ExPERT Exam Papers Electronic Retrieval Tool

ExPERT: An Online Database of University Examination Papers

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NUI MAYNOOTH

Ollscoil na hÉireann Má Nuad

Introduction

In this presentation, we will discuss:

- the development and operation of **ExPERT**

- how previous systems influenced the design of **ExPERT**

- the System Analysis and Design

- the selection of generic descriptor sets for describing examination papers

- an overview of the system (web-based) architecture; the user-interface; and a walkthrough of system operation

- user take-up, operational issues and system maintenance

- a brief plan for future work on the system

Project Goals

- **Primary Goal:** to archive, and provide access to, University Examination Papers for The Library, National University of Ireland, Maynooth.

- An existing electronic information system was already in place, but was becoming dated, and access to the system was limited (internal network, and limited to MS-Windows operating system). Users were resorting to requesting printed photocopies.

- The new system would be network-accessible, searchable, and available to the whole university community, not just in The Library.

- New work procedures would also have to be developed in parallel with the electronic database, as the system would require regular preparation and inclusion of new data (examination papers).

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EPOD - Examination Papers on Disk

- Precursor to **ExPERT** was **EPOD** (Examination Papers on Disk) which was introduced in 1995 and operated successfully for three years.

- **EPOD** used the Inmagic Database (DbTextWorks) software which used a complex hierarchical directory structure to archive papers saved in TIFF format. One CD-ROM was used for each examination period.

- **EPOD** implemented a free-text searching interface, based on keywords previously identified and stored in the database.

- By 1998, the **EPOD** CD-ROMs had grown to several disks, and was becoming unwieldy to maintain in the networked environment.

- Furthermore, the **EPOD** database was only accessible to Windows 3.1 users. As Library users were beginning to use the web for other information services, it was opportune to migrate this service to a web environment.

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EPOD Shortcomings

- The Library had to wait until all examination papers for an examination period had been received and processed before creating the indexes and burning the CD-ROM.

- The user had to receive a basic level of training in using the Inmagic GUI to access the papers.

- Paper format varied enormously from one department to another, and even within departments from one year to another resulting in multiple entries used to describe each searchable category,for example:

  - First Year Arts English, First Year English,
  - First Arts English, 1st Arts English, 1st arts English

- User would only retrieve the keywords/phrases that exactly matched their entry, and would be unaware that variations existed; not possible to get all papers unless ALL variations were used.

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Systems Analysis and Design

- We first conducted a User Needs Analysis, which included an analysis of keyword search log files in **EPOD**.

- Evident that users were <u>more likely</u> to require a complete examination paper for a specified subject and period, rather than individual exam questions covering a range of years.

- There are many reasons why this might be the case, for example, course contents are frequently revised/updated; new lecturers with different areas of specialization, etc.

- It was therefore deemed unnecessary to provide keyword searching <u>within</u> exam papers in a web-enabled database.

- Consequently, the initial design process focused on each examination paper as a separate entity and the provision of access to selected papers using keyword selection.

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Systems Analysis and Design

- The goal was to identify a descriptor-set for a generic examination paper, which was determined by an inspection of past examination papers.

- This descriptor-set would be the <u>definitive description</u> of an examination paper which, in reality, might not correspond to the actual labeling that appears on the printed paper, but would unambiguously identify that paper in the database.

- For example, the descriptor-set would read: First Arts; English, Paper 1, Summer, 1998 but the actual labeling may be "First B.A. English, First Paper, Summer 1998".

- Next task was to identify the attributes of each paper and to associate these with searchable components (i.e. generate descriptor sets).

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Generic Paper Descriptor-Set

- Descriptor set is a collection of entity identifiers. Obvious descriptors were **Year** (calendar year), **Examination Period** (summer, autumn, etc.), and **Paper Number**.

- A word list was compiled for each descriptor and the most unambiguous term to best describe each descriptor, was selected as the final descriptor.

  - **Year** : 1998, 1999 - a number - numeric (not date) format.
  - **Paper Number** : numeric (decimal) format.
  - **Examination Period** : word set (Spring, Summer, Autumn, Winter).

- Winter examinations did not exist at time of database creation, but it would be introduced at a later time. No "Repeat" descriptor used.

- Potential for expansion of schema without difficulty.

