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Section 1

Introduction

1.1 Summary of iLecture System in Operation

This section provides an overview of the system as it operates in sequence. It expands on the operational sequence of the system itself to include the overall flow of information and data. It also includes the human interaction with the system.

The iLecture System is a complex system consisting of a number of interrelated components. The iLecture Server is central to the operation of the system and features in most parts of the sequence. The recording process begins with the booking process. Depending on individual circumstances, bookings may be requested via an online form, by phone, or in person. A minimum set of information will be required to schedule a recording into the iLecture System. This includes information about the lecture (or recording event) as well as the unit (or recording collection). Once all information has been gathered, a recording schedule can be entered into the iLecture Administration Tool by an iLecture Administrator or an iLecture Scheduler. Recording schedules may be one-off or repeating.

The iLecture Server stores information about all aspects of the system, including venue details, recording schedules, and user access permissions. Each recording venue (or lecture theatre) has an associated computer that is referred to as the Digitiser. The Digitiser communicates with the iLecture Server on a regular basis to gather configuration settings and recording schedules.

Once a recording schedule has been entered, a Digitiser will collect the schedule details from the iLecture Server and then wait until the scheduled start time. A short time before the scheduled start time (usually 2 minutes), the Digitiser will begin listening for an audio signal. Once an audio signal is detected, the Digitiser will begin recording (based on the defined recording settings) for the duration specified. The speaker (or lecturer) does not interact with the Digitiser. All that is required is that the microphone be on (and used) and for the presentation to be delivered.

Following the completion of the recording, the Digitiser uploads the captured recording to the specified FTP or temporary storage server and awaits the next scheduled recording.

The iLecture System also includes other computers referred to as Processors. Processors communicate with the iLecture Server to request processing tasks. Tasks allocated to Processors may involve compressing the captured recording into a particular compression setting, ftping a compressed recording to a
specified FTP server, or publishing a delivery setting to a particular unit. Each recording will usually be published to one or more delivery settings.

Figure 1-1. Schematic diagram of the UWA iLecture System in 2003

The final component of the iLecture System is the PowerPoint Processor. This computer requests PowerPoint processing tasks from the iLecture Server. Lecturers can upload PowerPoint files to the iLecture Server using the iLectures Staff Tool. Using this tool, lecturers can also modify other details for each lecture (such as speaker and outline), listen to lectures, and view feedback from students.

Figure 1-1 shows how all of the iLecture System components work in sequence.

1.2 Major Changes

1.2.1 Unit/Recording Level Authentication

The iLecture System has been updated with a flexible authentication approach that is designed to integrate with existing authentication systems. The authentication system provides the following core features:

- Public and authenticated content
- Seamless login support
- Custom authentication modules
- Cascading authentication

For further information, see the Authentication System section in this document.

1.2.2 Integration API

The iLecture System has been extended with a new component, referred to as the iLecture Integration API. The Integration API has been introduced due to the growing need for the iLecture System to interface with related systems. The main candidates for integration are:

- Learning Management Systems (LMS)
The Integration API uses a Web Service model implemented using the Simple Object Access Protocol (SOAP). Systems integrating with iLecture must be validated by entering relevant information into the iLecture Administration Tool.

The first version of the Integration API provides the capability to interface iLecture with LMS such as WebCT Vista and BlackBoard. iLecture Plugins for WebCT Vista and BlackBoard have also been developed and are available under license as part of the iLecture product suite.

For further information, see the Integration API section in this document.

1.2.3 iLecture Processor Update

The iLecture Processor has had a major update as part of the Version 3 release. In particular, the application code base has had a major re-write to improve error handling and efficiency. In addition, iTunes has been added as a compression engine to support processing to new media formats.

The iLecture System Version 3 requires iLecture Processor v3 or higher.

1.2.4 iLecture Document (PPT) Processor Update

The iLecture Document Processor has had a major update as part of the Version 3 release. In particular, the application code base has had a major re-write to improve error handling and efficiency. In addition, the requirement for Adobe Photoshop, PDFCompress and QuicKeys has been deprecated, though the Document Processor now requires Adobe Acrobat Standard v6 and QuickTime Pro. The Document Processor now outputs multiple pdf formats such as 3, 6, and 9 per page colour and black and white versions.

The iLecture System Version 3 requires iLecture Document Processor v3 or higher.

1.3 New Features

1.3.1 Customisation via Administration Tool (v3.0)

Additional customizations have been exposed via global settings page in the iLecture Administration Tool:

- Copyright notice (gif image and associated ALT tag text)
- Text for Recording availability email
- Text for User account email

1.3.2 Edit Recording Format Data (v3.0)

The data stored in the iLecture back-end database for Recording Formats can now be modified via the recording details page in the iLecture Administration Tool.

1.3.3 File Size Reporting to Students (v3.0)

The file size of the compressed recordings is now recorded for each Recording Format. This data is displayed in the iLecture delivery environment so that iLecture users are aware of the amount of data being downloaded when accessing iLecture recordings.
1.3.4 **New Reports (v3.0)**

Three new reports have been added to the Reports tab in the iLecture Administration Tool:

- Recording hits by time of recording,
- Average file size per hour of media,
- Audio-Visual Copyright Survey (Communication).

