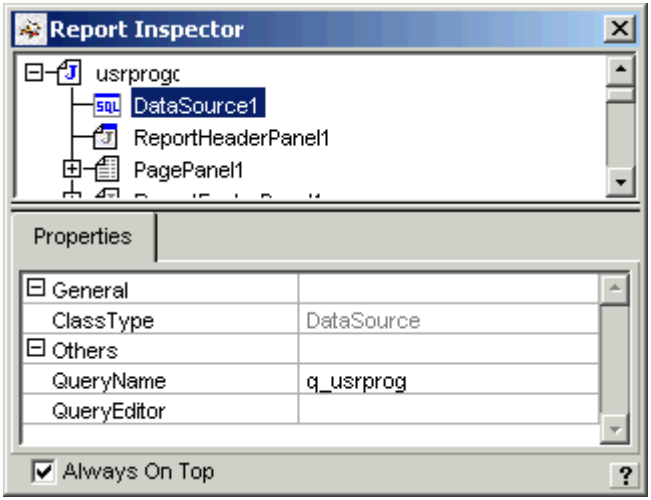


Figure 13-16 Finding the query name

8. Show the q_userprog SQL, as in Figure 13-17.

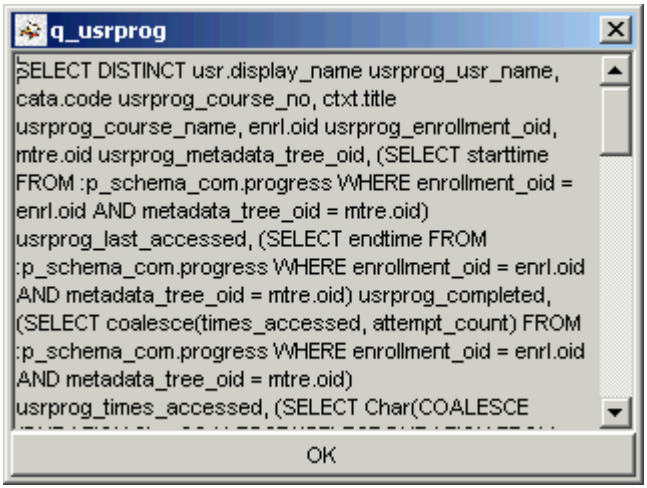


Figure 13-17 Showing the SQL in the query

Cut and paste into a text file, as in Example 13-2.

Example 13-2 Pasting the SQL query into a text file

```
SELECT DISTINCT usr.display_name usrprog_usr_name, cata.code usrprog_course_no,
ctxt.title usrprog_course_name, enrl.oid usrprog_enrollment_oid, mtre.oid
usrprog_metadata_tree_oid, (SELECT starttime FROM :p_schema_com.progress WHERE
enrollment_oid = enrl.oid AND metadata_tree_oid = mtre.oid)
```

```
usrprog_last_accessed, (SELECT endtime FROM :p_schema_com.progress WHERE
enrollment_oid = enrl.oid AND metadata_tree_oid = mtre.oid) usrprog_completed,
(SELECT coalesce(times_accessed, attempt_count) FROM :p_schema_com.progress
WHERE enrollment_oid = enrl.oid AND metadata_tree_oid = mtre.oid)
usrprog_times_accessed, (SELECT Char(COALESCE(DURATION,0) + COALESCE((SELECT
DURATION FROM ATTEMPT WHERE PROGRESS_OID = PROGRESS.OID AND IS_SUSPENDED=1),0))
FROM :p_schema_com.progress WHERE enrollment_oid = enrl.oid AND
metadata_tree_oid = mtre.oid) usrprog_time_spent, (SELECT
Char(max(uobj.raw_score)) FROM :p_schema_com.user_objective uobj,
:p_schema_com.objective objt WHERE objt.oid = uobj.objective_oid AND
uobj.enrollment_oid = enrl.oid) usrprog_enrl_score, (SELECT
CHAR(max(uobj.raw_score)) FROM :p_schema_com.user_objective uobj,
:p_schema_com.objective objt WHERE uobj.enrollment_oid = enrl.oid AND objt.oid
= uobj.objective_oid AND objt.metadata_tree_oid = mtre.oid) usrprog_mtre_score,
(SELECT CHAR(completion_amount) FROM :p_schema_com.progress WHERE
enrollment_oid = enrl.oid AND metadata_tree_oid = mtre.oid)
usrprog_completion_amount_old, (CASE cata.type WHEN 2 THEN (CASE enrl.state
WHEN 1OO THEN '0.5' WHEN 11O THEN '1' ELSE 'O' END) WHEN 3 THEN (CASE
enrl.state WHEN 1OO THEN '0.5' WHEN 11O THEN '1' ELSE 'O' END) ELSE (SELECT
CHAR(completion_amount) FROM :p_schema_com.progress WHERE enrollment_oid =
enrl.oid AND metadata_tree_oid = mtre.oid) END) usrprog_completion_amount,
(SELECT MAX(CAST(uobj.is_satisfied AS int)) FROM :p_schema_com.user_objective
uobj, :p_schema_com.objective objt WHERE uobj.user_oid = usr.oid AND objt.oid =
uobj.objective_oid AND uobj.enrollment_oid = enrl.oid) usrprog_is_satisfied
FROM :p_schema_com.usr, :p_schema_com.enrollment enrl,
:p_schema_com.catalogentry cata, :p_schema_com.catalogentry_text ctxt,
:p_schema_com.master mast, :p_schema_com.metadata_tree mtre,
:p_schema_com.reportselection_item rpsi_usr, :p_schema_com.reportselection_item
rpsi_crs WHERE rpsi_usr.reportselection_oid = @p_transaction_oid_com AND
usr.oid = rpsi_usr.ptr_oid AND rpsi_crs.reportselection_oid = @p_tx_course_oid
AND (enrl.catalogentry_oid = rpsi_crs.ptr_oid OR enrl.offering_oid =
rpsi_crs.ptr_oid) AND enrl.user_oid = usr.oid AND cata.oid =
enrl.catalogentry_oid AND cata.oid = ctxt.catalogentry_oid AND cata.lang =
ctxt.lang AND mast.oid = cata.master_oid AND mtre.oid = mast.metadata_tree_oid
```

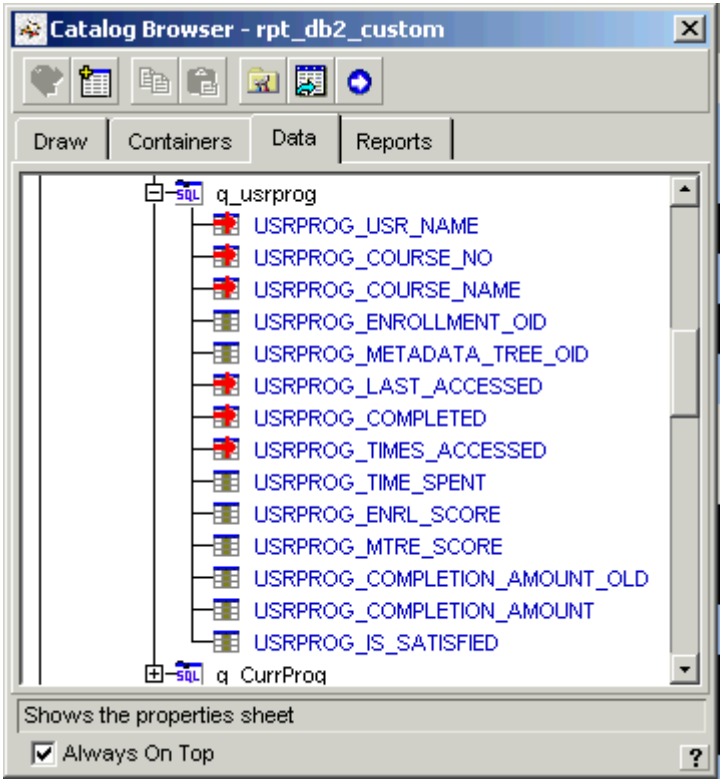


Figure 13-18 Default database column of the q_usrprog query

9. Change the q_usrprog query.

   Add userprog_usr_dname field for the users distinguished name in the q_usrprog SQL.

```
SELECT DISTINCT
         usr.display_name usrprog_usr_name,
         usr.distinguished_name userprog_usr_dname,
cata.code usrprog_course_no, ctxt.title usrprog_course_name,
        ....
```

   Save the changed query in a file, and in the Catalog Browser, right click and select **Update**. Now you can upload the file with the adjusted SQL statement.

   As you can see in Figure 13-19 on page 265, the new mapped field, usrprog_usr_dname, now appears in the list of mapped fields as USRPROG_USR_DNAME for the query q_usrprog in the Catalog Browser.

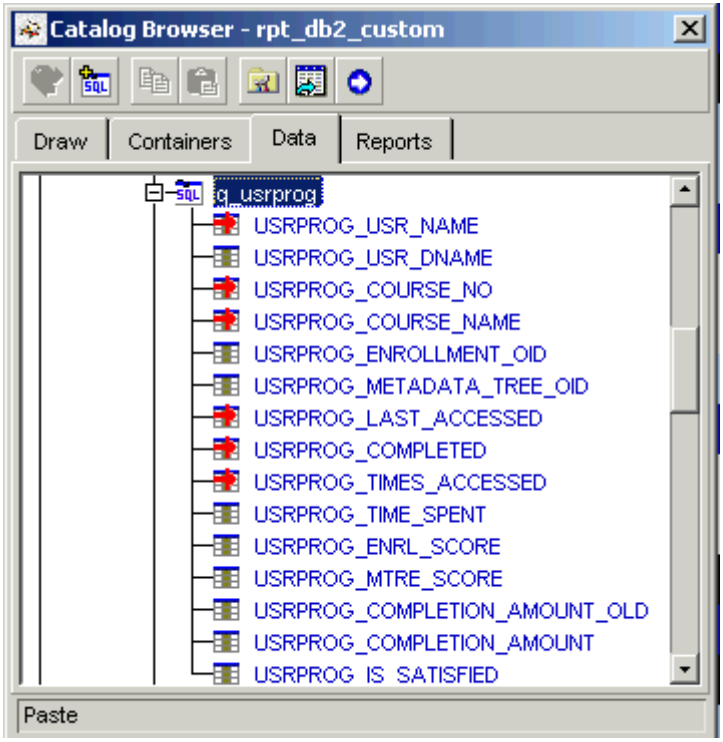


Figure 13-19 The q_usrprog query, with additional field USRPROG_USR_DNAME

10. Add the new user distinguished name, USRPROG_USR_DNAME, to the report.

    Figure 13-20 shows the report layout before the addition the user distinguished name field.

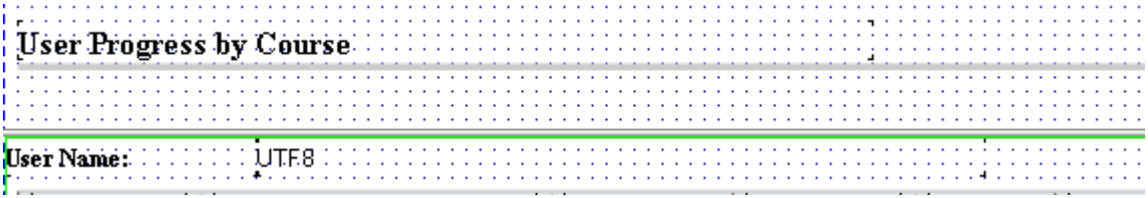


Figure 13-20 Report layout before DNAME field is added

Double click the USRPROG_USR_DNAME field in the Catalog Browser and drop the field into the report. Change the field format to UTF8 to accommodate Unicode, as shown in Figure 13-21 on page 266.

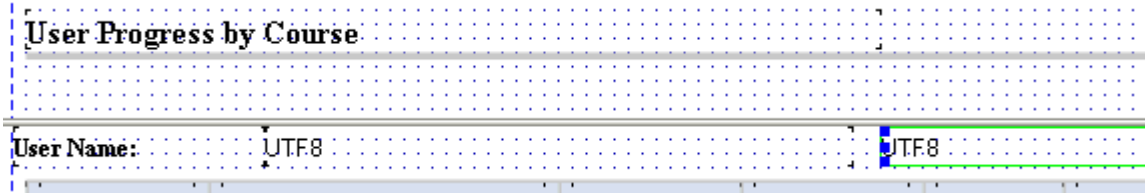


Figure 13-21 Report layout after DNAME field is added

A red arrow appears to indicate that this field is used in the report. See Figure 13-22.

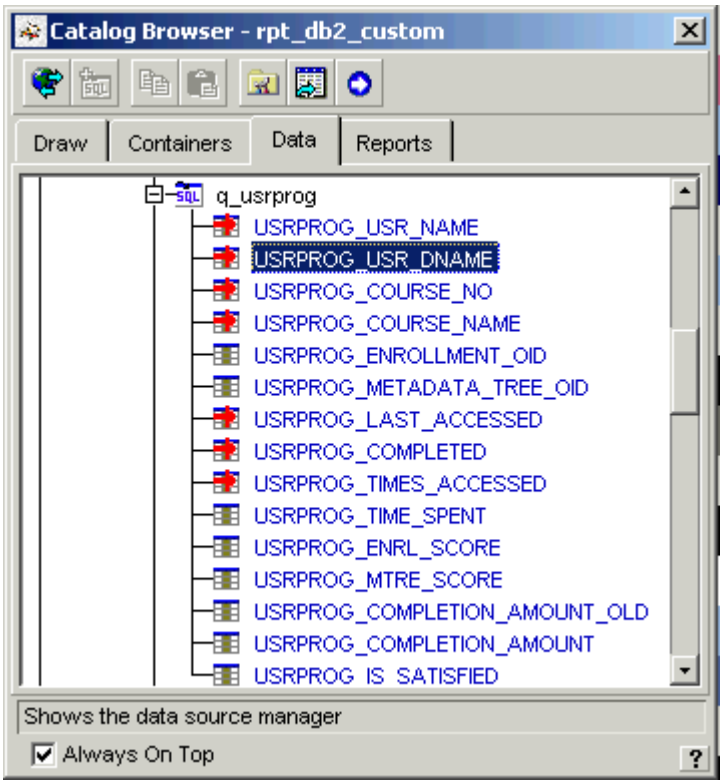


Figure 13-22 Query q_usrprog after DNAME field is added

11. Save the catalog and the report.
12. Add the report to reports.xml, as shown in Example 13-3.

Example 13-3 Adding a report to reports.xml

```
<report
```

```
         id = "userProgressCourseCustom"
         name = "Custom User Course Progress"
         description = "User Course Progress Report with distinguished name"
         category = "progress"
         template = "usrprogcustom.cls"
         permission = "User_Progress_Course_Report"
         localize = "false"
         catalog="rpt_db2_custom">
        <select type = "singleUser" parameter = "p_transaction_oid_com" />
        <select type = "multipleEnrolledCourse" parameter =
"p_tx_course_oid" />
        <select type="label" parameter="p_label_in_progress"
key="catalog.attrib.offering.status.inProgress"/>
        <select type="label" parameter="p_label_completed"
key="courseManagement.results.shared.progress.completed"/>
        <select type="label" parameter="p_label_not_started"
key="courseManagement.results.shared.progress.notStarted"/>
        <select type="label" parameter="p_label_passed"
key="courseManagement.results.shared.progress.passed"/>
        <select type="label" parameter="p_label_failed"
key="courseManagement.results.shared.progress.failed"/>
   </report>
```

13. Run Reports in the LMM and select the **Progress Reports**. Select the **Custom User Course Progress report**. See Figure 13-23 on page 268.

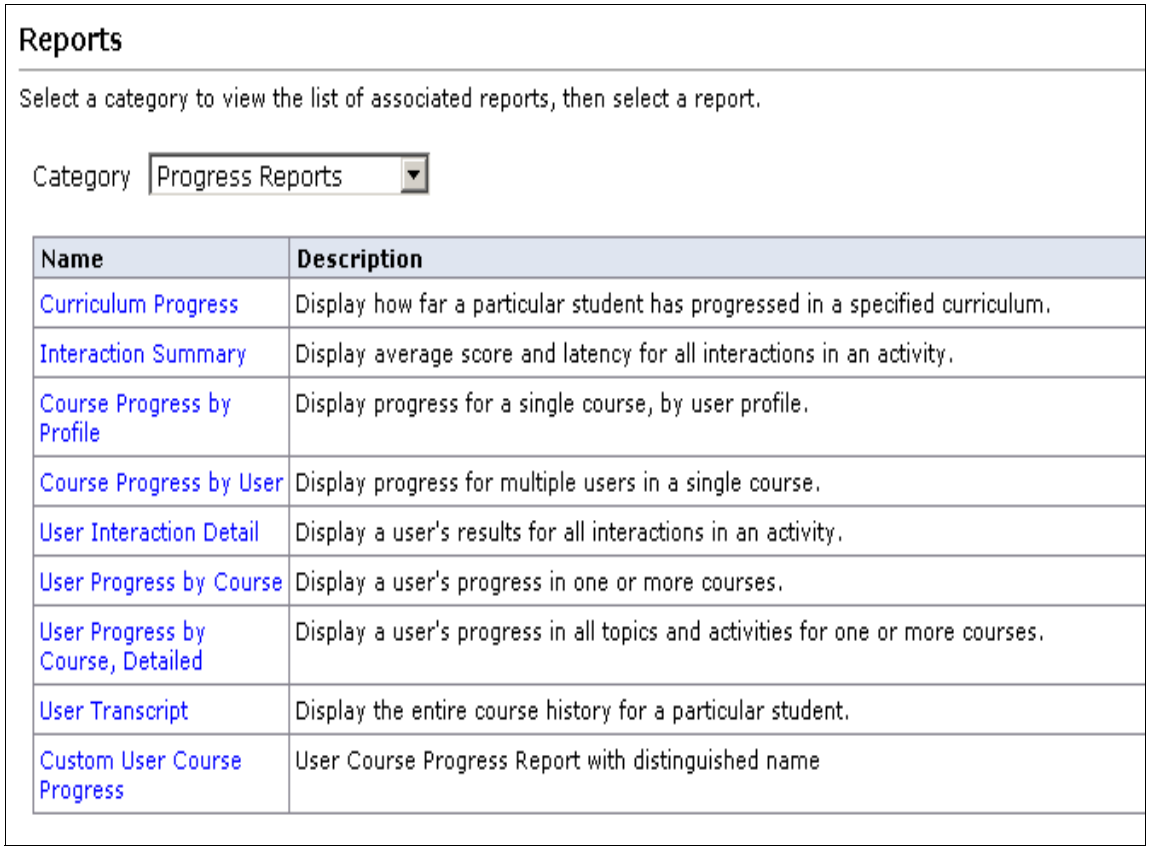


Figure 13-23 Selecting a report from the category Progress Report

The custom report will show the user's distinguished name after their display name. See Figure 13-24.

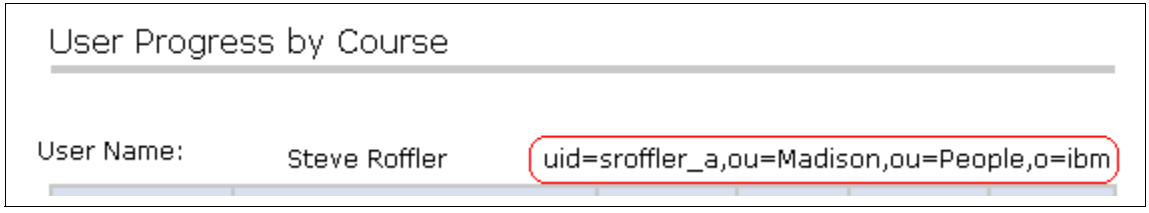


Figure 13-24 User's display name and distinguished name on 1 line in the report

13.9 Troubleshooting

In case of any problems while running the reports, you can change the log-level of the reporting part of LMM. This will help to determine possible problems.

You can change the log level by going to the settings.xml, located in the <WEB-ROOT>\WEB-INF\classes.

Search for enableLogging, which you will find in the ReporterSettings part of the file, and change this to yes. See example Example 13-4.

Example 13-4 Reporter settings

```
<!--================================================================
      ReporterSettings
      Points to the location of the report definition file, logging file,
      and indicates whether or not to enable report-level logging. Can
      optionally specify the location of the reporter home directory
      (via the "home"attribute).
      ================================================================ -->
   <reporter  component="com.lotus.elearn.reporter.ReporterMgrImpl"
              xmlConfig="/reports.xml"
              logFile="LMS-LMM_Reporter.log"
              enableLogging="yes"/>
```

After a restart of the LMM, the creation of a report will automatically be logged in the file LMS-LMM_Reporter.log. This is found in the default lms-log directory that has been defined as a parameter in WebSphere.

Part 4

Using the LMS

In this part we introduce some tips on how to use your LMS system.

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14

Content is still king

Why is content king? If your content does not meet the goals that it is designed for, regardless of the number of new learning tools and technologies available, the value of your learning environment is greatly diminished.

This chapter explores the essentials of e-Learning content design and development within the context of the IBM Lotus LMS. We look at different types of content and how you deploy this content in LMS.

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14.1 Course development

Where do you start when developing a new course? What does the development process look like?

14.1.1 The development process

Detailed elements and processes vary between organizations. However, most development processes involve the following components:

- Requirements analysis – Evaluation and feedback
- Conceptual design – Client and user evaluation and feedback
- Prototype – Client and user evaluation and feedback
- Development production – Client and user evaluation and feedback
- Pilot testing – Client and user evaluation and feedback
- Launch – Client and user evaluation and feedback
- Ongoing evaluation and feedback

14.1.2 Instructional design

Like the development process, the instructional design process may involve multiple methods, and instructional designers often develop their own unique method. However, most instructional design methods include the following components.

Requirements analysis

The requirements analysis is the most important piece of your work. This is the process of identifying and defining requirements and constraints, and analyzing their impact on the overall design. Your training program's success depends on identifying your learning goals and criteria for success.

During the requirements analysis, you will identify:

- The training need
- Audience profile
- Project constraints in terms of multiple audience characteristics, infrastructure and technology, and budget
- Success criteria at the management, departmental, and user levels
- LMS requirements
- Implementation requirements

- Evaluation requirements

You will also identify and define resources including

- Facilitators
- Help desk assistance and documentation
- Learning goal requirements and parameters (for example, does this course need collaboration for successful learning?)
- Content development requirements and parameters (such as re-purposing existing content or starting from scratch)

The results of this analysis impact all subsequent development and design decisions.

14.1.3 Design elements

When designing a course, a number of elements must be taken into account.

Learning outcomes

Define outcomes and determine how they impact the design; break down outcomes into clear learning objectives and break objectives down into lessons. This process provides the foundation for your course structure. Review your learning outcomes in terms of the objectives: Is the desired end result information transfer, skill development, a change in personal attitudes or interpersonal relations? The desired outcome affects how important it will be for the design to include collaboration, multimedia, simulations, or active learning. While collaboration is always helpful in learning, it is not essential for information transfer. However, collaboration is a key design element in courses teaching a change in attitude, such as teamwork, leadership, or sales skills.

Audience impact

How does the audience profile impact your design? All designs should include communication to the learner about why he should take this course and complete it. You should use a variety of motivational techniques including rewards and recognition. Also make sure your design includes engaging content and a variety of activities. Since not all people learn in the same way, a well-designed course will present the material in different forms for those with different learning styles. Design should take into consideration how the audience works now and their technology skill level. Course content should emulate the work environment as appropriate.

Resources

What are your available resources? You have to collect resources and determine what you can use, what will be benefit your particular audience, and what needs to be developed in order to meet the learning objectives.

Delivery format

Based on learning outcomes and resources, determine what delivery format(s) you will use—for example, blended solution of online collaboration and facilitated asynchronous material; self-paced tutorial; one stand-up teacher training class followed by synchronous online sessions, etc. Do you need discussion boards, e-mail, video, or on the job activities? Is asynchronous facilitation important? Include a section defining when collaboration, facilitation, and discussion are important.

Develop course structure

Based on the outcomes, resources, and delivery format, you have to develop a course structure or outline.

- Do your learning outcomes and content require branching based on a pre-test? Do you want multiple branching throughout the course?
- What is the lesson order?
- Which lessons are self-paced and which are online synchronous sessions?
- What activities are conducted online and which are conducted offline?
- Which lessons require active learning activities, video, role playing, audio, or discussion?

As a designer, to help your course participants, structure the course in manageable learning modules that have the following sequence:

1. Tell them what you want them to know.
2. Show what you want them to be able to do.
3. Provide the opportunity for participants to “do” what you want them to learn.

Usability - Human factors design

Notice the development process at the beginning of this section includes “User Feedback and Evaluation” following each step of the development phase. Placing the user in the center of the design process helps you to design a course that participants can use and follow.

To assist users, provide a well-thought-out user interface with simple navigation. Be sure to design the interface and share it with content developers prior to

developing content since the UI affects content “real estate”. Be sure to have end users test the UI design.

Accessibility

Be sure to consider the accessibility needs of your audience. Acessibility can mean learning anytime anywhere, in which case you may need to consider end user hardware and bandwidth. Accessibility also refers to development standards. Take into consideration screen size, font size, and design issues that are affected by end user vision, hearing, or motor skills. Be sure to view and follow the latest accessibility guidelines for your organization. For more information on accessibility guidelines, visit:

http://usability.gov/accessibility/

And:

http://www.w3.org/TR/WCAG10/

Determine development tools

Based on the demands of your learning outcomes and content requirements, determine what development tools you will need to use. Will the IBM Authoring Tool meet your requirements? What must be developed using other tools? Considerations include video needs, simulation needs, audio requirements, branching requirements, assessment requirements, synchronous session tools and requirements, and interactivity requirements.

Putting it all together

Of course, all of these decisions need to be made while taking into consideration the project’s budget and technology constraints and success criteria.

14.1.4 Development

When you develop a course, here are some concepts to keep in mind.

User-centered design

The development process should include a plan that incorporates frequent end user testing and feedback so the design and development can be adjusted throughout the development process.

For tips on using the Authoring Tool to develop content and importing third party content, refer to 14.4, “The LMS Authoring Tool” on page 293.

Content development

The desired learning outcomes and course content impact course structure and activities. Considerations include:

- Active learning strategies—Role playing, case studies, and problem solving activities—as appropriate to the content. That is, the higher the learning level, the stronger the need for collaborative activities.
- Multiple instructional methods to improve results.
- Motivational strategies to keep the participant coming back for more learning and support instruction.
- Using audio, video, and animation to optimize memory retention and support different learning styles.
- Provide scaffolding to fill in the gaps: Glossaries, reference material, Web sites, and self assessments.

Page design

Research indicates that certain page and layout formats enable users to better focus on learning the content versus navigating the course. Considerations include:

- Page length
- Color
- Navigation
- Graphics and multimedia placement, in terms of layout as well as use in terms of available bandwidth

Development team testing

Import content into LMS and set up test instructors and test users; test all pages in multiple browsers; test all exercises and assessments; test all code. Are the results tracking and scoring correctly in LMS?

Pilot

You are getting near the end of your instructional design and development process. It is time to pilot the course. Sometimes deadlines and schedules preclude us from implementing a pilot phase. Do not fall into this trap! The pilot phase provides you with critical feedback that the success of your course can depend upon. Initially, start with a small internal pilot user group. Gather their feedback and make adjustments. Then launch a pilot with a sample population of your end user group, including end user management. Make adjustments to the course based on end user feedback, and then you are good to go.

Budget

Of course, you have made many decisions in the preceding stages based on learning goals, requirements, and user feedback. All of these decisions need to be made within the context of your budget and technology platform.

How much collaboration, discussion, or interactivity does your design require? Why? Let us take a look at the IBM 4-Tier Model to help answer this question.

14.1.5 IBM 4-Tier Model

The IBM 4-Tier Model is a tool that provides a framework for placing e-Learning into one of four basic categories. Each tier defines a different model for learning content. For example, we learn through information presentation, content interaction, collaboration, and collocation. Placing your course content or educational experience into one of the four tiers, provides a framework to help you develop and deliver education more effectively and efficiently. Educational programs can range from tier-1 (standalone and self-paced) through blended to more powerful multi-tiered combinations. Since the tiers also represent different levels of performance and skill acquisition, you can develop your education in a way that allows you to successfully build from one tier to the next, or start at the right tier in the first place. Briefly, Figure 14-1 describes the four tiers.

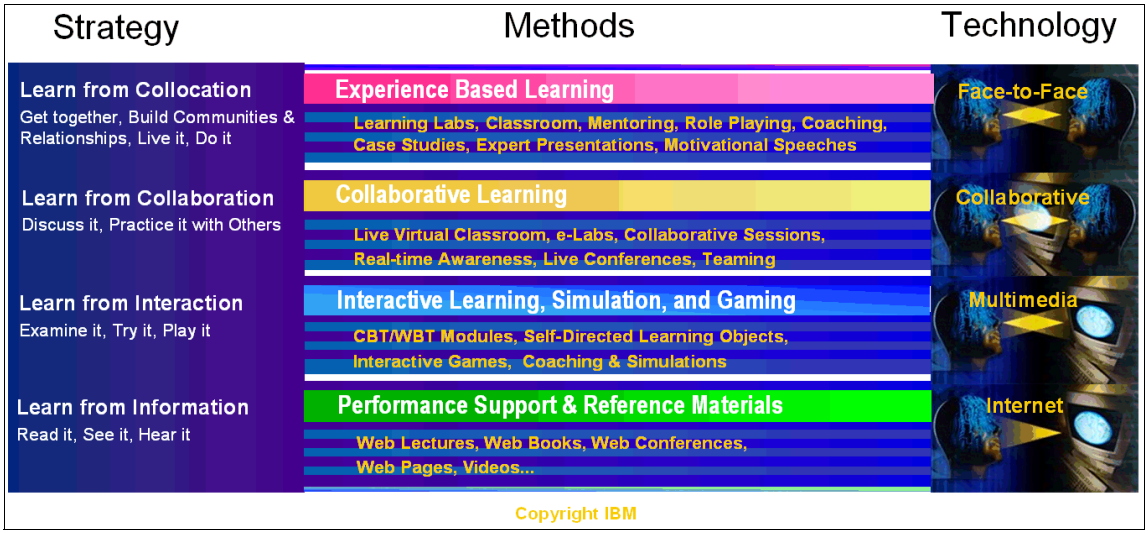

Figure 14-1 IBM 4-Tier Model

Tier 1: Learn from information

Read it, see it, and hear it.

Tier 1 is basic information transfer, which is ideal for communication information on new product launches, corporate strategy, or organizational announcements. Other examples include simple one-way presentations over the Web where learners can quickly and simply get the information they need, as well as books and e-books that they can read and learn from whenever and wherever. Basically this tier is self-paced and includes introductory content for learning relatively simple skills and knowledge.

Tier 2: Learn from interaction

Try it. Practice it yourself.

Learn somewhat more advanced skills in new applications, or simple procedural tasks at this level. Use computer-based training or web-based training, with computer games or simulations for practice. You are still primarily in a self-paced mode, only now you are trying to use what you have been learning. You are entering The Performance Zone.

Tier 3: Learn from collaboration

Discuss it. Practice it with others.

Collaboration tools, such as chats, team rooms, and interaction with online instructors and peers, allow learners to be able to learn in virtual groups from their shared experiences. Virtual team exercises can be used, as well as more sophisticated technologies such as application sharing, remote application labs, live virtual classrooms, and interactive presentations on the Web. As a learner, at this point you are interacting with others, but you do not need to be face-to-face. You are still in The Zone and on your own, but you are heading towards really being able to do what you have learned.

Tier 4: Learn from collocation

Get together. Build relationships. Try it.

Finally, the learners and the instructors or experts meet face-to-face. Classroom and mentoring, coaching, real-time learning labs, role-playing and more happen at this level. At this level, learners are acquiring really advanced skills and know-how that lead to performance. This requires learners to be in the same place at the same time as they are learning. Although more expensive, the cost can be mitigated by knowing when to develop and employ learning at this tier. This reduces the amount of time learners need to spend out of the office and traveling, and optimizes the use of expensive instructor and classroom facilities and other face-to-face meetings.

So the 4-Tier Model is really a tool that gives us a way to look at the real learning needs of the learner, find the appropriate tier or tiers, and produce a blended and often customized learning program that truly meets the needs of that learner.

This is part of the IBM Lotus white paper *The 4 Tier Model: Managing the New e-Learning Curve*. The complete white paper can be found at:

http://www-3.ibm.com/software/mindspan/distlrng.nsf/89297bbbe911d2788525674c00675635/e4e36aa7c520bcd185256b12005c6c55/$FILE/LSP-2002-022.pdf

14.1.6 Implementation

Here are some elements to consider when you roll out the course.

Implementation team

Your implementation planning team should include members from IT, marketing, help desk, trainers (facilitators), and subject matter experts (SMEs). The Requirements analysis conducted earlier should have defined the number of users and their technology profiles. Be sure the IT staff has this information. Marketing can help you determine how to best market the course and when to send out promotional materials. Work with the IT, informing them of live session dates and determine when users should test live sessions.

Time line

Develop a time line for all pre-session events including:

- Marketing tasks (sending out promotional materials)
- IT and help desk tasks such as supporting end user session tests
- Facilitator tasks (sending out course-specific information to end users, for example)
- Participant tasks (session test)

Marketing

Do not underestimate the importance of marketing your course. To ensure success, you need both management “buy-in” and learner “buy-in”. When learners understand “what's in it for me”, then they are more motivated to actively participate and complete the course.

Course packs

Courses imported into, or created in, the IBM Lotus Authoring Tool, as well as SCORM 1.2 compliant courses developed using third party tools, are packaged into a .zip file on export. This packaged file contains the course content, graphics, scripts, tracking data, and SCORM metadata in the XML Manifest file.

Prior to implementation, you will want to thoroughly test all course packs. Import your course into the LMS. Register the course and check the course status to make sure it has properly deployed to the Delivery and Content servers. Review the course creation document, course structure, and navigation to ensure it is correct. Test your tracking and scoring data: Enroll users and have them complete the course and all scored activities. Run user progress and completion reports to verify your tracking.

Once you have completed testing and are satisfied that your course is ready for pilot or implementation, then you can unregister the course to remove your test users and information, and register the course again for deployment.

Practice makes perfect

The instructor and facilitator will want to walk through the course and look for problems. Additional practice, using live sessions with the producer, facilitator, and SMEs, will help ensure that the course is accurate and ready for students to attend.

Keep your finger on the pulse

Throughout implementation, check the pulse of the course, course activities, responses, and so forth. Check in often with participants. If your course includes discussion, be sure to establish discussion guidelines and promptly respond to your participants' e-mail communications.

14.1.7 Evaluation

The evaluation stage is a key part of any training program. This stage allows you to gauge how well the training program met the objectives for which it was designed. Most trainers use the levels of evaluation as defined by Donald L. Kirkpatrick. The levels are:

- Level 1: Reaction
- Level 2: Learning
- Level 3: Behavior
- Level 4: Results

Level one: Reaction

The purpose of the first-level evaluation is to gauge learner satisfaction with the training experience by soliciting feedback from the learners on a course evaluation form, sometimes referred to as a "smiley sheet." Learner satisfaction is relevant not only because you want a course to address the needs of learners, but learner feedback helps you determine the effectiveness of the course documentation and instructor from the learner's perspective. If learners are dissatisfied with the course, this can affect long-term retention of the concepts or

skills covered in the training, as well as influence learner participation in future training opportunities. Also, dissatisfied learners will spread the word, and this can impact the attendance and effectiveness of future classes.

Typically, a smiley sheet is designed so learners rate different aspects of their learning experience on a 5-point scale (Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree, Nor Disagree, 4 = Agree, 5 = Strongly Agree). Questions cover course content, course instruction, information presentation, learning environment, and learning tools.

Use the built-in assessment development features in the LMS Authoring Tool to create a level-one evaluation for your class. For rating questions, use a multiple-choice format.

Since level-one evaluations are most effective when learners complete them immediately upon finishing the course, it is best to make this assessment part of your final course module or class session. If your course is a self-paced or facilitated online tutorial, include the assessment as part of the last module and let participants know completing this assessment is part of the course. If your last lesson is an online session, once you have reached the end of the session, have your participants complete the assessment before they leave.

The assessment development features in the Authoring Tool and the reporting tools included with LMS can be used to facilitate conducting level one through three evaluations.

Level two: Learning

The purpose of the level-two evaluation is to gauge whether the learners understood and learned the concepts presented in your training session. To better gauge the impact of the training session, a pre-assessment can be given before the training session to determine the learners' existing knowledge. At the end of a course, learners then complete a comprehensive assessment on the subject matter. Learner results before and after the session are then compared, and the degree of improvement is used as an indicator for the effectiveness of the training.

As trainers, often we are most concerned with the knowledge level of participants completing the course, and so we deliver assessments at the end of a course or class session. However, pre- and post-assessments offer a valuable way for you to document learning. Use the LMS reporting tool to view learner results and progress.

To do pre-testing, create a pre-assessment using the Authoring Tool and structure your course so users complete the pre-assessment prior to attending a course session or prior to completing self-paced online work. For post-testing,

create the assessment using the Authoring Tools and have learners complete it at the end of the course session or end of the self-paced online instruction. Once the learners have completed the assessments, use the reporting features of LMS to help analyze the results.

Level three: Behavior

The purpose of a level-three evaluation is to determine if the training resulted in any on-the-job behavioral changes. In other words, did the learners take what they learned in the session and begin to put it to use as part of their work responsibilities?

A precise determination of this change in behavior requires intensive workplace observation of the learners after they have completed the training. However, the value of this detailed information is typically considered less than the expense required to gather it. Instead, it is common practice to use surveys or focus groups three months after the completion of the training program to gather this data.

Level four: Results

The purpose of a level-four evaluation is to measure the impact of the training program on the wider community of the entire organization and determine its value to the organization. At this level of evaluation, we expand our thinking beyond the impact on the learners who participated in the training program and begin to ask what is happening within the organization as a result of the training effort. Examples of measurement criteria may include:

- Monetary: Are we saving money as a result of this training?
- Efficiency: Have our operations improved as a result of this training?
- Moral: Has employee moral improved as a result of this training?