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Generic Paper Descriptor-Set

- More difficult to distinguish were attributes such as **Degree/Course of Study**, **Year of Study**, **Level**, **Subject**, etc.

- Actual examination papers had composite labels with loose structuring, for example

    - Second Arts Honours English <u>or</u> First B.A. English (Common paper).

- EPOD had identified examination level as a descriptor and, by the end of its life, was found to include <u>all</u> of the following:

    - Honours, Pass, General, Common, and [others].

- Objective was to logically distinguish these attributes to reduce inappropriate or erroneous search combinations.

- University Calendar is organized by department, and a definitive list of subjects could be derived from this source, therefore, **Subject** appeared to be a unambiguous descriptor.

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Generic Paper Descriptor-Set

- The remaining attributes including Degree (Course of Study), Year of Study, and Level were more complex to extract.

- Apparent that the subdivision into three separate descriptors could lead to a substantial number of null hits, because it would be possible to select examination paper combinations that did not exist:
    - with **x** options for Degree (Course of Study), **y** options for Year of Study, and **z** options for Level, this **gives x multiplied by y multiplied by z** possibilities which is a far greater total than the actual combinations that exist.

- In addition, the potential for users to misinterpret the labels "degree" (course of study) and "level", could also lead to lead to false hits:
    - user searching for first year Biology examination papers may consider that "B.Sc. Degree" is his/her course of study and, if aiming to be awarded a general degree in three years rather than an honours degree in four years, that "general" is his/her level when, in fact, the paper that they require is labeled "First Year Biology - Common Level".

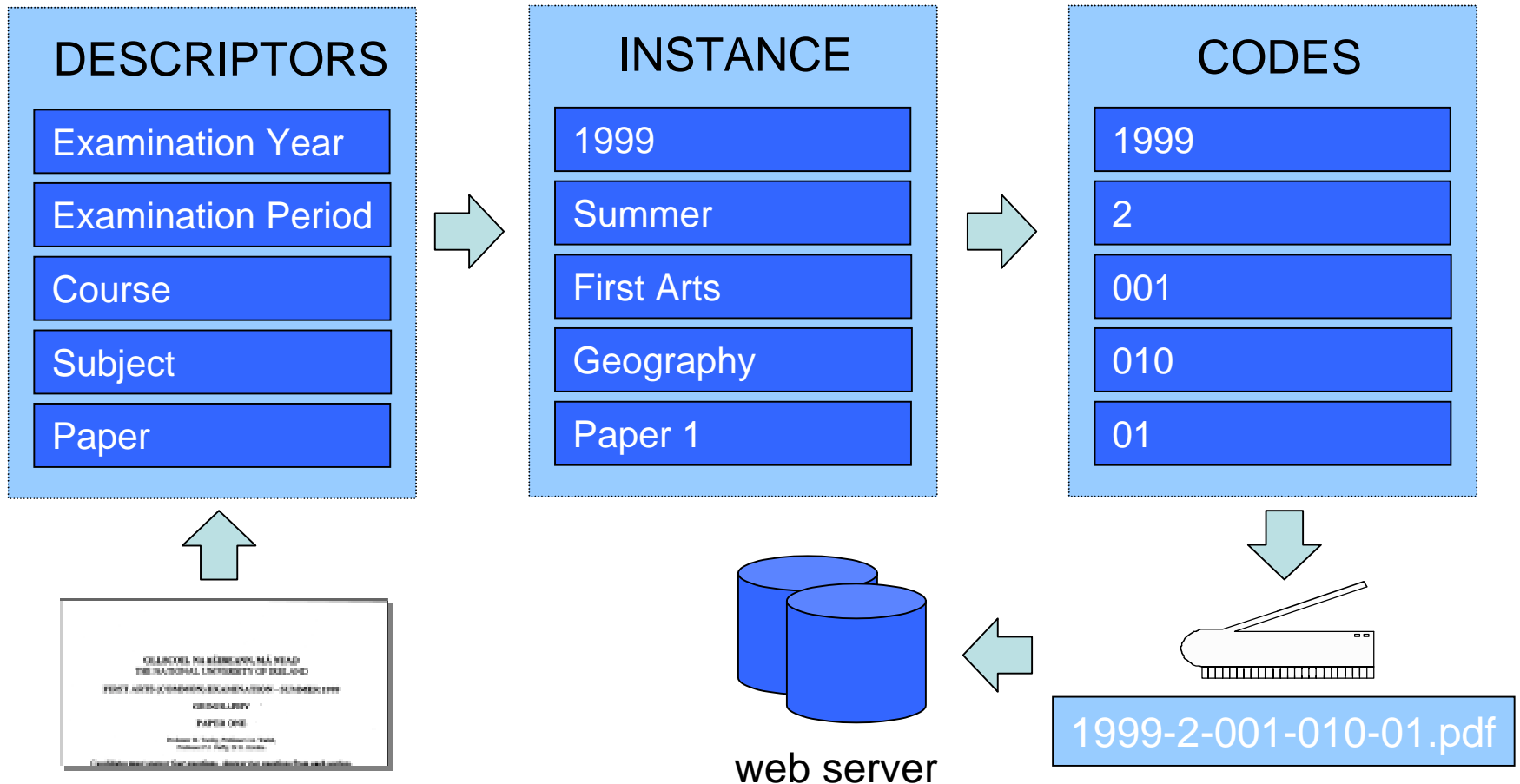- So all three were combined into one amalgamate descriptor, named "Course".