1.3.5 **Default Schedule and Unit Values (v3.0)**

The default values for a new recording schedule and new unit can be customised to ease the data entry process. These default values can be entered via the System Settings page in the iLecture Administration Tool.

1.3.6 **Extract Recording Contact Email Addresses (v3.0)**

A facility to extract the contact email addresses for Recordings has been introduced to facilitate contacting all staff using the iLecture System. This feature is available under Tools and Utilities on the main menu of the iLecture Administration Tool.

1.3.7 **Search Task Archive (v3.0)**

A facility to search the archive of completed tasks has been introduced to facilitate analyzing the performance of the iLecture System or to troubleshoot processing problems. This feature is available from the task status page in the iLecture Administration Tool.

1.4 **Known Issues**

1.4.1 **Disk Checking Event**

The disk checking event can be configured to automatically calculate the disk usage on the FTP Servers and to notify a system administrator by email in the event that the disk usage exceeds a specified amount. There are two known issues with this event. Firstly, this event only works for servers that use FTP, i.e. SFTP is not supported in this version. Secondly, the event does not correctly handle files larger that 2GB – incorrect results are reported.
Section 2
Summary of Functionality

This section provides an overall summary of the functionality and features of the iLecture System.

2.1 Media Acquisition and Publishing Management System

The iLecture System is best described as a media acquisition and publishing management system.

The central component of the iLecture System is the iLecture Server, a Lasso-based web application with MySQL as the back-end database. The main component of the iLecture Server is the iLecture Administration Tool, a web-based tool for administrators of the iLecture System. This tool enables administrators to configure different aspects of the system, schedule recordings, and to monitor the overall system activity including recording and processing functions.

The iLecture System also incorporates other components, called Digitisers and Processors. Digitisers and Processors can be geographically dispersed. Therefore the iLecture System supports distributed component-based model. The components are server-driven so far as they act according to instructions provided to them from the iLecture Server.

Media acquisition is a fundamental function of the iLecture System. The system has been built around the function of recording live events - these events may be lectures or other modes of presentation.

A second major aspect of the iLecture System is the publishing management system. The system enables recorded media to be grouped according to a unit, course or other group descriptor. Recorded media can be linked to from other systems. For example, Learning Management Systems such as WebCT can link to media stored in the iLecture System. Using the iLecture Administration Tool, administrators can determine availability of recorded media. Recorded media can be archived or un-archived with ease using this tool.

A fundamental feature of the management system is user management. The iLecture System incorporates a number of different user group categories, and provides tools for adding users and assigning group privileges to users. For example, an Instructor user can be created and the user can be given editing access to particular units (or courses). Instructor users can access their units via the web-based iLecture Staff Tool.

Both the iLecture Administration Tool and iLecture Staff Tool provide online help to enable users to gain immediate assistance when interacting with the respective tool.

The iLecture Administration Tool provides forms for generating reports about use of various aspects of the iLecture System. For example, a report can be generated that displays recording hits by unit.

2.2 Automated System

The iLecture System enables administrators to schedule recordings (both one-off and repeat) via the iLecture Administration Tool. Once a recording has been
scheduled, the entire sequence of capturing, compressing, publishing, and notification of availability of the recording is an automated process.

The system also incorporates a processing component for associating PowerPoint slides with the corresponding recording. Teaching staff upload their PowerPoint files via the iLecture Staff Tool. Once the files have been uploaded, the sequence of processing and associating the PowerPoint slides is an automated process.

2.3 Media Processing

A time-saving feature of the iLecture System is the media processing capability. The iLecture System model provides sophisticated control over the processing of captured recordings.

The iLecture System can be customised to use an extensive range of media formats, compression formats, codecs, bandwidths and delivery protocols. Each individual scheduled recording can have a customised delivery group. Similarly, customised delivery groups can be saved and used for processing numerous scheduled recordings. For example, a particular delivery group might be applied to all the recordings for a particular unit (or course).

The term Delivery Group describes the processing that occurs on a particular scheduled recording. A Delivery Group consists of one or more Delivery Settings. A Delivery Format is a particular Compression Setting (e.g., QuickTime Audio 14k using the Qualcomm PureVoice codec) that is delivered from a particular Server (e.g., the QuickTime Streaming Server on Campus A). A number of other parameters can be defined for a particular Delivery Setting including IP range restrictions.

The iLecture System supports the majority of major streaming media formats including QuickTime, MPEG 4, Windows Media and Real. The processing model’s support for multiple compression engines will allow for the adaption of other engines an example of which is the current investigation into processing of the Open Source Ogg Vorbis format. The fundamental compression engine upon which the Processor has been built is Cleaner, the defacto standard tool of the compression industry that is capable of compressing to a large range of compression settings.

In addition to supporting multiple media formats, the iLecture System also supports multiple media delivery servers. The system is capable of publishing media to any number of streaming and web delivery servers. Delivery servers can also be geographically dispersed in network terms. For example, it may be desirable to locate a media delivery server at an international location, close to where students are studying. The concept of server FTP Windows has been incorporated to enable tuning of the network in this type of environment where delivery servers are located at the end of a thin network line. This enables certain aspects of the delivery group to be delayed while network bandwidth is heavily utilized by other users. Multiple delivery servers also enable formats to be mirrored on multiple servers.