Although a level-four evaluation covers a broad category of possibilities, it should answer the question: Is the training working and yielding a value for the organization?

14.2 Content-related terminology in LMS

Here we define a few terms as they relate to LMS

14.2.1 Course

A course consists of lessons or units. A lesson consists of units.

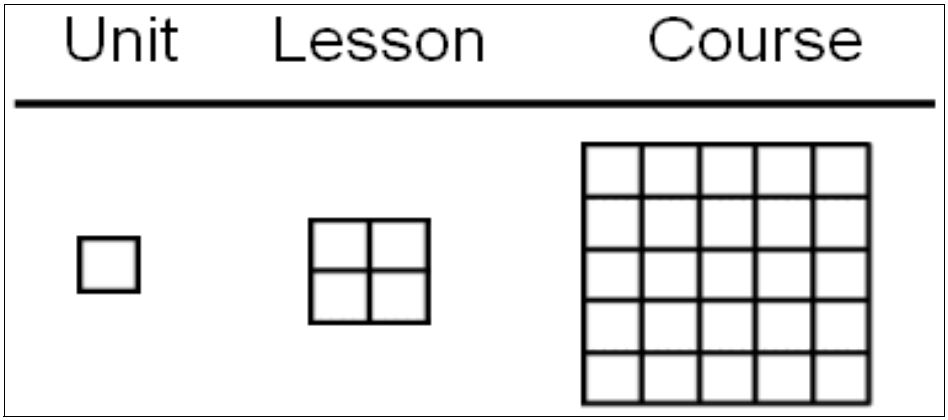

Figure 14-2 Unit, lesson, and course

In Figure 14-3 you see what this can look like in LMS.

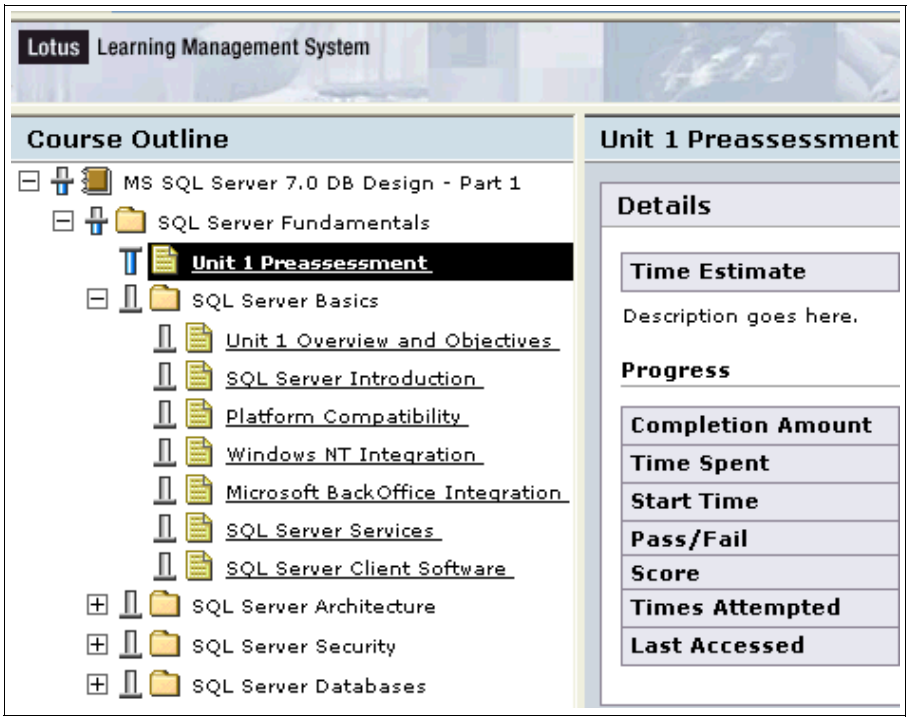

Figure 14-3 Course, lessons, and units

In LMS, a unit can be:

- An activity

- A classroom session
- A virtual classroom
- An e-Learning course
- A combination of the above

Courses can be created in the Authoring Tool or other third-party tools. It can be off-the-shelf content supplied by Thomson Learning, Element K, or other content providers. Live sessions are created with the Authoring Tool. Physical activities such as labs, workshops, seminars, or physical classrooms can either be created in LMS or with the Authoring Tool. When creating blended learning courses, the Authoring Tool is currently the only option.

14.2.2 Curriculum

The next level of organizing training in LMS is called a curriculum. A curriculum can be a group of courses or events. The curriculum is a very flexible way of building a path to achieve an education goal.

You can set up prerequisites, which means you can group courses or activities where you can state the number of mandatory courses or events to complete.

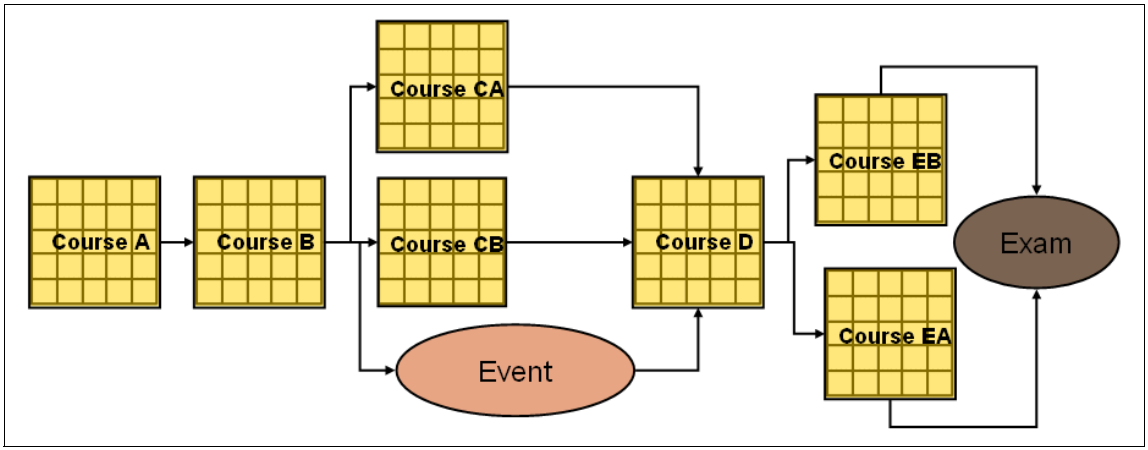

Figure 14-4 Curriculum example

14.2.3 Certificates

A certificate is a special type of a curriculum. Completion of a certificate program implies a certain level of competency in a particular skill or subject area.

As with other curriculum, LMS provides the option of setting up course prerequisites. Participants may have to complete certain courses or events prior

to moving forward, or they may have a mandatory number of courses or events to complete.

The main difference between curriculums and certifications in LMS is that a certification includes a function to allow the instructor to set a “Maximum Time to Complete” validity period. Administrators also have the option to set up additional courses for re-certification.

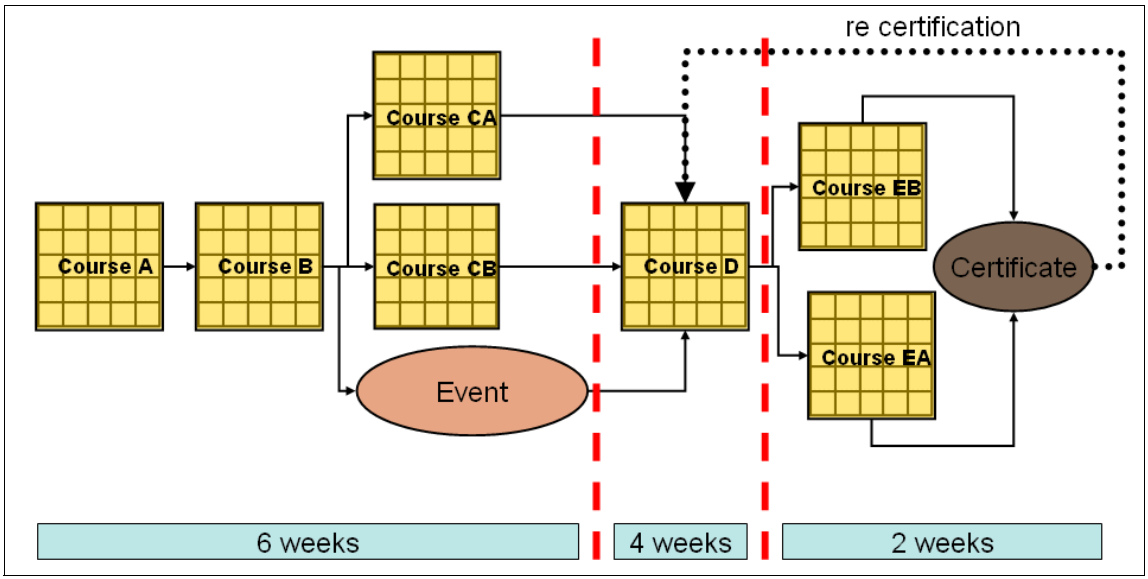

Figure 14-5 Certification example

14.3 Where the content comes from

Content is mostly built by course developers, people who have the knowledge and skills to create an online learning experience that is both effective and fun. As individuals or teams, course developers must be adept in all aspects of online education—as experts in a certain subject area, as Web developers experienced with course development software, as Web designers who can create appealing screens, and as instructional designers who understand online teaching strategies.

When course developers design a content screen, they consider the visual and auditory impressions, as well as the student's own interactions with the screen, to create a complete learning experience. Each screen must also blend with the context and design of other screens and contribute to the instructional goals for the course.

Note: This is part of the “Deploying content in the Lotus Learning Management System” article by Kerry Woodward. The complete article can be found at:

http://www.lotus.com/ldd

In addition to original content development, many companies have existing content used for previous training events. Some of this content my fit into the new learning structure, some of it may not. Course and content developers need to sit down and plan how they will integrate content into the new structure. Questions they might consider are:

- What topics are you going to cover?
- How is your content organized?
- What type of content will you include in the course? New content or pre-existing content?
- Who in your organization will create courses using the Authoring Tool?
- If including preexisting content, what kind of content will this be?
- For new content, will you be using the Authoring Tool to create the new content?

14.3.1 SCORM

Have you ever tried to fit a square peg in a round hole? Impossible, isn’t it? In contrast, have you ever noticed how the interlocking pieces of highly successful building toys, like Legos or K’Nex, allow for the reuse of basic components as much as possible to build a wide variety of models?

That is the concept behind the Shareable Content Object Reference Model (SCORM). SCORM is an industry standard for Web-based learning tools whose technical specifications allow users to reuse learning components across multiple e-Learning applications.

Although SCORM includes a set of technical specifications that facilitate the interoperability of e-Learning components and products, it is also a bridge between emerging technologies and commercial implementation. Users, developers, and industry leaders work together to develop and adopt industry standards for content organization, user data tracking, communication and delivery formats.

Why it exists

The evolving SCORM model stems from the U.S. Department of Defense's Advanced Distributed Learning initiatives (ADL). ADL brings together users, developers, and industry leaders to develop SCORM technical specifications that increase:

- Accessibility: Learning anytime, anywhere
- Interoperability: Separation of content from the Authoring Tool and environment
- Durability: Learning products that will evolve with technology
- Reusability: Develop once, and use many times in a variety of ways
- Adaptability: The right training at the right time
- Affordability: Better, faster, and less expensive learning

Why I care

Remember how we noted the Legos building toy allows children to reuse common pieces to build new models? SCORM provides a common model for developing learning components, allowing course designers and training facilitators to re-use components as needed in multiple courses. Before SCORM, we could not:

- Move a course from one Internet-based learning management system to another.
- Reuse content across multiple Internet-based learning management systems.
- Create content that is searchable across multiple learning management systems.

Finding out more about SCORM

To learn more about SCORM, visit some of the sites described in this section.

Advanced Distributed Learning

The ADL site includes general overview information, a step-by-step guide geared towards instructional designers tasked with implementing SCORM, and links to ADL cooperative lab Web sites. Become an ADL member and download technical specification documents.

http://www.adlnet.org

Go to **Focus Area -> SCORM**.

SCORM presentation

You can find a Powerpoint presentation covering SCORM basics, details of technical specifications of SCORM 1.2, as well as where SCORM 2.0 is headed:

http://www.jointadlcolab.org/scormtutorial.htm

SCORM online tutorial

This tutorial, developed by ADL Co-Lab partner, the University of Wisconsin, is no charge to the user:

http://www.academiccolab.org/learn/

Download SCORM technical documents

Download at:

http://www.adlnet.org/index.cfm?fuseaction=SCORDown

14.3.2 AICC

Aviation Industry Computer-Based Training Committee (AICC) is an international association of airplane manufacturers, technology-based training professionals, software vendors, and CBT developers. This association develops Aviation Industry guidelines for the development, delivery, and evaluation of computer-based training, and other technology-based training. AICC guideline goals include:

- Effective and economic CBT implementation
- Interoperability standards
- Facilitation of an open forum for technology training discussion

AICC has developed nine AICC Guidelines and Recommendations (AGRs) ranging from workstation guidelines to software development guidelines. Today the AICC coordinates its standardization efforts with other agencies including ADL-SCORM and International Electrical and Electronics Engineers (IEEE).

Why it exists

AICC was formed in 1988 to address hardware standardization needs for CBT delivery. The aviation training community began developing the interoperability standards in order to get the best possible value for its technology-based training dollar. The recommendations for making a course AICC-compliant are fairly general to most types of computer-based training and, for this reason, are widely used outside of the aviation training industry.

Why I care

Courses designed according to AICC guidelines will offer greater flexibility and interoperability. Depending on the AICC guidelines, you will be able to use course components across multiple applications. However, it is important to note that AICC compliance means the course is designed and tested for at least one of the AICC AGRs.

Finding out more about AICC

The AICC FAQ page is a great place to start to learn about AICC. This page covers basic information and then provides links to more complex articles and technical documents.

http://www.aicc.org/pages/aicc_faq.htm

14.3.3 Importing existing content into LMS

Note: Detailed procedures on how to import the different content types described in this section are provided by Chapter 8, “Working with External Content” in the Authoring Tool Guide.

See 14.4.3, “The LMS Authoring Tool Guide” on page 295, for information on how to obtain this guide.

SCORM-compliant courses

If a course is SCORM 1.2-compliant and requires no changes or additions, you can import it directly into LMS with the CLIMP utility. (For more information, see Appendix I, “CLIMP help” on page 439.) To the extent that the original course has metatags, the activities are then tracked and the assessment scores available through the reporting function in LMS. However, if changes are to be made, it will be necessary to bring the course into the Authoring Tool. For example, if HR wants to change the content or add an assessment using examples specific to their organization, then the course must first be imported into the LMS Authoring Tool.

If the course should happen to be a SCORM release that is below SCORM Version 1.2, you will need to use the Authoring Tool import facility in order to repackage and import the course into LMS.

AICC-compliant content

All AICC courses require import into the Authoring Tool prior to LMS import. The AICC-compliant workplace safety course will have to be imported into the Authoring Tool in preparation for its import into LMS.

What if your content is not SCORM- or AICC-compliant?

What if your company wishes to utilize existing content, third-party courses, Web-Based Training, or standard slide presentations that are not AICC- or SCORM-compliant?

Return to the development tool

If it is a course created in-house, go back to the tool that created the content to determine whether it can generate AICC- or SCORM-compliant courses. If it can, then repackage the course to comply with one of the two standards.

Macromedia

For example, if it was created in a MacroMedia tool (Dreamweaver, Flash, or Authorware) it can now be exported in a SCORM-compliant format.

Microsoft PowerPoint

If the content was created in PowerPoint or is in the form of simple html pages that can be imported into PowerPoint, you can use Microsoft's Learning Resource iNterchange (LRN) to create a SCORM-compliant package.

Lotus LearningSpace 4/5

If the content was created using LearningSpace 5, it can be imported into LMS by using the Authoring Tool.

Contact course author

If the content was created by a third party, contact them to determine whether they now have a standards-compliant version.

Create a new course

If none of the above options is suitable, you can copy the content to any Web server and create a new course in the Authoring Tool that contains a single activity. This activity points to the URL of your content's start page. See the *Authoring Tool Guide* for more information, specifically Chapter 3, "Creating a Course" - Step 5. Create a link that launches a Welcome page."

This last approach has two drawbacks. First, courses created in this way cannot be made available for offline use, because the content is not managed by LMS. Second, no detailed learning progress tracking of units and lessons is available, because LMS is only aware of the content's first page.

14.4 The LMS Authoring Tool

The LMS Authoring Tool is a course authoring and packaging utility that comes with LMS. This section introduces you to the concept of the Authoring Tool.

14.4.1 What the LMS Authoring Tool is meant to do

Table 14-1 helps authors understand the purpose of the Authoring Tool and how they might use it.

Table 14-1 Authoring tool Q&A

Question	Answer
What is the Authoring Tool?	- The IBM Lotus Learning Management System (LMS) Authoring Tool is a content planning, creation, and packaging application. Course designers and developers can use the Authoring Tool at their workstations to import third-party content or create new Web-based content for their courses. The Authoring Tool is provided as part of the LMS package and can be used at no additional cost by any licensed user of the Learning Management System. - The sole purpose of the Authoring Tool is to create Web-based content for the Learning Management System (Note: SCORM Export from the Authoring Tool is planned for a future release).
Who should use this tool?	- The tool is intended for Subject Matter Experts to easily create content for the Learning Management system without requiring the purchase of third-party Authoring Tools. This tool is not intended to be used by an entire user population (who would require more simple tools) or by training professionals (who would require more advanced tools). - The tool is designed to be easy to use for simple content creation by most users while providing some advanced features for a more limited audience (advanced navigations, objectives, etc.).

Question	Answer
What are the scenarios that would prompt me to use the tool?	- Quickly create Web-based content for LMS (form-based content authoring). - Add tests to new or existing content (for example, multiple choice questions, fill-in-the-blank, etc.). - Assemble blended courses for LMS (live sessions, instructor-led classes). - Re-purpose existing content (merge different courses, add blended course components, sequence/branch activities). - Add LMS-specific functionality to existing content (for example, preview, expert location). - Promote consistent content creation by using custom-branded templates.
What are IBM plans for the future of the Authoring Tool?	- While we expect the tool to be incrementally improved based on future needs and customer feedback, it is not IBM's intention to significantly add new functionality to the tool in order to compete with more sophisticated Authoring Tools such as Dreamweaver. - IBM has no plans to market and sell the Authoring Tool as a separate product for creating content outside of the IBM learning products.

14.4.2 What the Authoring Tool is not intended to do

The Authoring Tool is not intended to replace content creation performed with ubiquitous “low-end authoring” tools (MS Powerpoint, MS Office, etc.), and is also not intended to provide the functionality provided by high-end Authoring Tools, such as Dreamweaver or Flash, that are required by professional training personnel.

This tool is not designed for team authoring where multiple users work on the same course. This type of activity would require more advanced content creation and management functionality usually provided by a Learning Content Management System (LCMS).

This tool is not designed to create printed training materials.

More advanced requirements for authoring (for example, team authoring, simulations, etc.) can be provided by third-party tools or by IBM's own services-based asset IBM Knowledge Producer (KP).

14.4.3 The LMS Authoring Tool Guide

The *LMS Authoring Tool Guide* is available at:

`ftp://ftp.software.ibm.com/software/lotus/fixes/LearningSpace/LMS/AuthoringToolGuide.zip`

It contains detailed information on using the Authoring Tool and also comes with sample SCORM course packages.

Note: This download file is about 100 MB in size.

14.5 Content deployment

To offer an e-Learning or blended course in LMS, you will have to deploy the course content to the LMS.

14.5.1 Deployment process overview

Note: This section is based on the article “Deploying content in the Lotus Learning Management System” by Kerry Woodward. The complete article can be found at:

`http://www.lotus.com/ldd`

The content deployment process involves the following steps.

Step 1: Packaging

If you want to deploy course content to LMS you will first have to put the content into the right format. As described in 14.3.3, “Importing existing content into LMS” on page 291, you can only use SCORM 1.2 compliant course packages with LMS. If the content is non-SCORM, you will have to import it into the LMS Authoring Tool first and transform it to a SCORM package.

A SCORM package is a compressed file archive (zip file). It contains one or more XML manifest files defining the course structure, the list of the files in use, and any additional data associated with the course. The package also contains either

the content files needed for running the course or the URLs that define the location of content files.

Each course package processed through the Authoring Tool contains a unique package ID and a version number. This allows courses to be updated correctly in LMS later. Packages created elsewhere may or may not have these identifiers. If the package ID and version number are missing, a package can still be imported, but the course will not recognize subsequent imports of the package as updates, so the package will not be updated automatically.

Step 2: Importing

After you prepare your SCORM compliant courses, you have to decide how to import them into LMS.

- Courses you imported into or created with the LMS Authoring Tool can be imported into LMS by using the Authoring Tools import facility.
- If you want to import third-party SCORM packages without further modifications, you can use the LMS Command Line Import Utility (CLIMP). You can of course use CLIMP to import courses you created with the Authoring Tool. To see how to run CLIMP, see “Running CLIMP” on page 301. For more information on CLIMP, see Appendix I, “CLIMP help” on page 439.

Step 3: Registering

A course shown in the Course Catalog is an offering. Each offering is based on the content and structure of a course master. The package that you imported appears in the LMS Course Masters Catalog as an unregistered master. Register the master to make it available to anyone who wants to use it as a template for their course offerings.

To register a master, you need to be logged into the LMS interface with permission to create course masters. This permission, “Manage Masters Catalog,” is assigned to the administrator role by default.

Step 4: Offering

Each offering is unique with its own Delivery and Content Servers, availability schedule, instructor, location, enrollment list, and so on. After you create an offering and make it available, it appears in the Student Catalog for students to preview, enroll in, and complete.

You need to be logged into the LMS interface with permission to create course offerings. This permission, “Manage Offerings Catalog,” is assigned to the administrator role by default.

14.5.2 The deployment process in detail

This is a description of the steps performed by you and the system when you deploy a course to LMS. A flowchart is shown in Figure 14-6 on page 298.

1. You initiate the content deployment process using CLIMP or the LMS Authoring Tool (AT).
2. If you selected the upload option, AT copies the content package to the specified import location (a FTP directory or a directory on the file system).
3. AT sends an import request using HTTP to the LMS Content Manager (CM) residing on the LMM. The request includes the package name and the import location (FTP server, user, password, or the file system path).
4. CM retrieves the course package and copies it to the packages directory defined during the LMM installation. It also extracts the course content to a subdirectory of the packages directory.
5. CM creates an unregistered course master.
6. CM sends a completion notification by e-mail to you.
7. You register the course master using the LMS user interface.
8. Optionally you delete the course package from the import location, since it is not needed any longer.
9. You create a course offering based on the course master and select a DS to handle the offering.
10. Through HTTP, CM sends the offering information (especially the course content structure) to the specified DS.
11. For every content server attached to the DS, the DS sends a request back to the LMM CM to push the content to the content server. These requests include the way (FTP or file system) and the location of where to send the content to.
12. CM serves DS's requests by copying the content at the specified locations.

    To supplement the process flow in Figure 14-6 on page 298, Figure 14-7 on page 299 shows a ocmponent flow.

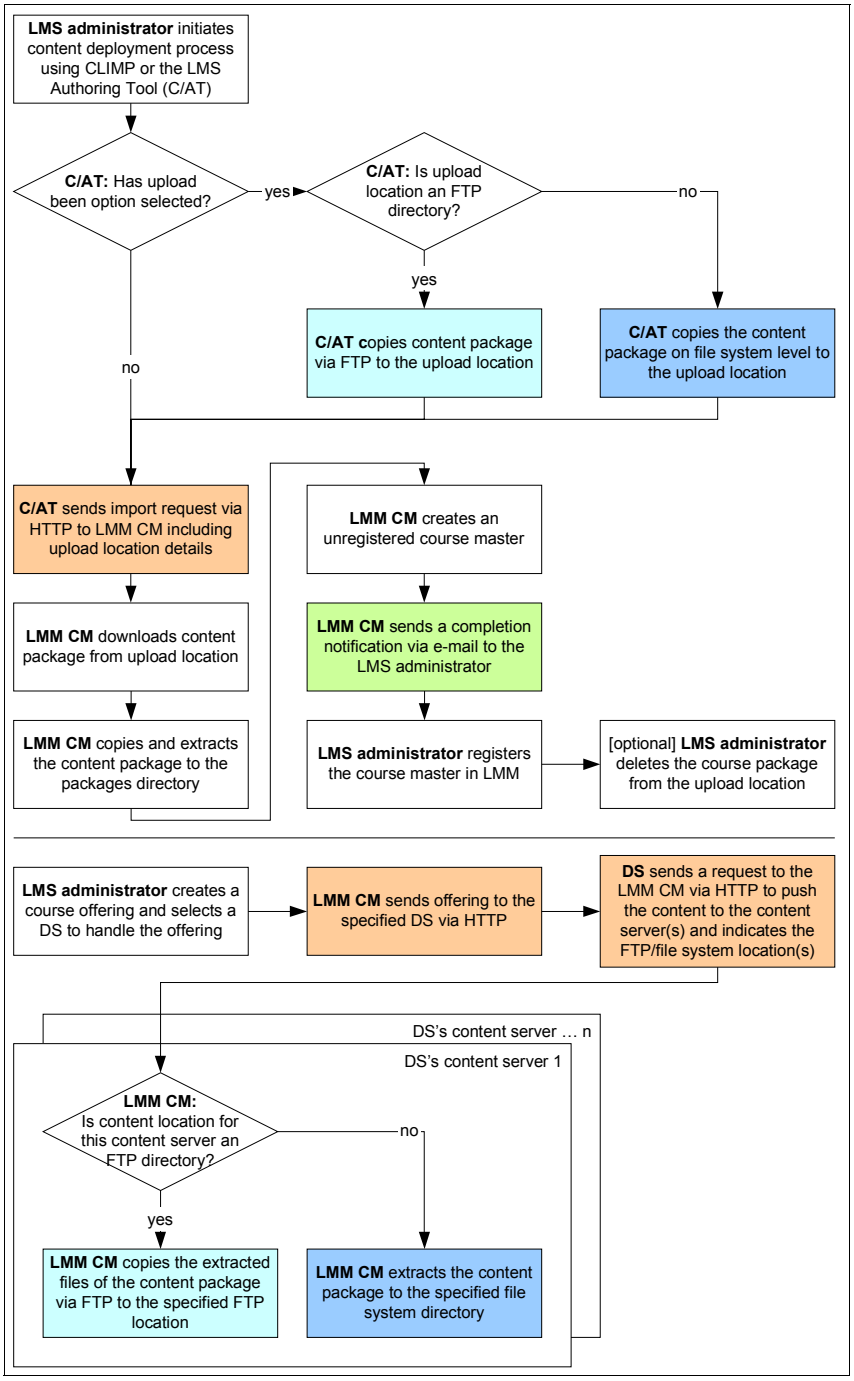

Figure 14-6 LMS content deployment - Process flow view

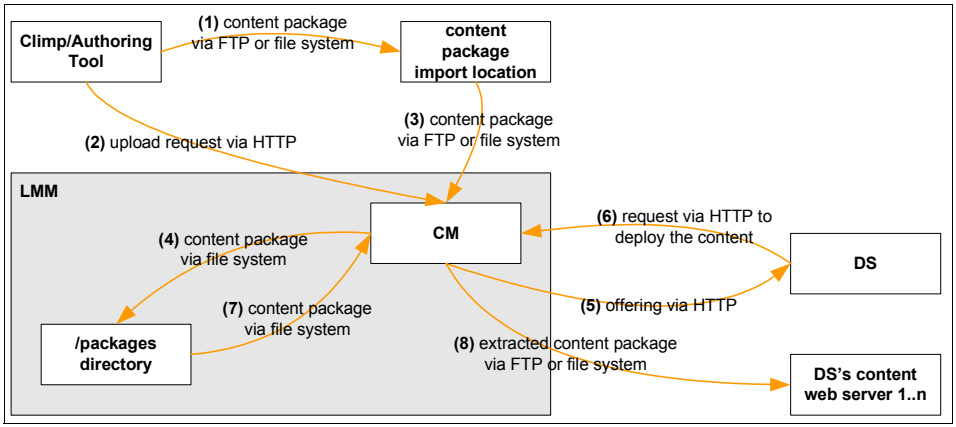

Figure 14-7 LMS content deployment process - component view

14.6 CLIMP, the LMS Command Line Import utility

CLIMP is the command line tool provided by LMS to import into or to update existing SCORM 1.2 course packages in LMS. CLIMP is Java-based and runs under Windows and UNIX.

14.6.1 Installing CLIMP

If you selected the Utilities option when you installed LMS, CLIMP was installed in the installation directory specified.

To use CLIMP from another workstation, you have the following two options:

- Copy the CLIMP-related files manually from the installation directory to the workstation. To do this, create a directory called CLIMP on the workstation and copy the bin, java, and lib directories from the LMS server's LMS installation directory to this directory.
- Run the LMS installer on the workstation and select to install Utilities only. Adjust the installation directory.

14.6.2 Using CLIMP

In this section we discuss using CLIMP.

Check prerequisites

Before you start using CLIMP, check the following things:

- Ensure that the content you want to import is SCORM 1.2 compliant.
- If you are using FTP:
  - Is the import location accessible (FTP or file system)?
  - What is the FTP user name/password to access the FTP server?
  - Does the FTP user have write permission?
  - Is the FTP server accessible from the workstation AND the LMM machine?

  Tip: To test the access to the FTP server, you can use:
  - Your Web browser (use the FTP URL, starting with ftp://),
  - The command line FTP client (start it with, for example, ftp myftpserver.com), or
  - A third-party FTP client such as FileZilla, available for free at:

    `http://sourceforge.net/projects/filezilla`

- If you are using file system transfer, ensure that the course package is available to the LMM via the same file path as on the machine you are running CLIMP on.

  File system transfer is automatically used when you omit FTP settings. You should use the file system transfer only when running CLIMP directly on the server.
- What is the LMS administrator's name and password?
- What is the URL of the LMS Content Manager servlet? It is usually something like this:

  `http://<web_server>/lms-lmm/import`
- In which directory is the course package you want to imported located?

The properties file

You can run CLIMP from the command line by starting a batch file from the bin directory. Under Windows it is called climp.bat and for UNIX it is climp.sh. The batch file expects several parameters to perform the import. See Appendix I, "CLIMP help" on page 439, for detailed information on the CLIMP syntax.

To make the usage of CLIMP easier, you can also provide most of those parameters in a separate properties file, and when you run CLIMP, you then specify the properties file and the course package you want to deploy.

To create a properties file, open an text editor on the workstation (for example,Notepad) and insert the following lines with the right values for your LMS environment.

- The URL for the Content Management servlet, for example:

```
cm=http://itsolms3.cam.itso.ibm.com/lms-lmm/import
```

- The LMS administrator's name and password, for example:

```
cmu=lmsadm
cmp=starshine
```

- The URL for the FTP server, for example:

```
ftp=itsolms3.cam.itso.ibm.com
```

- The FTP user name and password, for example:

```
ftpu=ftpadm
ftpp=starshine
```

- The e-mail-address(es), for example:

```
e=myname@mycompany.com
```

Save the file in the CLIMP bin directory as climp.properties.

Running CLIMP

Open a command line on your workstation and go to the bin directory on your machine. For example:

```
cd c:\climp\bin
```

To start the import process use the following command on Windows:

```
climp -u -p climp.properties <course_package_filepath>
```

On UNIX you will enter:

```
./climp.sh -u -p climp.properties <course_package_filepath>
```

You can also use an asterisk in the <course_package_filepath> to upload multiple packages at once, for example: c:\packages*.zip.

If your course import using CLIMP has been successful, you should see a message similar to Figure 14-8 on page 302. If you see a different message or no message at all, then the import process has not been successful.

For more information on CLIMP, see Appendix I, "CLIMP help" on page 439.

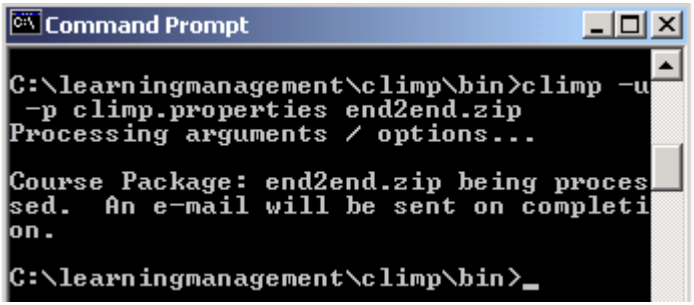

Figure 14-8 Successful course import

The course package is now stored on the LMM machine in the packages directory.

Next steps

Check if the course is available as unregistered master.

1. Log in to LMS with an administrator user.
2. Click the **Course Catalog** tab.
3. Click **Register Master** to register the new course as a master.
4. Choose either **Course**, **Curriculum** or **Certificate** depending on your course structure.
5. Click **Continue**.
6. Your course should appear as unregistered master, as shown in Figure 14-9.

Unregistered Master	Description
No Title Given	
"The art of writing"	
MS Win 2000 Administration Part 3	
MS Word 2000 Fundamentals	
default	

Figure 14-9 Unregistered Master

7. Now you can register the course master and create course offerings as described in the *LMS Administration Guide*.

14.6.3 Troubleshooting with CLIMP

If you are experiencing problems when deploying courses, check the following things:

- Is the LMS up and running?
- Is the FTP server running?
- Is the FTP server accessible from your workstation and from the LMM Server?
- Does the FTP user have write permissions?
- Are there typing errors in the properties file?
- Is the content SCORM 1.2 compliant?

Below we include examples of typical errors and how you can resolve them.

URL for Content Management is wrong

If this error message appears, you must check the content manager URL that you entered in the properties file; for example:

```
cm=http://<web_server>/lms-lmm/import
```

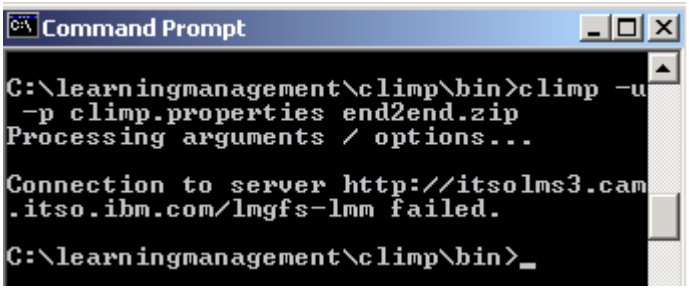

Figure 14-10 CLIMP error: Wrong Content Manager URL

LMS administrator and password are wrong

If this error message appears, you should check the LMS administrator's name and password in the properties file, for example:

```
cmu=lmsadm
cmp=pass12word
```

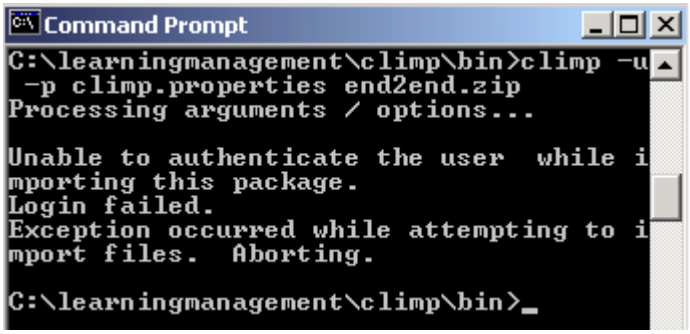

Figure 14-11 CLIMP error: Wrong LMS administrator

FTP Server unreachable

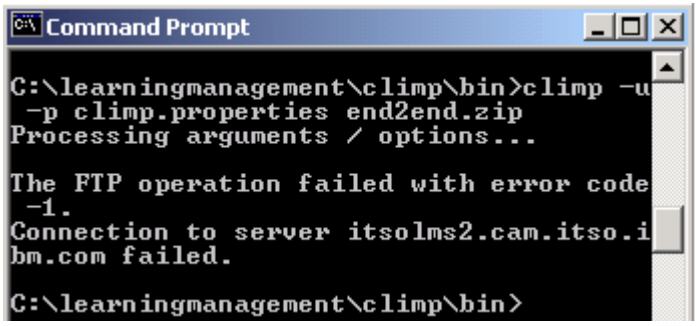

Figure 14-12 CLIMP error: FTP server not reachable

If this error message appears, you should check if the FTP server is running and if the FTP server name specified in the properties file is correct, for example:

```
ftp=myftpserver.mycompany.com
```

You also should check if the FTP server is accessible from the workstation and from the LMM machine.

FTP user name and password are wrong

If this error message appears, you should check the FTP user's name and password, for example:

```
ftpu=ftpadm
ftpp=mysecretpw
```

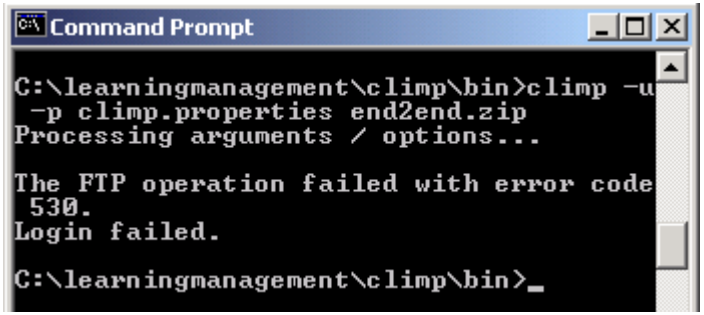

Figure 14-13 CLIMP error: Wrong FTP user

15

A User view of LMS

In this chapter we explain the use of the LMS by covering the user interfaces and describing the functions and features. These change, depending on the role you have when you log in.

We also describe the installation and deployment process of the Offline Client.