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Naming Convention Rule Set

- It was decided to use the descriptor sets to build a file-naming structure for archival and retrieval purposes.

- The five descriptors (Examination Year, Examination Period, Course, Subject, Paper) were combined to produce a generic filename by producing a codebook for all known instances of each descriptor. Numeric codes were assigned.

- This codebook could be used by personnel to categorize a new examination paper ready for inclusion in the database. If a code was not available it could be generated.

- The codes were used to identify the file (PDF) containing the scanned examination paper. The codes may be used automatically (using the web search-form and search-engine software) to identify papers.

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Applying Naming Convention Rules

DESCRIPTORS	INSTANCE	CODES
Examination Year	1999	1999
Examination Period	Summer	2
Course	First Arts	001
Subject	Geography	010
Paper	Paper 1	01

web server

1999-2-001-010-01.pdf

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User Interface Design

- It was decided to utilise web search engine technology as the primary search method as most users would already be familiar with this type of interface.

- Help is placed on the search page, including a link to the Adobe Acrobat Reader software required to view the examination papers.

- The search engine (written by Jason Doran, Computer Centre) is hosted by the university web server and have read access to the directories containing the examination papers that were also located on the university web server.

- The User Interface to the search engine is a minimum specification HTML form that does not utilise DHTML or JavaScript. This ensures university-wide accessibility.

- Validation of user input is not required at the user interface, as all input is via drop-down selection boxes, and submission is accomplished using a single "Search" button.

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User Interface Design

- The actual search terms used in the Interface are "Examination Year", "Examination Period", "Course", "Subject" and "Paper" and correspond to the search identifiers described earlier.

- The options available for each of the search terms correspond directly to those identified in the earlier analysis phase.

- Each of the selections in the drop-down boxes, has an associated code which is used to identify a particular feature of an examination paper. These codes correspond to the paper codes previously constructed. These are not visible to the user.

- When the user clicks the "Search" button each of the codes corresponding to the selected items is URL-encoded by the browser and sent to the CGI script specified in the form `<FORM>` HTML tag.