The media processing model has been developed with reliability and redundancy in mind. This is particularly important as the entire process is automated. To achieve this, iLecture installations are configured with a number of iLecture Processors that perform with cluster-like behavior. The processing activity is granular to maximise cluster efficiency, enable detailed trouble-shooting, and complete manual control.

In addition to processing media captured by the Digitiser component of the iLecture System, the media processing capability can also be used to process
existing media captured by other means. For example, users of the iLecture System can use a standard video editing application to import and edit video footage, and then use the recording linker feature of the Digitiser to upload the existing media into the media processing queue. See the Processor User’s Guide for supported media types.

2.4 Delivery of Media to Clients

The iLecture System has been developed to deliver media to clients using standard Internet delivery technologies including web browsers, media players and plugins. The exact requirements of client computers depends partly on the custom formats used by your iLecture installation, however generally a modern PC or MAC using Internet Explorer, Safari or some other common web browser is suitable. Multi-platform support for clients is a fundamental aspect of the iLecture System.

The media processing model also supports multiple delivery protocols such as rtsp, http and ftp.

In normal circumstances, a variety of media formats will be accessible for a particular scheduled recording. Offering multiple formats allows you to cater for different network and media player options. In some cases it may be desirable to hide particular formats from certain clients, or to only show certain formats to other clients. A customised IP-based delivery restriction function has been incorporated to support this requirement.

In addition to these technology-type features, other features such as lecture rating and feedback have also been incorporated to enable presenters to seek feedback from their clients.

An advanced authentication system is available to allow stored recordings to be public or protected. Content requiring authentication can use built-in authentication features or custom authentication options.

2.5 Media Capture

Capturing or recording live lectures or presentations is a fundamental feature of the iLecture System. A distributed computer system model is used, with computers known as Digitisers configured to perform scheduled recordings. The system is capable of recording both video and audio.

The exact capture settings are customizable and depend to a large extent on the audio and video input device and the specifications of the capturing computer. The settings for a particular recording are specified at the time of scheduling. Recording settings can be saved and used for multiple recordings.

Digitisers can be configured to operate in one of two modes: scheduled and manual. Scheduled Digitisers perform recordings automatically according to recording schedule retrieved from the iLecture Server. Manual Digitisers require human operation to initiate the recording process. Both Digitisers handle completed recordings in the same way. The Manual Digitiser is also capable of operating in a portable mode in which recordings can be performed and later uploaded when a network connection is available.

Digitisers can be configured to activate the recording process automatically, manually or after the detection of an audio signal. This setting is set on a recording-by-recording basis using the iLecture Administration Tool.
2.6 Scheduling Recordings

Recordings can be scheduled as one-off or repeating events. Repeating events can be customised using the advanced repeating options built into the iLecture Administration tool. Scheduled recordings can be repeated on a particular day and time in defined weeks, or on a particular date at specified minute intervals. Customised repeating options can be saved for regular use. For example, preconfigured repeating options include Semester 1 and Semester 2.

ISO standard week numbering is used to determine specified weeks for repeating schedules.

Public holidays can be defined at a system level. Scheduled recordings falling on defined public holidays will be labeled as skipped. This default behaviour can be overridden when creating recording schedules.

Email notifications can be sent at the time the iLecture Server sets a published recording to available.

2.7 System Monitoring

The iLecture Administration Tool incorporates extensive system monitoring capabilities for system administrators. Daily recording activity can be monitored via the main monitoring menu that displays current recordings, upcoming recordings, and past recordings. Advanced recording search capability is provided using the extended monitor recordings feature.

Component monitoring features display the current status of the distributed system components. Individual components are configured to communicate regularly with the iLecture Server to update their status.

The task-based processing model can also be monitored using the iLecture Administration Tool. The task status feature displays the currently allocated tasks, the queue of recordings to be processed, and any tasks with errors. A number of tools are built into the iLecture Administration Tool to enable manipulation of the processing activity.

In addition to the human system monitoring features, the system also incorporates a number of proactive system monitoring and system alert functions. The system periodically monitors the completed recordings in the processing queue and will initiate maintenance tasks for Processors to delete the raw captured recordings. The duration that raw recordings are maintained is customizable.

The hard disk utilisation on the system servers used for storing the raw recordings can be monitored by the iLecture Server. Email alerts can be sent if the disk utilization exceeds a defined disk capacity.

Digitiser contact times can be monitored by the iLecture Server, with email alerts sent if a Digitiser misses its defined contact time. The general contact frequency of Digitisers and the Digitiser checking frequency are both defined via the iLecture Administration Tool.

The iLecture System enables clients accessing recordings to submit problem reports about particular recordings or recording formats. Problem reports can be monitored and handled via the iLecture Administration Tool. Quick links enable resolution emails to be sent to clients.
2.8 Technologies and Protocols

The iLecture System utilizes a variety of technologies and protocols to achieve its function.

The iLecture Server is configured as a multi-layered web application with MySQL as the back-end database, Blueworld’s Lasso Professional as the middleware, and Apache as the web server software. All iLecture System clients interact with the iLecture Server via standard http. The iLecture components also communicate with the iLecture component API via standard http.

The iLecture Digitiser is a Java application that utilizes the QuickTime API for media capture. Captured media files are transferred to a temporary storage server via ftp (or sftp).