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15.1 The user interface

The LMS provides features and functions for several types of users. Each user sees the interface that is appropriate to the user role he has been assigned. We can differentiate by default between five interfaces:

- Anonymous interface
- Student interface
- Manager interface
- Instructor interface
- Administrator interface

A company can customize more interfaces, depending on the roles and functions in the company.

Note: For more about roles, see Chapter 11, “Configuring LMS” on page 177, in the *LMS Administration Guide*.

15.1.1 Anonymous access

The LMS allows users to enter the site without any login. But the administrator can revoke this anonymous access.

An anonymous user can display the Home Module and the Course Catalog; see Figure 15-1. If online courses are available for anonymous users, they can enroll.

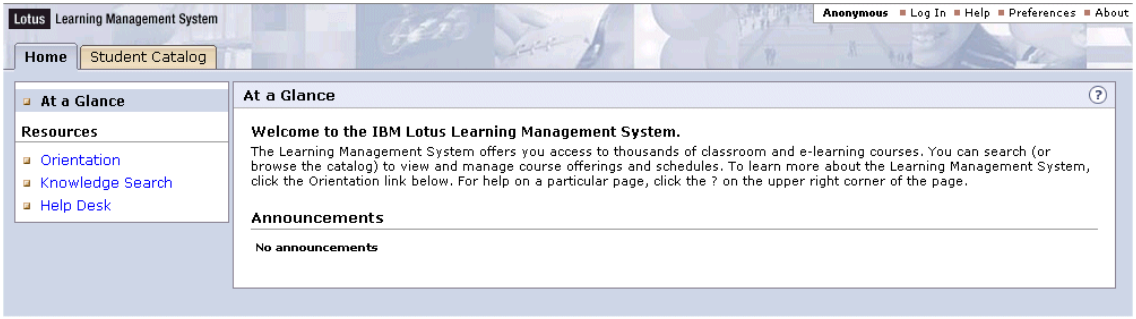

Figure 15-1 Anonymous interface

15.1.2 Student access

Students can access the Home module and the Student Catalog.

The Home Module

The LMS Home Module is composed of several categories and related functions. From the Home Module, the user begins working in the LMS. In the next sections we explain some of the main features.

At a glance

This category contains several functions related to a Person's Calendar and Profile. The Notification function lists any notifications (messages) you have received, while the Approval function informs you about any approval you need to perform. Last but not least, the Offline Learning Client can be used for those who want to go through their e-Learning materials disconnected from the LMS System. See Figure 15-2.

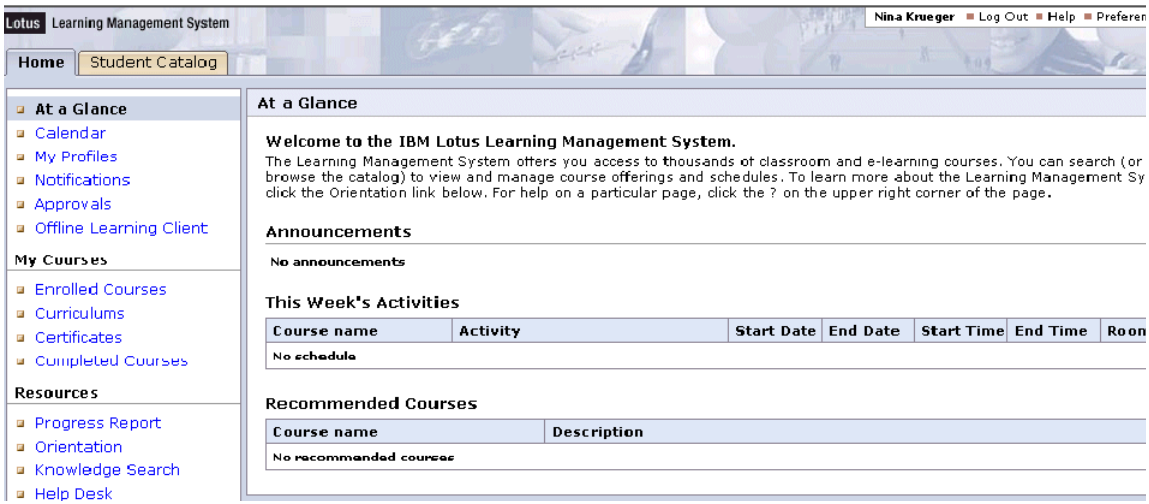

Figure 15-2 Home - At a glance

Calendar

The Calendar section shows two different tabs. The Schedule tab provides you with information on scheduled activities. You can change the view by month, week, or day. See Figure 15-3 on page 310.

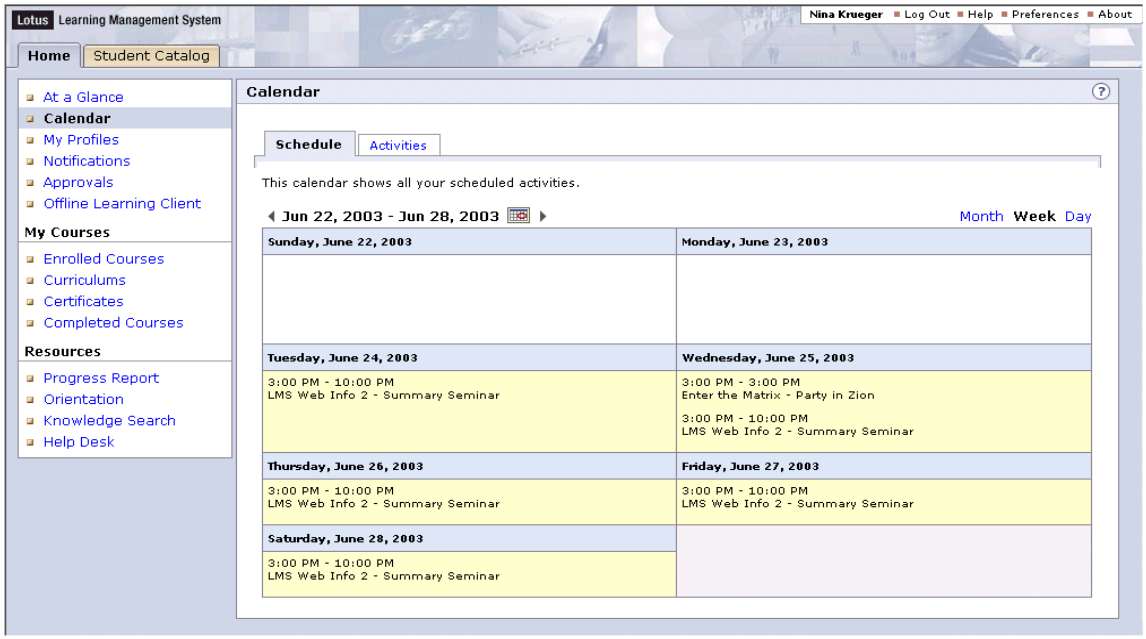

Figure 15-3 Calendar - Schedule

In the Activities tab, you find information on current activities, including starting and ending dates and locations. See Figure 15-4.

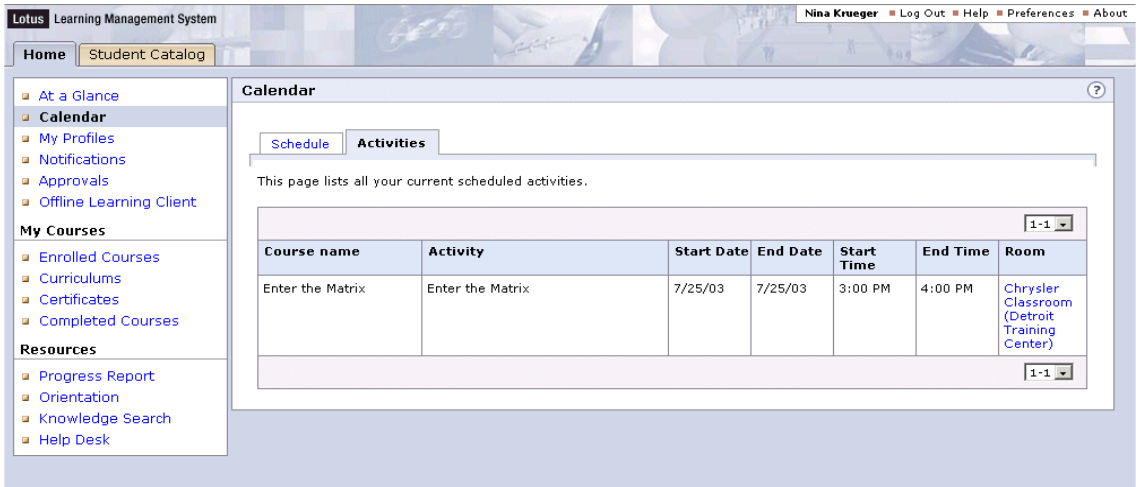

Figure 15-4 Calendar - Activities

My Profile

Profiles represent skill sets and areas of interest, and are used to determine your list of Recommended Courses. My Profiles allows you to define your interests by selecting one or more profiles created by your LMS administrator. Each profile group contains several related profiles from which to choose. Users can select any number of profiles. Based on your selections, the Learning Management System displays a list of recommended courses at the bottom of the At A Glance page at the Home tab. From this list, the users can self-enroll (if it is allowed) or request enrollment from the instructor or administrator for a course on the list.

Profiles are set up in different categories or groups. Each user can choose a group in which different profiles have been set up during the configuration part by the LMS administrator. See Figure 15-5.

For more details on profiles, see Chapter 11, “Configuring LMS” on page 177.

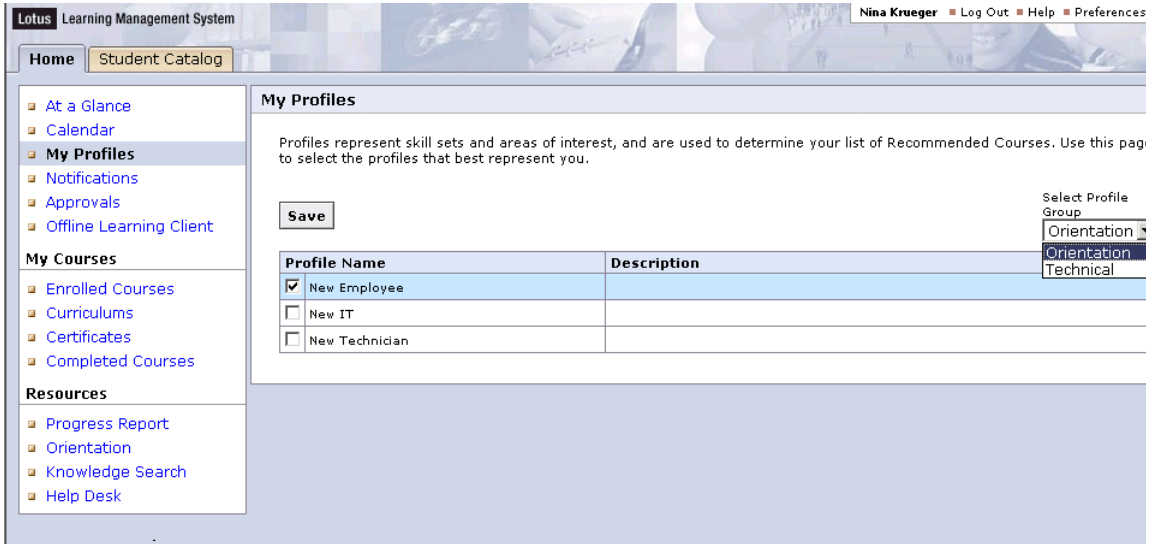

Figure 15-5 My Profile

Based on this selection, the LMS will display a list of recommended courses for this specified profile group. The user will find all courses recommended for a profile in the list at the bottom of At a Glance.

Notifications

The Notification section lists all notifications you receive while you are working with the LMS. You can receive different notification types. One might be an enrollment notification; another might be information from another user. See Figure 15-6 on page 312.

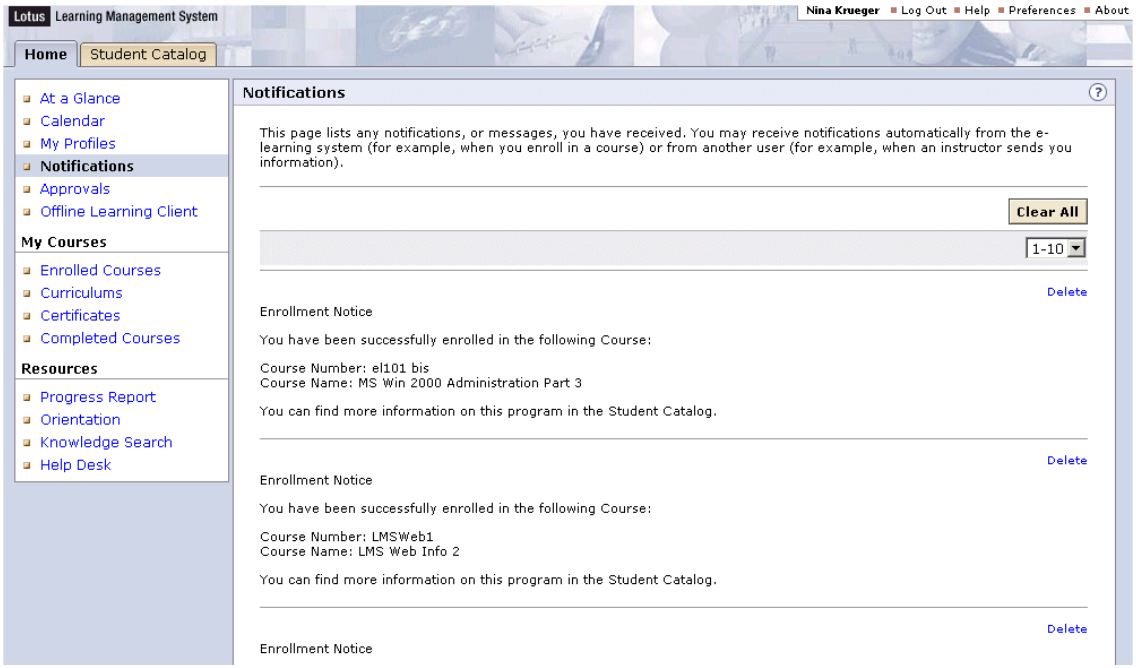

Figure 15-6 Notifications

Approvals

Some courses in your system might need management approval. The status of approvals is found in the Approval section. See Figure 15-7.

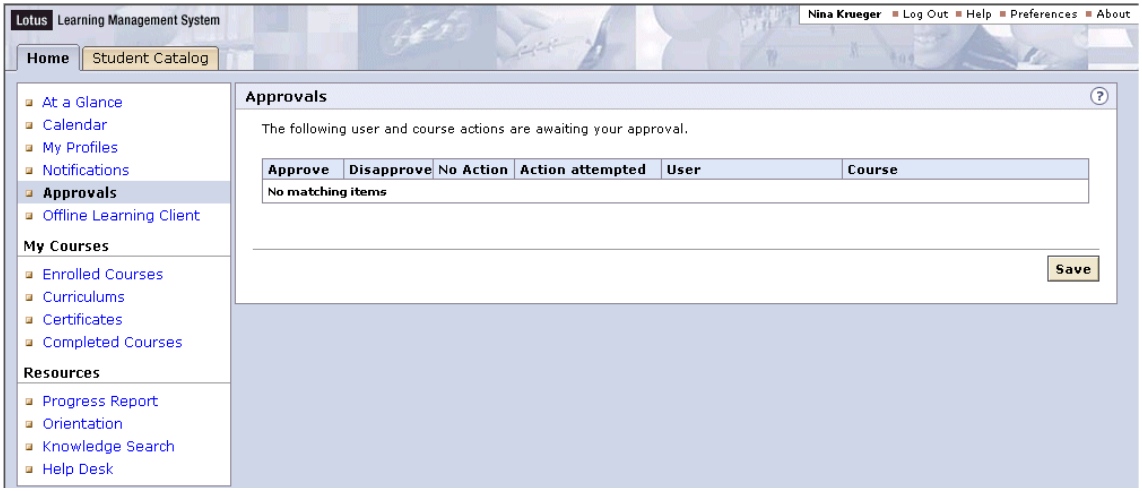

Figure 15-7 Approvals

Offline Client

The Offline Client is described in 15.2, “Offline Learning Client” on page 318.

My Courses

This Category explains in more detail the functions related to the enrolled courses and curriculums or certificates that the user is interested in. You also can have a look at all completed courses within a given curriculum or certificate path. See Figure 15-8.

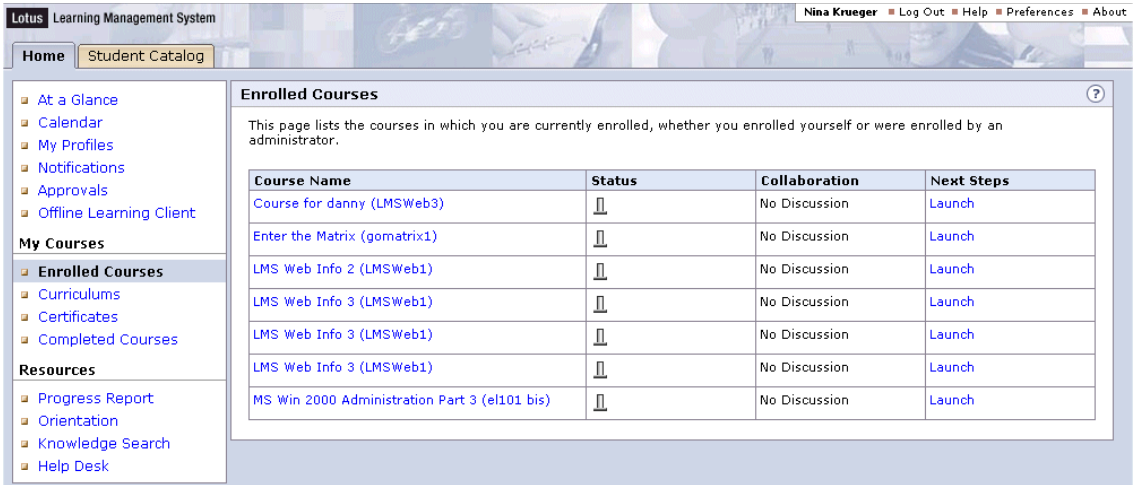

Figure 15-8 Enrolled courses

Resources

Miscellaneous functions related to progress reports and how to obtain additional information or help are available in this area of the home page. See Figure 15-9 on page 314.

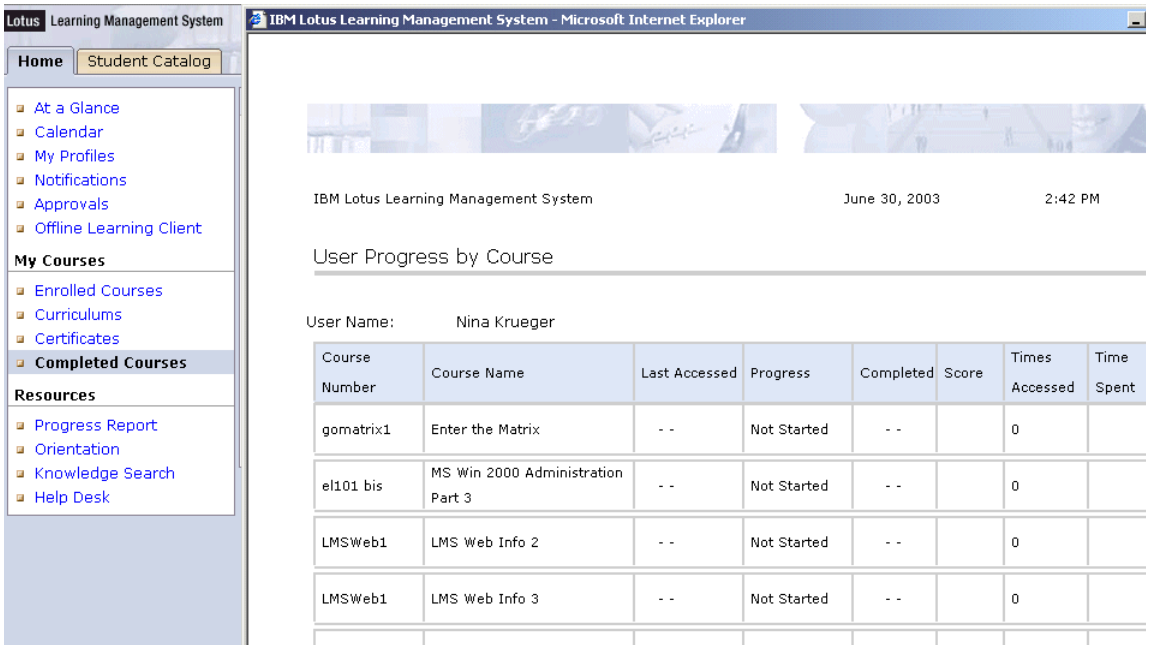

Figure 15-9 Progress report

Student catalog module

Authenticated users have access to courses and course catalogs that are not available to anonymous users. Anonymous users have access only to courses in the Student Catalog, which have been made available for them. See Figure 15-10.

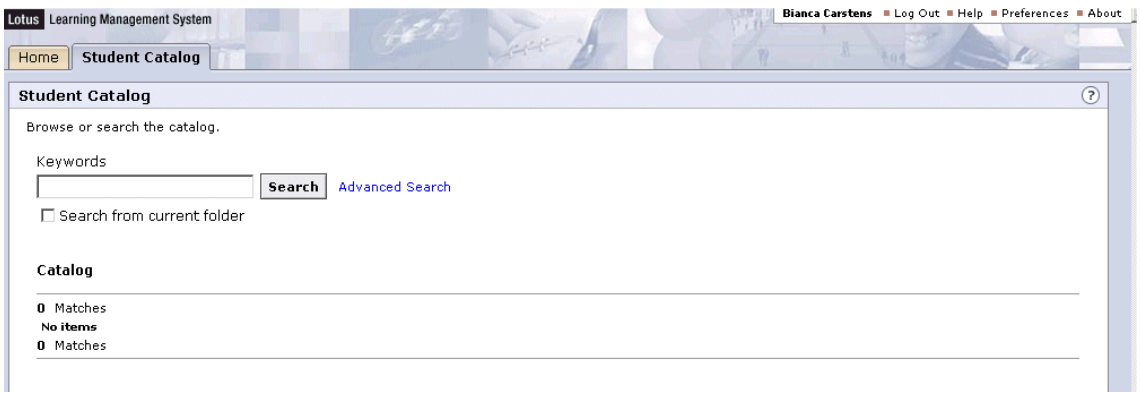

Figure 15-10 Student Catalog

15.1.3 Manager interface

Managers are assigned in the LDAP directory. When a user is rostered in the LMS, the user's manager is automatically rostered. See Figure 15-11.

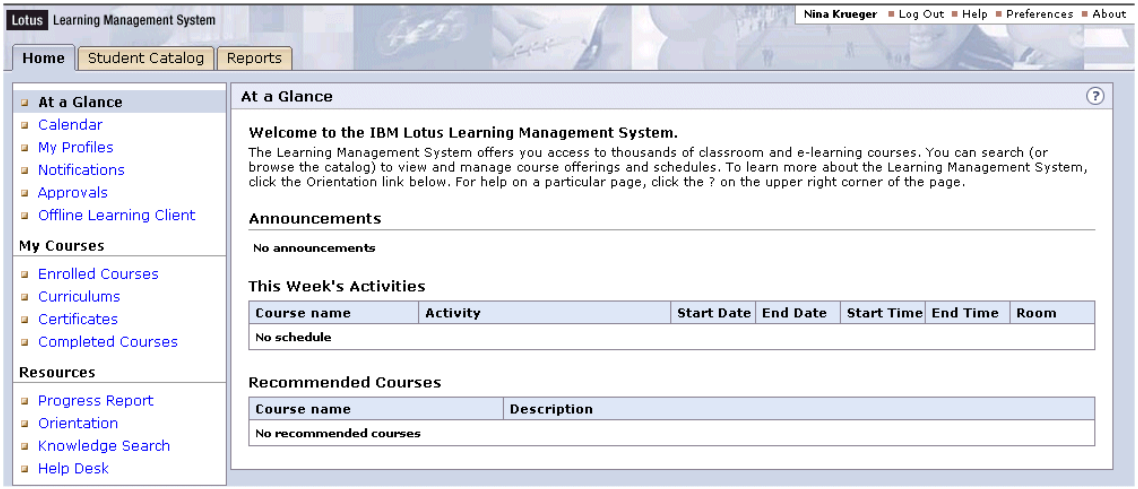

Figure 15-11 Manager interface

Home module

In addition to the student options in the navigation pane, the Home Module in the Manager Interface is used to view and respond to requests for enrollment approval. The approval request is routed to the manager's Home Module.

Student catalog module

Managers are also students. They can view the Student Catalog and enroll in courses that allow self-enrollment.

Report module

In the report module the managers can compile reports to track student progress, and view a list of courses in which their direct reports are enrolled.

15.1.4 Instructor interface

The instructor uses additional LMS functions as a student. See Figure 15-12 on page 316.

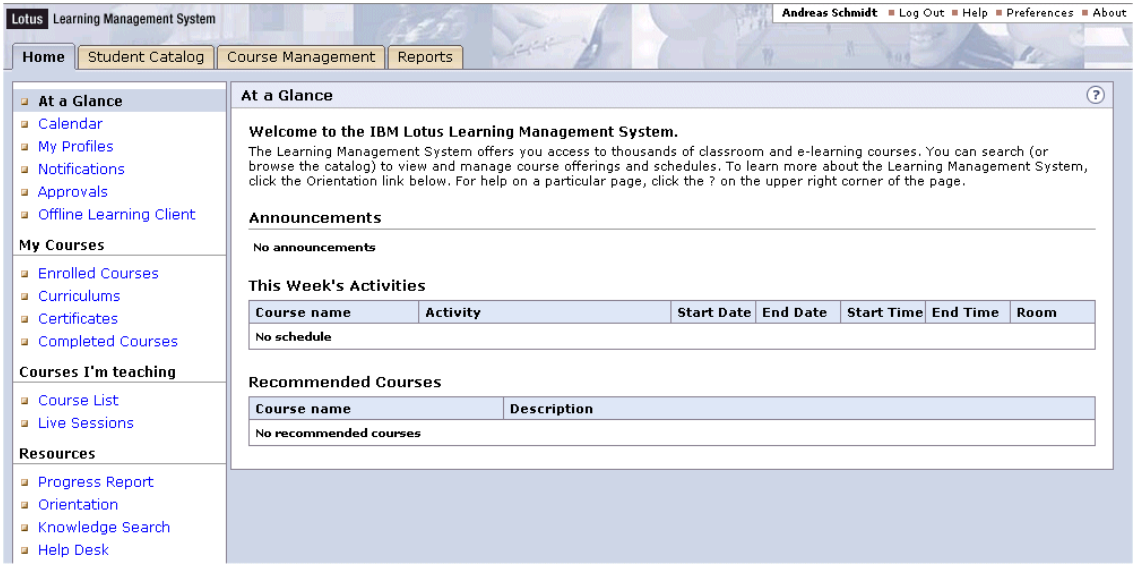

Figure 15-12 Instructor interface

Home module

In addition to the student options, instructors use the Home module to:

- View and modify live sessions
- View courses they are teaching

Course management module

In the Course Management Module, the instructors view progress data and final results. Some progress data is automatically tracked by the LMS. However, in some instances the instructor must manually enter progress and results data.

Reports module

The instructor compiles reports to view:

- Individual student and group progress
- Teaching schedule
- Class roster

15.1.5 Administrator interface

The administrator role provides permissions to view all modules and functions of the LMS. See Figure 15-13 on page 317.

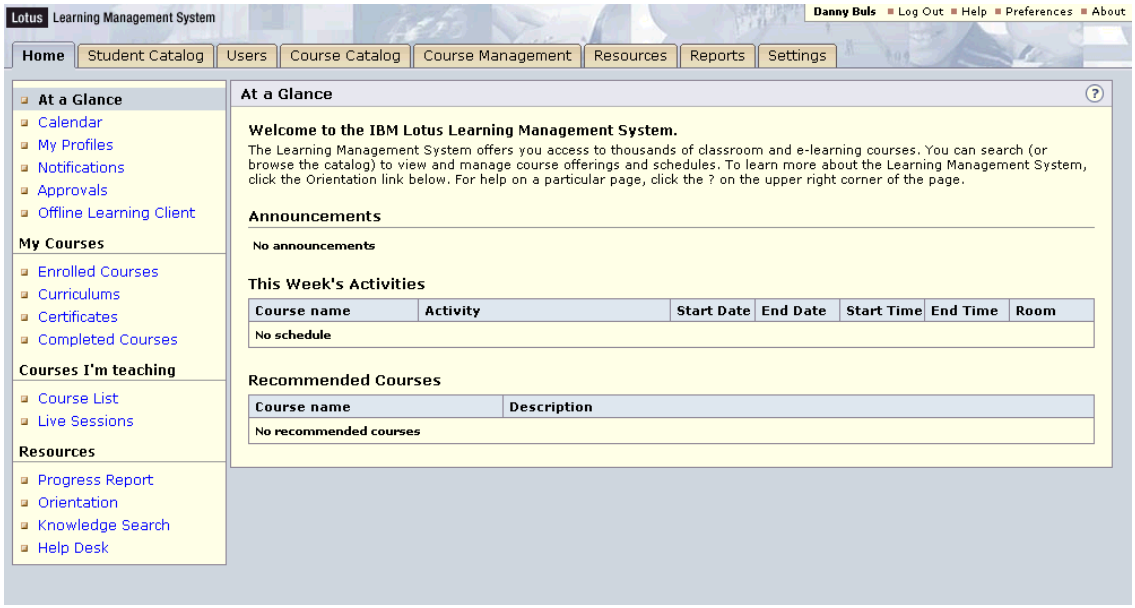

Figure 15-13 Administrator interface

User module

Administrators use the tools of the Users module to:

- Add and remove users from the LMS roster.
- Create and assign user and system profiles.
- Manage access and assign access roles to users.

Course catalog

Administrators use the tools of the Course Catalog module to:

- Create and register Course Masters.
- Create and manage curricula and certificate programs.
- Manage the Course Catalog.
- Assign instructors to courses.
- Schedule course offerings.
- Schedule offering resources.

Course management

Administrators use the tools of the Course Management module to:

- Manage enrollment.
- View and override enrollment restrictions (approvals, wait-list).
- View results.

Resources

Administrators use the tools of the Resources module to:

- Manage physical training spaces such as classrooms, auditoriums, meeting rooms, and labs.
- Manage instructors.
- Manage vendor information.

Reports

Administrators use the tools of the Reports module to compile information and reports, and to schedule automatic compilation of reports.

Settings

Administrators use the tools of the Settings module to manage the LMS configuration, manage system settings, and create and distribute system announcements.

15.2 Offline Learning Client

The Offline Learning Client allows users to take course content offline. When working on a course offline, all course prerequisites and navigation features are fully functional for the student. The Offline Learning Client lets you access the disconnected use feature. To properly deploy the Offline Learning Client after you have installed and deployed the LMS Server, the administrator first needs to update some general settings on your LMS Server.

15.2.1 Deploying the Offline Learning Client

Note: The different components and outpaces of the Offline Client are not split across several chapters. The deployment of the Offline Client should be done during the configuration of the LMS if your company has decided to make the Offline Client available for the users.

In this section, we describe how to set up the Offline Client before using it.

1. Start the LMS Server.
2. Go to the **Settings** tab.
3. Click **LMM Server**.
4. Click **General Settings**.
5. Enter `<HTTPServerdirppath>/duc/OfflineClientWin32.exe` in the URL of the Offline Learning Client field. This should point to the path in your Web server where you have put the OfflineClientWin32.exe package. See Figure 15-14.

   initial.exe has been extracted during the installer phase, which can be found in your <installed_dir>\distribute..

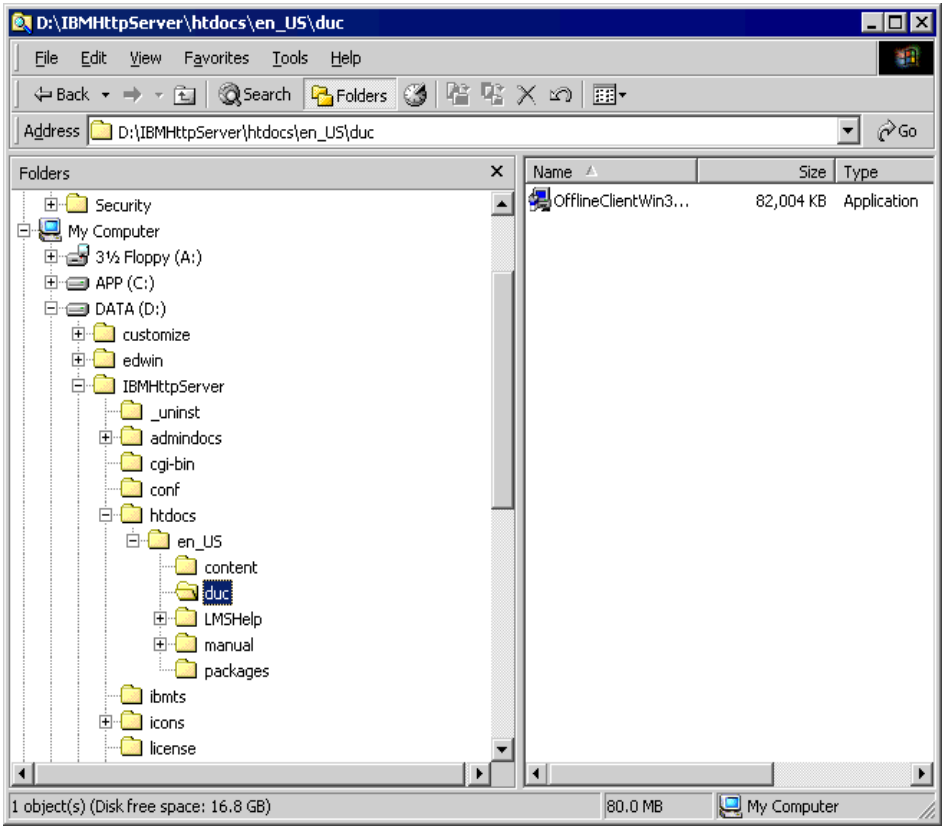

Figure 15-14 Offline Client directory

6. Enter the version of the Offline Learning Client that is being deployed in the Version field. The LMS Server “About” document contains a version number

like 1.0 -eu200221122_M12. Enter the `1.0`. Your screen should look like Figure 15-15.

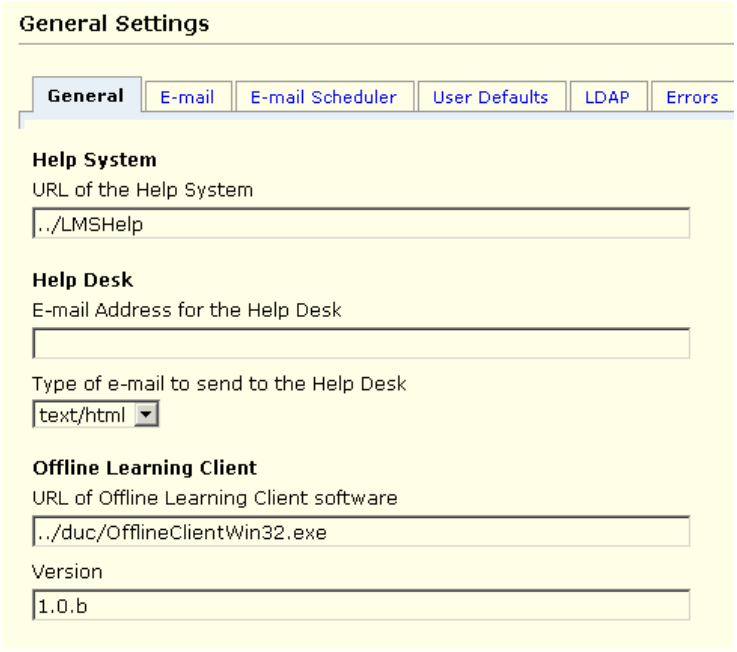

Figure 15-15 Settings in LMS

15.2.2 Downloading the Offline Learning Client

Once you have deployed the Offline Learning Client, any user can download the Client onto his local environment (machine). After the download, run the installation of the package.

The installation is easy. You will be prompted for some input. One of the installation screens will ask you for the LMS Server information. Type in the URL of your Learning Management Module Server, as shown in Figure 15-16 on page 321.

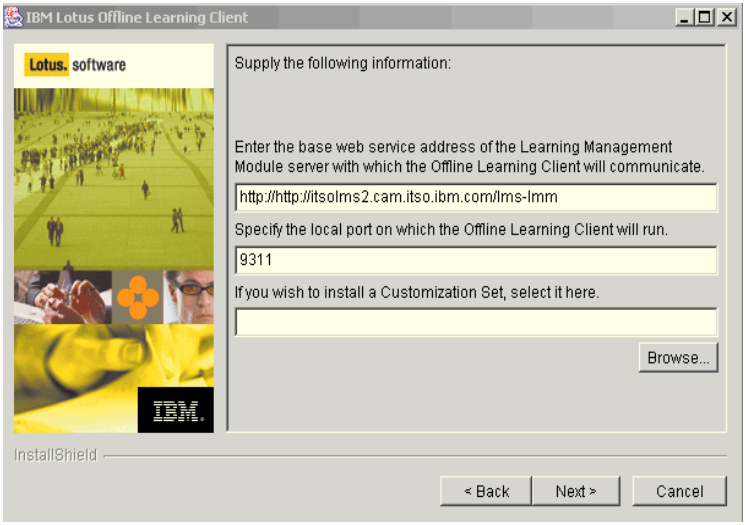

Figure 15-16 Setting up the Offline Client

15.2.3 Using the Offline Learning Client

Once the installation has been performed, you now can start the Offline Learning Client, as follows:

`Start - Programs - IBM Lotus - Offline Learning Client - Start / Stop`

Starting the Client will take some time, as several services will start in the background and course information needs to be downloaded. The first time, you will be prompted for your user ID and password. Afterwards, whenever you start the Client again, you will only need to type in your password, as the Client will remember your user ID. This means that your workstation is dedicated to that Offline Learning Client. See Figure 15-17 on page 322.