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User Interface Design

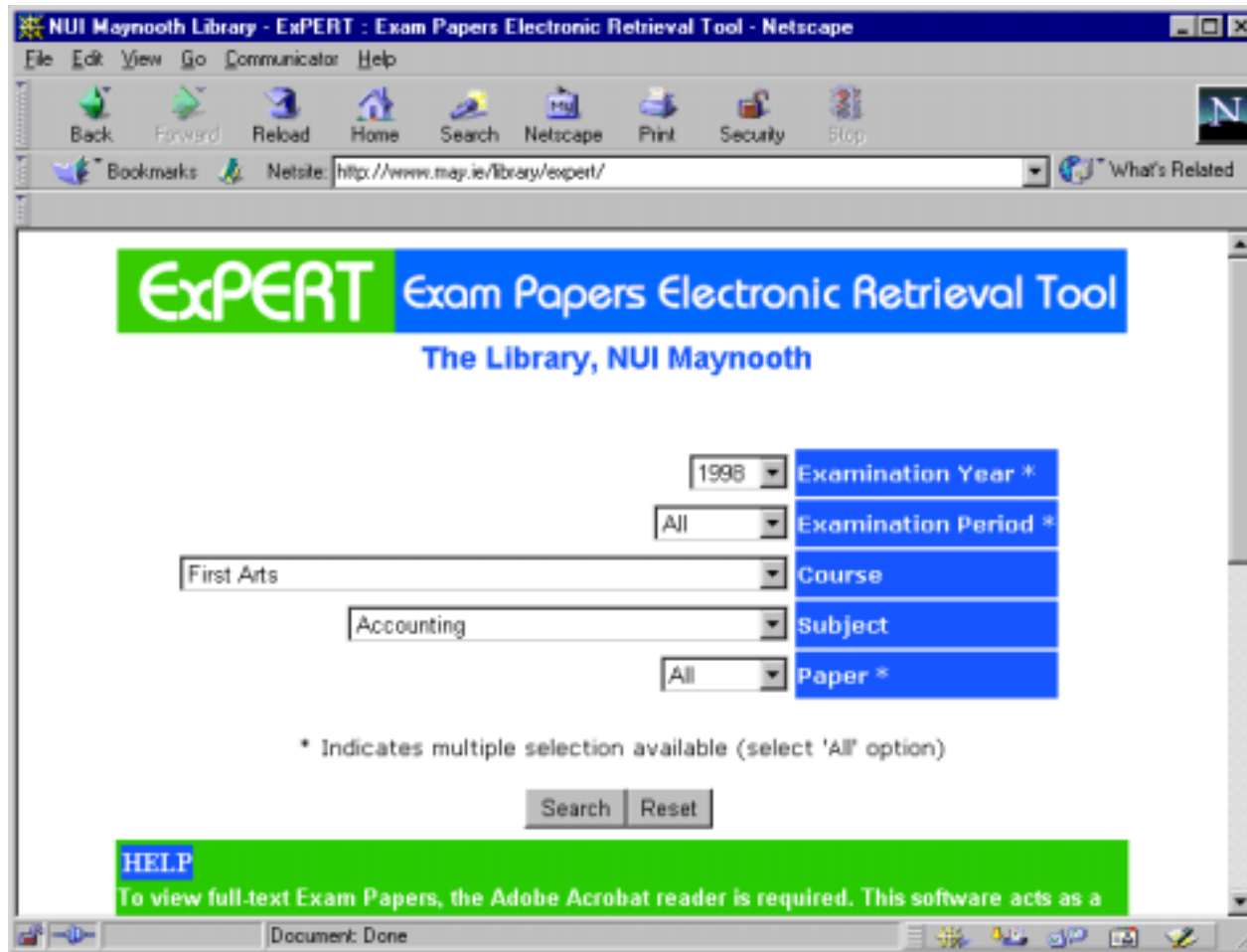- Sample `<SELECT>` statement showing codes and value labels:

```
<select name="course" size="1">
  <option value="001">First Arts
  <option value="002">Second Arts (General)