The iLecture Processor is an AppleScript application that utilizes Discreet’s Cleaner as the compression engine. Media files can be compressed to a variety of media formats, compression formats, and file sizes. It supports QuickTime, Real Media, Windows Media, MPEG, and a variety of other common media formats. Media files are transferred to and from media servers via ftp (or sftp).

Clients access recordings via a standard web browser. Depending on the recording formats made available, clients view the recordings using the standard web browser with the appropriate media plugin, or using the appropriate media player.

2.9 Systems Integration

The iLecture Server provides an advanced Integration API that allows external information systems to search, retrieve and change information in the iLecture System programmatically. The Integration API is based on the Simple Object Access Protocol (SOAP).

This facility currently provides the ability for Learning Management Systems such as WebCT and BlackBoard to interface with the iLecture System so that uses of these systems can interact seamlessly with iLecture. Future versions of the Integration API will allow iLecture to be integrated with other related systems such as Learning Object Repositories, User Management Systems and Scheduling Systems.
Section 3
System Overview

This section provides a detailed overview of the iLecture System. It includes an overview of each of the system components as they work in sequence. A detailed low-level architecture diagram is explained.

3.1 Overview of Components

The iLecture System consists of a number of interrelated components. At a fundamental level, the system is a distributed network application that operates according to a client server model.

3.1.1 iLecture Server

The iLecture Server is the central component of the iLecture System. It consists of a series of related web interfaces (or web applications) that are specifically designed for each user type of the system.

The various web interfaces are served by Apache, the standard web server software that is installed on Mac OS X. Running behind the web server is Blueworld’s Lasso, a modern Web Data Engine (or middleware as it is commonly referred). Lasso acts as the interface between Apache and the iLectures web application, and the back-end data store. The back-end data store for the iLecture System is MySQL – “the world’s most popular open source database, recognized for its speed and reliability” (MySQL web site, http://www.mysql.com, November 1, 2003).

The primary iLecture System web application is the iLecture Administration Tool. Using this tool, administrators of the system can monitor and manage the system activity, add and update recording schedules, and configure the various components and settings used by the system. The iLecture Server also hosts the iLecture Staff Tool and the iLecture delivery environment.

3.1.2 iLecture Digitiser

The iLecture Digitiser is the content generator of the iLecture System. It is a custom Java application that runs on a variety of platforms, though most commonly on MacOS X and Windows XP. In most iLecture installations there are a number of iLecture Digitisers installed in various locations around the organization, generally alongside the audio-visual equipment within presentation venues.

The iLecture Digitiser is capable of operating in two modes: scheduled and manual. The most common mode is scheduled. In this mode, the Digitiser periodically requests recording schedules from the iLecture Server, and then performs the recordings. It is able to record both audio and video, depending on the specifications of the hosting computer and the connecting audio-video devices.

The Digitiser utilizes the QuickTime file format for recording video media. QuickTime is an extremely common media file format and is the platform of choice for digital video capture and editing. The Audio Interchange File Format (AIFF) is used by the Digitiser for recording audio.
3.1.3 iLecture Processor

The iLecture Processor, as its name suggests, is the fundamental media processing component of the iLecture System. It is a custom AppleScript application that runs on Mac OS X. In most iLecture installations multiple iLecture Processors operate in a redundant cluster.

The iLecture Processor uses a Compression Engine model in which the AppleScript application automates the entire process of compressing raw media files into a variety of compressed file formats, distributing compressed media files to local and remote delivery servers, and updating data on the central iLecture Server.

The primary Compression Engine used by the iLecture Processor is Cleaner. Cleaner is the de facto industry standard for video and audio encoding.

3.1.4 Document (PPT) Processor

The Document (PPT) Processor, as its name suggests, is the component that converts PowerPoint files into web delivery compatible formats such as html and pdf. Like the iLecture Processor, it is a custom AppleScript application that runs on Mac OS X. In all iLecture installations only one Document Processor is required. PowerPoint files can be uploaded, processed and made available to students before or after a recording has been published. Making powerpoint files available before a lecture allows students to download and print out the pdf version in order to use it for note taking during the lecture.

3.1.5 Related Servers

The iLecture System also utilizes other servers, referred to internally as FTP (or Scratch) Servers, and Streaming (or Media Delivery) Servers. While both of these server types are required by the system, they are considered to be outside the iLecture software solution.

FTP Servers are used by the iLecture System as a temporary storage location for raw (or partially compressed) recorded media. The FTP Servers can run on any platform, as long as the Digitiser and Processor are capable of communicating with them via FTP (or SFTP). In most cases only one FTP Server is required. The FTP Server is also referred to as a temporary storage server.

Streaming (or Media Delivery) Servers are used by the iLecture System to deliver the compressed media files to clients. The Streaming Servers can run on any platform, as long as the Digitiser and Processor are capable of communicating with them via FTP (or SFTP). Streaming Servers can be located anywhere on the network, geographically close or far from the iLecture Server.

3.1.6 Integration API

The iLecture System has an increasing requirement to cater for flexible integration with other information systems. Some candidates for integration are:

- Learning Management Systems (LMS)
- Learning Object Repositories (LOR)
- User Management Systems, e.g. LDAP.
- Scheduling Systems, e.g. Syllabus Plus.