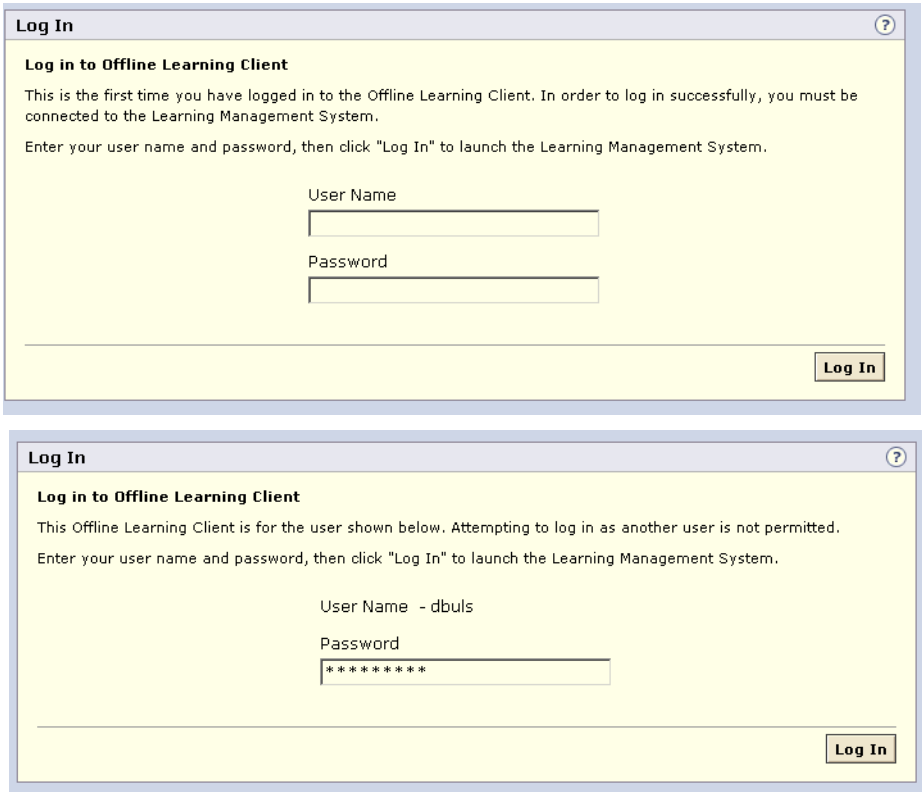

Figure 15-17 Log into Offline Client

When a user wants to take a course offline from a file, she needs to be enrolled in the course. It must also appear in the list of courses she can take offline (by clicking **Update course data** in the offline Client). Also she must have access to the zip file that corresponds to the course she wants to take offline. From that list of courses, the user can choose to take a given course offline (just by checking the course and clicking **Take offline**). Once the course is offline, she can start it by clicking **Launch**. See Figure 15-18 on page 323.

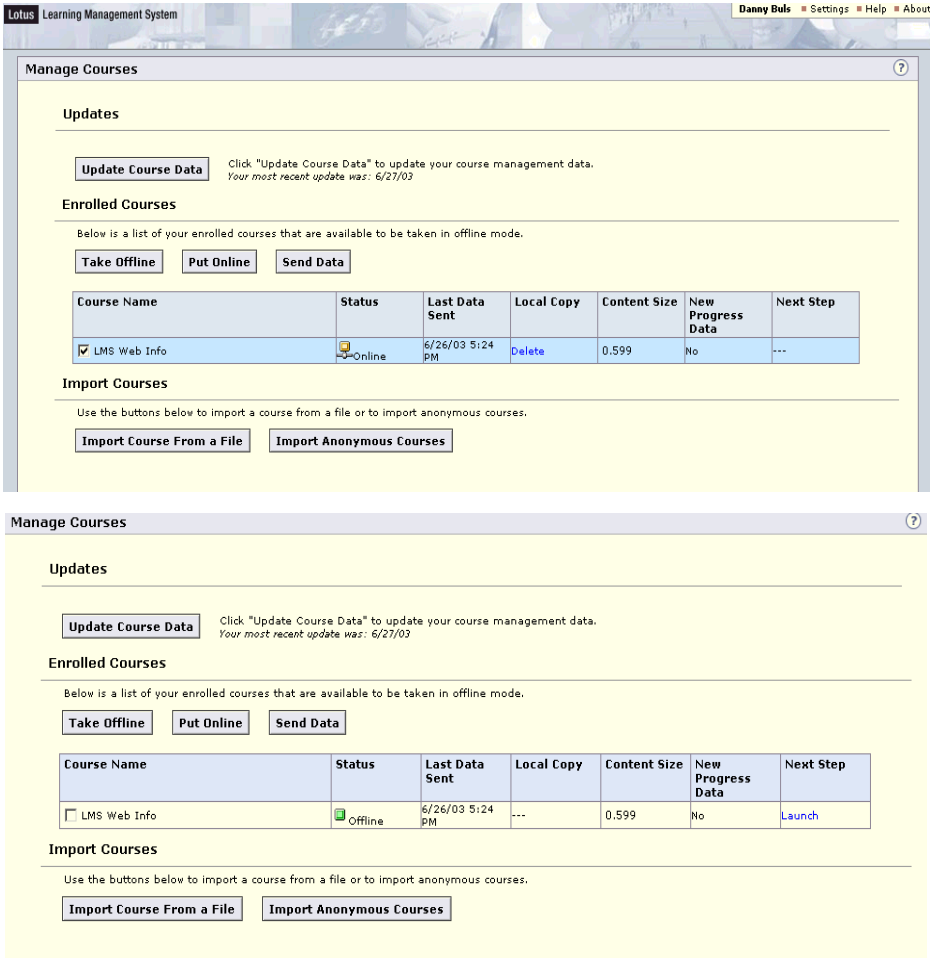

Figure 15-18 Using Offline Client

15.2.4 Using the Offline Client on one workspace for different users

The LMS does not support having multiple Offline Clients installed for multiple users on the same machine.

15.2.5 Silent mode installation

In your company, some users might not have the rights to install any software on their machines, so the installation has to be done by administrators. For this reason, you should install the Offline Client in a silent mode. You need to fill out a

simple response file with the actual values for the LMS address, port, and install location.

You must copy that file to the same directory as the Offline Client Installer and run the following command:

```
OfflineClientWin32.exe -options "offlineOptions.txt" -silent
```

15.2.6 Install the Offline Client from a CD

The offline client is available as an .exe file that can optionally be distributed from a CD.

Part 5

LMS scenario

This part illustrates the techniques we have described by using a fictional story.

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16

Corporate scenario

In this chapter we describe a fictitious scenario of how LMS can be deployed and configured in a company.

After you read this chapter, see Appendix G, “Configuring LMS for the MAGIC company” on page 397, for a detailed step-by-step scenario on how a company might configure LMS for its educational offerings. This appendix uses the situation of the ficticious MAGIC company to step you through the configuration setup.

The MAGIC company and all its employees are fictitious and are in no way describing real-life people or companies.

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16.1 What it takes to implement the LMS

The Manufacturing Global Industrie Corporation (MAGIC) is a company involved in the design and fabrication of steel joists, deck, and steel components. The company also specializes in the fabrication of semi-trailers and forestry equipment. The company operates 34 plants, including 16 in the United States, 7 in Canada, 6 in Europe, and 5 in Asia Pacific. It has over 30,000 employees.

MAGIC wants to develop and implement a learning solution to enable employees to use IT business applications within the company's steel unit. Previously, a group of approximately 10 applications specialists had been responsible for the deployment of business systems across the company's physical sites. When implementing new applications in a site, each specialist spent one to two weeks on location training and assisting employees in the start-up process. While this approach was fairly efficient during the initial launch, the system quickly became unmanageable for training new personnel across all sites. Each new employee has unique as well as site-specific training requirements.

Since it was critical for new hires to get trained as rapidly as possible, the company decided that a learning solution would address this challenge. In addition, MAGIC is challenged with the need to train a wide variety of individuals in many different areas. These individuals are located across many business areas and are located in 30 offices. Therefore, MAGIC had to identify the most cost-effective and efficient method for conducting this training without diminishing its effectiveness.

This solution should also allow the management to track students' progress and understanding of the material. After researching many training options, it was determined that the LMS would provide an efficient way of delivering training to such a large and widely-dispersed audience.

Deploying IBM e-Learning technologies would enable employees to acquire basic skills across the Web while benefiting from interactive sessions with a trainer. These live sessions, running under the Lotus Virtual Classroom, would ensure that all questions have been answered and all skills mastered. Training material also needed to be available in different languages to cover the company's geographically dispersed sites.

A successful implementation and deployment relies heavily on expertise and involves a certain amount of organizational change—none of which happens overnight. The benefit to an organization in undertaking this challenge is having a system in place that will serve the whole enterprise, giving greater flexibility and significantly reduced operating costs.

16.1.1 The project team

Implementing LMS requires a team effort from qualified people.

Figure 16-1 Ron

Have you met Ron? He is a highly committed top manager who coordinates global projects at MAGIC. He has heard that the LMS provides all kinds of learning offerings to all the employes in his company. Ron committed to his managers to quickly deliver solutions that not only reduce costs but also support a global extension and optimization of the different learning offerings within the company. He wants a global solution more quickly than the competitors.

Figure 16-2 Paul

Do you know Paul? He is an experienced project manager in the company. Paul will deliver the LMS deployment ASAP. He knows about the problems of deploying LMS and the visions of his management. So he has to make sure that the project team will do a good job.

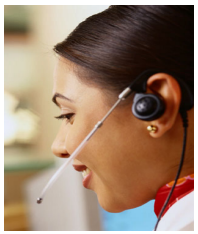


Figure 16-3 Lisa

Lisa is a Senior Project Consultant. Lisa will support Paul in the delivery of the project. She knows all about the technical possibilities and constraints within the company. She has many contacts who can support the project team, and she knows some experts on the topic of learning in the company.

Figure 16-4 Ana

Because of new hires training and resource coordination, the HR Department has to be involved in the project. Have you met Ana, the resource coordinator? One of her roles is to hire new employees and to offer them a quick, tailored training and development plan. She works very close with Janett, who is the learning expert in the company.

Figure 16-5 Janett

Janett is not only a learning expert in the company, but also she is a professional trainer and a tutor for some e-Learning courses. In her opinion, education is one of the major things a company should offer. She will help to plan the new learning strategies and offerings in the company. In addition, she supports Ana in the HR New Hire program and has an eye on the education that comes with the implementation of LMS.

Figure 16-6 Mike

Mike is the leader of the IT Department. He is involved in the project because his department has to enroll the infrastructure and is in charge for IT and system services. This cannot be done by Mike himself. His task might be to build another team regarding all IT topics because of the complexity of the new product.

Kick-off meeting for the project

The project team attends a kick-off meeting and gives a features and benefits presentation. Each member immediately starts thinking of how the product will solve their immediate problems and provide a springboard to functionality that they previously considered prohibitive with the current infrastructure constraints.

Ron reinforces his commitment to the project. The presentation drove home the possibility of putting a global solution in place to assure that MAGIC can present a consistent educational offering worldwide. Currently, each plant manages their own learning offerings and corporate had no way to assure that mandatory offerings were made available worldwide. Ron also realizes that he may need to add another member to the team. The administration features of LMS will require all participating plants to post their course masters and offerings into the LMS database. Someone experienced in the ongoing scheduling and administration of the learning offering needs to be added to the team.

Paul is excited to see how responsive the team is to the presentation. As with any task force, there are people on his team that he has not personally worked with before and he was very pleased to see how excited they are about the product. He is aware of Ron's goal to make this globally available and he feels confident that this is the tool that can make it happen. Based on the team's questions during the presentation, he anticipates the need for a follow-up project to accommodate many of the more advanced functions of the product, such as implementing LVC functionality with the product and certification tracks for employees.

Lisa realizes that the ideas her associates from the learning arena have been sharing with her are about to happen here at MAGIC. Learning professionals

within the organization have often commented that there is an extraordinary amount of wasted manpower and duplicate effort within the organization, because each plant is responsible for its own education offerings. Finally she will be able to present the organization with a tool to allow them to search all course content available within the company. The possibility of language conversions is an enhancement that she feels the company should consider in the near future. The rollout has been justified based on the need for a more efficient IT offering, but Lisa knows that other training areas will also greatly benefit.

Ana is receiving approximately 100 new employees per month, so her office has been overwhelmed with tracking and reporting. Critical OSHA reports are time consuming to prepare due to the numerous different tracking systems that each plant uses. She has tried on several occasions to get all plants to conform; however, her previous attempts have been unsuccessful. She sees this LMS product as the solution. In addition, she sees the possibility of worldwide compliance on mandatory training requirements for legal compliance and an easy way to track them. This is a feature she is very excited about having in place.

For Janett, this is her dream come true—state of the art technology being rolled out. She has the opportunity to be part of the planning process. She understands that the initial rollout is to move their assorted course offerings into a consistent global offering but she also knows that this tool will allow her to incorporate some of the ideas that she has been unable to move ahead with due to time and infrastructure constraints. She is especially interested in putting together a certification track offering that corresponds to MAGIC's professional development goals for advancement within the company.

Mike has to build a team who will start the capacity planning and the server deployment. Mike noticed that it is not only the installation point of view, but also the IT services he must keep in mind. Since he does not know a lot about business on demand or J2EE, Mike searches for a good skilled team in topics such as J2EE, WAS, and LDAP.

16.2 Project plan for the deployment at MAGIC

During the kick-off meeting, the team has developed a stepping stone approach, as was recommended by external consultants, towards implementation of the LMS. Then MAGIC can make the most of this powerful learning system and take advantage of its many facets.

The stepping-stone approach leads the project team through three stages to full deployment followed by periodic health checks.

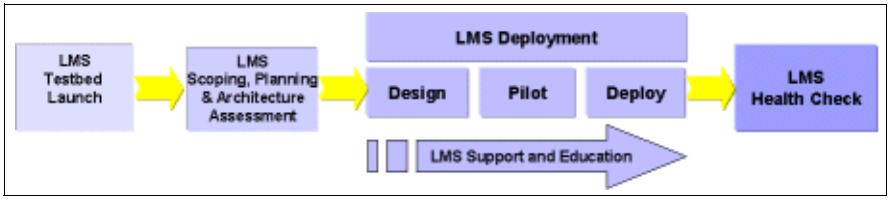


Figure 16-7 Project plan

16.3 LMS testbed launch

In MAGIC, it is known that the product and its deployment is something difficult. Therefore they will start with an overall project plan. Paul has to convince Ron that a quick deployment and solution may cause some problems. To be better than all competitors, offering learning on demand and having a good ROI is one consideration to be kept in mind by management. To offer a good solution with high performance is the other consideration; this will be done by the project team in the next steps. After some energetic discussions with Ron, Paul convinces him to spend more time in planning and testing before they will start the complete deployment. MAGIC's project team starts with the planning, just as we recommend in Chapter 2, "Planning your LMS deployment" on page 9.

16.3.1 Define boundaries

After the successful kick-off meeting, Paul invites the project team to a one-day workshop. His goal is to make the team understand the complexity of the product, though he is willing to make the team think about both the business and technical aspects. The team splits into technical- and business-oriented teams. During this session, the teams will brainstorm on how best LMS can be utilized within MAGIC to identify and agree on the scope.

16.3.2 Building a testbed system

Before starting a complete deployment in the company, Paul and Mike decide to install and configure a limited, non-production, testbed model of the LMS. Once the testbed has been built, it will be populated with a sample of the already existing content. Ana and Janett will join them during this tasks. This testbed is available for use during the entire deployment.

16.3.3 Skills transfer for both business and technical communities

The technical team (Lisa, Mike, and his team) will work out the configuration plan using the existing testbed installation. They plan the configuration as it is described in the configuration chapter in this publication. The business team (Ana, Janett, Paul) has to configure a sample of their live course data and will test the use of the content Authoring Tool and the CLIMP to import existing content. They start to work on an education program and skill development plan for the product.

During this phase of the LMS deployment, the testbed is subsequently used for:

- Internal demonstrations and awareness
- Technical design validation
- Investigation of existing content assistance with feature implementation decisions
- Further skills development.

After few days of testing and working on the LMS, the team meets again to start the planning for the official deployment.

16.4 Scoping, planning, and architecture

After a few days of testing the system, the team starts with scoping, planning, and architecture planning, which addresses both the business and technical requirements of MAGIC's solution. It provides an understanding of the impact of the deployment within the production environment. MAGIC's Project Team has to review the environment and business needs. Mike and his team will provide recommendations of what is required to deploy LMS, its components and courseware, within the organization.

This phase of the project follows two streams and includes the following activities.

Business assessment

The business team—Ana, Janett, and Paul—works out the related business topics:

- Assess learning and content delivery requirements.
- Define course administration and management processes.
- Design content migration and taxonomy standards.
- Survey the market for learning content specific to the organization's needs.

- Skills gap analysis for business and technical individuals.
- Create a High-Level Business Transformation Plan.

Technical assessment

The technical group has to make a more technical plan concerning the implementation of LMS. Mike, the IT specialist, contacts other people in his department. Business on demand and J2EE is something he has not worked with before. He stays with the team and supports them with his IT thinking. The following topics must be solved by his team in the next couple of days:

- Infrastructure scalability and readiness for hosting e-Learning activities.
- Integration concept (workflow, ERP, and databases requiring change for the successful rollout of LMS).
- Identify areas necessary for governance.
- Perform capacity planning.
- Define archiving strategy.
- LDAP Schema integration and design security policies.
- Create High-Level Implementation Plan.

Also, they can use a questionnaire like the one in Appendix A, “Sample sizing questionnaire” on page 359.

When the tasks are finished, the team will provide an impact and gap analysis report for implementing the LMS, a blueprint design for the required architecture, and an outline deployment project plan.

16.4.1 Capacity planning for MAGIC

As we mentioned in “Technical assessment” on page 335, Ana, Lisa, and Janett have to find out how many users are going to use the LMS and where. When they have finished this task, they can give their sizing to Mike and his technical team. The technical team can then start the hardware sizing planning.

As we mentioned, the company operates in 34 plants, including 16 in the United States, 7 in Canada, 6 in Europe, and 5 in Asia Pacific. There are over 30,000 employees registered in the LDAP Directory, but not all of them need to access the system. For the first deployment, MAGIC plans 15,000 rostered users. The rostered users are employees who get trained in using IT business applications within the steel unit; new employees receive unique training to be prepared for the new job. Ana knows that they plan to offer management training through the LMS. In the future, these will surpass the training offerings for all employees.

A very small portion of the rostered students will be enrolled in courses at any one point in time, so the size of this population will have a minimal effect on the performance of the LMS system and will impact mostly disk space requirements.

Finally Ana and her team come to the population that is of most interest to us. These are the students who are logged onto the system. These students who are actively and simultaneously logged onto the system form one of the largest requirements for LMS system performance.

Table 16-1 gives an overview of MAGIC's user population for the LMS.

Table 16-1 Capacity planning for MAGIC

Type	#	%
Number of employees in MAGIC's Corporate Directory	30,000	
Rostered students in the LMS	15,000	100.0
Enrolled	1,500	10.0
Concurrent users	750	5.0

For capacity planning, a configuration for this corporation needs to support about 750 concurrent logins. With this information, the technical team can start the hardware sizing for the LMS deployment.

16.4.2 Pre-configuration

MAGIC takes the testbed system as a starting point for the pre-configuration part and the activities for the configuration of LMS. They define a concept and checklist related to the pre-configuration. The elements of the checklist will be used later on during the configuration and will reflect the business requirements of MAGIC mapped onto the LMS environment.

Pre-configuration checklist

This checklist is a laundry list of things a company such as MAGIC needs to collect before starting to configure the LMS.

You will see that most probably there is a mismatch between the existing procedures and how it is supposed to be once LMS is up.

Also, there will most likely be issues relating to consistent course codes.

Since this is a worldwide installation all locations must conform to the same course coding system.

This checklist will help MAGIC to collect the requested information related to the different topics they need prior to updating LMS.

- Course masters and offerings
  - Course Catalogs
  - Course codes
  - Prerequisite information
  - Course length
  - Room/equipment requirements
- Resources
  - Building/room listings and who manages them
  - Vendor lists
  - Instructor lists
  - Instructor skills
  - Instructor zones—geographies serviced by instructors
- Security
  - Who will administer?
  - Who will manage users?
  - Will self-enrollment be allowed?
- LDAP

  What fields will be required in LMS?
  - Manager—for enrollment approval
  - EmployeeType—for security and profiles
  - Organizational Units (OUs)—for security and profiles
- Users
  - Will all employees be rostered or only a subset?
  - Will anonymous access be allowed?
  - Will you require roles in addition to defaults?
  - How will profiles be implemented?
    - Review what groups exist in organization.
    - Investigate what “informal terms” are used to define collections of employees.

Note: Do not fall into the trap of duplicating what you already have if it is not working. Fix it and define manageable profiles that everyone agrees on.

16.5 LMS deployment

After planning, MAGIC starts with the official deployment of the LMS. It is broken down into three key phases:

- Solution design
- Pilot
- Deployment

The solution design is taken out of the results of the scoping, planning, and architecture project phase. The solution design will define the complete enterprise-wide solution for MAGIC, covering such areas as Learning Management Module and Content Server Topology, security and LDAP integration, operational and support models, transactional activity, reporting and auditing, content migration, student profile design and administration, course taxonomy standards, access rights and system governance, and offline client deployment.

In the pilot phase the project team will validate the learning requirements, prove the technical design, and identify early potential roadblocks. Mike and his IT team will run the pilot. They deliver this within the production environment using a 'Reference Build' that can be fine tuned prior to full deployment and will cover multiple business units. After implementing the reference build successfully, the team completes the implementation and documents the deployment standards and operational procedures to empower to replicate the phased deployment of the LMS throughout your organization.

Skills transfer, training, and a communication is incorporated in the planning of the deployment. Ana and Janett will organize these.

Ron, who committed to his managers to deliver quick solutions that reduce costs, must also ensure that the implementation of LMS will gain the maximum ROI and end user satisfaction. Since he noticed that the planning is one of the most important points in the deployment of LMS, he insists that Paul develop an LMS Health Check that reviews the educational processes and the infrastructure on a periodic basis. The Health Check will make recommendations for adjustments and improvements, ensuring that the organization's learning management system avoids future problems and that your education environment continues to runs efficiently and effectively at all times.

16.5.1 Installation at MAGIC

The installation for the pilot was one of the more challenging steps for the project team. The technical team followed the installation instructions described in Part 2, "Installation" on page 39, of this publication. They therefore performed a

successful installation of each LMS component and continued on to the configuration phase.

16.5.2 LMS configuration checklist for MAGIC's pilot

It is important to plan the configuration in advance.. MAGIC plans the following configuration for the pilot of the installation. They follow the steps for planning that are listed in Chapter 11, "Configuring LMS" on page 177.

Departments

The following departments are involved in the pilot:

- Accounting = ACCT
- Human Resources = HR
- Information Technologies = IT
- Production = PROD
- Sales = SALES
- Executive Management = EXEC

LDAP settings

For the MAGIC environment, the following LDAP information is required:

- O = MAGIC
- OU = Pittsburgh/Detroit/Stuttgart/Cambridge
- Department Number = HR/ACCT/IT/SALES/PROD/EXEC
- Employee Type = Executive/Manager/Staff/Tech/Developer

ACL access

MAGIC decided to give to the EmployeeType=Developer security access to all course catalogs and resources. It will be the persons belonging to this EmployeeType "Group" who will be in charge later on to create and maintain all courses and resources.

Users

For the pilot, MAGIC needs approximately 20 users per city and each city has all departments represented. MAGIC specifies the managers for each employee in order to utilize approval for course enrollment. The OU identifies the city. The DepartmentNumber identifies the department where each employee works. The employee type is populated as Executive, Manager, Staff, Tech, or Developer.

Roles

In addition to the default roles of LMS, MAGIC decides to create the role of Scheduler. This role is for people who are responsible for scheduling course

offerings. This role contains more than manager privileges but less than administrator, with privileges adjusted accordingly.

So MAGIC goes along with six roles:

- Anonymous
- Student
- Manager
- Scheduler
- Instructor
- Administrator

Roles to be applied

The roles to be applied are:

- Student role—Everyone
- Admin—Cambridge only
- Instructor—Four per city (representing HR, IT, ACCT, and PROD)
- Scheduler—One per city (IT manager)
- Manager—One per city (IT manager)

Note: It is unrealistic to have only one manager or scheduler per city in a bigger deployment. The application would have multiple skilled resources available.

Profiles

After discussing profiles, MAGIC decides to create two profile categories:

- Technical
- Orientation

Course masters and course offering

The company creates the following course categories for the course masters and offerings.

- Accounting
- Corporate Information
- Employee Orientation
- HR
- IT
- Safety
- Soft Skills

Course codes

For structuring the courses, MAGIC decides to give the courses a code convention, defined as follows:

- For Accounting: ACC000 - ACCX
- For Corporate Information: COP000 - COPX
- For Employee Orientation: EMO000 - EMOX
- For HR: HR000 - HRX
- For IT: IT00 - ITX
- For Safety: SAF000 - SAFX
- For Soft Skills: SSK000 - SSKX

Resources

MAGIC starts the LMS deployment in three different locations. For each location they have to set up resources in the system. The company focuses on 6 locations (buildings) in 3 cities. Each of the 3 pilot cities has 2 classrooms, 2 conference rooms, 1 lab, and 1 auditorium. See Figure 16-8 on page 342.

- Cambridge

  For Cambridge they do not set up any facilities. The location is used for developers. These persons will maintain courses and resources only.

- Pittsburgh
  - Corporate Headquarters
  - Pittsburgh Training Annex
  - Room Naming—compass—North, South, East, etc.
- Detroit
  - Detroit Training Center
  - Room Naming—cars—Ford, Pontiac, GM, etc.
- Stuttgart
  - Stuttgart Headquarters
  - Stuttgart Training Center
  - Room naming convention: Rivers

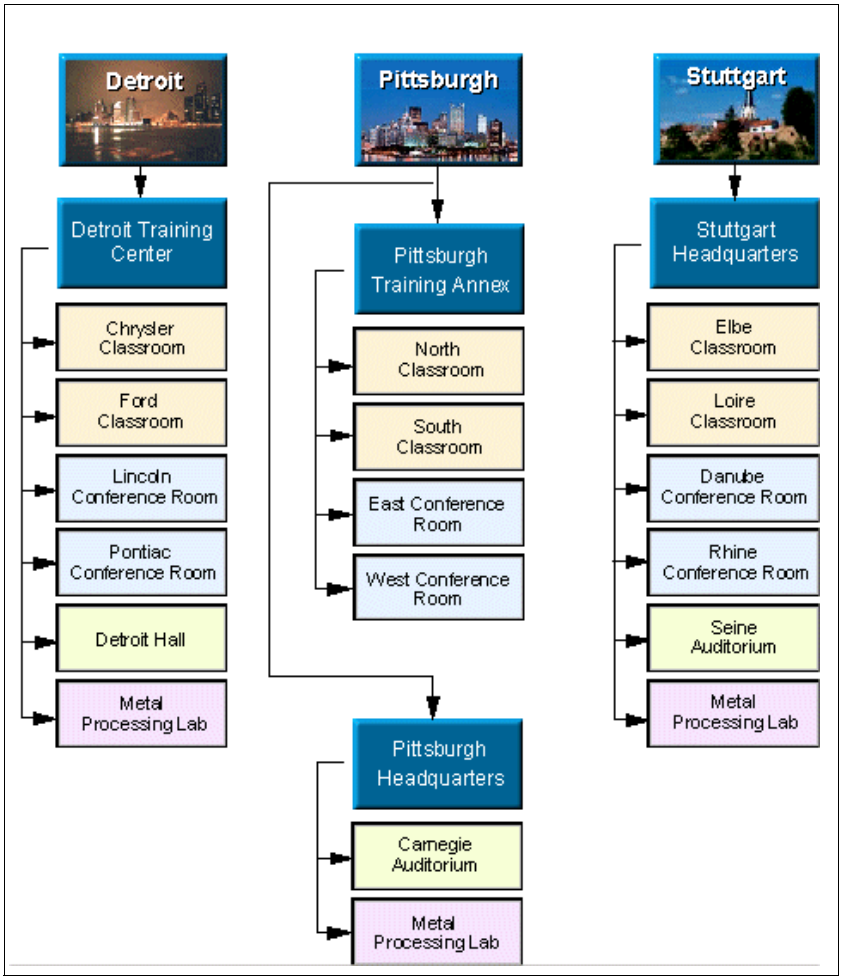


Figure 16-8 Education organization and resources for MAGIC

Vendors

All the trainings cannot be held by the company. Therefore the company needs to add vendors for professional trainings. The following training business partners will be added into the system:

- IBM
- Microsoft
- Oracle
- Stuttgart Technical Exchange
- Three Rivers Support Service
- Detroit Management Trainers, Inc.

Skills

The following skills must be added into the system:

- E-mail
- Corporate info
- Employee orientation
- Pressure values
- Purchasing
- Quickplace
- Soft skills

Zones

Zones need to be created for each continent:

- North America
- Asia
- Europe
- Africa
- South America

16.5.3 LMS configuration settings for MAGIC's pilot

Note: We do not describe the process step by step. You will find a detailed description in the *LMS Administrator's Guide* or in the student guide *Administering IBM Lotus Learning Management System.*

Also, for more details, see Appendix G, "Configuring LMS for the MAGIC company" on page 397.

After the technical team defined the configuration, one person from the team began entering the settings into the system. See Figures 16-9 through 16-11.

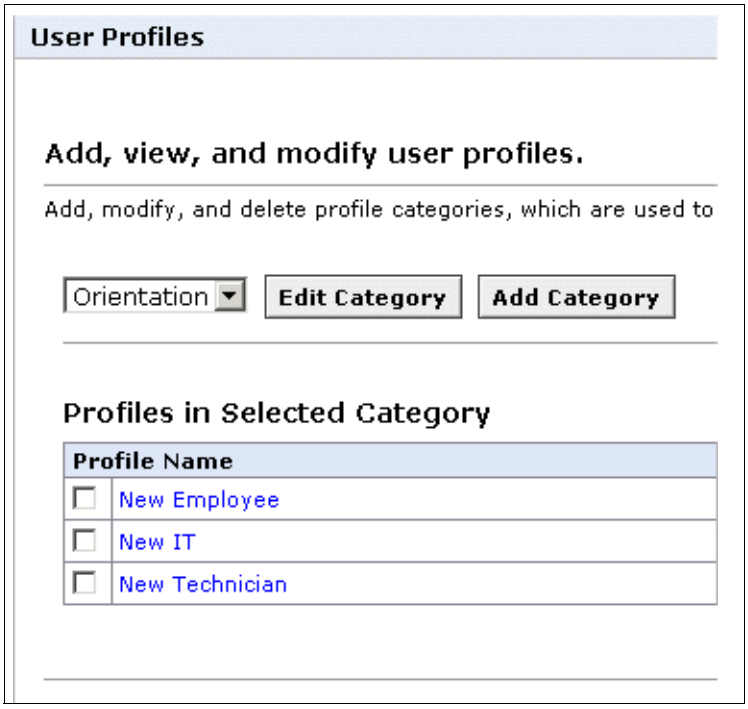


Figure 16-9 Profile Category Orientation

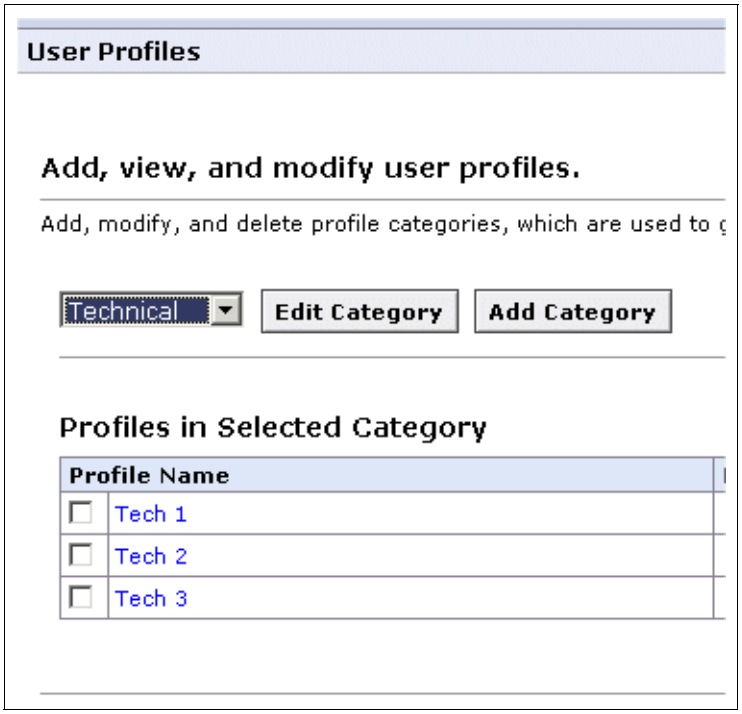


Figure 16-10 Profile Category Technical

Figure 16-11 Course master

Creating course offerings

The planning team decided to keep consistent folders in both Course Master and Course Offerings. The only Course Offering Catalog they add is called General IT. The steps for the configuration of Course Masters must be repeated using Manage Course Offerings selection on the Course Catalog tab. See Figure 16-12 on page 347.

Figure 16-12 Course Offering

Adding resources

The company has 6 building locations in 3 cities. Each of the 3 pilot cities has 2 classrooms, 2 conference rooms, 1 lab, and 1 auditorium, as listed in Figure 16-13 on page 348.

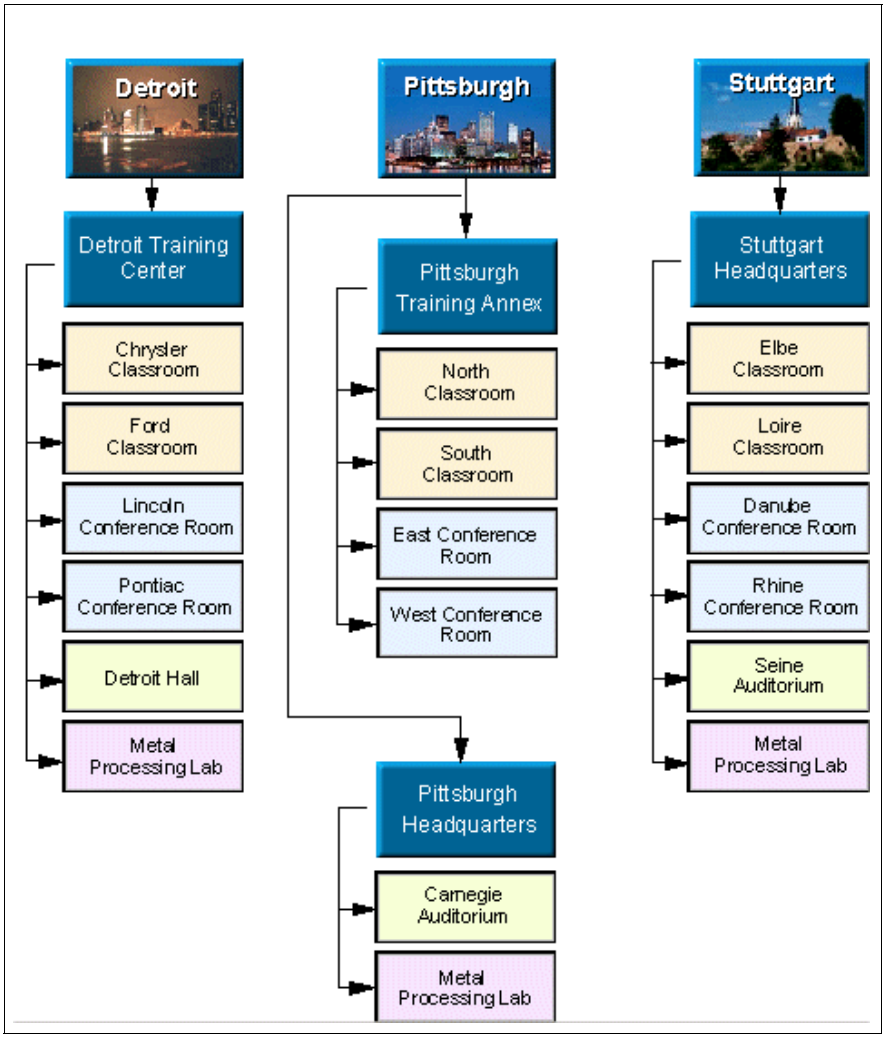


Figure 16-13 Locations and rooms

The first step taken by the MAGIC implementation team is to set up the locations and the rooms. If you run a search for all the newly created locations using matching string =*, you will find the following in MAGICS's LMS, shown by Figure 16-14 on page 349.