  <option value="003">Second Arts (Honours)
  ..
  <option value="044">B.Divinity (General)
  <option value="045">B.Divinity (Honours)
</select>
```
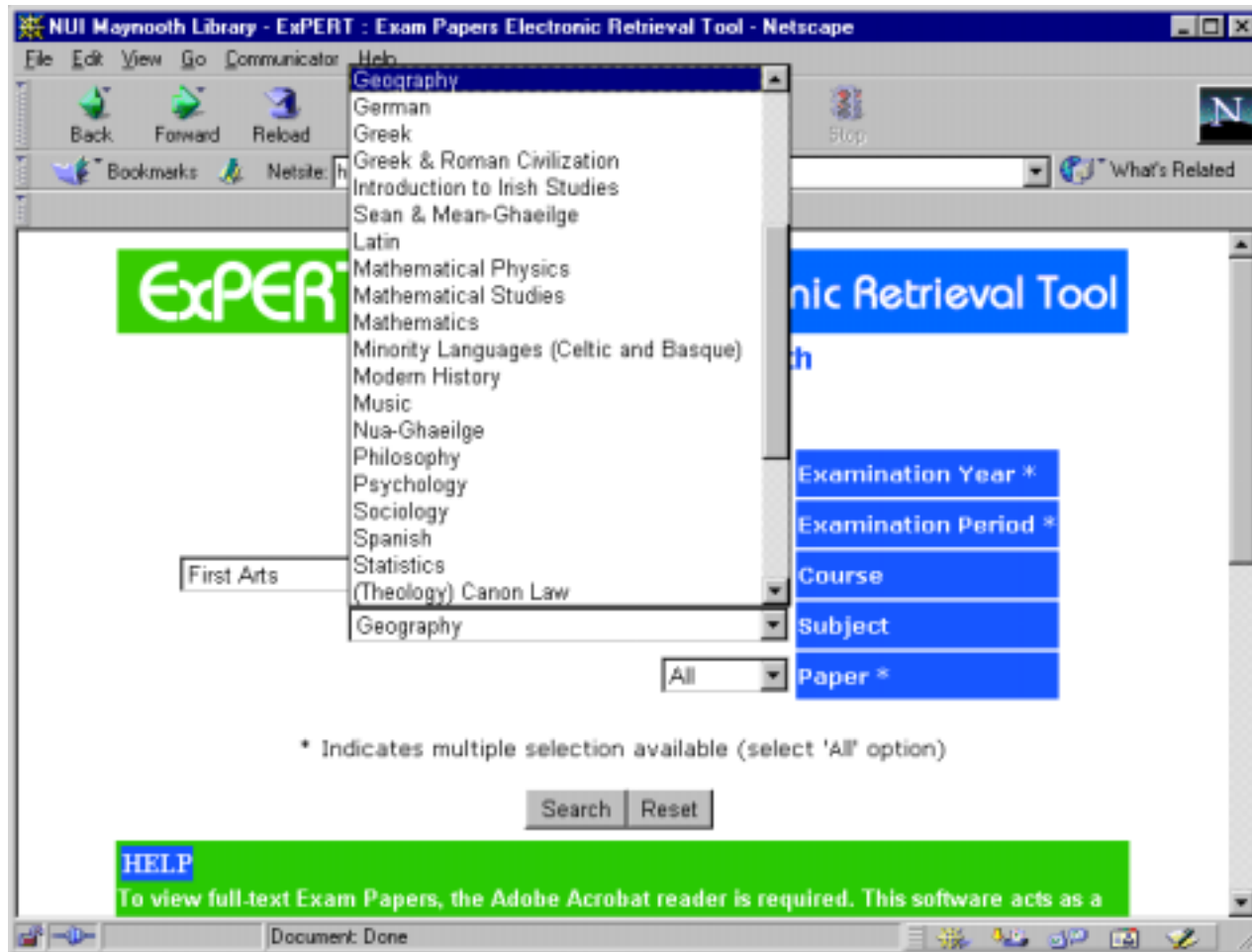
- The `<FORM>` element showing `ACTION=""` section:

```
<form name="FormName" action="/cgi-bin/expert.pl" method="post">
```