Because of the wide range of information systems available, the iLecture System incorporates a flexible component referred to as the Integration API. The Integration API has an associated authentication framework.

The Integration API allows external information systems to search, retrieve and change information in the iLecture System programmatically. It is based on the Simple Object Access Protocol (SOAP) and runs on the iLecture Server.
Information systems wishing to call functions available through the Integration API must be known to the iLecture System. Known integration systems must be configured in the iLecture Administration Tool.

In version 3.0 of the iLecture System, the only elements of the Integration API that have been exposed are those designed for integration with Learning Management Systems. Subsequent versions of the iLecture System will provide access to a wider range of elements.

For more information about the Integration API, refer to the iLecture Integration API Reference document.

3.2 Technologies and Protocols

The iLecture System is a complex system that utilizes a mix of technologies and protocols to achieve its overall objective. As described in the previous section, it is a distributed network application that operates according to a client server model.

3.2.1 Communication Protocols

The fundamental communication protocol used by the iLecture System is HTTP. The iLecture Server is the central component of the iLecture System as it stores the majority of data associated with the system, and is the primary component with which the other remote components communicate.

All communication between the remote components (the iLecture Digitiser, the iLecture Processor and the PPT Processor) is conducted using HTTP, the standard web delivery protocol. XML is used for the communication of data between these components.

All file transfers between the remote components are conducted using the FTP (or SFTP if specified).

Other protocols are also used by the iLecture System and depend to a large extent on the specific configuration and media formats adopted by individual installations. Streaming media protocols are used for the delivery of streaming media. iLecture Processors will communicate with Streaming Servers using the appropriate protocols during normal processing.

The delivery of iLecture content to clients is usually performed using standard HTTP. Naturally, if streaming media protocols are adopted, then the appropriate protocols will also be used.

3.2.2 Low Level Architecture

The diagram in Appendix 1 displays an example of an overall iLecture System architecture. The diagram displays the communication protocols used for communication between the various components. This diagram is particularly useful for network administrators wishing to understand the bandwidth implications of the iLecture System and related firewall considerations.

3.2.3 Licensing and Third Party Software

The iLecture System uses a range of third party software applications and libraries. Some of these are open source, some freeware, some commercial, and some have other licensing conditions. Where the version is marked as 'bundled', the software will be installed with the component application.
### iLecture System: System Overview

#### 3.3 System Interfaces

The iLecture System is accessed by a number of different client groups or end-users. The majority of clients will interact with the system through a web browser. Each client group has a different access point, different access permissions and different views to the data contained within the iLecture System. For example, the iLecture Administrator will have read/write access to virtually all information, whereas an iLecture Instructor will have only a subset of these permissions.

#### 3.3.1 System Users

The iLecture System is configured with 6 groups of clients, each group with different access permissions:
- iLecture Administrators
- Digitisers
- Processors
- Document (PPT) Processor
- Document (PPT) Processor
- Document (PPT) Processor

### Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Software</th>
<th>Version</th>
<th>License Conditions</th>
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<td>Sorenson Video 3 Pro Codec (Sorenson)</td>
<td>3</td>
<td>Commercial</td>
</tr>
<tr>
<td>Document (PPT) Processor</td>
<td>PowerPoint (Microsoft)</td>
<td>v.X</td>
<td>Commercial</td>
</tr>
<tr>
<td>Document (PPT) Processor</td>
<td>Acrobat Standard (Adobe)</td>
<td>6</td>
<td>Commercial</td>
</tr>
<tr>
<td>Document (PPT) Processor</td>
<td>Interarchy (Stairways Software)</td>
<td>6.2</td>
<td>Commercial</td>
</tr>
<tr>
<td>Document (PPT) Processor</td>
<td>QuickTime Pro (Apple)</td>
<td>6.4</td>
<td>Commercial</td>
</tr>
</tbody>
</table>

**Note:** For more information on licensing, please see the iLecture Licensing document.

This product includes software developed by the JDOM Project ([http://www.jdom.org/](http://www.jdom.org/)).

This product includes software developed by the Apache Software Foundation ([http://www.apache.org/](http://www.apache.org/)).

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**Component** | **Version** | **License Conditions**
---|---|---
Apache (Apache) | 1.x | Built into Mac OS X
Lasso (OmniPilot Software) | 7.1.2 | Commercial
MySQL | 4.0.14 | MySQL License (free use)
Java Runtime Engine (Sun Microsystems) | 1.3.x | Built into Mac OS X. Free download for Windows.
QuickTime Player (Apple Computer) | 6.x | Apple License (free use)
QuickTime for Java (Apple Computer) | 6.x | Apple License (free use)
Apache Commons Library (Apache) | 6.0.2 | Apache License (free use)
JDOM (JDOM) | 6.2 | Commercial
WinVDIG (vdig.com) | 2.5 | License conditions (free use)
Cleaner (Discreet) | 4.7 | Apple License (free use)
QuickTime Pro (Apple) | 3 | Commercial
Interarchy (Stairways Software) | v.X | Commercial
XML OSAX (Late Night Software) | 6 | Commercial
iTunes (Apple Computer) | 6.2 | Commercial
Sorenson Video 3 Pro Codec (Sorenson) | 6.4 | Commercial
PowerPoint (Microsoft) | 4.7 | Apple License (free use)
Acrobat Standard (Adobe) | 6 | Commercial
Interarchy (Stairways Software) | 6 | Commercial
QuickTime Pro (Apple) | 6.2 | Commercial