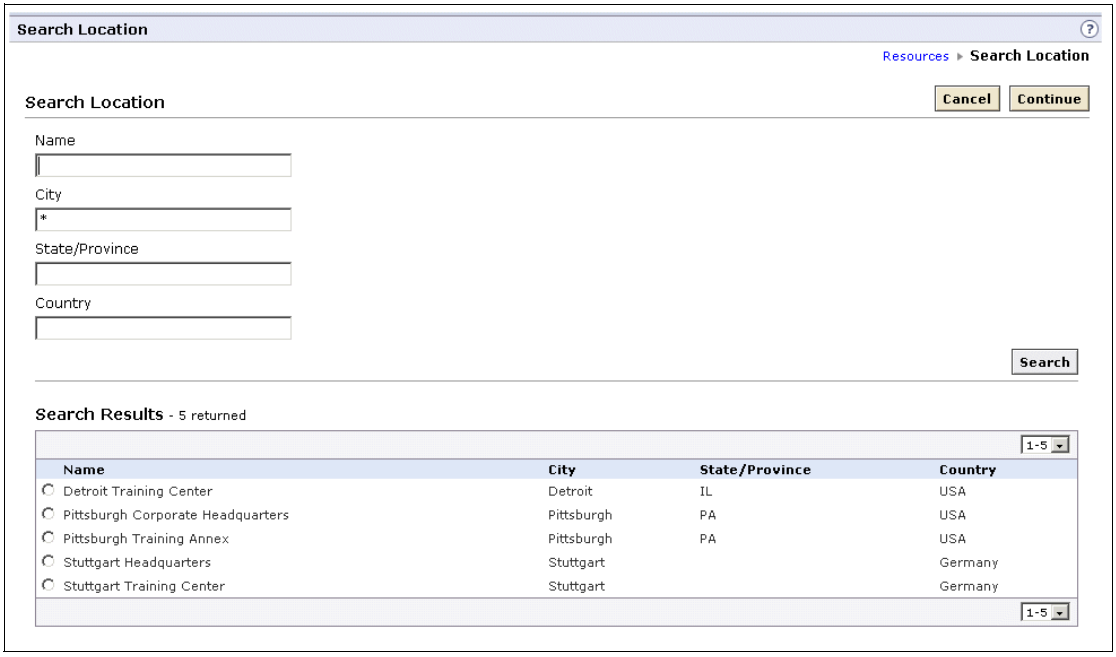


Figure 16-14 Locations

After creating locations, the MAGIC team starts to set up rooms. See Figure 16-15.

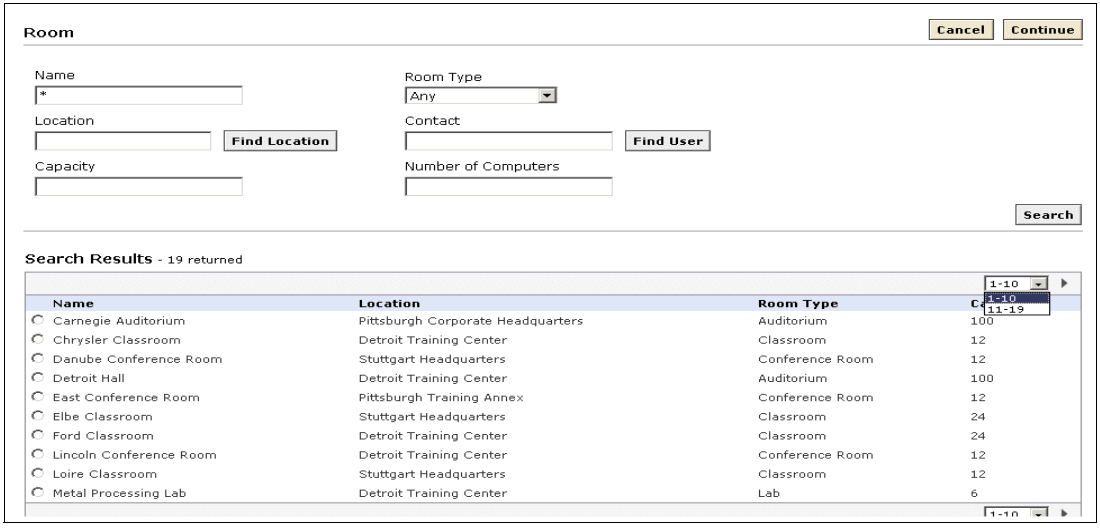
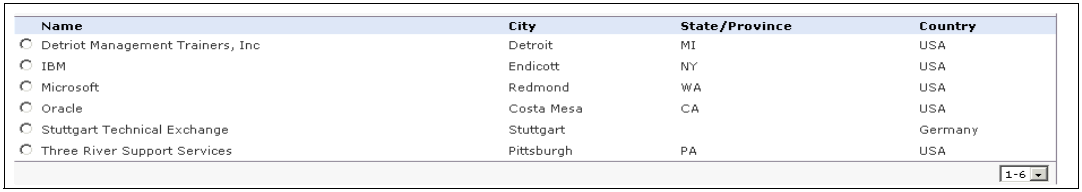


Figure 16-15 Rooms

Adding vendors

A list of all their vendors has to be created in the system. See Figure 16-16.



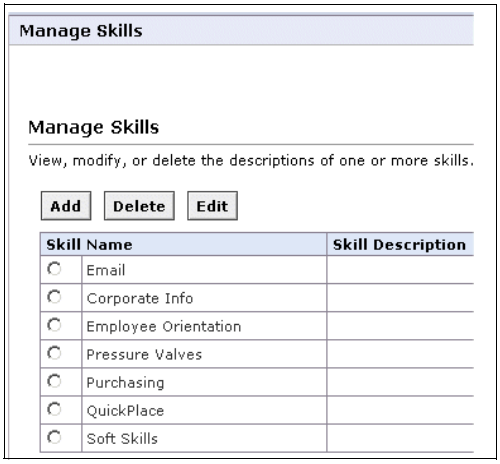
Name	City	State/Province	Country
Detriot Management Trainers, Inc	Detroit	MI	USA
IBM	Endicott	NY	USA
Microsoft	Redmond	WA	USA
Oracle	Costa Mesa	CA	USA
Stuttgart Technical Exchange	Stuttgart		Germany
Three River Support Services	Pittsburgh	PA	USA

1-6

Figure 16-16 Vendors

Skills

An assortment of skills needs to be entered to reflect the course offerings selected for the company. See Figure 16-17.



Manage Skills

Manage Skills

View, modify, or delete the descriptions of one or more skills.

Add Delete Edit

Skill Name	Skill Description
Email	
Corporate Info	
Employee Orientation	
Pressure Valves	
Purchasing	
QuickPlace	
Soft Skills	

Figure 16-17 Skills

Defining zones

Zones need to be created for each continent, as shown in Figure 16-18 on page 351.

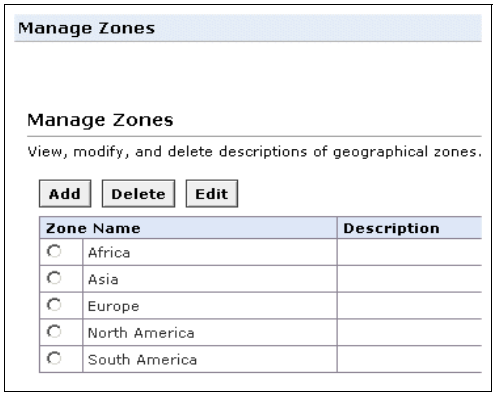


Figure 16-18 Zones

Deployment settings

The setting tab in LMS contains different setting options. Some of them can be modified, others can only be displayed. They are divided in deployment, announcement, and customization settings.

MAGIC decides not to modify many settings.

Under General Settings, they modify the help pages and the e-mail address for the help desk. For offline use, they specify the URL and the version of the Offline Client. MAGIC decides that some of the courses are available for offline use; therefore they have to set up the system for offline use.

The Notification Settings will be modified by the administrators. MAGIC decides to enable all events that will trigger the automatic notifications. In the system you have to specify general, enrollment, certificate, curriculum, and course management notifications. For MAGIC the most important thing is that people are automatically informed about course changes, enrollments, and new offerings.

The administrator has to specify the Delivery Server, even if MAGIC uses only one in the first deployment phase.

MAGIC does not modify the Collaboration Settings, because they have decided to use the LMS without a collaborative element. They still consider the use of a chat server, a discussion server, and even the LVC. But in the first deployment they do not include them.

Announcement and customization settings

Announcements are notifications that are displayed in the user's Home module. The administrator can select which users will see the announcement and in which language it will be displayed.

MAGIC decides to display the announcement for German users in German and for US users in English. It is the responsibility of the administrator to display an announcement if something important occurs.

MAGIC has developed customization sets for the different departments in the company. The customization sets do not differ in many cases. The corporate identity for the departments is different in logo type and style, but the colors have to stay the same.

16.6 Content deployment at MAGIC

Janett started working on the existing content and planned the new hire training with Ana. Now, for the LMS, they want to structure this new hire training in a blended learning solution. Janett reminds Ana that the content has to be SCORM 1.2 compliant. SCORM-compliant tools and content allow you to fit the pieces of the e-Learning puzzle together, bringing your clients learning that is more accessible, reusable, durable, and affordable.

Importing SCORM- or AICC-compliant content

For all new hires, Magic's Human Resources requires a sexual discrimination course that happens to be SCORM 1.2 compliant. A course on workplace safety is AICC compliant. What does Ana need to do to get these courses ready to import into the LMS?

If the sexual discrimination course is SCORM 1.2 and it requires no changes or additions, Ana could import it directly into the LMS with the CLIMP tool, using the procedure described in the *Authoring Tool Guide* on page 3. To the extent that the original course has metatags, the activities are then tracked and the assessment scores available through the reporting function in the LMS. However, if changes are to be made, it will be necessary to bring the course into the Authoring Tool. For example, if HR wants to change the content or add an assessment using examples specific to their organization, then the course must first be imported into the Authoring Tool.

Or, if the course should happen to be a SCORM release that is below SCORM Version 1.2, then Ana will need to use the Authoring Tool import in order to import the course into the LMS.

What if MAGIC's content is not SCORM- or AICC-compliant

Ana can work with SCORM- or AICC-compliant courses. Now Ana is thinking about how to utilize her existing content: Third-party courses, Web-based training, or standard slide presentations that are not AICC- or SCORM-compliant. For example, "Meet our Company", an html course that kicks off the new hire training is neither AICC- or SCORM-compliant? What can she do?

She has to think about different means:

- Use the original development tool that created it in-house.
- Macromedia—The content can be exported in a SCORM-compliant format.
- PowerPoint—Use the Resource iNeterchange toolkit.
- LearningSpace 5—Import the course with the Authoring Tool.
- Contact the course creator (if not in-house).
- Create a new course.
- Use the course as is, outside of LMS.

If she takes this last approach:

- The students' computers will have to have any software required to run the original course.
- She is sacrificing the tracking data.
- Finally, if she wants performance information to be compiled in the LMS, she will have to create an assessment in the Authoring Tool.

Course development at MAGIC

To introduce her sales staff to a new product, Ana has decided to create a SCORM-compliant course to meet their specific needs. How does she begin? What does the development process look like?

Ana followed the steps that are mentioned in 14.1, "Course development" on page 274. She noticed that course development is one of most the difficult and expensive things in a learning environment. It takes a long time to develop something nice and useful for the company. The course developers start working on some specific content that belongs to the company. But the company has to decide whether to create their own content, whether to out-source it, or whether to buy standard content. It is obvious that future investment has to be done on this subject.

Course deployment at MAGIC

After developing the courses, the course developers have to deploy them in the system. All courses are now SCORM-compliant. That means Ana can use either the Authoring Tool or CLIMP to deploy the courses.

16.6.1 Managing changes and deploying updated courses

MAGIC realizes that, over time, the course content and structure has to be updated. Reasons might include that content is not accurate anymore, or that they want to improve students' learning experience.

For the content and course developer, the important question is, how does it work in the LMS to update a course? The important question for the management and HR is how to prevent tracking data from getting lost during the update.

While updating courses, the company has to differentiate between structural and content changes. Structural changes affect a course's outline. Meanwhile the content changes affect the text, images, and media files that students see when they launch a course.

The following describes the process the course developers must go through for updating content in the LMS. The steps for distributing changes to a course are similar to those used to deploy the course originally. However, you have the option of deciding how far to disseminate the changes. You can either update a master without changing existing offerings, or you can distribute changes to all active offerings created from the original master. E-mail notifications are sent to administrators when the update has been accepted or rejected.

Packaging

If you used the LMS Authoring Tool to create the original course package, the first step is to repackage the course with the changes you made. The package ID remains the same, but the version number increments by one. The course content and structure version numbers are also updated if they have changed since the last time the course was packaged. The content version number is checked only when content is stored in the package. If all the content is external to the package, the content version number is ignored.

Importing

Use the Authoring Tool or the command-line import utility to import the updated package into the system. The LMS Server checks the package ID and version number to determine if the package is an update to a previously deployed course. If no package ID was specified, the server generates one. If the updated course package contains only a structural update, the structure is imported to the LMS Server, but the content is not.

If you have received an updated course from a courseware vendor and it does not have a package ID (or its package ID is not the same as the previous course), you cannot update the corresponding master directly. Import the package and

follow the instructions described later in this procedure to use the Masters Catalog option “Update a master using an imported master.”

Updating the master and its offerings

When LMS finds a match between the course ID of the re-imported updated course package and the original master, it flags the master in the catalog as a master with changes pending. You now have choices about how to handle the updated course:

- Do not update the master. Do this when you do not want the original master or its current or future offerings to be affected by the update. Reject the update by selecting **Discard update**. This action deletes the master from the list of masters with pending updates.
- Update the master, but do not update any offerings. Use the Update Master button in the Course Catalog to initiate the process, but do not select Update all offerings. Any new offerings created from the master will reflect the update, but you will not change or disrupt any active course offerings.
- Update the master and all its offerings. Use the Update Master button in the Course Catalog to initiate the process and select **Update all offerings**. This updates the master and all existing and future course offerings created from it. This choice changes all active course offerings created from the master. Avoid confusing students by making the course unavailable until the content has been successfully updated.

You can also update a master by using the content and structure of a newly imported package. Select **Update a master using an imported master** and select the new unregistered master to use as the new format.

Course update workflow

Figure 16-19 on page 356 summarizes how updates flow through the system. If an offerings manager chooses to update all offerings, existing offerings created from this master are changed, and structure and content changes are sent to the Delivery and Content Servers.

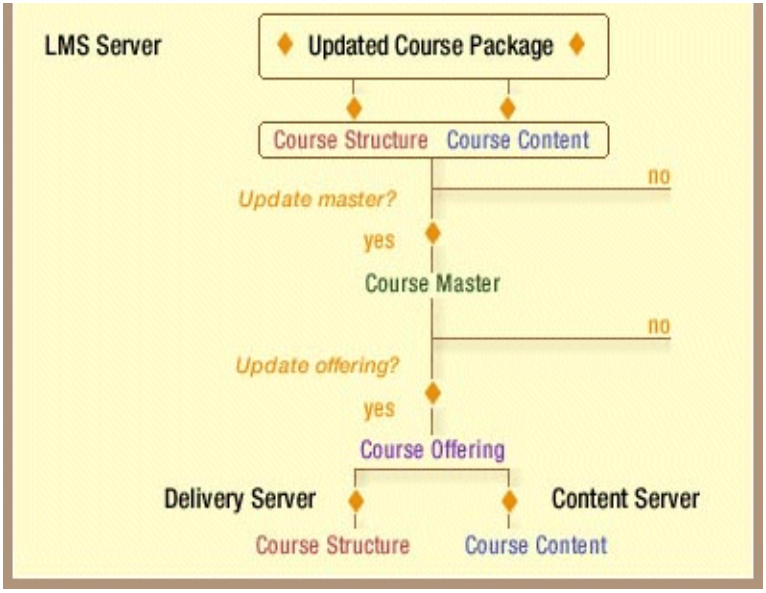


Figure 16-19 Course update workflow

16.7 Education rollout

Since the system has been deployed successfully, MAGIC starts their new education program.

The important thing is to convince the employees that the new system will help them to organize and improve their skills development. But like it is with new products and rollouts, many employees might have doubts.

The plan is to offer for each department a roadshow with an introduction to the main features and functions in LMS. Nevertheless, in each department they offer one training session for the administrators and instructors. For the content development, they need some subject matter experts from each department. For these persons, MAGIC offers trainings on using the Authoring Tool in each department.

But not only does face-to-face training help the employees to get in touch with the system, but also, for the administrators and end users, MAGIC develops Web-based training that helps them to understand how the system works. Finally, MAGIC prepares a reference card where all major features are explained. This card is given to all employees.

Last but not least, MAGIC sets up a support line and a help desk.

16.8 Health check

It is quite necessary to make some improvements in the system. That means, the system needs a periodic health check. New opportunities will arise to further improve the LMS environment, to increase learning efficiency, and to maintain technical optimization. Therefore the system is checked every month. The team will check the system for workload capacity and access. Depending on the load, the team might make some changes in the infrastructure.

A

Sample sizing questionnaire

In this appendix we provide a sample sizing questionnaire that you can use for capacity planning.

Table 16-2 Sizing questionnaire

Question	Response
Total number of students in corporate LDAP directory	
Total number of students to be rostered from the LDAP directory	
Concurrent users to be supported	
Average number of visits per day	
Average visits per hour	
Will this configuration be subject to a constant load or does it need to support unexpected bursts in usage?	
Ratio of peak workload vs. average load	
Maximum accepted response time (as perceived from the browser)	
Expected think time for UI navigation (usually 20 seconds)	
Expected think time associated with reading content pages (usually 3 minutes)	

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Question	Response
Number of content pages read by students per visit	
HW platform preferences (xSeries vs. pSeries) or info on existing configuration ► Model, N ► Number of processors ► Speed of processors ► RAM ► OS	
DBMS preference if any or info on existing Database server that the LMS system will be connected to ► Model, N ► Number of processors ► Speed of processors ► RAM ► OS	
LDAP preference if any or info on existing LDAP server that the LMS system will be connected to ► Model, N ► Number of processors ► Speed of processors ► RAM ► OS	
Maximum processor utilization that you would prefer the application server to operate at (50%, 60%, 70%, 80%)	
Number of courses in the system	
Any details regarding content: Size, media type (for example, html vs. windows media vs. netG), etc.	
Will the delivery servers be centrally located with the LMM or geographically dispersed?	
Available network connections between customer sites	
How are users connected to the network : LAN or dial-up? (speed of the modems)	

Question	Response
Reporting patterns (for example, end of month reporting by all managers)	

B

LMS installation checklist

This appendix provides a sample checklist/data sheet for the pre-installation tasks that have to be performed before the LMS software is installed. It also provides a handy parameter table that you can fill out during installation for your records.

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LMS servers - Preconfiguration checklist

During your planning and pre-configuration activities, fill out this checklist to make it easier to keep track of your progress and resource names.

LMM machine

Responsible contact person_____
_____
_____

Machine assembled ____

Server location _____
_____
_____

Hardware description _____
_____
_____

Installed software _____
_____
_____

Operating system installed ____

Administrator account

User name _____

Password _____

Network access configured ____

Network settings

IP address _____

Subnet mask _____

Fully qualified hostname_____

Default gateway _____

DNS hostname resolution tested ____

Remote access available Y/N

Client Software _____

User name _____

Password _____

Xfbv on UNIX systems installed ____

DS machine

Responsible contact person_____
_____
_____

Machine assembled ____

Server location _____
_____
_____

Hardware description _____
_____
_____

Installed software _____
_____
_____

Operating system installed ____

Administrator account

User name _____

Password _____

Network access configured ____

Network settings

IP address _____

Subnet mask _____

Fully qualified hostname _____

Default gateway _____

DNS hostname resolution tested ____

Remote access available Y/N

Client software _____

User name _____

Password _____

LDAP server

Responsible contact person _____
_____
_____

Supported LDAP server identified/installed ____

Server location _____
_____
_____

Operating system _____

LDAP server software _____

Fully qualified hostname _____

LDAP directory port (default is 389) _____

Base distinguished name _____

Fully distinguished bind user name _____

Bind user password _____

User identifier attribute (e.g., uid _____ _____

LDAP bind user has the right permissions ___

LDAP server access from all LMS machines tested ___

Required users created/identified ___

WAS administrator user name_____

WAS administrator password_____

Fully distinguished LMS administrator group name
_____

LMS administrator user name_____

LMS administrator password_____

Database server

Responsible contact person_____
_____
_____

Supported database server identified/installed ____

Server location _____
_____
_____

Operating system _____

Fully qualified hostname _____

DBMS software _____

Database instance port _____

For DB2 on UNIX: Required system parameters changed ____

For Oracle: Database instance is in UTF-8 format ____

Required database client software installed on all LMS servers ____

All LMS servers can connect to the database server ____

SMTP server

Responsible contact person_____
_____
_____

SMTP server identified/installed ____

Server location _____
_____
_____

Operating system _____

Fully qualified hostname _____

SMTP server software _____

SMTP relaying enabled for LMM Server ____

HTTP servers

HTTP server for LMS-LMM user interface

Responsible contact person _____
_____
_____

Supported HTTP server identified/installed ____

Server location _____
_ _____
_____ _____

Operating system _____

Fully qualified hostname _____ _____

HTTP server software _____ _____

WebSphere plugin installed and works____

DS machine can connect to port 80 of LMM's HTTP server ____

HTTP server for LMS-DS user interface

Responsible contact person _____
_____ _____
_____ _____

Supported HTTP server identified/installed ____

Server location _____
_____
_____

Operating system _____

Fully qualified hostname _____

HTTP server software _____

WebSphere plugin installed and works ____

LMM machine can connect to port 80 of DS's HTTP server ____

HTTP server for content

Responsible contact person _____
___ _____
_____

Supported HTTP server identified/installed____

Server location _____
_____
_____

Operating system _____

Fully qualified hostname _____

HTTP server software _____

Content access prepared ____

Content directory on file system _____

Content directory access URL _____

HTTP server configuration updated ____

Content deployment prepared ____

FTP user name _____

FTP user password _____

FTP directory _____

FTP directory is accessible from LMM machine ____

WebSphere Application Server

Platform-specific tips for WAS 5 considered ____

WAS installed on all machines ____

WAS admin user name _____

WAS admin password _____

WAS installation path _____

Global Security and SSO enabled ____

WebSphere plugin on HTTP server for LMS user interface access installed and tested____

Separate application servers for LMS modules in WAS created ____

Names of created application servers for LMS modules

_____

Installation overview

Parameter	Values
LDAP Settings	
Provider URL	
Base Distinguished Name	
LDAP User ID	
LDAP Password	
LDAP Provider	
LMS Server Settings	
Base URL	
Description	
User Name	

Parameter	Values
Password	
Administrator Settings	
Administrator Role Type	
Administrator LDAP User ID	
Content Management Settings	
Path to imported Course Packages	
FTP User Name	
FTP Password	
Notification E-mail format	
Delivery Server Settings	
Server ID	
Base URL	
Description	
Delivery Server User Name	
Delivery Server Password	
Web Server Settings	
URL of Deployed Content	
Tracking URL	
Content Deployment Settings Use “Add Server”—button to add content server to the Servers-list	
Deployment Type	
Location for Deployed Content	
FTP Host	
System Administrator E-mail Settings	
E-mail to Address	
E-mail from Address	
Installation directory	

Parameter	Values
Directory Name	

C

Software requirements

This appendix lists the supported software for use with the IBM Lotus Learning Management System (LMS) R1.

Always check the Release Notes, corresponding to the release level of the components you are installing, for the most accurate list of requirements.

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Supported operating systems for LMS servers

The following operating systems are supported for LMS R1 servers:

- Microsoft Windows 2000 Server and Advanced Server (Intel 32 architecture)
- IBM AIX Release 5.1 or later (PowerPC® RISC architecture - pSeries)
- Sun Solaris Release 8 or later (UltraSPARC 32/64 architecture - not on Intel)
- Linux Release 2.2 or later (Intel 32/64 architecture with SuSe 7.2 or later and Red Hat 7.2 or later only)
- Red Hat Enterprise Linux AS 2.1

Note: Windows 2003 Server is not yet certified.

Supported LDAP directory servers

LMS R1 requires an LDAP V3 compliant directory. The list of supported LDAP products includes:

- IBM SecureWay® V3.2.2
- IBM Directory Server V4.1 or 5.1
- Lotus Domino Enterprise Server 5.0.9a
- Microsoft Active Directory 2000 (W2K)
- Sun ONE Directory Server 5.0 (formerly iPlanet Directory Server)

Supported database servers

You need a relational database management system with LMS R1. When you install LMS, you create or upgrade a database specifically for use with LMS. LMS R1 supports the following relational database management systems:

- IBM DB2 Release 7.2 or later. Note that if you use DB2 on a Linux 2.4 server, you must recompile the Linux 2.4 kernel with new parameters to ensure that DB2 operates correctly.
- Microsoft SQL Server Enterprise 2000 SP2®.
- Oracle 8i Enterprise Release 3 v8.1.7 or later.

LMS supports these databases for all the platforms on which they run. DB2 running on IBM zSeries® or IBM iSeries™ machines is not supported.

Supported Web servers for use with WAS

The following HTTP servers are supported for use with the LMS. This means that the WebSphere plug-in is provided for these servers. This server list is only important for LMS user interface access. You are free to use any other Web server to host the course contents.

- Apache HTTP Server Version 1.3
- IBM HTTP Server powered by Apache 1.3
- IBM HTTP Server powered by Apache 2.0
- Lotus Domino Enterprise Server 5.0.9a
- Sun ONE Web Server, Enterprise Edition 6.0.4 (formerly iPlanet Web Server)
- Microsoft Internet Information Server 5.0 on W2K

Note: You can find an up-to-date list at in the “WebSphere Application Server Prerequisites” documentation at:

`http://www-1.ibm.com/support/docview.wss?uid=swg27003903`

Client operating system and browser requirements

The LMS supports the following client operating systems and browsers:

- Microsoft Windows 95, 98, ME, XP, and 2000. Supported browsers: Microsoft Internet Explorer 5.0x, 5.5x, 6.0x and Netscape 6.2 or 7.0.
- Linux - Suse 7.2 or later, and RedHat 7.2 or later only. Supported browser(s): Netscape 6.2 or 7.0.
- Apple Macintosh - OS 9.x and OS X. Supported browser(s): Netscape 6.2 or 7.0.

Note: LMS Authoring Tool and LMS Offline Learning Client only support Microsoft Windows 2000 and XP.

Note: LMS does *not* support Netscape Release 4.7.

D

WebSphere Application Server security parameters

This appendix provides additional information about key WAS security parameters that have to be configured properly for LMS.

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How to set up security in WAS

To set up security within WebSphere, you have to perform these steps in the WAS administration console:

1. Set up LDAP server connectivity (LDAP User Registry + Advanced LDAP Settings).
2. Set up the LTPA key (LTPA Settings and LTPA SSO Settings).
3. Activate Global Security.

LDAP user registry

For lookups of the user name and password to authenticate the users, LDAP is the supported directory for LMS.

You find LDAP Settings in the WAS administration console under **Security -> User Registries -> LDAP**.

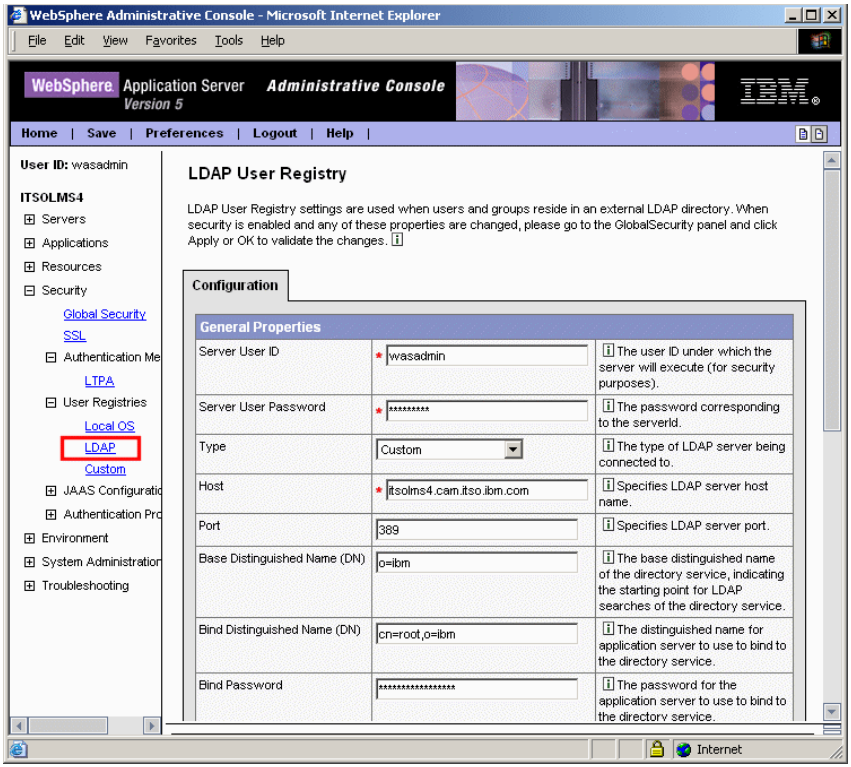

Figure 16-20 Accessing LDAP user registry settings

Below is an explanation of the fields that are important for the LMS setup.

Server user ID

This is the WebSphere administration user ID (usually wasadmin). It has access to the administration console and can stop a running application server.

When using LDAP (which is the case for LMS), the following conditions apply:

- The user must be a valid user in the LDAP.
- The user should not be a root DN or administrator DN, because those users are not part of the directory in all LDAP implementations.

Type

This is the directory service product that will be used to locate information and against which users and groups will be authenticated.

Modifications to the default values in the advanced LDAP properties will cause this field value to change to Custom. This change will show after you save the new configuration.

Base distinguished name

The base distinguished name of the directory service indicates the starting point for LDAP searches of the directory service. See RFC 1779 for a discussion of this technique. For example, for a user with a DN of cn=John Doe, ou=Rochester, o=IBM, c=US, the base DN can be specified as any of (assuming a suffix of c=us):

```
ou=Rochester, o=IBM, c=us
o=IBM, c=us
c=us
```

This field is not case-sensitive.

This field is required for all LDAP directories except the Domino Directory. If you are using the Domino Directory and you specify a base distinguished name, you will not be able to grant permission to individual Web users for resources managed by your WebSphere application server.

Bind distinguished name

This is the distinguished name for the application server to use to bind to the directory service. If no name is specified, the application server binds anonymously. Examples are:

```
cn=root
cn=John Doe, ou=Rochester, o=IBM, c=US
```

Bind password

This is the password for the user defined in bind distinguished name to use to bind to the directory service.

Ignore case

If you use the IBM Directory Server, enable the IgnoreCase flag. This is required because when the groups information is obtained from the user object attributes, the case is not the same as the one obtained when you get the groups information directly. In order for the authorization to work in this case, a case insensitive check has to be performed.

Advanced LDAP settings

You find the Advanced LDAP settings in the WAS administration console under **Security -> User Registries -> LDAP -> Advanced LDAP Settings**. See Figure D-1.

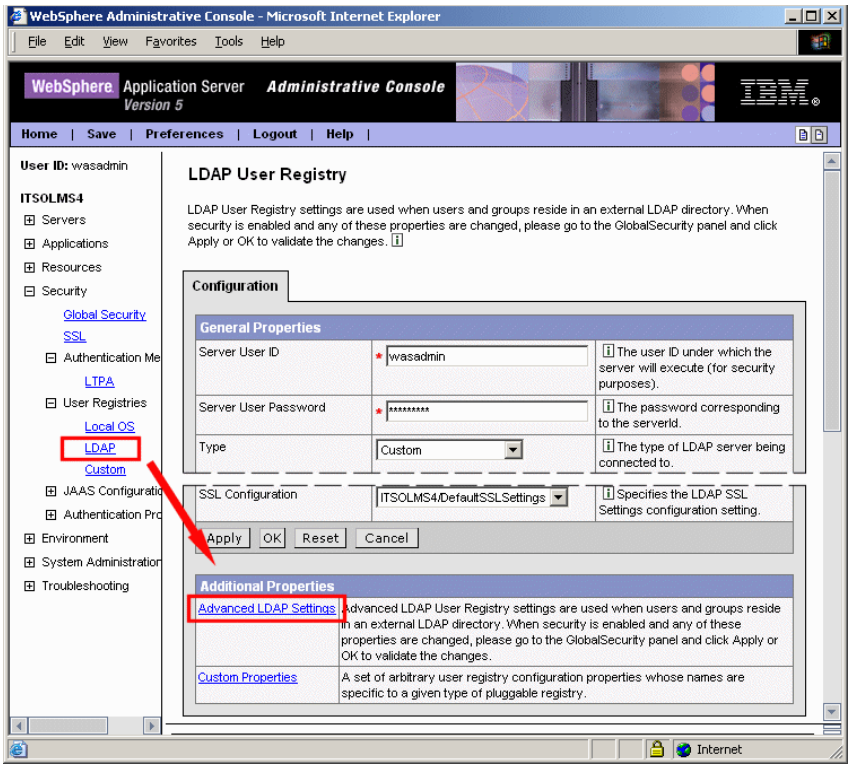

Figure D-1 Accessing advanced LDAP settings

Here is an explanation of the fields that are important for the LMS setup.

LDAP filters

Here we discuss some general information related to both user and group filters.

Lightweight Directory Access Protocol (LDAP) filters are used by the WebSphere Application Server to search and obtain information about users and groups from an LDAP directory server. A default set of filters is provided for each LDAP server that the product supports. These filters can be modified to fit your LDAP configuration. Once the filters are modified (and OK or Apply is clicked) the directory type in the LDAP registry panel changes to custom, which indicates that custom filters are being used. Also, you can develop filters to support any additional type of LDAP server. The effort to support additional LDAP directories is optional, and IBM does not provide support for other LDAP directory types.

In order to improve performance for LDAP searches, the default filters for IBM Directory Server, iPlanet Directory Server, and Active_Directory have been defined such that when you search for a user, the result contains all the relevant information about the user (user ID, groups, and so on). This prevents the product from going to the LDAP server multiple times and improves performance. This is possible only in these directory types because these support searches are where the complete information about a user can be obtained.

User filter

An LDAP filter is used for searching the registry for users. It is typically used for Security Role to User assignment. It specifies the property by which to look up users in the directory service. For example, to look up users based on their user IDs, specify (ampersand(uid=%v)(objectclass=inetOrgPerson), where ampersand is the ampersand symbol.

The user filter is used for searching the registry for users and typically used for the Security Role to User assignment. Also, the filter is used to authenticate a user using the attribute specified in the filter. It specifies the property used to look up users in the directory service. In the following example, the property that is assigned to %v, which is the short name of the user, must be a unique key. This means that two LDAP entries with the same object class cannot have the same short name. To look up users based on their user IDs (uid) and using the object class inetOrgPerson, specify the following:

```
(&(uid=%v)(objectclass=inetOrgPerson)
```

You can find more information about this syntax in Appendix F, “Default LDAP attribute mappings” on page 393.

Group filter

The group filter is used for searching the registry for groups and typically used for the Security Role to Group assignment. Also, the filter is used to specify the property by which to look up groups in the directory service. In the following example, the property that is assigned to %v, which is the short name of the group, must be a unique key. This means that two LDAP entries with the same object class cannot have the same short name. To look up groups based on their common names (cn) and using the object class of either groupOfNames or groupOfUniqueNames, specify the following:

```
(&(cn=%v)(|(objectclass=groupOfNames)(objectclass=groupOfUniqueNames)))
```

User ID map

This is an LDAP filter that maps the short name of a user to an LDAP entry. It specifies the piece of information that should represent users when users are displayed. For example, to display entries of the type object class = inetOrgPerson by their IDs, specify inetOrgPerson:uid. This field takes multiple objectclass:property pairs delimited by a semicolon (;).

This filter maps the short name of a user to an LDAP entry. This specifies the piece of information that should represent users when users are displayed using their short names. For example, to display entries of the type object class = inetOrgPerson by their IDs, specify inetOrgPerson:uid. This field takes multiple objectclass:property pairs delimited by a semicolon (;). To provide a consistent value for methods like getCallerPrincipal( ), getUserPrincipal() the short name obtained by using this filter is used. For example, the user CN=Bob Smith, ou=austin.ibm.com, o=IBM, c=US can log in using any attributes that were defined for him (for example, e-mail address, social security number, and so on); but when the above methods are called, the user ID bob is returned no matter how he logs in.

Group ID map

This filter maps the short name of a group to an LDAP entry. This specifies the piece of information that should represent groups when groups are displayed. For example, to display groups by their names, specify *:cn. The * is a wildcard character that searches on any object class in this case. This field takes multiple objectclass:property pairs delimited by a semicolon (;).

Group member ID map

This filter identifies user-to-group memberships. For SecureWay, Netscape, and Domino directory types, this field is used to query all the groups that match the specified object class(es) to find if the user is contained in the attribute specified. For example, to get all the users belonging to groups whose object class is groupOfNames and the users are contained in the member attributes, specify

groupOfNames:member. This specifies which property of an object class stores the list of members belonging to the group represented by the object class. This field takes multiple objectclass:property pairs delimited by a semicolon (;). For the IBM Directory Server, iPlanet Directory Server, and Active Directory this is used to query all users in a group by using the information stored in the user object (instead of querying all the groups individually to find if the user exists in that group). For example, the filter memberof:member (for Active Directory) is used to get the “member of” attribute of the user object to get all the groups that the user belongs to. The *member* attribute is used to get all the users in a group using the group object. Using the user object to obtain the group information is expected to improve performance. For example:

```
groupOfNames:member
```

Certificate map mode

The X.590 certificates can be used for user authentication when LDAP is selected as the user registry. This field is used to indicate whether to map the X.509 certificates into an LDAP directory user by EXACT_DN or CERTIFICATE_FILTER. If EXACT_DN is selected, the DN in the certificate should exactly match the user entry in the LDAP server (including case and spaces). One can use the Ignore Case field in the LDAP settings to make the authorization case insensitive. If CERTIFICATE_FILTER is selected, fill in the appropriate certificate filter (in the next field) that should be used for mapping the certificate to a user in the LDAP. If EXACT_DN is selected the certificate filter is ignored.

The validation of the changes (if any) does not take place in this panel. Validation is only done when the OK or Apply buttons are pressed in the Global Security panel. If you are in the process of enabling security for the first time, complete the remaining steps and go to the Global Security panel and select **LDAP** as the Active User Registry. If security was already enabled and any information on this panel is changed, make sure to go to the Global Security panel and click **OK** or **Apply** to validate your changes. If your changes are not validated the server may not be able to come up.