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The ExPERT User Interface
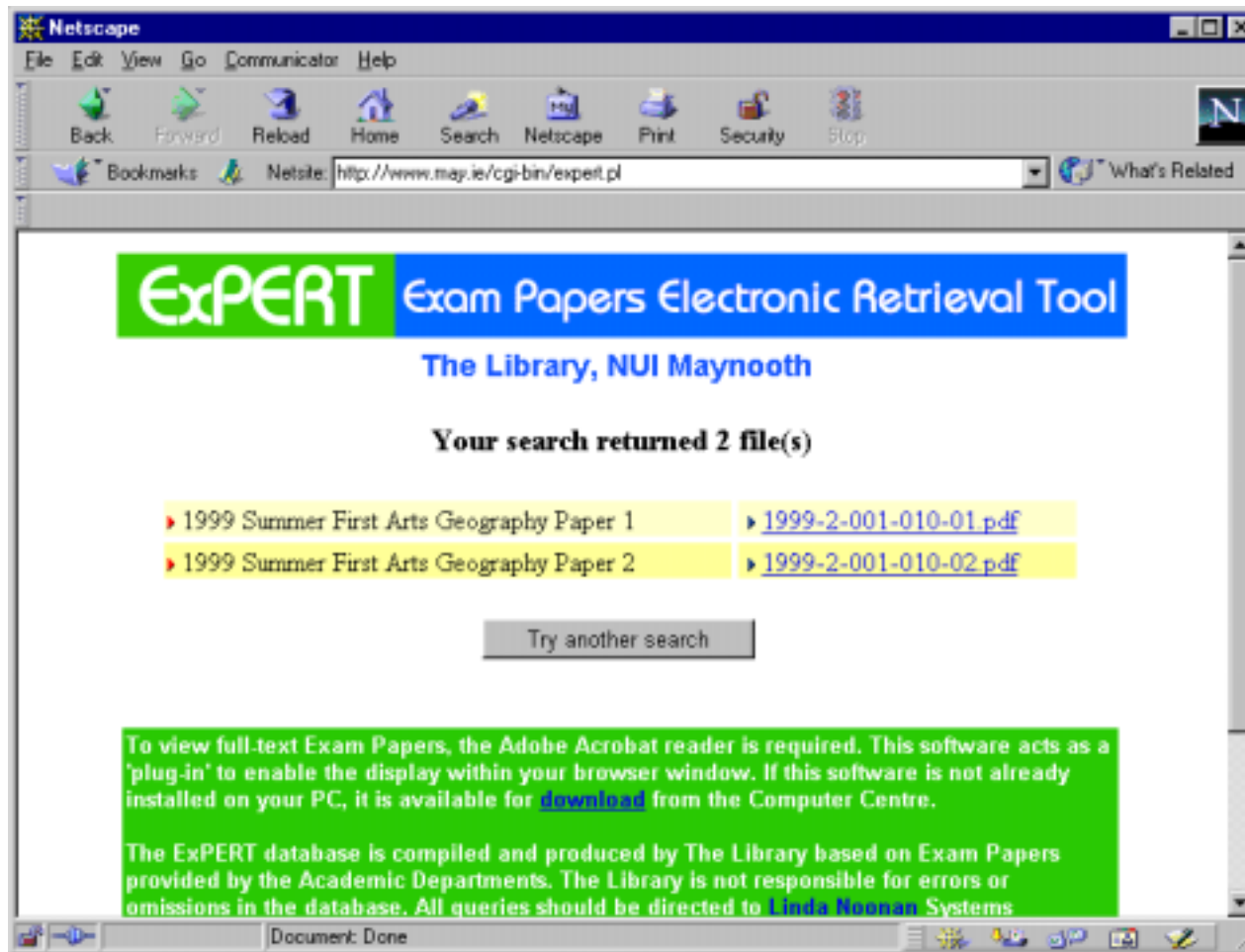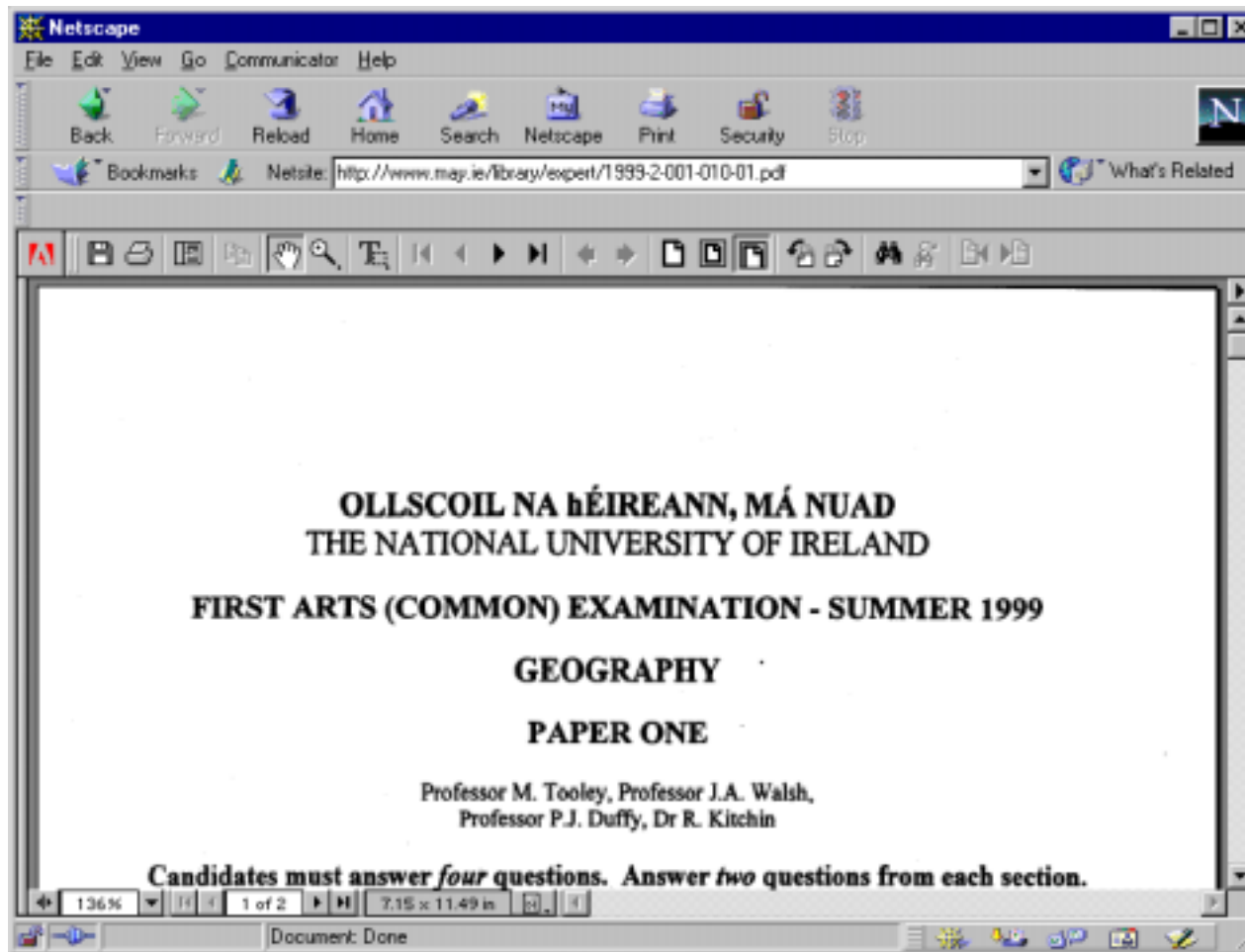
The ExPERT User Interface