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QuickTime Player (Apple Computer) | 6.x | Apple License (free use)
QuickTime for Java (Apple Computer) | 6.x | Apple License (free use)
Apache Commons Library (Apache) | 6.0.2 | Apache License (free use)
JDOM (JDOM) | 6.2 | Commercial
WinVDIG (vdig.com) | 2.5 | License conditions (free use)
Cleaner (Discreet) | 4.7 | Apple License (free use)
QuickTime Pro (Apple) | 3 | Commercial
Interarchy (Stairways Software) | v.X | Commercial
XML OSAX (Late Night Software) | 6 | Commercial
iTunes (Apple Computer) | 6.2 | Commercial
Sorenson Video 3 Pro Codec (Sorenson) | 6.4 | Commercial
PowerPoint (Microsoft) | 4.7 | Apple License (free use)
Acrobat Standard (Adobe) | 6 | Commercial
Interarchy (Stairways Software) | 6 | Commercial
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This product includes software developed by the Apache Software Foundation ([http://www.apache.org/](http://www.apache.org/)).
The iLecture Administrators have the most powerful access. Their access to the information is via the iLecture Administration Tool:
http://web_server_address/ilectures_admin/

Digitisers and Processors are client groups that are components of the iLecture System. The Digitiser and Processor components require particular access permissions to complete their tasks during operation. These users communicate with the iLecture System via http using the component API.

The iLecture Instructors are the individual unit custodians or lecturers. Each Instructor may be provided with access to one or more units. Their access to the iLecture System is via the iLecture Staff Tool:
http://web_server_address/ilectures/staff/

The iLecture Schedulers are clients who are able to create and edit unit details, create and edit recording schedules, and monitor the system as it operates. Their access to the information is via the iLecture Administration Tool:
http://web_server_address/ilectures_admin/

The final client group is referred to as Any Users. These users have access to only the recordings and associated media for a particular unit or units. Access to recordings is usually provided via a web address derived using the iLecture Administration Tool.

All access to the iLecture System data uses standard http requests, usually via a web browser. Authentication to iLecture System data relies on Lasso security and uses the web authentication realms that are built into most web browsers. Once authentication has been entered into a web browser, the same authentication information will be sent with each subsequent interaction, until the web browser is quit. Some anomalies have been experienced using Internet Explorer running on Windows 2000 and Windows NT.

### 3.5.2 iLecture Administration Tool

The iLecture Administration Tool is a web-based interface to the data contained within the iLecture System. The main menu is divided into three major sections:

- Monitoring
- Scheduling
- Configuration
The iLecture Administration Tool is covered in detail in the Administration Tool User’s Guide.

### 3.5.3 iLecture Staff Tool

The iLecture Staff Tool is a web-based interface to the data contained within the iLecture System. The tool has been designed to allow Instructors to update details for their unit and the recordings belonging to their unit.

Access to the iLecture Staff Tool requires a username and password. Access accounts for Instructors can be created using the iLecture Administration Tool. Each Instructor can be provided with access to either a selection of units or to all units.

Using the iLecture Staff Tool, an Instructor can edit some of the details about their unit. These details are:

- Lecturer Name
- Lecture Rating
- Display Lecture Rating
- Unit Contact Details (Name, Email, Phone)
- Various Delivery Options

Instructors can also view a list of their recordings and edit some of the details about each recording. These details are:

- Speaker(s)
- Lecture Title
- Related URL
- Lecture Outline

Instructors can upload an associated PowerPoint file for their recording from the recording details page.

---

Figure 3-1. Administration Tool main menu
3.5.4 Client Access to Recordings

The iLecture System has been developed to allow recordings to be delivered to students (or other clients) through a web-based interface. Recordings are usually delivered via a lecture recordings link. This link can be added to a standard web page, added to the unit information contained within a Learning Management System such as WebCT, or derived dynamically from within a server cgi application.

The iLecture System has been developed to operate independently of other web-based systems, while also allowing a level of connectivity. For this reason, access to reading the data in the recordings database is relatively open. In some cases additional security may be required.

The lecture recordings link will usually display a list of recordings for a particular unit as shown in Figure 3-3.
3.3 Authentication System

The iLecture Application uses a flexible authentication approach that is designed to integrate with existing authentication systems. The first release of the iLecture System incorporating this authentication system is iLecture version 3.0. The authentication system provides the following core features:

- **Public and authenticated content**
  The primary iLecture object is the recording, with each recording belonging to a unit. An iLecture unit object can be configured as requiring authentication (login) or not. If the object does not require authentication, it is deemed to be a publicly accessible object. The authentication mode set at the unit level is inherited at the recording level when a recording is scheduled. The unit level authentication mode can be overridden, i.e., a public unit may contain a recording that requires authentication.