LTPA configuration settings

In the LTPA configuration settings screen at **Security -> Authentication Mechanisms -> LTPA**, you have to define the password to encrypt and decrypt LTPA keys. The LTPA keys are automatically generated the first time security is enabled and saved correctly. See Figure D-2 on page 384.

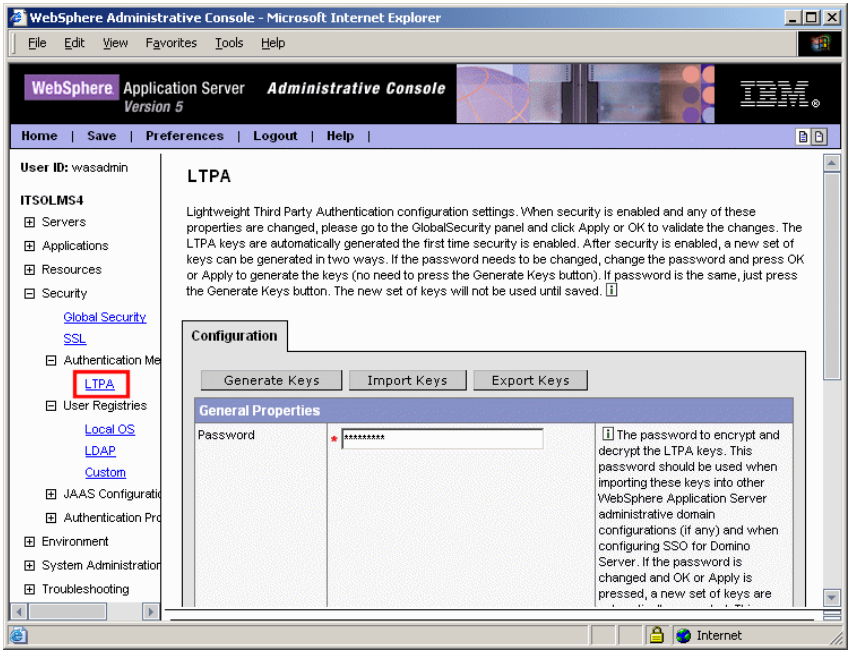

Figure D-2 Accessing LTPA settings

Single sign-on

You find the LTPA single sign-on (SSO) settings under **Security -> Authentication Mechanisms -> LTPA -> single sign-on (SSO)**.

See Figure D-3 on page 385.

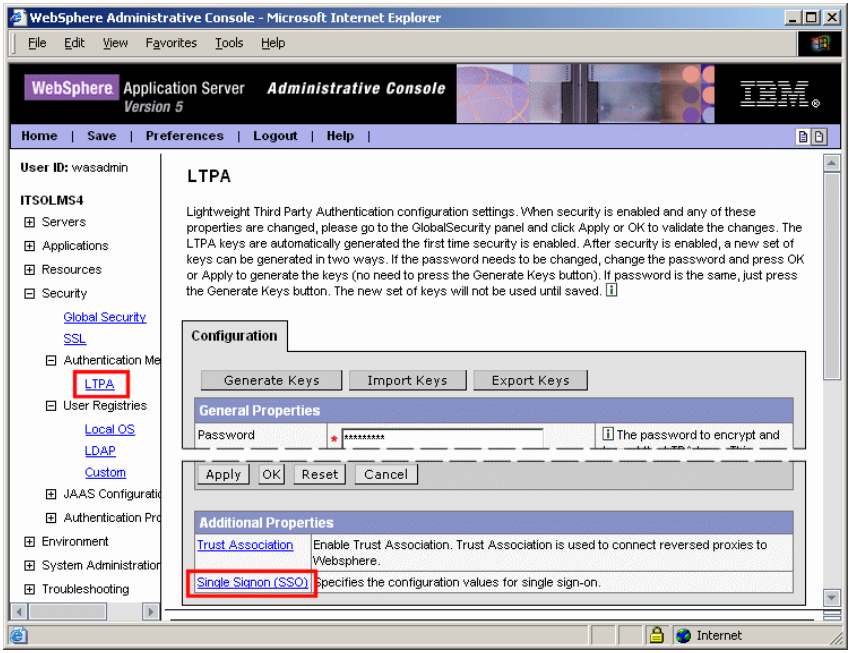

Figure D-3 Accessing LTPA single sign-on settings

Here is an explanation of the most important fields that are required for the LMS setup.

SSO - Domain

The Domain field restricts SSO to servers in the domain you specify in this field. This domain name is used when creating HTTP cookies for single sign-on. It determines the scope to which single sign-on applies. For example, a domain of austin.ibm.com would allow single sign-on to work between WebSphere application server A at serverA.austin.ibm.com and WebSphere application server B at serverB.austin.ibm.com. Note that cross-domain single sign-on is not supported. That is, a server at austin.lotus.com, and another at austin.ibm.com, cannot participate in WebSphere single sign-on.

Note: The LTPA token that is sent back to the browser is scoped by a single DNS domain that is specified when global security is configured.

This means that all application servers in an entire WebSphere Application Server cell must share the same DNS domain for security purposes.

Enable single sign-on

The single sign-on causes your LTPA directory service to store extra information in the tokens so that other applications can accept clients as already authenticated by WebSphere Application Server. When clients try to access the other applications, they will not be interrupted and asked to log in.

When you enable single sign-on, the Domain field will be enabled. You must enter a DNS domain name.

Token expiration

The expiration time defines how many minutes can pass before a client using an LTPA token must authenticate again. LTPA uses tokens to store the authenticated status of a client.

A positive integer indicates the token life in minutes.

Global security settings

To activate WebSphere security, you have to enable global security.

Before global security is enabled, you can enter any user ID to log into the administrative console. The user ID is only used to track changes to the configuration, but not to authorize access to the administration console.

After global security is enabled, you must enter a valid user ID and password.

You find the global security settings under **Security -> Global Security**.

See Figure D-4 on page 387.

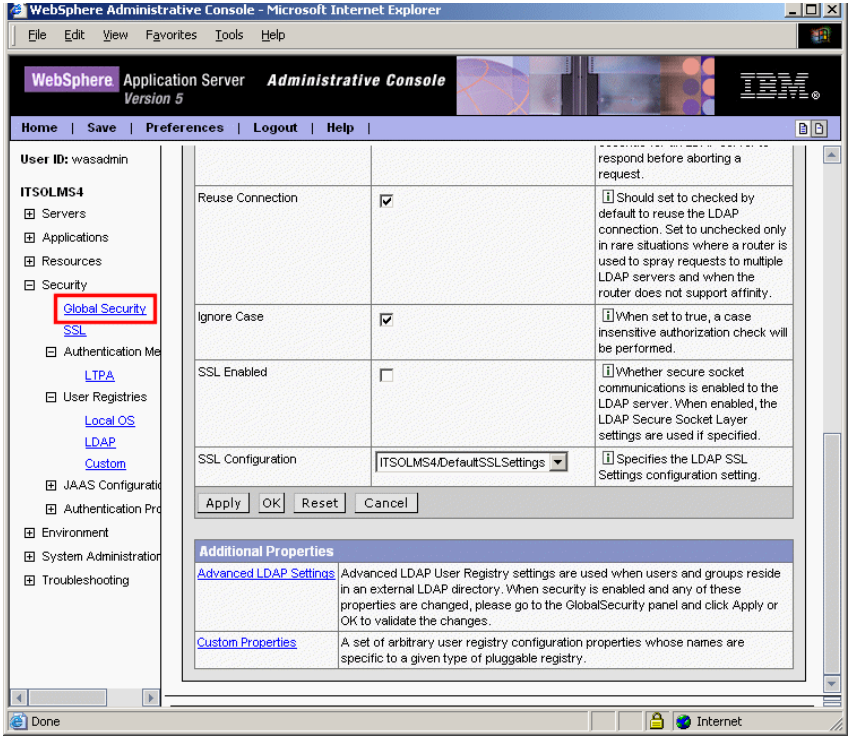

Figure D-4 Accessing global security settings

Here is an explanation of the fields that are important for the LMS setup.

Enabled

The Enabled field specifies for the server to enable security subsystems.

This flag is commonly referred to as the global security flag in WebSphere Application Server literature. When enabling security, set the authentication mechanism configuration and specify a valid user ID and password in the selected user registry configuration.

Enforce Java 2 security

Specifies whether to enable or disable Java 2 security permission checking. By default, Java 2 security is disabled. However, if you enabled global security, this automatically enables Java 2 security. You can choose to disable Java 2 security, even when global security is enabled.

When Java 2 security is enabled and if an application requires more Java 2 security permissions then are granted in the default policy, then the application

might fail to run properly until the required permissions are granted in either the app.policy file or the was.policy file of the application.

Cache timeout

The cache timeout is the time after which the authentication cache will be refreshed. Caching can improve performance with respect to authentication lookups.

Specify this value in seconds, with a minimum of 30.

Active protocol

The Active Protocol determines which ORB-based authentication protocols are accepted by the Application Server. For more information on this, check *IBM WebSphere V5.0 Security WebSphere Handbook Series,* SG24-6573.

Active authentication mechanism

In the active authentication mechanism you specify the mechanism that you have configured before. For LMS this is LTPA.

Active user registry

In the active user registry you specify the registry that you have previously configured. For LMS, this is LDAP.

E

WebSphere scope setting

In this appendix we show how the WebSphere parameters are set, and how to make sure they are set to the scope level you require. We also show how to save your work.

This appendix has been included because problems during the LMS installation can occur because of incorrect scope settings.

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Set the correct scope of the parameters in WebSphere

Most of the settings in the administration client require that you select on which level the parameters apply: Cell, node, or server level. We advise you to set all parameters that are required for LMS on node level; see Figure E-1. All parameters will have to be defined for every node where LMS is deployed.

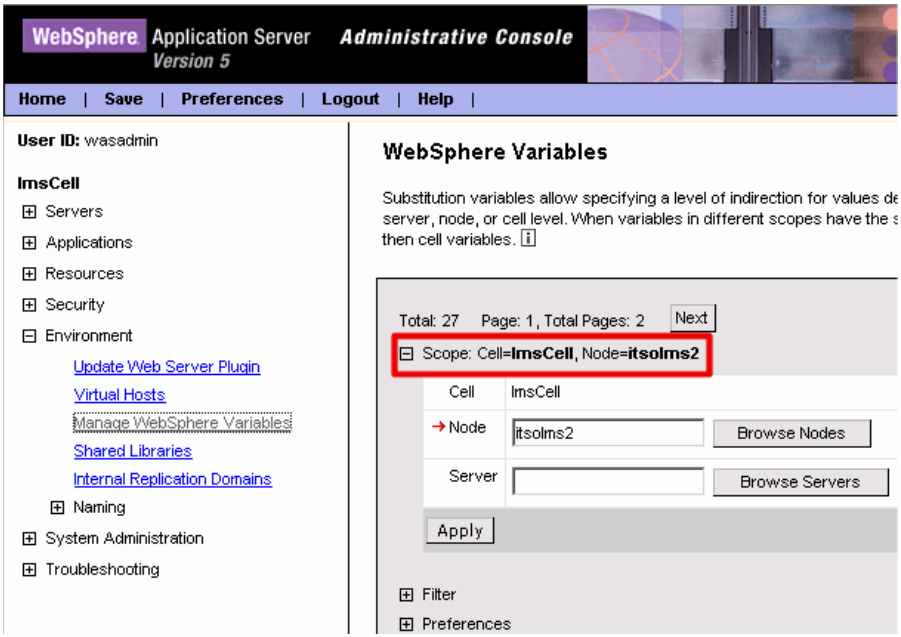

Figure E-1 Example of setting the scope level of the WebSphere variables

Click **Browse** next to a field to see choices for limiting the scope of the field. If a field is read-only, you cannot change the scope. For example, if only one server exists, you cannot switch the scope to a different server.

- To specify cell scope, clear the node and server fields and click **Apply**.
- To select a node scope, type in or browse for a node, then clear the server field and click **Apply**.
- To select a server scope, select a node scope first, then type in or browse for a server, and click **Apply**.

Use the the Scope settings option within the administration console to filter the contents of an administrative console collection table to a particular cell, node, or server.

The server scope has precedence over the node and cell scopes, and the node scope has precedence over the cell scope. Note that objects are created at only one scope, though they might be visible at more than one scope. See Figures E-2 and E-3 for examples in setting the scope. The scope setting is available for all resource types, WebSphere variables, shared libraries, and name space bindings.

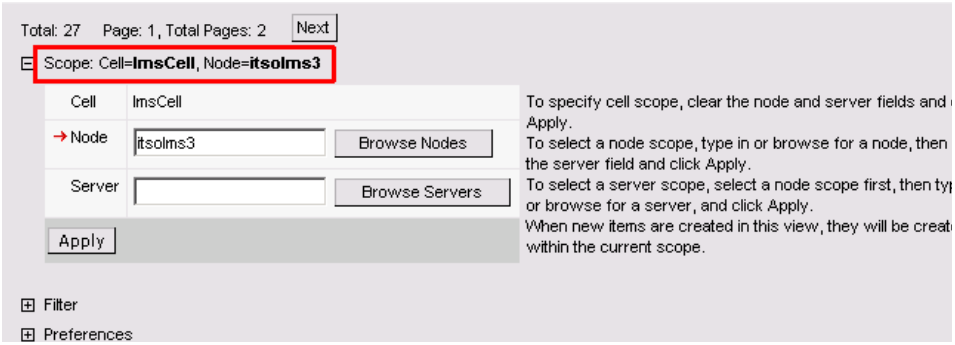

Figure E-2 Example of setting the scope to node level

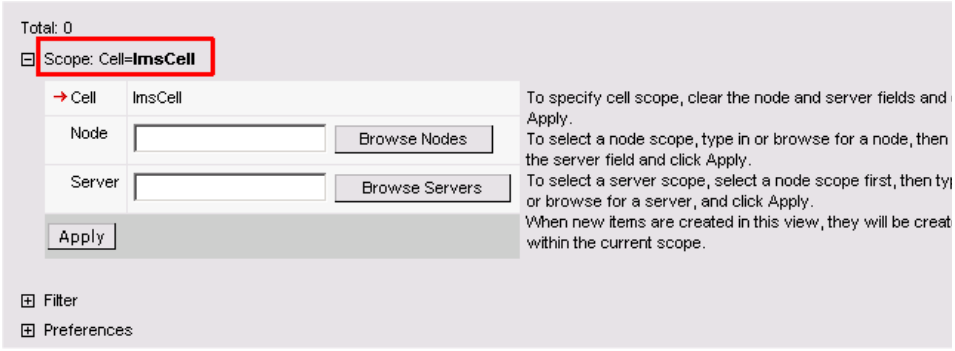

Figure E-3 Example of setting the scope to Cell level

Always remember to click **Apply** after selecting the correct level, as otherwise you are still at the previously selected scope level.

Saving the work

As you make changes to the WebSphere configuration, your changes are saved to a temporary workspace storage. For the configuration changes to take effect, they must be saved to the master configuration and then synchronized (sent) to the nodes.

Click **Save** to save changes to the master repository. This can be done from the taskbar in the Messages area. You should receive a message similar to Figure E-4.

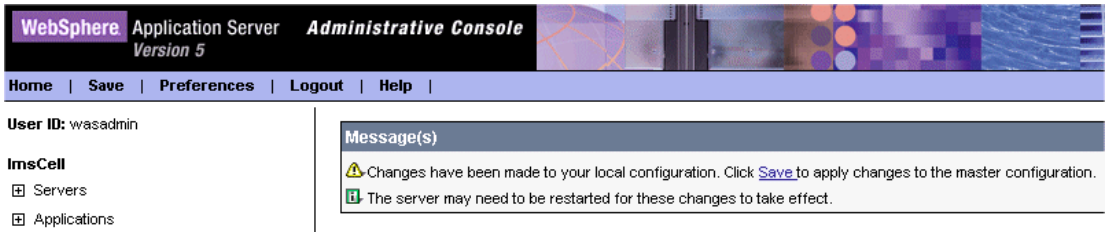

Figure E-4 Example of a save message in the WebSphere Administration Client

If you do not save changes to the master repository, the changes will not be pushed to your node's configuration repository; effectively the new settings will be lost.

F

Default LDAP attribute mappings

This appendix lists the default LDAP attribute mappings that are defined in the settings.xml file. The LMS attributes and the LDAP attributes mapped can be used to define matching strings, such as ACLs.

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Default LDAP user attribute mappings

Table F-1 Default LDAP user attribute mappings

LMS attributes	LDAP objectClass attributes			
	dominoPerson	ePerson	inetOrgPerson	user
Address_1	postalAddress	postalAddress	postalAddress	postalAddress
Address_2	postalAddress	postalAddress	postalAddress	postalAddress
BusinessCategory	businessCategory	businessCategory	businessCategory	
City	l (=lowercase L)	l (=lowercase L)	l (=lowercase L)	l (=lowercase L)
CommonName	cn	cn	cn	cn
Country	c	c	c	c
DepartmentNumber	departmentNumber	departmentNumber	departmentNumber	department
Description	description	description	description	description
DisplayName	displayName	displayName	displayName	displayName
EmailAddress	mail	mail	mail	mail
EmployeeNumber	employeeNumber	employeeNumber	employeeNumber	
EmployeeType	employeeType	employeeType	employeeType	
FirstName	givenName	givenName	givenName	givenName
Initials	initials	initials	initials	initials
IsManager				
LanguageLocale	preferredLanguage	preferredLanguage	preferredLanguage	
LastName	sn	sn	sn	sn
LdapId	uid	uid	uid	sAMAccountName
Location		location		
Manager	manager	manager	manager	manager
Organization	o	o	o	o
OrganizationalUnit	ou	ou	ou	ou
PhoneNumber	telephoneNumber	telephoneNumber	telephoneNumber	telephoneNumber
PostalCode	postalCode	postalCode	postalCode	postalCode
State	st	st	st	st
Title	title	title	title	title
UserId	uid	uid	uid	sAMAccountName

Default LDAP group attribute mappings

Table F-2 Default LDAP group attribute mappings

LMS attributes	LDAP objectClass attributes			
	dominoGroup	groupOfNames	groupOfUniqueNames	group
BusinessCategory	businessCategory	businessCategory	businessCategory	
CommonName	cn	cn	cn	cn
Description	description	description	description	descripion
DisplayName	cn	cn	cn	cn
Member	member	member	uniqueMember	member
Organization	o	o	o	
OrganizationalUnit	ou	ou	ou	
Owner	owner	owner	owner	managedBy

Default directory profiles

Table F-3 Default directory profiles

LMS Directory Profile	objectClasses used for … users	groups
IBM Directory Server	inetOrgPerson, ePerson	groupOfNames, groupOfUniqueNames
IBM SecureWay	ePerson	groupOfNames, groupOfUniqueNames
iPlanet	inetOrgPerson	groupOfNames, groupOfUniqueNames
Lotus Domino	dominoPerson	dominoGroup
Microsoft Active Directory	user	group

Determining the effective mapping

By default, multiple LDAP attribute mappings are defined in the settings.xml. However, based on the actual LDAP directory you use, only some of them will take effect. To find out which mappings are used in your LMS, follow these steps:

1. Open settings.xml located at:

   ```
   <WAS_installation_path>\installedApps\<node>\LMSLMM.ear\lms-lmm-complete-23
   .war\WEB-INF\classes\settings.xml
   ```

2. Search for the parameter “directoryProfile.” It contains the name of the active profile for your LMS. In Figure F-1, it is “IBM Directory Server.”

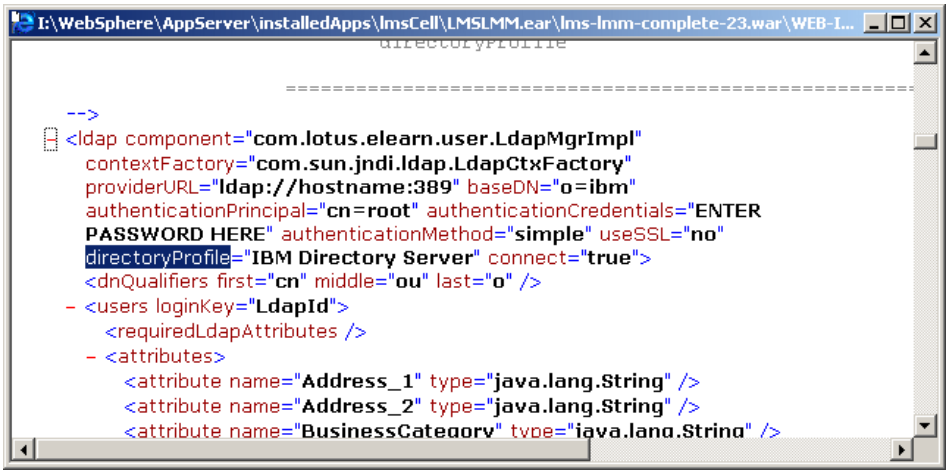

Figure F-1 Determining the LDAP directory profile in use

3. Determine the object classes (schemas) that LMS uses for users and groups.

In Table F-3 on page 395, find the row that contains the name of your active profile (in the first column). The second and third columns in that row contain the object classes in use.

- In our example, for the “IBM Directory Server” profile, inetOrgPerson and ePerson are used as object classes for users.
- For groups, the object classes are groupOfNames and groupOfUniqueNames.

4. Now you can determine the attribute mappings that are in effect. Select an LMS attribute in the first row and in Table F-1 (for users) or F-2 (for groups) and view the entries in the columns of the object classes that are in use.
   - In our example, for users, the LMS attribute “PhoneNumber” maps to telephoneNumber in both inetOrgPerson and ePerson object classes.
   - For groups, “Member” maps to member in groupOfNames and to uniqueMember in groupOfUniqueNames.

G

Configuring LMS for the MAGIC company

This appendix describes the steps of configuration that our case study company, MAGIC, has to go through in the LMS after the preconfiguration phase.

The company, MAGIC, and its employees are completely fictional.

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Scenario configuration example

Once the thought process has been completed and appropriate documentation has been collected and reviewed, the configuration process can begin. The following steps will be taken to configure LMS to match the corporate scenario defined in Chapter 16, “Corporate scenario” on page 327:

- Roster developers.
- Apply roles to rostered developers.
- Add developers to access control on course folders.
- Test developer access.
- Switch to developer ID.
- Configure roles.
- Configure profiles.
- Configure locations.
- Configure rooms.
- Configure skills.
- Configure zones.
- Configure course master folders.
- Configure course offerings folders.
- Add course masters.
- Roster users.
- Apply roles.
- Apply profiles.
- Apply skills and zones to instructors.
- Add course offerings.
- Enroll students.
- Auto enrollment.
  - Configure profiles.
  - Configure courses.
  - Apply profiles.
- Test.

Roster developers

LMS automatically reflects the members of the LDAP associated with the installation. Any user listed in the LDAP directory by default will be granted anonymous access to the system until he has been granted rostered. We will begin our configuration by only rostering the Cambridge developers. Other users will be rostered after the configuration is complete.

To roster the developers, follow these steps.

1. Log into LMS with the lmsadmin ID and select the **Users** tab. See Figure G-1 on page 399.

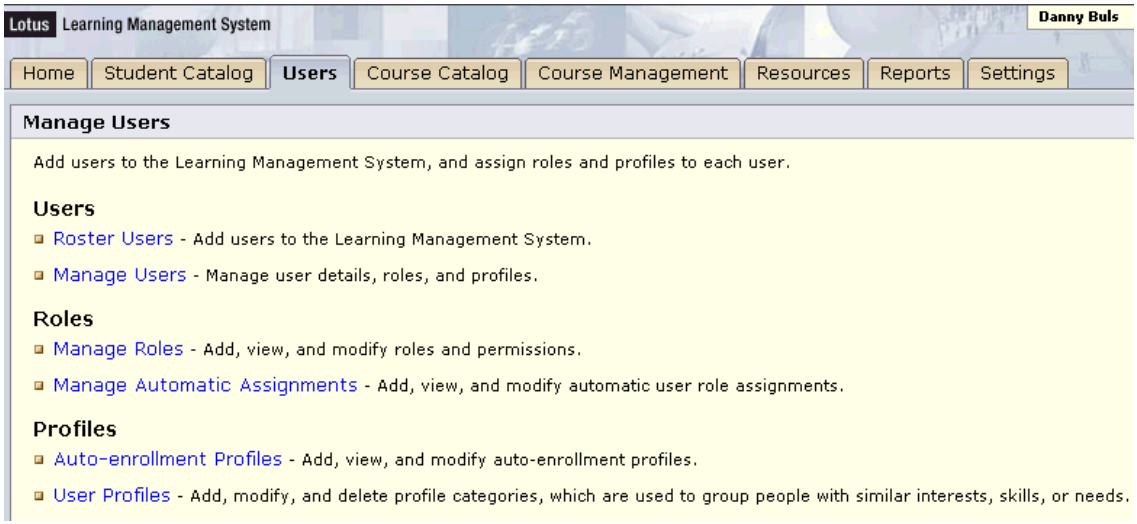

Figure G-1 Selecting the users tab

Choose **Roster Users** to pull LDAP entries into the LMS system. The screens present a complete list of all users registered in the associated LDAP directory.

Choose **Manage Users** to manage previously rostered users. The screens present a subset of the associated LDAP directory reflecting users already moved into LMS.

2. Select **Roster Users** to move the Cambridge developers into the LMS system.
3. Select **Roster One or More Users** to access the selection screen shown in Figure G-2 on page 400.

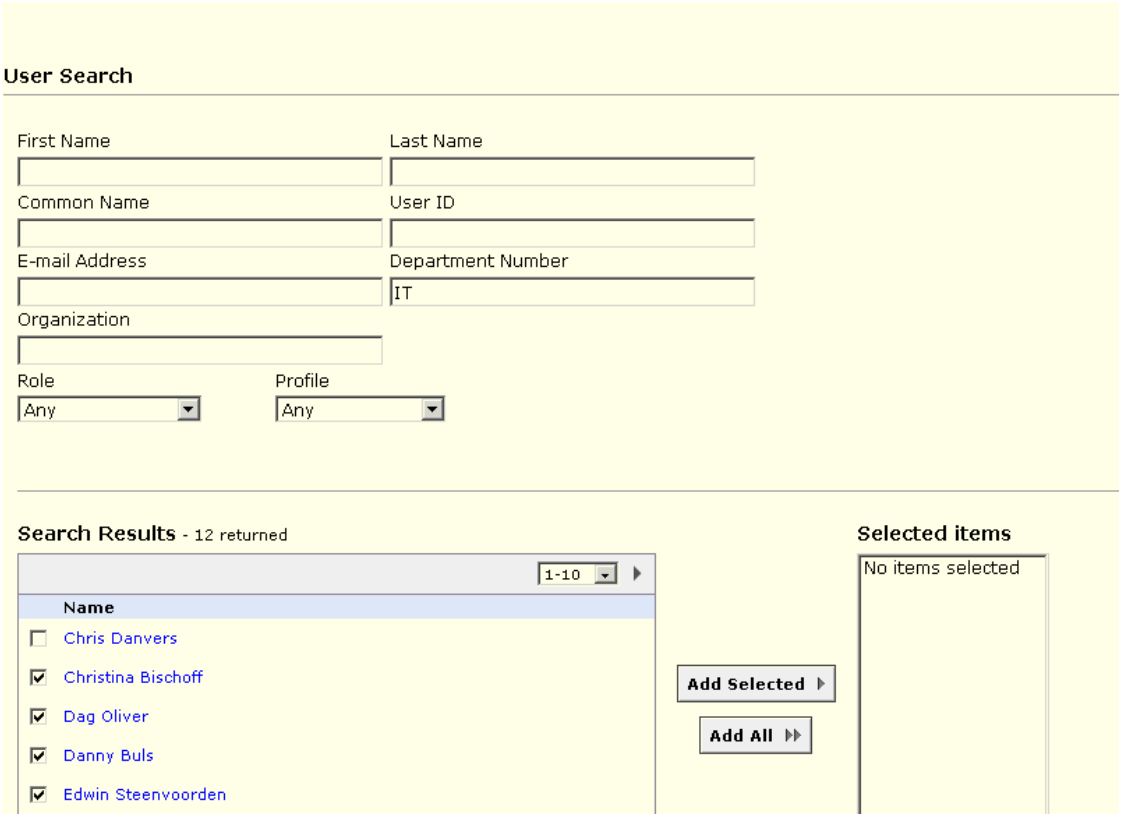

Figure G-2 User search screen

Tip: This screen shows the search interface that is used throughout the LMS system, so take time to get familiar with the navigation of this interface.

4. The quickest way to select entries is to use a wildcard (*) in one of the search fields and then click the **Search** button to the right of the search fields. This will generate a list of matches in the Search Results box in the lower left. Select the desired entries and click the **Add Selected** button to the right of the search results.
5. After all users to be rostered are selected, click **Continue** in the lower right corner.
6. You will see a message indicating `You have successfully rostered the selected users`.

Apply roles to rostered developers

Rostered users, by default, are granted the student role. Since we require our developers to have full administrative access, we need to give them the administrator role, as follows.

1. Select **Manage Users** from the choices on the Users tab.
2. Use the selection feature to select the collection of users that will be given the Administrator role.
3. Press **Continue** to display the screen of available roles. You will notice that Student is selected by default.
4. Select the **Administrator** role, as demonstrated in Figure G-3.

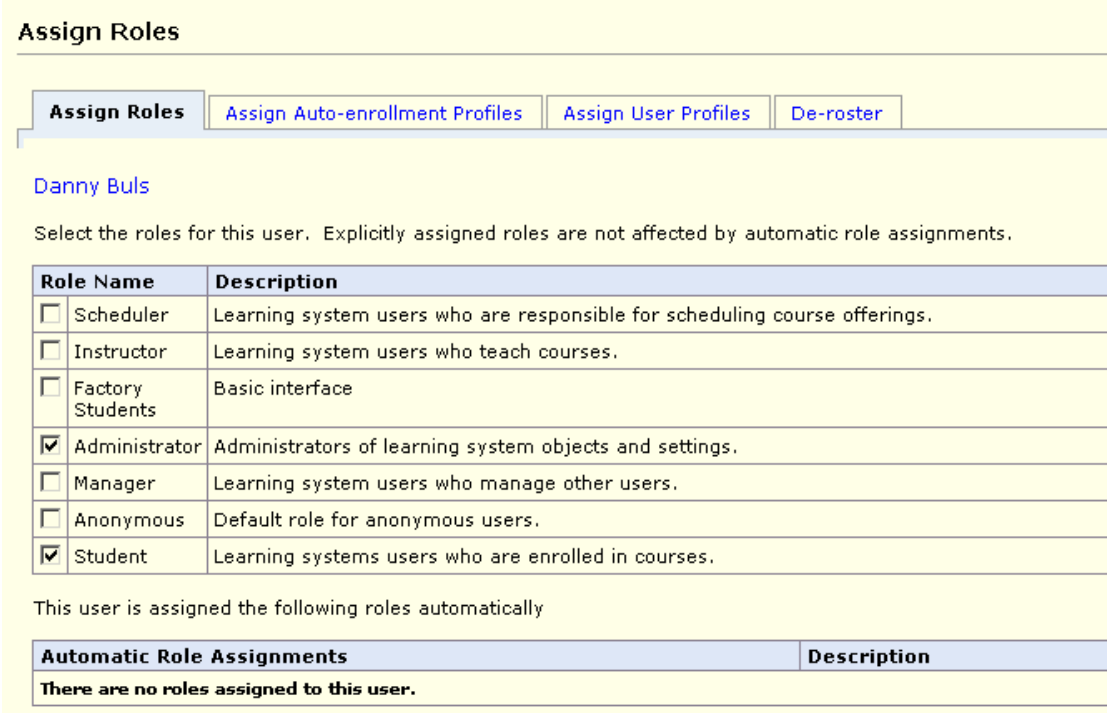

Figure G-3 Assigning roles

5. Click **Add Selected** in the lower right of the screen.

Add developers to access control on course folders

In our scenario, we determined that all employees with the EmployeeType of Developer should have access to all courses and resources. This was

accomplished by adding an attribute to the ACL security of the master catalog and master offerings folders. The procedure is as follows.

1. Select the **Course Catalog** tab. See Figure G-4.

Figure G-4 Selecting the course catalog tab

2. Select **Manage Masters Catalog**. See Figure G-5.

Figure G-5 Selecting Manage Masters Catalog

3. At this point, the only folder available is the Masters Catalog. Click the yellow folder icon to access the security settings for the Masters Catalog and then select the **Access Control** tab.

4. Click **Add** to add an entry to the Access Control. In our case we need to specify the level of Manage and scope of All Children to assure that all subfolders will inherit the security. For Match String, we enter EmployeeType=Developer to assure that all employees of the type developer will have manager access to all folders and subfolders. See Figure G-6.

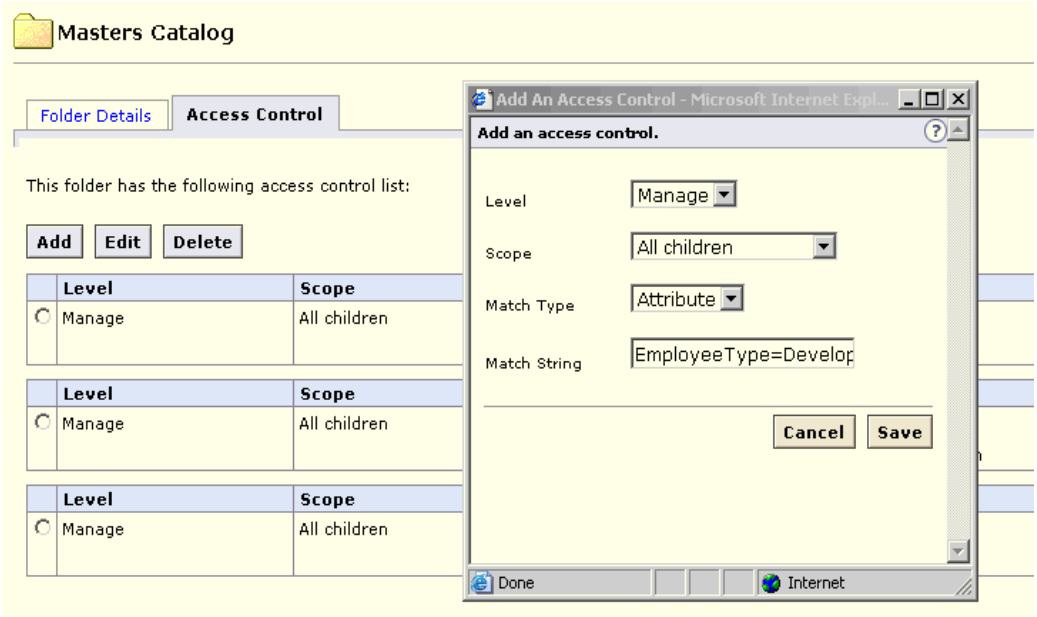

Figure G-6 Adding an ACL entry

5. Repeat this process for the Course Offerings selection to assure that security is adjusted for both masters and offerings.

Test developer access

At this point, the designated developers should have full access to the LMS system. To test this, follow these steps.

1. Log out from the lmsadmin ID.
2. Log in with a designated developer ID.
3. Select the **Users** tab and assure that you have access rights to manage and roster users.
4. Select the **Course Catalog** tab, then select **Manage Masters Catalog**. You should see the folder for the Master Catalog, as shown in Figure G-7 on page 404.

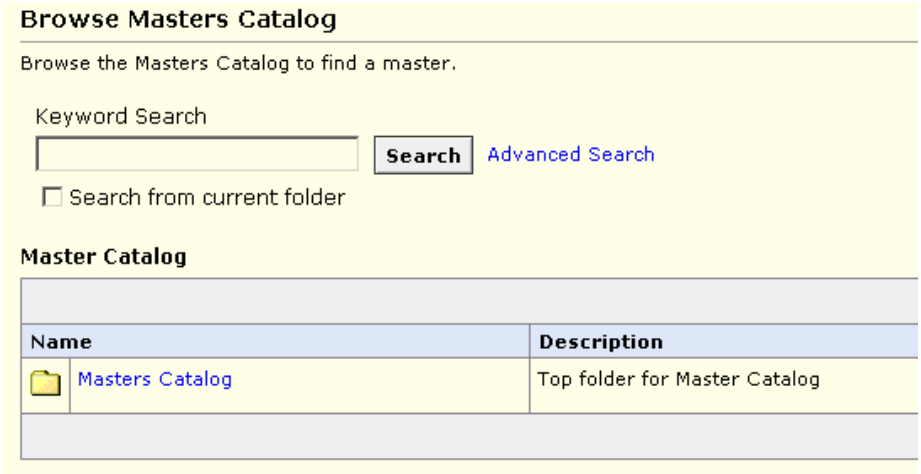

Figure G-7 Accessing the Masters Catalog folder

5. Select **Manage Offerings Catalog** and be sure that you can see the Offerings Catalog.

If any of these options are not available, then go back and re-check the security settings applied in the previous sections.

Switch to a developer ID

Now that security access for the developers is in place, all remaining configuration can be done with one of the developer IDs.

Tip: Use the secure the lmsadmin ID for problem solving only. Do all configuration with other appropriately-configured user IDs.

Configure roles

In our pre-configuration planning, we determined that an additional role would be required for the Schedulers. These users would have more access than the typical student but not have full admin access or manager access to employee information. Their function would be limited to managing the courses offerings, instructors, and enrollments. The procedure to accomplish this is as follows.