The ExPERT User Interface

The ExPERT User Interface

Overview of System Architecture

❶ User Connects to Search Page

CLIENT (BROWSER)

CGI (POST Request)
❷

User Interface (HTML)

CGI Search Launched
❸

SERVER

Result Generation
❺

Search Results (HTML)

Search Engine (Perl)

❹
Directory Read

Paper Request (Hyperlink)
❻

Examination Papers Directory

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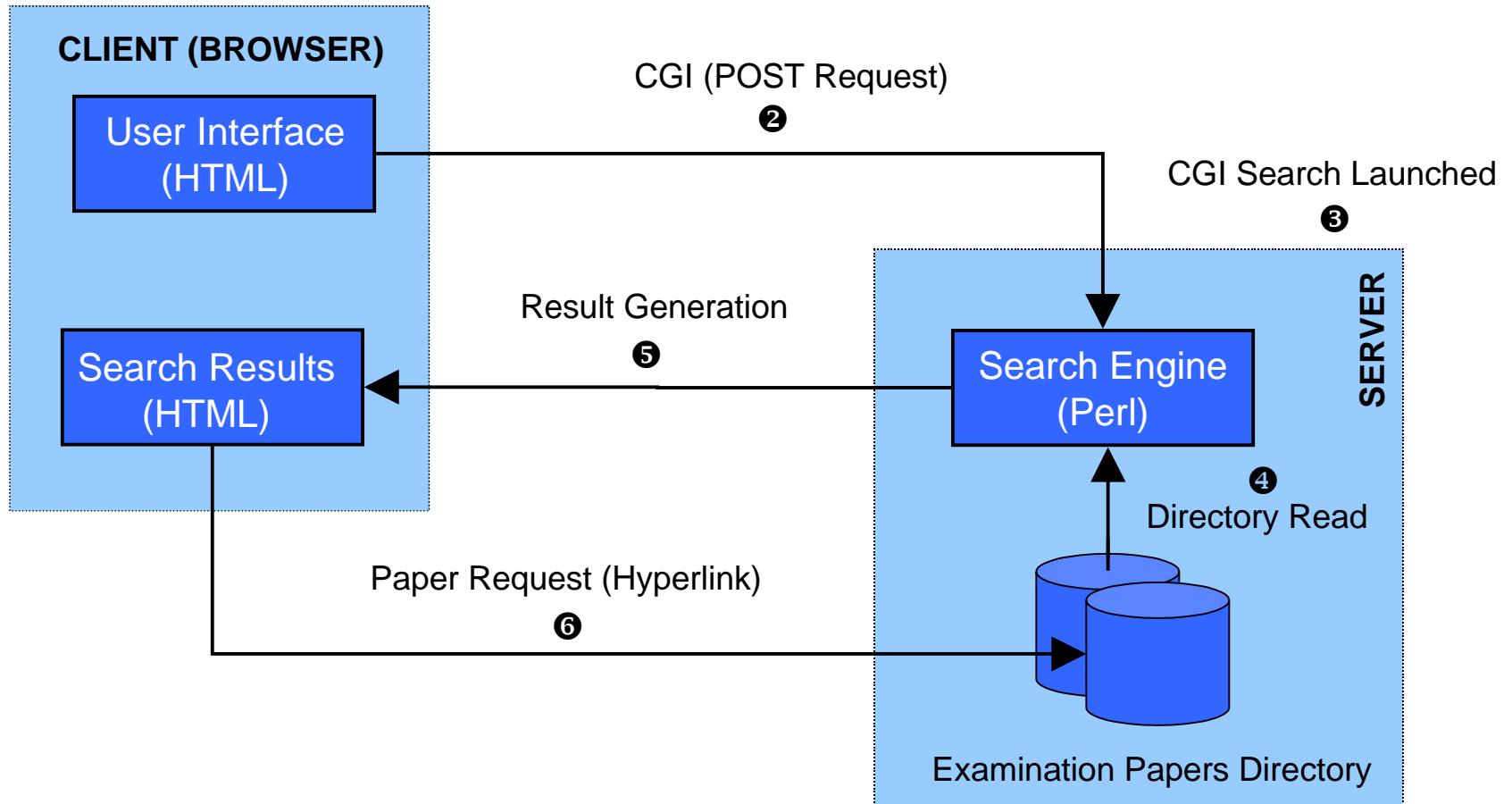
System Implementation