- **Seamless login support**
  Seamless login functionality has been implemented by providing a SOAP Web Service that can be interrogated by external information systems, such as WebCT. At a practical level, this requires external information systems that have been registered with the iLecture implementation to call a SOAP function to generate a valid session key for any iLecture user. This key should then be appended to the URL that is used to redirect the user to the stored content. The user will then be authenticated using this session key, rather than requesting independent login.
- Custom authentication modules
  Authentication modules can be added to extend the authentication system to authenticate against any external authentication source, such as LDAP. Customised modules must be written as LDML tags, however LDML provides bindings to both the C and Java programming languages, therefore catering for the majority of needs. LDML or Lasso Development Markup Language is the scripting language used by Lasso, the underlying language used by the iLecture System.

- Cascading authentication
  iLecture objects (units and recordings) requiring authentication are secured by a new iLecture object called an Authentication Group – an ordered list of authentication tags (or modules) that the iLecture System will cascade down until one of the tags is successful.

Figure 3-4 shows how the authentication and seamless login operate in sequence, together with the iLecture SOAP Web Service.
Section 4
Human Resource Requirements

This section outlines the various roles and duties associated with configuring and supporting an iLecture System installation. Indicative figures are used and have been gathered through the experience of the staff members at the University of Western Australia who have been running a large iLecture System implementation since 1999.

4.1 Roles

4.1.1 Systems Administration

As outlined in previous sections, the iLecture System is a complex network dependent application that runs across a number of different computers. Each of the different component types is configured differently and therefore has different systems administration requirements.

The iLecture Server should be handled like any other critical server – the level of criticality will depend on the service expectation levels defined within your organization. The server runs Apache web server, Lasso middleware, the iLecture web application, and MySQL. Note that MySQL may be run on a different physical server for performance reasons. Normal systems administration activity should be performed on the iLecture Server, including routine backups, security patching, log monitoring, disk scanning, and server performance checking.

MySQL database administration is another task that should be performed by a Systems Administrator. Typical activities will include data integrity checking, backup verification, and other database administration activities.

The iLecture Digitiser is a Java application that runs on a variety of platforms. The exact system administration expertise required will depend on the chosen platform for this component. Given the criticality of the performance of the Digitiser application, the Digitiser computer should be viewed as a server-like computer. Security patches, performance monitoring, disk scanning, and periodic reboots (perhaps weekly) are typical systems administration tasks for this component.

The iLecture Processor has been designed as the component in the system with the most built-in redundancy. Given the Processor’s performance is provided by the automated and un-interrupted running of the Processor applications, the Processor computers should be viewed as server-like. Security patches, performance monitoring, disk scanning, and periodic reboots (perhaps weekly) are typical systems administration tasks for these components. The PPT Processor would require similar activity.

The iLecture System also incorporates other servers that are not part of the iLecture System software, but are still part of the overall solution. These are the FTP, HTTP and Streaming Servers used for media storage and delivery. Like the iLecture Servers, these computers will require routine backups, security patching, log monitoring, disk scanning, and server performance checking.

4.1.2 iLecture System Configuration

This role incorporates the installation and configuration of additional iLecture components such as an additional iLecture-enabled lecture venue, or additional
processing capability. Further, this role includes the extension of the iLecture System to integrate with related systems using the iLecture Integration API.

4.1.3 System Monitoring

The task of monitoring the iLecture System is critical to the provision of a quality iLecture Service. The overall monitoring activity can be separated into a number of distinct components. These are listed here according to the overall operating sequence of the iLecture System.

Monitoring of the recording process is perhaps the most important activity as there is no easy recovery from a failed recording. There are two main ways to monitor the recording process. The first is the home page of the iLecture Administration Tool. This page displays the daily list of recordings, grouped according to current recordings, upcoming recordings and past recordings. Each of the current recordings has a current status that indicates when the Digitiser last contacted the server with the recording status. Recordings are also coloured according to their status. The second way of monitoring the recording process is to use a desktop monitoring tool such as Apple’s Remote Desktop. This application enables system monitors to interact with the iLecture Digitiser software when necessary.

Monitoring of Digitisers can be assisted by configuring the pro-active internal system monitoring and alerts feature. This feature sets the iLecture Server to periodically monitor the general contact frequency of the Digitisers. An urgent email will be sent should a Digitiser miss a general contact frequency deadline by more than 30 seconds.

Monitoring of the processing activity is a more complex process and requires a greater understanding of the internal processing model. This monitoring activity is achieved using the Monitor processing tasks page in the iLecture Administration Tool. This page displays the currently allocated tasks, the recordings awaiting processing queue, and any tasks with their status set to error. While the iLecture processing model is automated, occasional errors in recording, ftp transfers, and compressing can lead to errors in the processing of a particular recording or recording format. Therefore a person assigned this task requires a range of knowledge and skills.

The iLecture delivery environment includes an optional feature that allows clients to submit problem reports about particular published recordings. The problem report will usually contain information about the recording, information about the client configuration, as well as information submitted by the client such as a description of the problem. The iLecture Administration Tool incorporates a problem reports page that allows one to monitor the submissions. Monitoring of problem reports requires a determination regarding the nature of the problem report, ie. is it a problem with the published recording, or is it a problem with the client’s configuration? In some cases deeper diagnosis is required that may or may not require a greater understanding of the internal processing model. The problem report administration feature allows problem reports to be assigned to particular iLecture Administrators, therefore two or more levels of monitoring could be established.