1. Select the **Users** tab. See Figure G-8 on page 405.

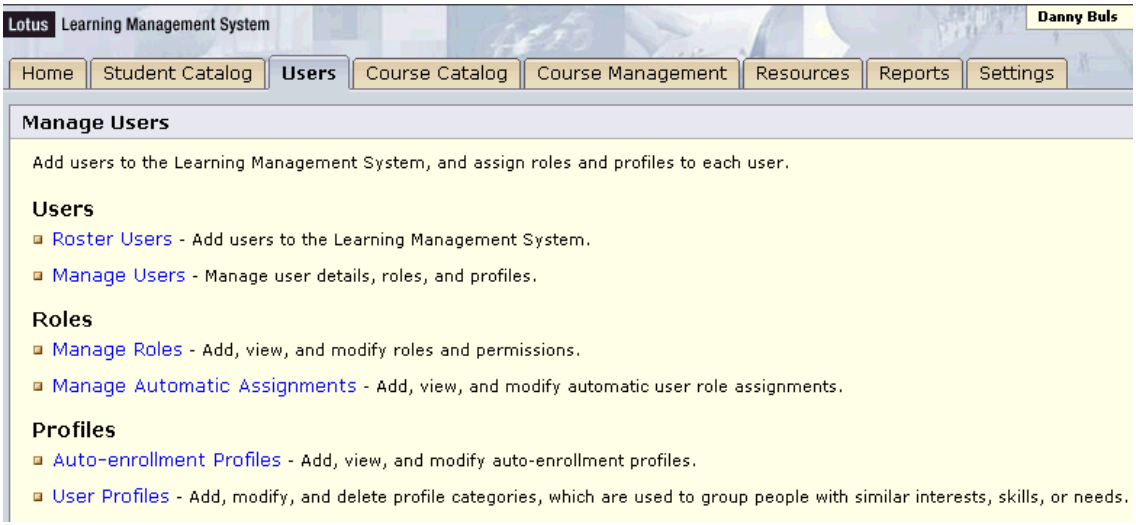

Figure G-8 Users tab

2. Select **Manage Roles**. You will see the five default roles displayed.
3. Click the **Add** button and enter the desired information. See Figure G-9.

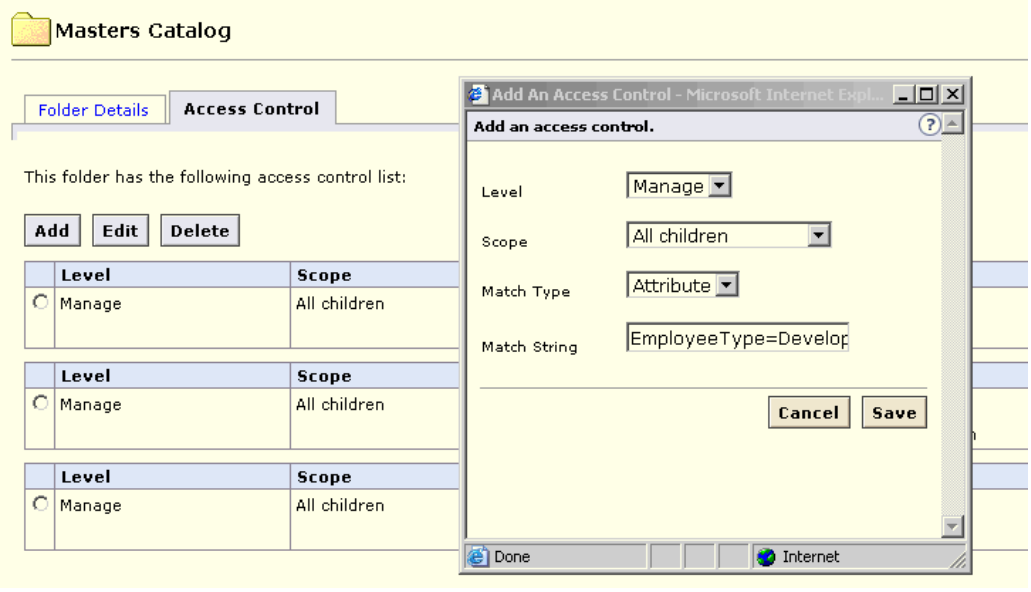

Figure G-9 Adding role information

4. Click **Save**. You will see the new role listed along with the default roles. Should you chose to remove this newly defined role, click the **Delete** hotspot next to the role in the table.

   There is no “Are you sure?” warning on this delete. It immediately removes the role from the system.

5. Select the newly created role to access the security details to be applied to this role, as seen in Figure G-10.

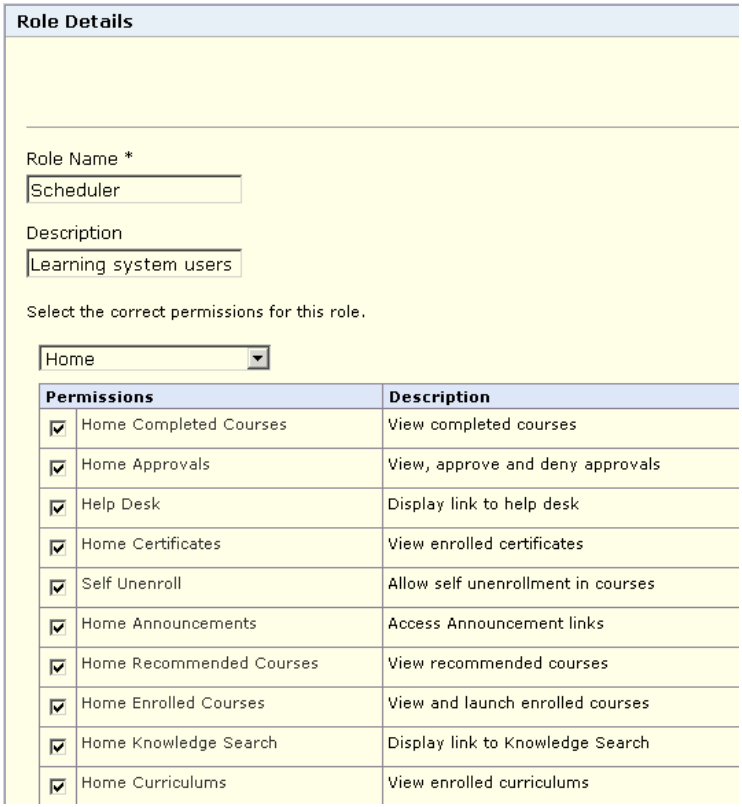

Figure G-10 Role details

There are numerous choices presented. The dropdown list relates to the LMS tabs and presents functionality related to the selected tab. The *Administrator's Guide* provides printouts of all the screen choices and can be used as a checklist to determine what privileges should be assigned. For scheduler, we selected an assortment of choices reflecting features of the LMS product that a scheduler would require access to.

6. Make the appropriate choices.

7. Click **Save** in the lower left.
8. Click **Done** when finished.

Configure profiles

In our pre-configuration planning, we decided to take advantage of Profiles to allow us to classify our users and apply course recommendations based on associated profiles. We divided our profiles into two categories: *Technical* for the three technician levels at the manufacturing site (Tech1, Tech2, and Tech3) and *Orientation* for the three types of new hire training programs that HR provides (New Hire, New IT, New Tech). The procedure to accomplish this is as follows.

1. Select the **Users** tab, then select **User Profiles**. By default there are no profiles.
2. Click the **Add Category** button. See Figure G-11.

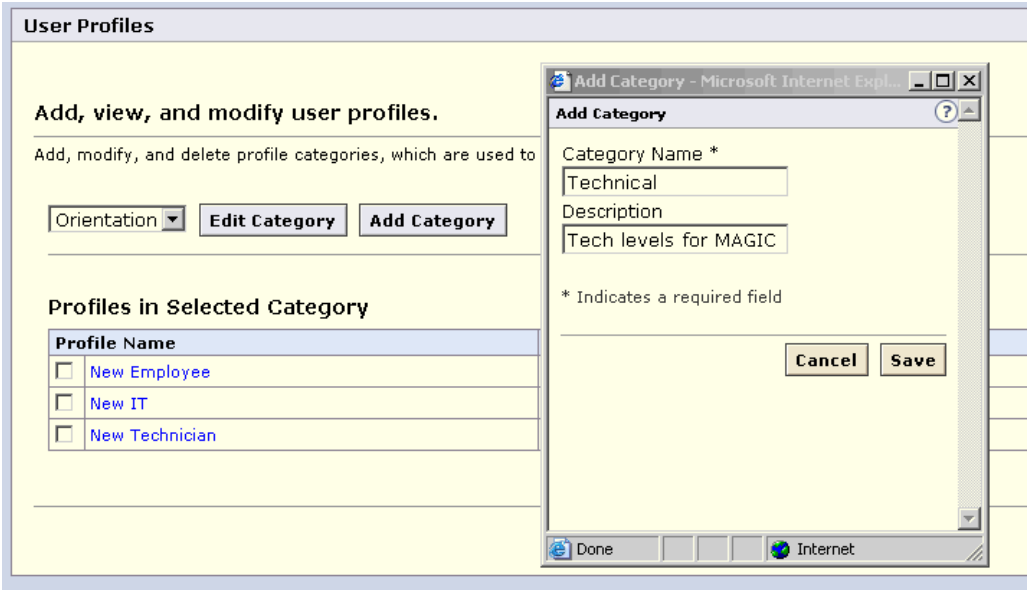

Figure G-11 Adding a category

3. Enter the appropriate category name and description and then click **Save**.
4. When the categories are in place, click **Add Profile** on the right side of the screen to add profiles to the already defined categories. This process defines the profiles that will be used later to refine user privileges.See Figure G-12 on page 408.

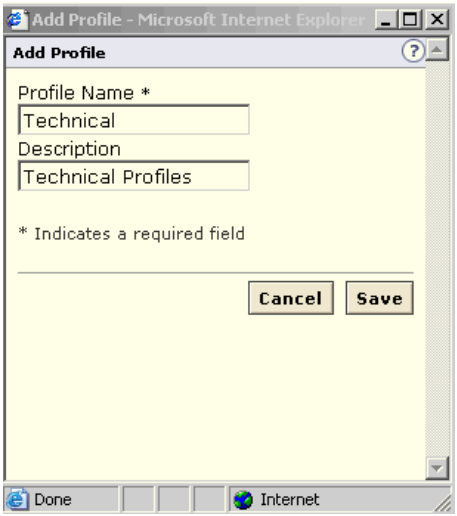

Figure G-12 Adding a profile

5. Repeat this process to enter the remaining profiles into LMS.

Configure locations

Based on our business scenario, we have chosen to limit our pilot to three cities: Pittsburgh, Detroit, and Stuttgart. We will need to add a location document for each city. Since Pittsburgh has two separate buildings, we have chosen to create four locations. This allows us to have a location for each building that will house training activities. Figure G-13 on page 409 shows the location resources available to us.

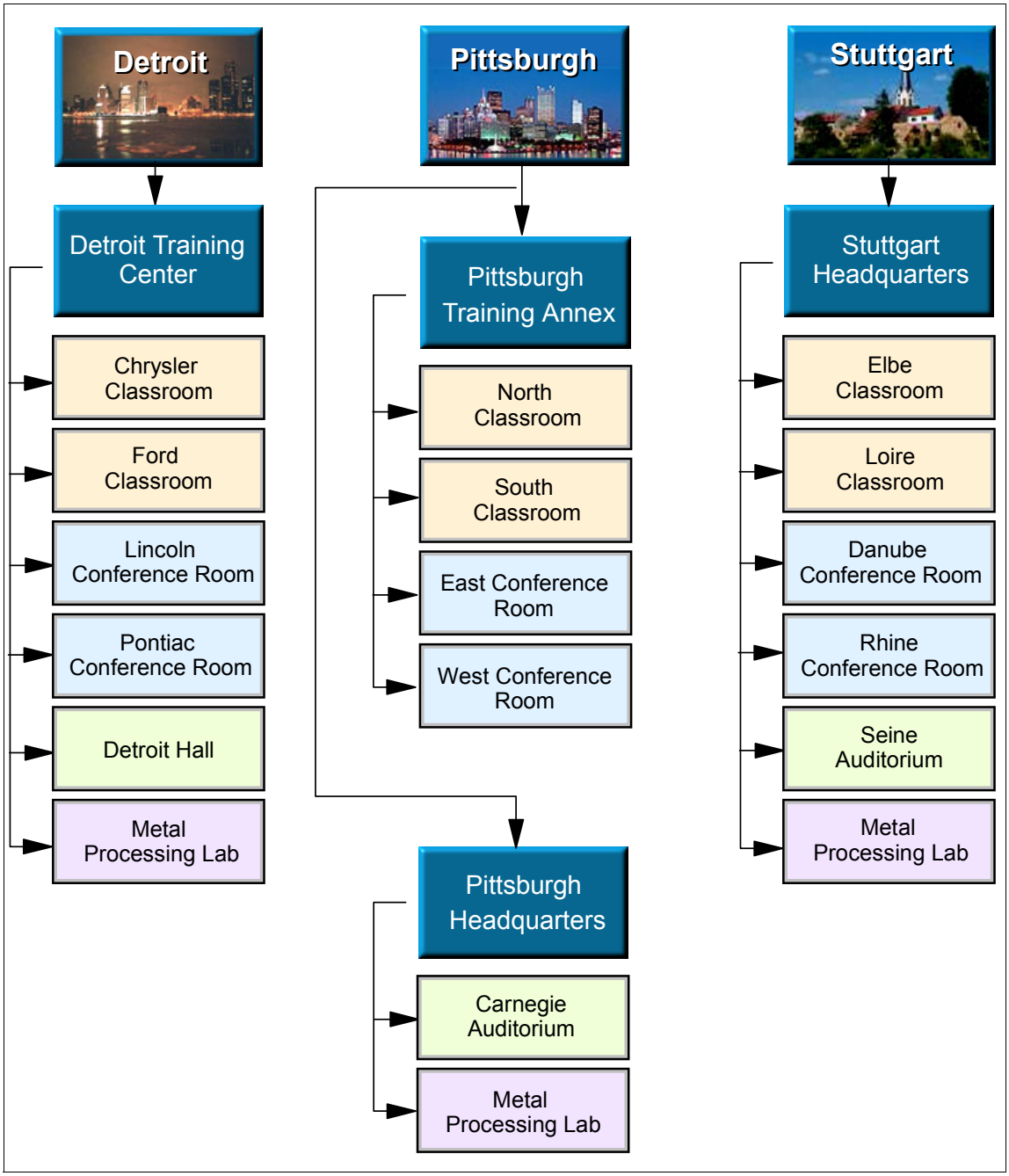

Figure G-13 Case study locations with their resources

The procedure to add a location follows:

1. Select the **Resources** tab. See Figure G-14.

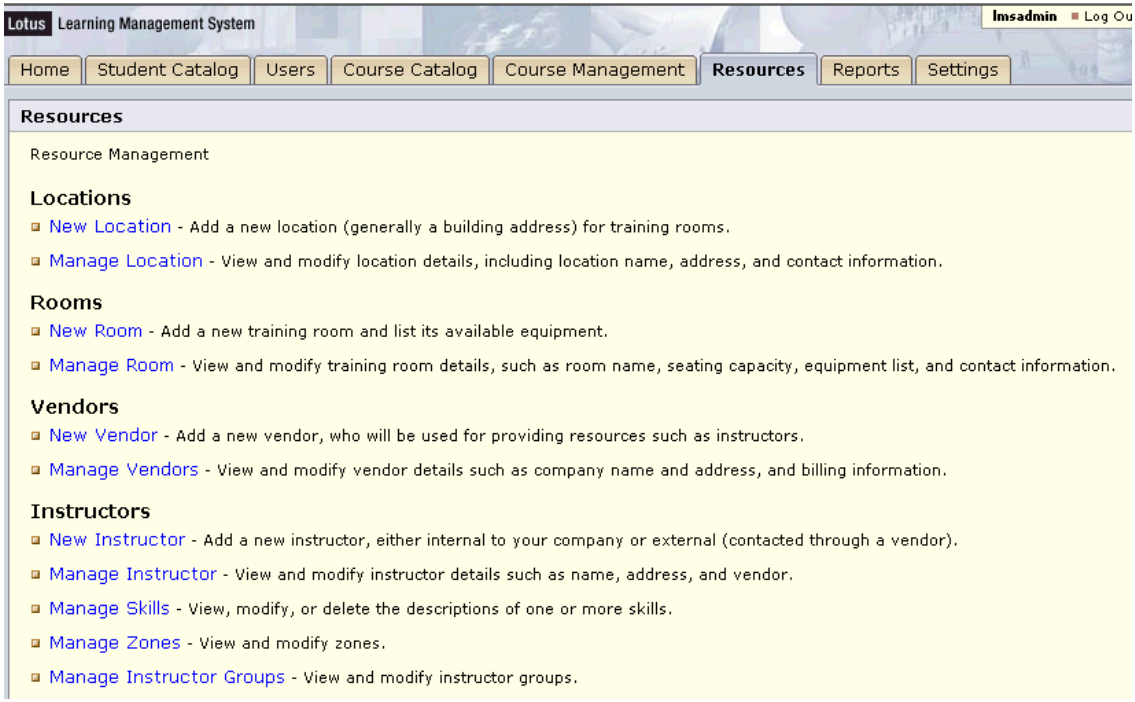

Figure G-14 Resources tab

2. Select **New Location**. See Figure G-15 on page 411.

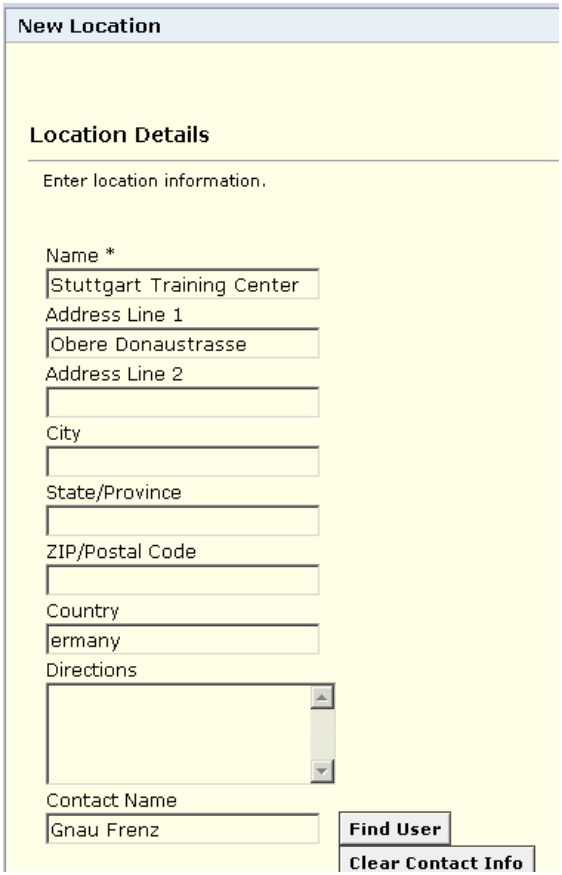

Figure G-15 Entering a new location

3. Enter the location information. The only required field is the Location Name. Since we have not rostered our complete user list at this point, we will not apply Contact information. This will need to be completed at a later date.
4. Click **Save**.
5. Repeat this process to enter the remaining locations into LMS.

You can use Manage Locations on the Resources tab to edit previously entered location information. See Figure G-16 on page 412.

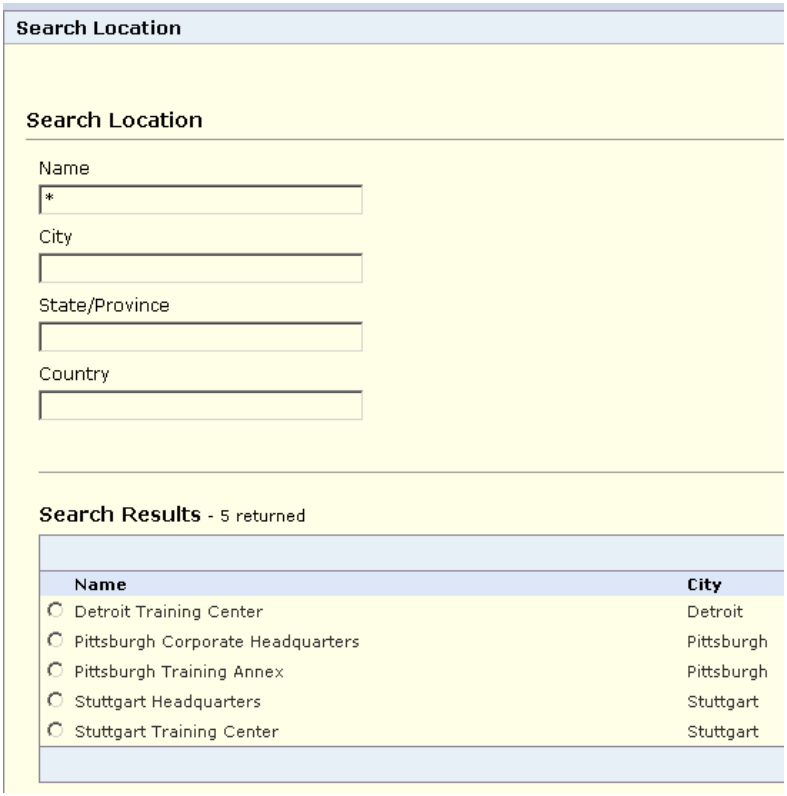

Figure G-16 Managing locations

The Manage Location screen utilizes the standard search format. You will need to enter a wildcard and press **Search** to the right of the search selection entries.

Configure rooms

After defining locations, the actual rooms can be added to LMS. Rooms are defined as with classrooms, conference rooms, labs, or auditoriums. Specific capacity settings can be made as rooms are entered. The procedure to add a room is as follows.

1. Select the **Resources** tab.
2. Select **Add Rooms**. See Figure G-17 on page 413.

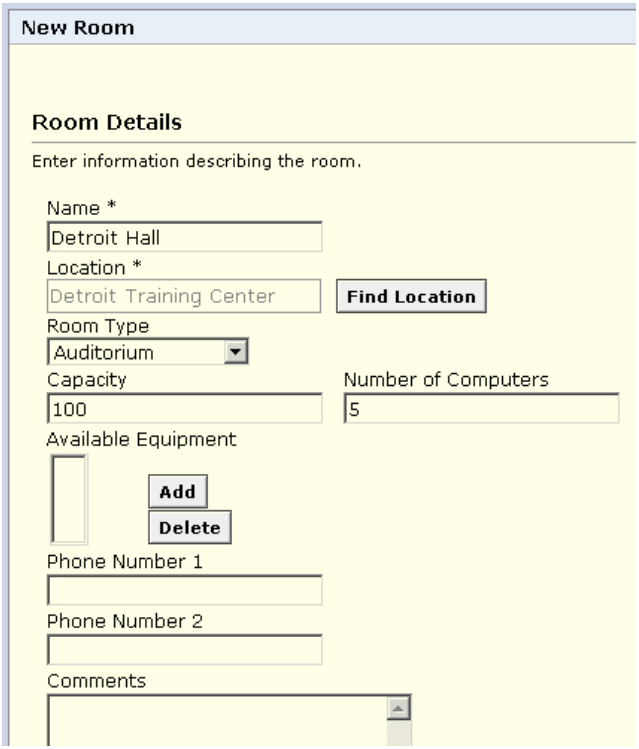

Figure G-17 Adding a room

3. Complete the required information.

   You must use the Find Location button to select a predefined location. This pop-up uses the now-familiar selection screen to select appropriate locations from those already defined.

4. Click **Save** in the lower right of the screen.

5. Repeat the above steps for the remaining rooms.

Once the rooms are added, you will need to adjust the access control for each individual room, using the Manage Rooms selection on the Resources tab. The interface for these adjustments is identical to those used earlier to configure the developers for access to the Course and Offering Catalogs. See Figure G-18 on page 414.

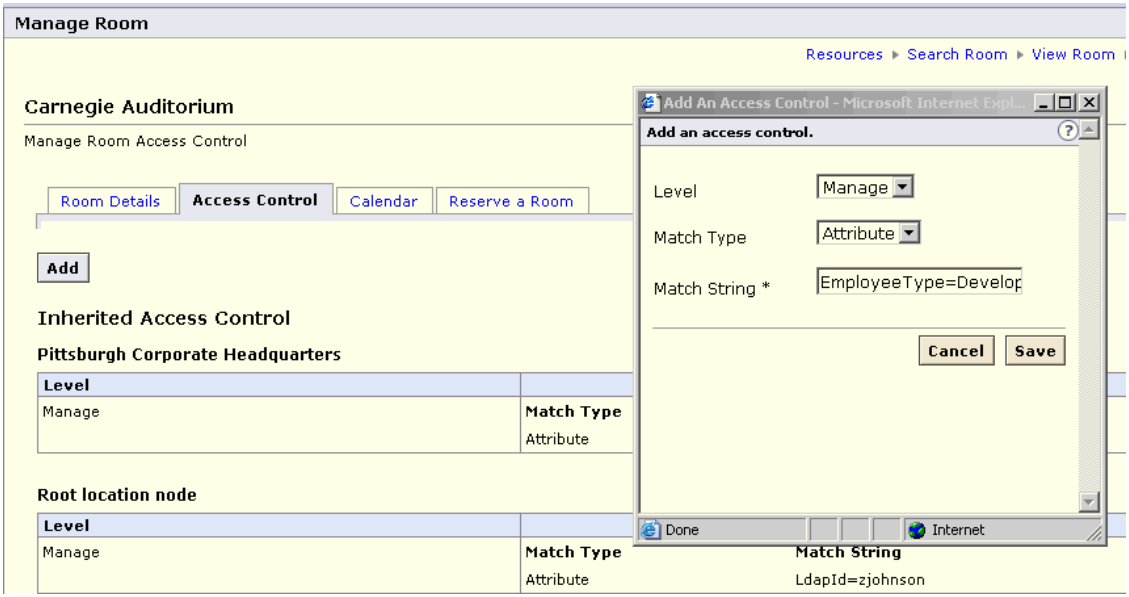

Figure G-18 Managing a room

Configure skills

Skills relate to the skill sets that are associated with instructors. In order to assign appropriately qualified instructors to course offerings, LMS keeps a database of skills that can then be applied to instructors as they are configured in the system. Skills and Zones (which is the next section) need to be in place before they can be applied to the instructors. The procedure to add skills is as follows:

1. Select the **Resources** tab.
2. Select **Manage Skills**.
3. Click **Add** to enter a new skill. See Figure G-19 on page 415.

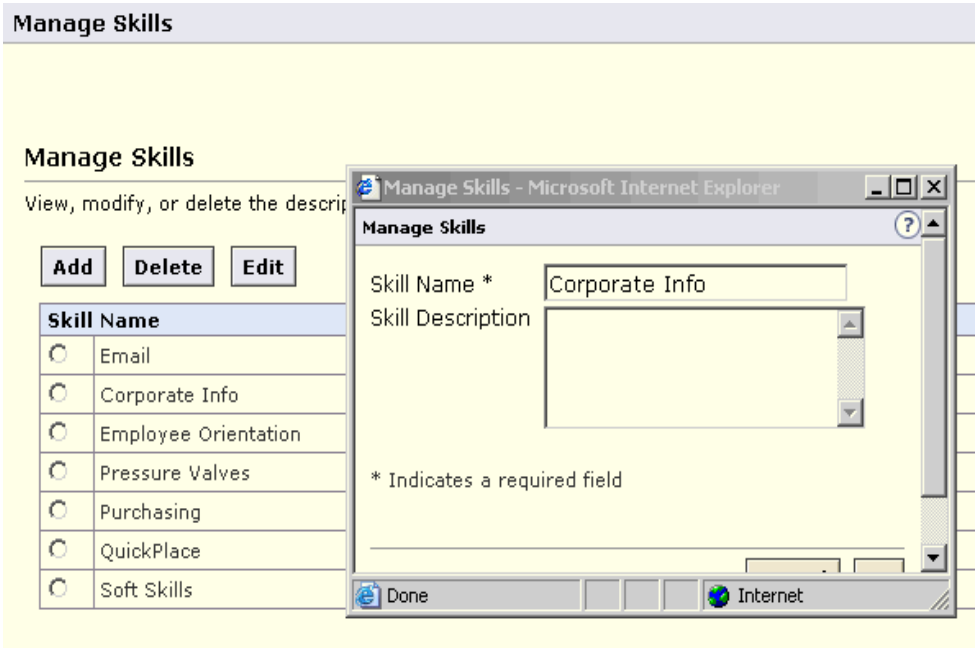

Figure G-19 Managing skills

4. Complete the required information and click **OK**.

Skills can be added, deleted, and edited from this one screen, which is very convenient.

Configure zones

Zones is a way of defining what area an instructor is available to travel to. In our pre-configuration planning meetings it was determined that our zones will be based on continents. This is a very general zoning plan and most corporations will most likely define zones more in line with their physical locations. The procedure to add a zone is as follows.

1. Select the **Resources** tab.
2. Select **Manage Zones**.
3. Click **Add** to enter a new zone. See Figure G-20 on page 416.

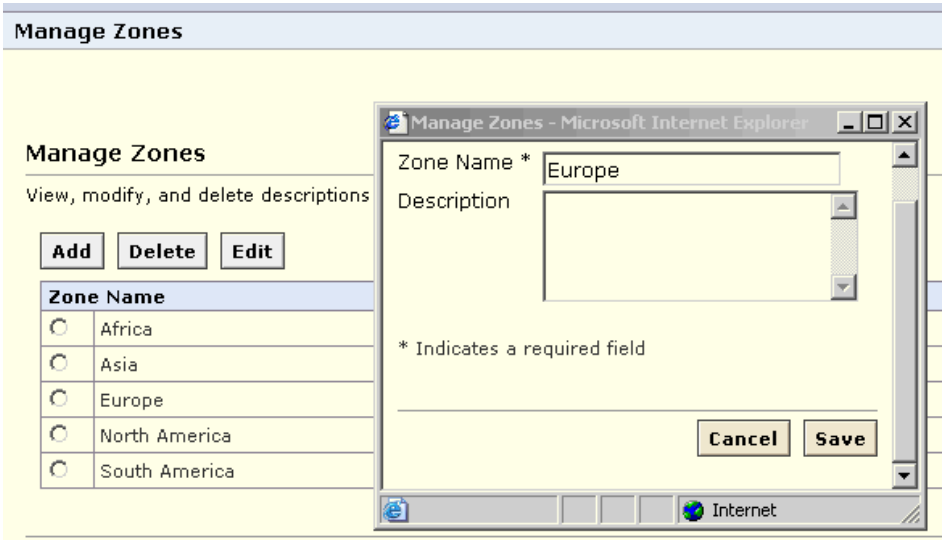

Figure G-20 Adding a zone

4. Complete the required information and click **OK**.

Zones can be added, deleted, and edited from this one screen, which is very convenient.

Configure course master folders

We determined that it would be convenient to have a course master folder for each of the categories of courses offered. The five categories currently utilized at MAGIC are Soft Skills, IT, Corporate Info, Safety, and Employee Orientation. These five folders will be added as subfolders to the Master Catalog. Since we already adjusted the access control of the Master Catalog and specified the scope of All Children, the newly defined folders will inherit the same security settings. The procedure to add course master folders is as follows.

1. Select the **Course Catalog** tab. See Figure G-21 on page 417.

Figure G-21 Course catalog tab

2. Select **Manage Masters Catalog**.
3. Select the Masters Catalog by clicking the underlined entry **Masters Catalog**.

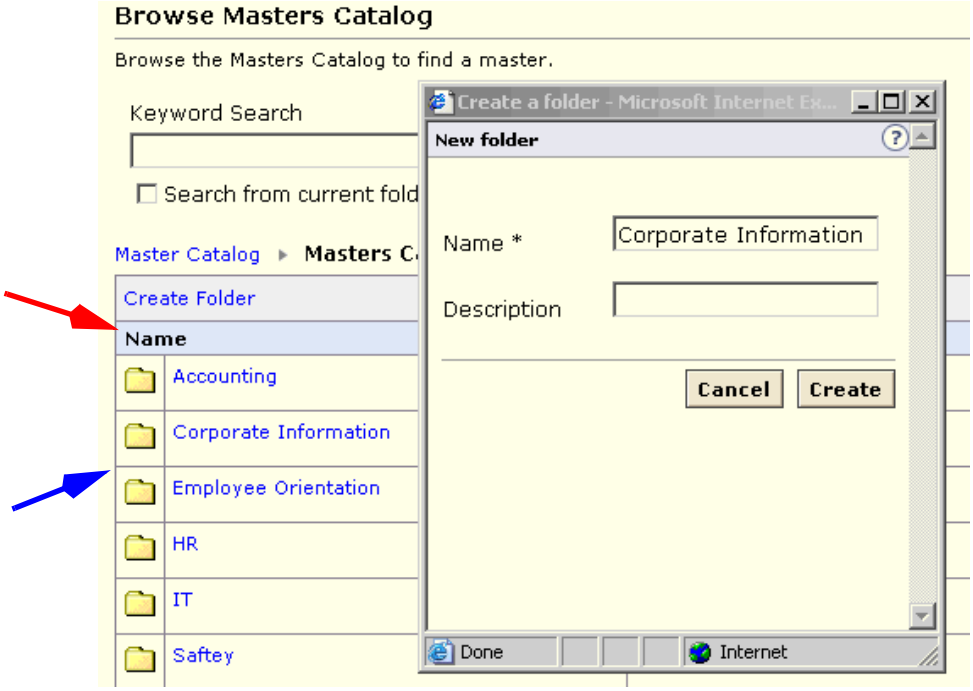

Figure G-22 Masters catalog

4. Click the underlined **Create Folder** entry in the top row of the table. See the red arrow in Figure G-22 on page 417.
5. Enter the required information.
6. Click **Create**. You will see your folder listed in the table.
7. To adjust the security of the folder, click the yellow folder icon in the first column of the table. See the blue arrow in Figure G-22 on page 417.

Figure G-23 Adjusting security of a folder

From the screen shown in Figure G-23, you can edit the folder and apply the appropriate access control. For our pilot purposes, developers have access to all folders based on previous settings, so no additional configuration is required at this point. When the LMS system goes live, these folders will have access control settings that reflect who has security access to the courses contained in the folder.

Configure course offering folders

Our planning team decided to keep consistent folders in both Course Masters and Course Offerings. Therefore, the steps described above for Configuring Course Masters Folders must be repeated using the Manage Course Offerings selection on the Course Catalog tab.

Add course masters

Now that the folders have been defined, we can begin to add our courses to the masters catalog and eventually generate course offerings from the registered masters. On the Course Catalog tab, there are selections for Masters and Offerings. Masters refers to the course master and Offerings refers to the actual incident of the course being presented.

In our scenario, our company MAGIC has a course called the “Story of Steel” that is defined as a course master in the Corporate Information subfolder of the Master Catalog. This course is offered to employees once a month in the auditorium. Therefore, we will need to generate 12 offerings of the course (one for each month). These offerings will be stored in the Corporate Information subfolder of the Offerings Catalog.

The procedure to register a course master is as follows.

1. Select the **Course Catalog** tab. See Figure G-24.

Figure G-24 Course Catalog tab

2. Select **Register Master**. You will see three choices as follows:
   - Course Master—a specific course
   - Curriculum Master—to be used for a collection of courses leading to a predefined curriculum program
   - Certificate Master—used for a collection of courses leading to a predefined certificate program
3. Select **Course Master** and press **Continue** in the lower right.

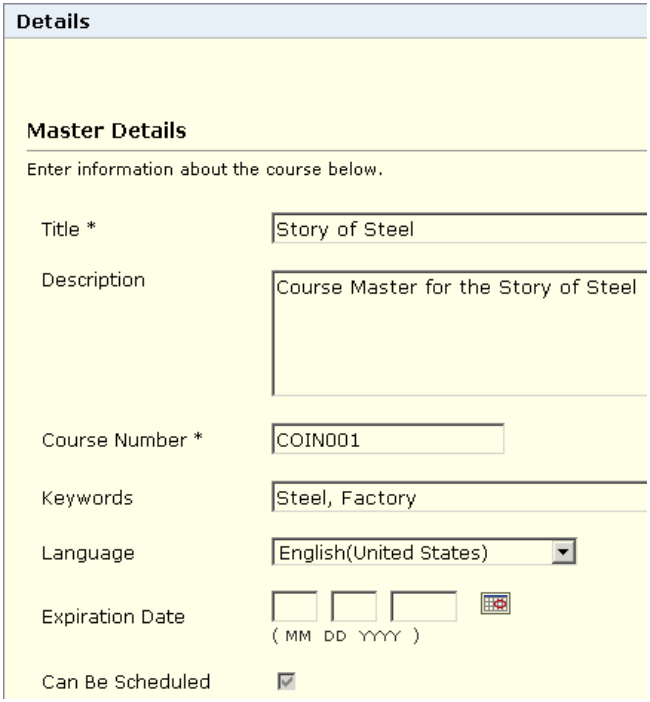

Figure G-25 Course master details

4. Enter the appropriate information in the screen shown in Figure G-25. The only required fields are Title and Course Number. However, if you intend to allow students to search the course catalog, you will need to provide appropriate keywords for the search index.
5. Click **Continue** in the lower right and you will be presented with a screen to define prerequisites. Prerequisites must be previously defined courses, so be sure to register the masters of your prerequisite courses beforehand.
6. (Optional) To add a prerequisite course, click **Add Prerequisite** and use the search tool to select the appropriate course.

   Note: In our scenario, there are two courses that have prerequisite requirements. E-mail Basics (IT203) is a prerequisite for E-mail Advanced (IT204) and Steel Plant OSHA Requirements (SA402) is a prerequisite for Fire Extinguishers Types & Usage (SA404).

7. Click **Continue** in the lower right of the screen.
8. You are now presented with a course schedule outline and have the opportunity to specify default parameters for the course offerings that will be

generated from this master. Click **Add Booking Requirement** to access the screen where you can define these defaults.See Figure G-26.

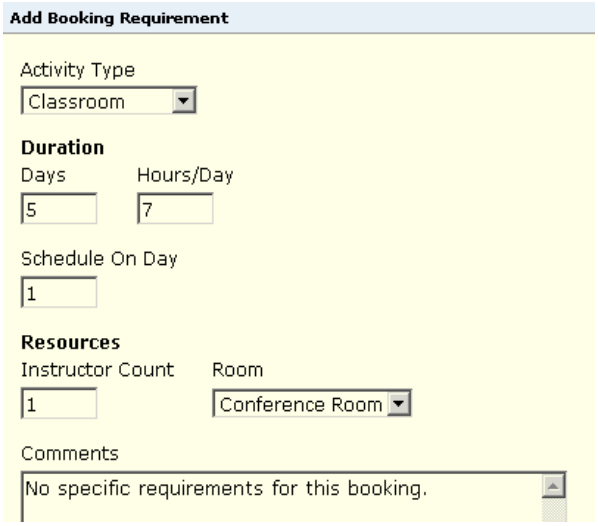

Figure G-26 Adding a booking requirement

9. Specify the appropriate information being sure to clearly define the duration and resources required. These details will be important when actual course offerings are generated later in the configuration process.
10. Click **OK** on the lower right of the screen.
11. . Once the Booking Requirements are complete, press **Continue** in the lower right of the screen.
12. You are now presented with the available folders in which to place the registered master.
13. Select the appropriate folder by clicking the radio button and pressing **Continue** in the lower right of the screen.
14. The course master is now posted to the appropriate folder.

You can edit attributes of the course master by clicking the icon of the tree-ring binder to the left of the course entry in the appropriate folder. See Figure G-27 on page 422.

Figure G-27 Course details

Roster users

Now that the framework is in place, we can move ahead to roster our pilot users. We have three cities, but for demonstration purposes we will initially roster only the Pittsburgh students. The procedure to roster students is the same as we followed in “Roster developers” on page 398 to roster the Cambridge developers. We can take advantage of the automatic rostering feature to have all members of the Pittsburgh organization unit automatically registered. The procedure is as follows.

1. Select the **Users** tab.
2. Select **Roster Users**, as shown in Figure G-28 on page 423.

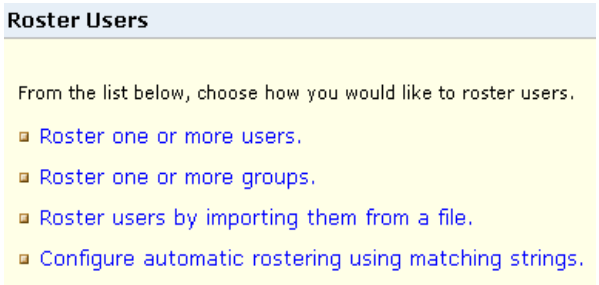

Figure G-28 Rostering users

You will see four choices. Earlier we used the first option to select the handful of developers by name. Now that we have approximately 20 users to roster, we will select the last choice for automating the process.

3. Select **Configure automatic rostering** using matching strings.
4. Click **Add**, as shown in Figure G-29.

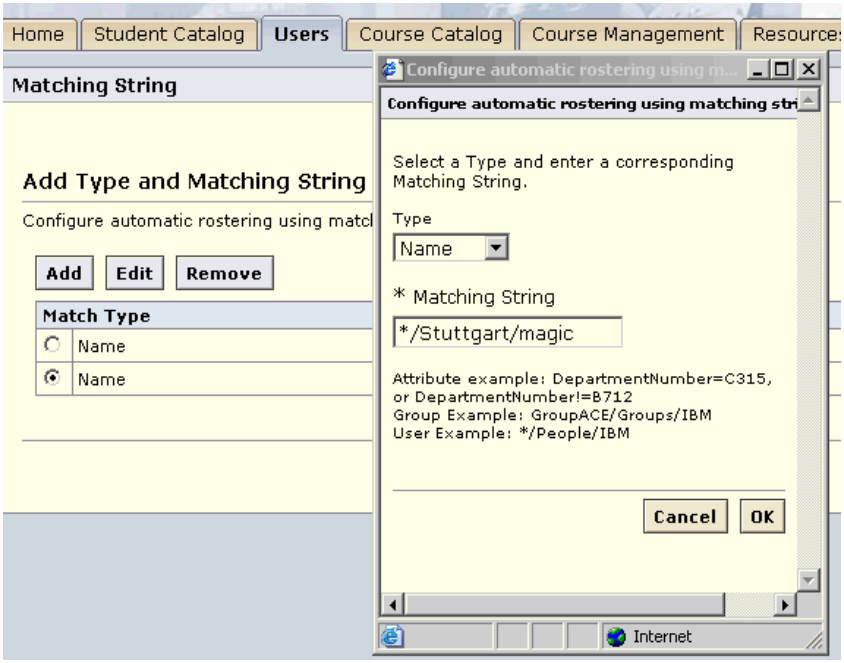

Figure G-29 Automatic rostering using matching strings

5. The type choices are Attribute, Group, and Name. In our case we, used the Name type and a wildcard reflecting all entries in the Pittsburgh OU.

6. Click **OK**.
7. Press **Continue** in the lower right of the screen. You will be presented with a message, as in Figure G-30, indicating that users will be automatically rostered as they log in.

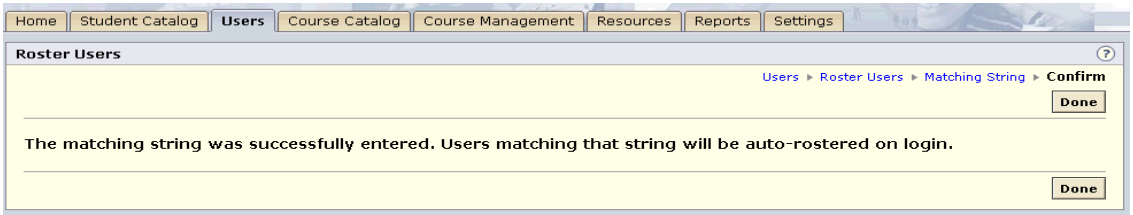

Figure G-30 Message from automatic rostering

Apply roles

Using the spreadsheet developed in the pre-planning meetings, the Pittsburgh users now need to have the appropriate roles applied. By default they all have the student role. We need to add the designated instructor, scheduler, and manager roles. The procedure to apply roles is as follows.

1. Select the **User** tab.
2. Select **Manage Users**.
3. Use the search tool to select the appropriate user.
4. Click **Continue** in the lower right of the screen.
5. You are presented with the available roles in the top half of the screen and any automatic roles are listed in the lower part of the screen. In the case of the person displayed in Figure G-31 on page 425, his EmployeeType is Manager. Therefore, he has the Manager role by default, in addition to the Student role that all rostered users have. In this case, we are also giving the user the Scheduler role, which we defined in “Configure roles” on page 404.

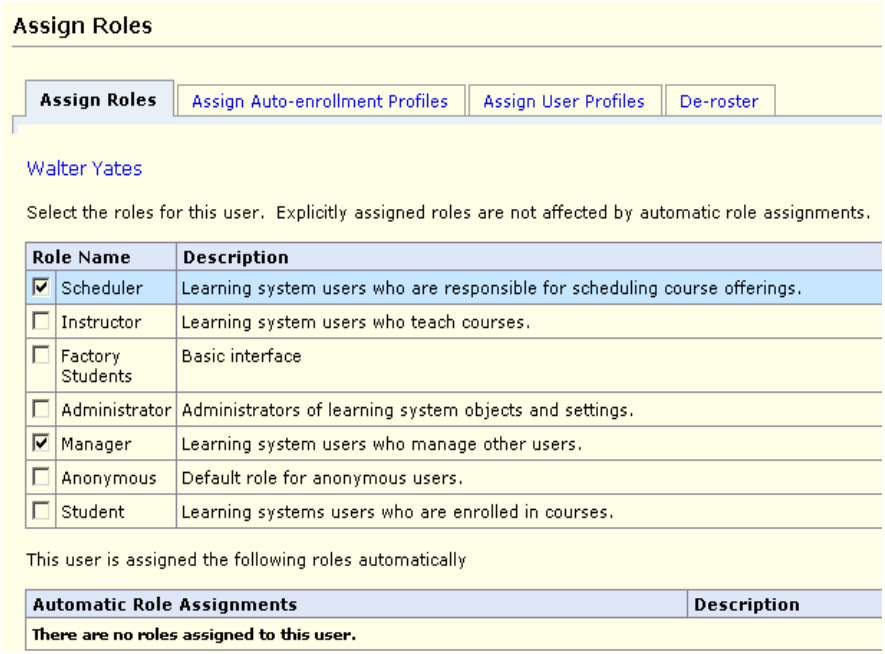

Figure G-31 Assigning roles

6. Click **Save** in the lower right of the screen.
7. Repeat this process for all required role adjustments.

Assign user profiles

Profiles can be applied at the same time as applying roles by accessing the Assign User Profiles tab. The procedure to apply profiles is as follows.

1. Select the **User** tab.
2. Select **Manage Users**.
3. Use the search tool to select the appropriate user.
4. Click **Continue** in the lower right of the screen.
5. You are presented with the user specifics defaulting to the Assign Roles tab. Select the **Assign User Profiles** tab, as shown in Figure G-32 on page 426.

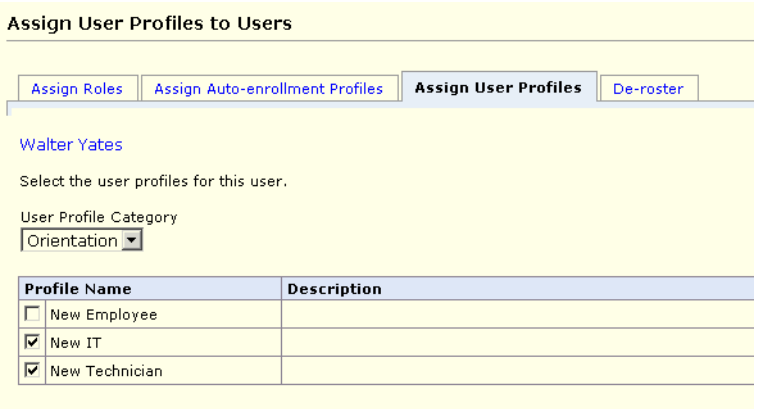

Figure G-32 Assigning user profiles

6. Select the appropriate profile category and then check the desired profiles. Users can have multiple profiles just as they can have multiple roles.
7. Click **Save** in the lower right of the screen.

Apply skills and zones to instructors

We have four designated instructors in Pittsburgh. They need to have their skills and zones defined. The procedure is as follows.

1. Select the **Resources** tab.
2. Select **New Instructor**. You are presented with a screen allowing you to find a rostered user to be listed as an instructor. See Figure G-33 on page 427.
3. Click **Find User** on the right to select an internal instructor.
4. Use the search tool to select the appropriate user.

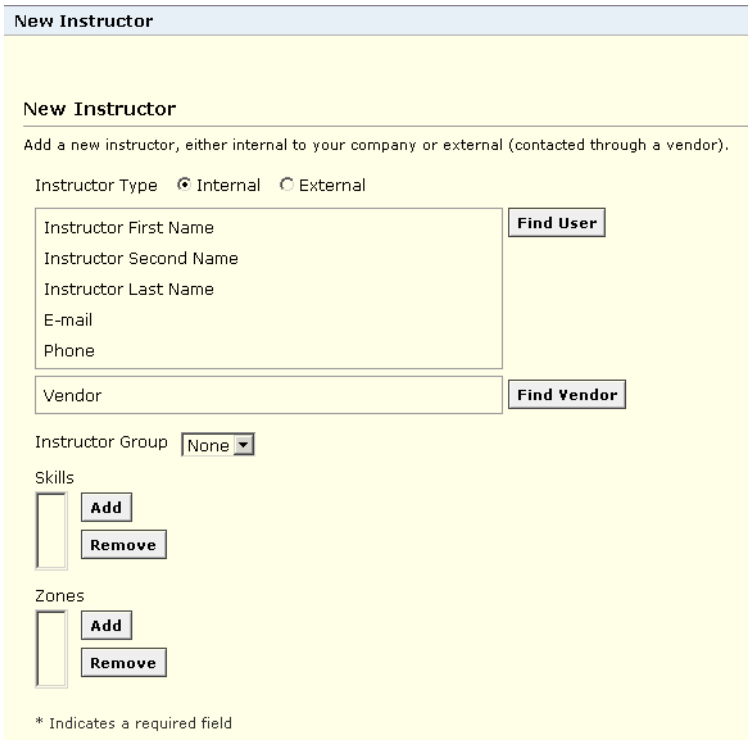

Figure G-33 New instructor screen

5. To add skills, click **Add** to the right of the skills entry. See Figure G-34 on page 428.

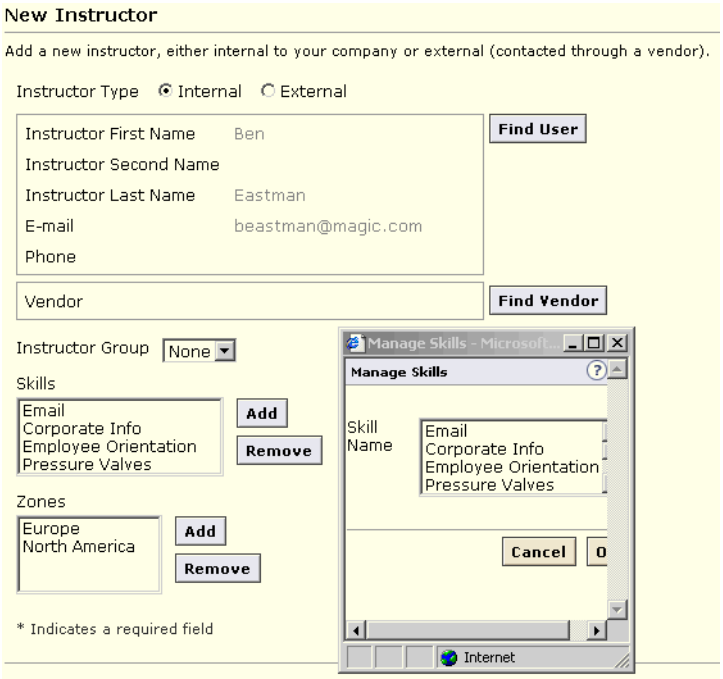

Figure G-34 Adding a new instructor

6. Select the appropriate skills from the dropdown list.
7. Click **OK** on the lower right of the dialog box.
8. To add zones, click **Add** to the right of the zones entry.
9. Select the appropriate zones from the dropdown list.
10. . Click **OK** on the lower right of the dialog box.
11. Click **Save** on the lower right of the screen. You are presented with a confirmation message.
12. Click **Done** in the lower right of the screen.

Add course offerings

Now that we have instructors in place, we can proceed to generating actual course offerings for the course masters that we posted to LMS in topic “Add course masters” on page 418. The procedure is as follows.

1. Select the **Course Catalog** tab.
2. Select **Register Course Entry**.

3. Select the radio button for course and click the **Continue** button on the lower right of the screen.
4. Drill down to you desired course master and select the radio button to the left of the course name.
5. Click the **Continue** button on the lower right of the screen. You are presented with a wide assortment of settings to be used to define the course offering. See Figure G-35.

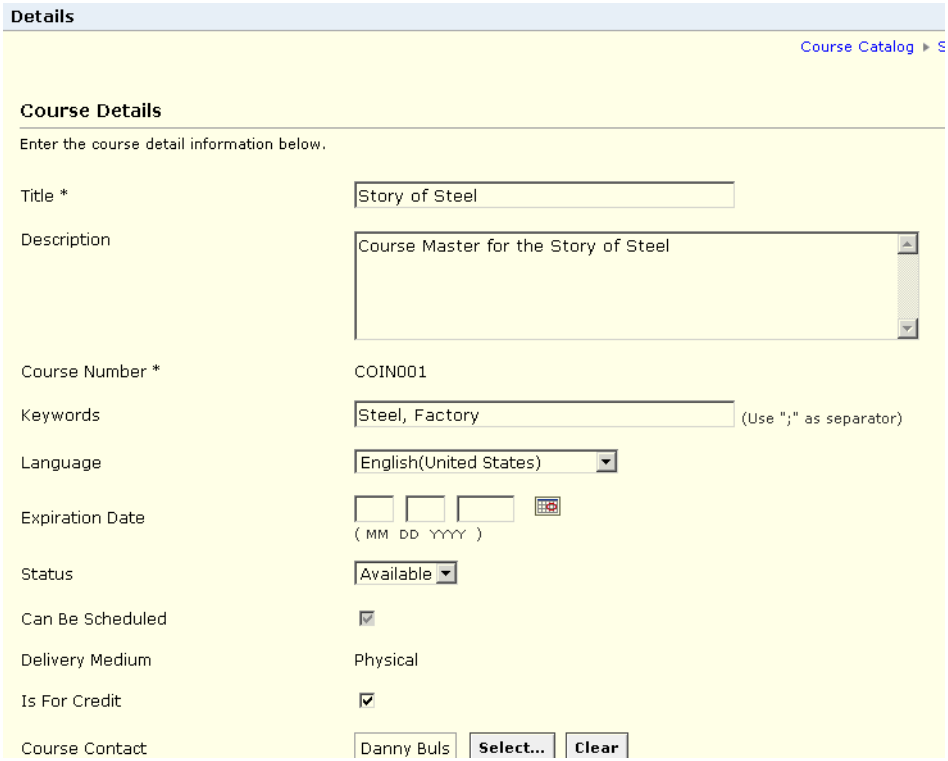

Figure G-35 Course settings

6. Complete the desired fields and click **Continue** in the lower right of the screen.
7. Drill down to select the folder to store the offering.
8. Click **Save** in the lower right of the screen.
9. You are presented with a message confirming that the offering has been created. Click **Done** in the lower right of the screen.

Schedule class offerings

Now that the offering is defined, you can add actual schedule entries to LMS. The procedure is as follows.

1. Select the **Course Catalog** tab.
2. Drill down to the desired course offering and click the three-ring binder icon to the left of the course name. You will be presented with a tabbed table of information for the course. See Figure G-36.

Figure G-36 Course information

3. Select the **Scheduled Offerings** tab.
4. Click **Schedule New Offering**. You are presented with a screen displaying the fields of information required to define the specific course offering.
5. Complete the required date fields.
6. Click **Select Instructor** and use the search tool as required. Notice that the previously defined skills and zones are available to expedite the search process.
7. Select the appropriate instructor and click **OK**.

8. Click **Find Location**. You will be presented with a dialog box to search for an appropriate location.
9. Specify the location of the offering and click **OK**.

   You cannot specify the specific room at this point. That is defined in the next step. The reason for this is that an offering may occur over several sessions and the room assignment (and instructor assignment) may be different for each session. For example, the offering is three sessions on three separate evenings. The first two sessions are in a conference room and the third session is in the lab with a lab instructor rather than the course instructor.
10. Then you move ahead and adjust the specific offering details at the lower part of the screen. Figure G-37 shows some of this activity.

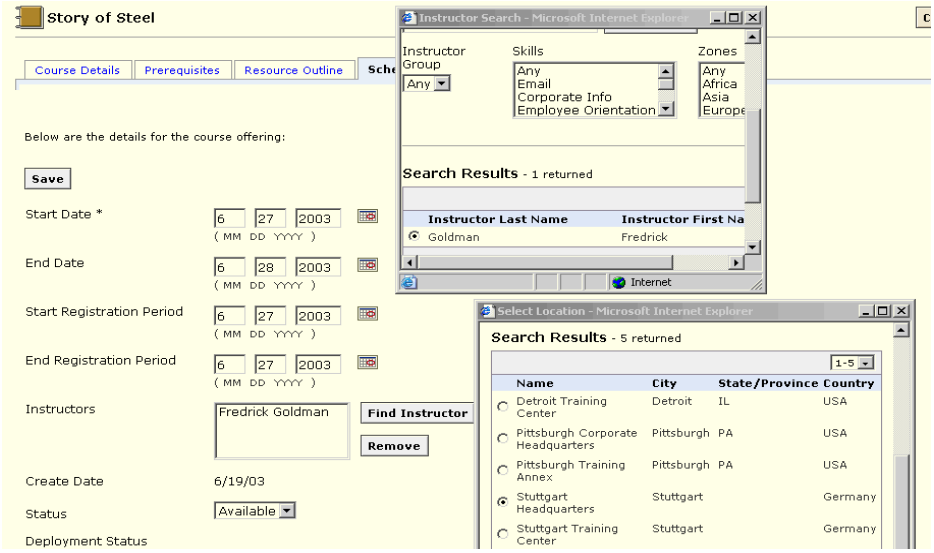

Figure G-37 Adjusting the offering details

11. When all entries are completed, click **Save** at the bottom left of the screen.
12. Click **Add Booking requirement** and click **Edit** and **Select** at the right of the screen to update the booking requirement. See Figure G-38 on page 432.

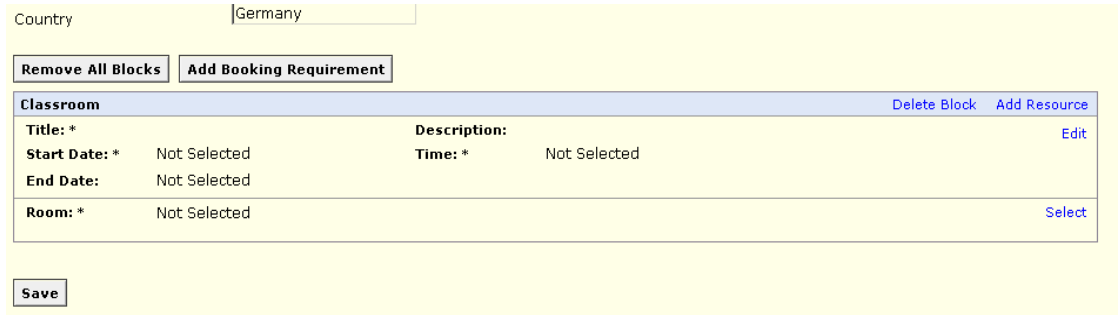

Figure G-38 Updating the booking requirement

13. Click **Select** to the right of the Room choice. See Figure G-39.

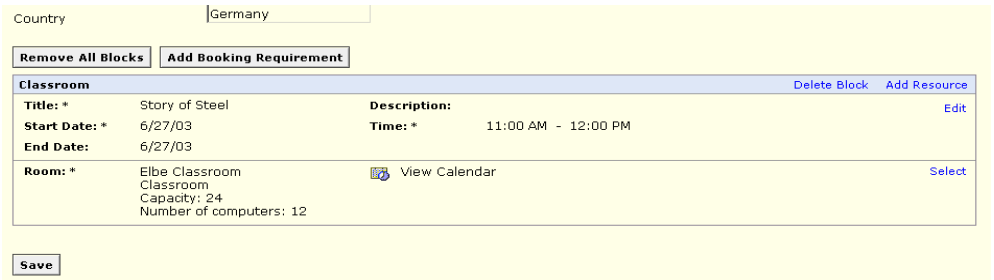

Figure G-39 Selecting a room

14. When all entries are completed, click **Save** at the bottom left of the screen.
15. Repeat this process for as many offerings as required.

H

Default LMS user roles

This appendix provides a table of the default LMS user roles and their permissions. An X marks the permissions that apply to each role.

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Roles and permissions

		Anonymous	Student	Manager	Instructor	Administrator
Home						
Home Completed Courses	View completed courses		X	X	X	X
Home Approvals	View, approve and deny approvals		X	X	X	X
Help Desk	Display link to help desk	X	X	X	X	X
Home Certificates	View enrolled certificates		X	X	X	X
Self Unenroll	Allow self unenrollment in courses		X	X	X	X
Home Announcements	Access Announcement links	X	X	X	X	X
Home Recommended Courses	View recommended courses		X	X	X	X
Home Enrolled Courses	View and launch enrolled courses		X	X	X	X
Home Knowledge Search	Display link to Knowledge Search	X	X	X	X	X
Home Curriculums	View enrolled curriculums		X	X	X	X
Home Weeks Activities	View this weeks activities		X	X	X	X
Instructor Live Sessions	View and modify live sessions				X	X
Orientation	Display orientation link	X	X	X	X	X
Home Offline	View and download offline learning client		X	X	X	X
Home Profiles	View and modify user profiles		X	X	X	X
Home Progress	View student progress report		X	X	X	X
Home Module	Permission to see Home module	X	X	X	X	X
Instructor Courses	View courses being taught				X	X
Home Notifications	View and delete notifications		X	X	X	X
Home Calendar	View student calendar		X	X	X	X

		Anonymous	Student	Manager	Instructor	Administrator
Student Catalog						
Self Enroll	Allow self enrollment		X	X	X	X
Student Catalog	Access Courses section	X	X	X	X	X
Course Catalog						
Course Catalog	Access the Admin Catalog					X
Booking	Ability to book rooms					X
Manage Offerings Catalog	Manage Offerings Catalog					X
Manage Masters Catalog	Manage Masters Catalog					X
Instructor Booking	Ability to book instructors					X
User Management						
User Profiles	Create and modify user profiles					X
Manage Users	Permission to assign users to roles and profiles					X
Roster Users	Permission to add or delete users					X
System Profiles	Create and modify auto enrollment profiles					X
Manage Role Auto Assign	Create and modify role auto assignments					X
User Management	Access User Management section					X
Manage Roles	Permission to create and modify roles					X
Course Management						
Manage Auto Enrollments	Manage the courses in a system profile					X
Enroll Approvals	Permission to override approvals					X
View Results	Permission to view any students results					X

		Anonymous	Student	Manager	Instructor	Administrator
Instructor Results	View and modify results for courses you are teaching				X	X
Enroll User	Administratively enroll users into courses					X
Manage User Profiles	Manage the courses in a user profile					X
Course Management	Access CourseManagement section				X	X
Modify Results	Permission to modify any students results					X
Resource Management						
Manage Instructors	Permission to manage instructors					X
Limited View Locations	Access to a subset of location attributes					X
Manage Vendors	Permission to manage vendors					X
Manage Locations	Ability to edit locations					X
Limited View Rooms	Access to a subset of room attributes					X
Resource Management	Access Resources section					X
Limited View Instructors	Access to a subset of instructor attributes					X
Manage Rooms	Ability to edit rooms					X
Reports						
Profile Roster Summary Report	Run profile roster summary reports			X	X	X
Classroom Schedule Report	Run classroom schedule reports			X	X	X
User Progress Course Report	Run user progress course reports			X	X	X
Custom Report	Run custom reports			X	X	X
Instructor Schedule Report	Run instructor schedule reports			X	X	X
User Transcript Report	Run user transcript reports			X	X	X
Logon Summary Report	Run logon summary reports			X	X	X

		Anonymous	Student	Manager	Instructor	Administrator
Student Schedule Report	Run student schedule reports			X	X	X
Run Reports	Permission to run reports			X	X	X
Classroom Location Report	Run classroom location reports			X	X	X
Course Progress User Report	Run course progress user reports			X	X	X
Interaction Summary Report	Run interaction summary reports			X	X	X
Curriculum List Report	Run curriculum list reports			X	X	X
Activity Report	Permission to run activity reports			X	X	X
Reporter	Access Reporter section			X	X	X
Course Progress Profile Report	Run course progress profile reports			X	X	X
Certification Expiration Report	Run certification expiration reports			X	X	X
Instructors Vendor Report	Run instructors vendor reports			X	X	X
User Permissions Report	Run user permissions reports			X	X	X
User Interaction Detail Report	Run user interaction detail reports			X	X	X
Enrollment Summary Report	Run enrollment summary reports			X	X	X
Instructors Group Report	Run instructors group reports			X	X	X
Classroom Utilization Report	Run classroom utilization reports			X	X	X
User Progress Course Details Report	Run user progress course detailed reports			X	X	X
Curriculum Progress Report	Run curriculum progress reports			X	X	X
Enrollment Activity Report	Run enrollment activity reports			X	X	X
Manage All Scheduled Reports	Permission to view and edit all scheduled reports in the system					X
Instructor Utilization Report	Run instructor utilization reports			X	X	X
Course Detail Report	Run course detail reports			X	X	X
Wait List Report	Run wait list reports			X	X	X

		Anonymous	Student	Manager	Instructor	Administrator
Certification List Report	Run certification list reports			X	X	X
Schedule Reports	Create and manage scheduled reports			X	X	X
Course Enrollments Report	Run course enrollment reports			X	X	X
Available Certifications Report	Run available certifications reports			X	X	X
Scheduled Reports Report	Run a report on scheduled reports			X	X	X
Settings						
Settings	Access Settings section					X
Manage Notifications	View and manage notification settings					X
Manage Servers	View and manage delivery and collaboration servers					X
Manage Settings	View and manage all global settings					X
Manage Customizations	View and manage customization settings					X
Manage Announcements	View and manage global announcements					X

I

CLIMP help

This appendix provides a printed version of the Command-Line Import Utility's command help.

This file can also be viewed by entering **`climp.bat -h`** or **`java -jar climp.jar -h`**.

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LMS Command-Line Import Utility (CLIMP)

This is a printout of the CLIMP help.

Description

The LMS command-line import utility (CLIMP) imports one or more SCORM 1.2 course package files into the IBM Lotus Learning Management System.

Usage

Imports the specified course package file(s), optionally uploading the file(s) to an FTP server first. If the -u (upload) option is specified, the file specifications can contain wild cards.

```
climp.bat [ option... ] file...
java -jar climp.jar [ option... ] file...
```

Options

Options are case insensitive and can be specified anywhere on the command line. Options apply to all specified files, even those preceding the options on the command line.

-cm url	URL of Content Manager server to receive the course package file(s).
-cmp password	Content Manager password.
-cmu username	Content Manager user name.
-d	Enables the course for disconnected use (disabled by default).
-e emaillist	Comma-delimited list of e-mail addresses to receive import status notifications.
-ftp ftpserver	URL for FTP server to contain course package file(s). If the -u (upload) option is specified, the specified files are uploaded to the specified FTP server and imported from there. If the -ftp option is not specified, the specified files must be accessible to the Content Manager server via the file system.
-ftpp password	FTP password, required if an FTP user name is specified.
-ftpu username	FTP user name. Used by both the Content Manager server and this utility (if the -u option is specified) to

	access the FTP server. If not specified, anonymous access is used.
-h	
-?	Displays this Help file.
-l locale	Specify a locale for use with this utility.
-p file	Properties file containing command-line options. The properties file uses command-line parameter names without the '-' prefix; for example, ftp=ftp.xyz.com.
-u	Uploads course package files to specified FTP server and imports them from there. If this option is not specified, the Content Manager imports the file from the specified FTP server (that is, it assumes the files have already been uploaded), or from the file system if no FTP server is specified.
-keystore filename	Sets the keystore climp uses to verify a LMM Server's SSL certificate. By default climp uses the java\jre\lib\security\cacerts keystore which has a default password of “changeit” and contains root certificates for many popular commercial certificate authorities. Use the java keytool command to create a keystore for use by climp. Do this if the LMM uses a self signed certificate or a certificate from a private certificate authority.
-storepass password	Sets the password used to access a keystore specified with the -keystore option.

J

Additional material

This redbook refers to additional material that can be downloaded from the Internet as described below.

Locating the Web material

The Web material associated with this redbook is available in softcopy on the Internet from the IBM Redbooks Web server. Point your Web browser to:

ftp://www.redbooks.ibm.com/redbooks/SG247028

Alternatively, you can go to the IBM Redbooks Web site at:

ibm.com/redbooks

Select the **Additional materials** and open the directory that corresponds with the redbook form number, SG247028.

Using the Web material

The additional Web material that accompanies this redbook includes the following files:

File name	*Description*
SG247028.zip	Zipped files to use as samples for customizing LMS

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System requirements for downloading the Web material

The following system configuration is recommended:

Hard disk space: 14 MB minimum

How to use the Web material

Create a subdirectory (folder) on your workstation, and unzip the contents of the Web material zip file into this folder.

Abbreviations and acronyms

DS	Delivery Server
FTP	Filetransfer Protocol
HTML	Hypertext Markup Language
HTTP	Hypertext Transport Protocol
IBM	International Business Machines Corporation
IDS	IBM Directory Server
ITSO	International Technical Support Organization
LAN	Local Area Network
LDAP	Lightweight Directory Access Protocol
LMM	Learning Management Module
LMS	IBM Lotus Learning Management System
MS	Microsoft
SOAP	Simple Object Access Protocol
SSL	Secure Sockets Layer
URL	Uniform Resource Locator
WAS	WebSphere Application Server

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Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

IBM Redbooks

For information on ordering these publications, see “How to get IBM Redbooks” on page 451. Note that some of the documents referenced here may be available in softcopy only.

- *IBM WebSphere V5.0 Security WebSphere Handbook Series,* SG24-6573
- *IBM WebSphere Application Server V5.0 System Management and Configuration: WebSphere Handbook Series*, SG24-6195
- *Generating Web server plug-ins in WebSphere Network Development,* TIPS0141
- *DB2 UDB/WebSphere Performance Tuning Guide,* SG24-6417:
- *Up and Running with DB2 for Linux,* SG24-6899
- *IBM Tivoli Monitoring for Databases: DB2 An Overview,* REDP3608
- *IBM Tivoli Monitoring for Databases: Oracle An Overview*, REDP3609
- *Up and Running with DB2 for Linux*, SG24-6899
- *DB2 UDB V7.1 Performance Tuning Guide*, SG24-6012
- *Database Performance Tuning on AIX,* SG245511
- *Getting the Most From Your Domino Directory,* SG24-5986
- *Understanding LDAP,* SG244986
- *LDAP Implementation Cookbook,* SG24-5110
- *Using IBM Lotus Virtual Classroom*, SG24-6842-01
- *Lotus LearningSpace R5.01 Deployment Guide,* SG24-6843

Other publications

The following publications are also relevant as further information sources.

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Online resources

These Web sites and URLs are also relevant as further information sources. They are listed by category.

Web serving

- *WebSphere Application Server 5.0 - Tuning Guide*

  http://publib7b.boulder.ibm.com/wasinfo1/en/info/tuning/50TuneGuide.html

- Manually configuring supported Web servers

  http://publib7b.boulder.ibm.com/wasinfo1/en/info/aes/ae/tins_manualWebServer.html

Product information for supported database systems

- Microsoft SQL Server

  http://www.microsoft.com/sql/

- Oracle 9i

  http://www.oracle.com/ip/deploy/database/oracle9i/

- IBM DB2

  http://www-3.ibm.com/software/data/db2/

- IBM DB2 Performance Expert

  http://www-3.ibm.com/software/data/db2imstools/db2tools/db2pe/index.html

- DB2 Developer Domain Library

  http://www7b.boulder.ibm.com/webapp/dd/ViewServlet.wss?viewType=Library&devDomain=dmdd&sortBy=Posted&prodfam=1&topic=12

- Quest Software Central for DB2

  http://www.quest.com/quest_central/db2

- Google Groups: databases

  http://groups.google.com/groups?group=comp.databases

- Quest Software Central for Oracle

  http://www.quest.com/quest_central/qco

- dBforums - Database design, development and administration

  http://dbforums.com

- Unofficial Oracle - Frequently Asked Questions

  http://www.orafaq.com/faq2.htm

- IBM Manuals for DB2 Information Management Products

  http://www-3.ibm.com/software/data/db2/library
- DB2 Performance Expert Add-On - Overview

  http://www-3.ibm.com/software/data/db2imstools/db2tools/db2pe/index.html
- DB2 tuning parameters: WebSphere Application Server

  http://publib7b.boulder.ibm.com/wasinfo1/en/info/ae/ae/rprf_db2parameters.html
- DB2 Performance Problem Determination

  http://www-3.ibm.com/cgi-bin/db2www/data/db2/udb/winos2unix/support/tutorial_performance.d2w/toc
- SQL Server Database Performance Tuning Tips

  http://www.sql-server-performance.com/
- Oracle Performance and Scalability

  http://www.oracle.com/appsnet/technology/performance/content.html

Directory server information

- IBM Directory Server

  http://www-3.ibm.com/software/network/directory/server/
- IBM Lotus Domino

  http://www.lotus.com/products/r5web.nsf/webhome/nr5serverhp-new
- Sun ONE Directory Server

  http://wwws.sun.com/software/products/directory_srvr/home_directory.html
- Microsoft Active Directory

  http://www.microsoft.com/windows2000/technologies/directory/ad/default.asp

Free LDAP viewers

- GQ [Linux]

  http://biot.com/gq/
- JXplorer [Cross Platform]

  http://pegacat.com/jxplorer/index.html
- LDAP Browser/Editor [Cross Platform]

  http://www.iit.edu/~gawojar/ldap/

- Sash LDAP Editor [Windows]

  http://sash.alphaworks.ibm.com/release/current/weblications/gallery/ldapeditor/install.htm
- SashXB LDAP Editor [Linux]

  http://oss.software.ibm.com/sashxb/download/gallery.html
- Softerra (tm) LDAP Browser [Windows]

  http://www.ldapadministrator.com/download/index.php

Other LDAP links

- RFC2251: LDAP v3

  http://www.ietf.org/rfc/rfc2251.txt
- RFC2252: LDAP v3 Attribute Syntax Definitions

  http://www.ietf.org/rfc/rfc2252.txt
- RFC2253: UTF-8 String Representation of Distinguished Names

  http://www.ietf.org/rfc/rfc2253.txt
- RFC2254: The String Representation of LDAP Search Filters

  http://www.ietf.org/rfc/rfc2254.txt
- RFC2255: The LDAP URL Format

  http://www.ietf.org/rfc/rfc2255..txt
- LDAP Schema Viewer

  http://ldap.akbkhome.com/attribute.html
- Introduction to LDAP Development

  http://www.sbfsbo.com/mike/OpenldapTutorial/

HTTP server information

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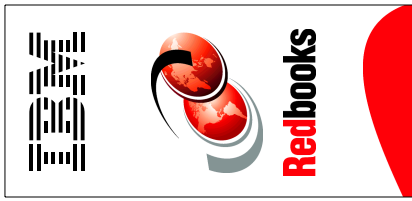

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IBM Lotus Learning Management System Handbook

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How to install and configure your LMS system

How to administer and use your LMS system

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