4.1.4 Scheduling Recordings

The scheduling activity is a critical activity in running an iLecture System. This activity is usually intense before the beginning of a new teaching period. The actual scheduling of recordings is achieved using the iLecture Administration Tool. Using this tool, schedulers can create and edit unit information, and create and edit recording schedules. Creating a recording schedule is an extremely simple process that requires attention to detail. The scheduling feature
incorporates advanced repeating options to simplify the process of creating recordings that repeat each week over the duration of a teaching period.

An important activity associated with the scheduling of recordings is the collation of bookings. There are a few ways this can be achieved. The exact processes will depend on the environment in which the iLecture System is installed.

4.1.5 Media Capture and Format Configuration

The product of the iLecture process, the compressed media, also requires monitoring and ongoing configuration. The extent of this activity will depend on the size of the iLecture installation and the variety of formats adopted. It should not be underestimated.

Tasks include verification of published media formats, tuning of compression settings, quality checking, bandwidth verification, and codec research/evaluation. This activity requires sound knowledge of video and audio compression, particularly in a network-constrained environment. Tasks relating to the recording process include the analysis and selection of video and audio capture devices, and capture settings.

4.1.6 Staff Liaison/Development/Training

Liaising with teaching staff using the iLecture System is an ongoing activity, and is usually more intense at the beginning of teaching periods. Staff liaison involves handling queries about the iLecture technology, follow-up regarding booking queries/issues, and communication regarding recording and processing status.

Staff Development activities may include workshops or related documentation that outlines best practices for using iLectures. Topics may include the use of audio-visual material, lecturing techniques, and other presentation advice.

Staff Training activities may be specific instructional sessions or material relating to the use of related audio-visual equipment in lecture theatres and the use of the iLecture Staff Tool for uploading PowerPoint files, updating lecture details, and analyzing student feedback.

These tasks are best undertaken by someone with a staff development background and sound understanding of educational principles.

4.2 Duties and Skills Matrix

The following table outlines the various roles and duties associated with running an iLecture System.

<table>
<thead>
<tr>
<th>Role</th>
<th>Duties</th>
<th>Skills, Knowledge and Abilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>iLecture Administrator</td>
<td>- Monitor the overall iLecture processing activity</td>
<td>- Ability to communicate with people from both technical and non-technical backgrounds</td>
</tr>
<tr>
<td></td>
<td>- Reprocess tasks, formats, and recordings as required</td>
<td>- Knowledge of video and audio capture and compression</td>
</tr>
<tr>
<td></td>
<td>- Troubleshoot recording problems</td>
<td>- Organization skills</td>
</tr>
<tr>
<td></td>
<td>- Troubleshoot processing problems</td>
<td>- Ability to troubleshoot complex technical issues</td>
</tr>
<tr>
<td></td>
<td>- Configure iLecture System settings</td>
<td>- Knowledge of network issues, particularly as they relate to the performance of the iLecture System</td>
</tr>
<tr>
<td></td>
<td>- Liaise with relevant System Administrators regarding server</td>
<td>- Knowledge of a wide variety of computer communication protocols</td>
</tr>
<tr>
<td></td>
<td>configuration and performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Liaise with Multimedia Developer regarding capture settings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and compression settings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Liaise with iLecture Scheduler regarding bookings and venue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>requirements</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Liaise with Staff Developer regarding</td>
<td></td>
</tr>
<tr>
<td>Role</td>
<td>Responsibilities</td>
<td>Skills</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| iLecture Scheduler       | • Develop booking procedures  
• Liaise with iLecture Monitor regarding recording process  
• Evaluate equipment and software maintenance issues | • Organization skills  
• Attention to detail  
• Ability to clearly document procedures  
• Ability to communicate with people from both technical and non-technical backgrounds |
| iLecture Monitor         | • Monitor the recording process using the iLecture Administration Tool  
• Monitor the Digitiser computers using a relevant desktop monitoring tool | • Organisation skills  
• Attention to detail  
• Ability to follow defined procedures  
• Knowledge of audio and video capture devices |
| Systems Administrator    | • Install system updates and security patches  
• Monitor server performance  
• Configure and monitor backup procedures  
• Monitor various server usage logs  
• Monitor server performance  
• MySQL database administration | • Knowledge of relevant server environments  
• Ability to carry out routine systems administration activities  
• Knowledge and skills in MySQL administration |
| Audio/visual Specialist  | • Research and evaluate video and audio compression  
• Test and configure compression settings  
• Verify bandwidth and quality settings  
• Research and evaluate video and audio devices  
• Test and configure video and audio capture settings | • Knowledge of media compression and media file formats  
• Skills in the use of video and audio compression applications  
• Knowledge of video and audio capture devices  
• Skills in configuring video and audio capture settings |
| Staff Developer          | • Prepare policies regarding the iLecture service  
• Prepare workshops, training sessions and related documentation  
• Conduct workshops and other training sessions  
• Provide pedagogical support to teaching staff using the iLecture System  
• Develop supportive material for student using the iLecture System | • Knowledge of educational principles, particularly as they relate to the lecture method and learning styles  
• Ability to conduct workshops and training sessions  
• Skills in the preparation of teaching material such as handouts and PowerPoint presentations |
Appendix 1: Low Level System Architecture