- The search engine is written in Perl and is called when the user clicks the search button on the search page (written by Jason Doran, Computer Centre).

- This script has read access to the examination papers directory located off the library web root and builds a list of files containing in this directory when initially called.

- The rest of the script is devoted to identifying the files (examination papers) which match the user's selection. The script builds a match template from the data chosen by the user and this template is matched against the list of files and all items matching are marked and the number recorded.

- If the number of matching files is zero an HTML document indicating this case dynamically generated and sent to the user. If the list is not zero, an HTML page containing the list of files, with appropriate embedded links, is generated and returned to the user.

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System Design and Operational Issues

- For security reasons, it is general policy operated by the University Computer Centre that web authors do not have access to the CGI script directory on the University web server.

- This means that it is not possible for web authors to place scripts in this directory without first having had error, security, and usage inspection checks by Computer Centre personnel.

- A constant supply of scripts, or regular changes to scripts may lead to substantial time and communication overheads associated with change to any script for Computer Services personnel.

- By design, the search script does require information about the filenames, or even features associated with the naming convention to perform its task. It only needs to build a template according to the rule set, and match against the files in the directory. As both keyword construction and file-naming are performed by Library personnel unnecessary work is placed on Computer Services. In practice, naming details are included in current version of script.

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Implementation & System Maintenance

- The Library is responsible for the implementation and maintenance of this service. This includes:

  - Acquisition of papers, scanning, assigning filenames, and uploading to web server.

- Needs supervisor to keep close eye on project.

- Four examination periods means that **ExPERT** is updated at regular intervals throughout the year.

- Streamlined acquisition of papers - the Library now gets them directly from the Examination Office - more consistent.

- Currency & value of information are keys to success - important to work in a realistic timeframe.

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User Population and System Promotion

- User population : 4,500 undergraduate students.

- **ExPERT** is available within the Library and campus-wide - accessed through the library website. Additional link from the Library catalogue menu.

- Print facility in Library - users can access exam papers from any PC in the Library and print from a networked printer.

- Promotional programme:

  - Dynamic posters throughout the campus at strategic times (i.e. the week before exams to advertise the service).

  - **ExPERT** Week - Library staff demonstrated and promoted **ExPERT** in the Library to encourage usage before examinations.

- Important to get feedback from academic staff and students to review the success of this service.

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User Population and System Promotion
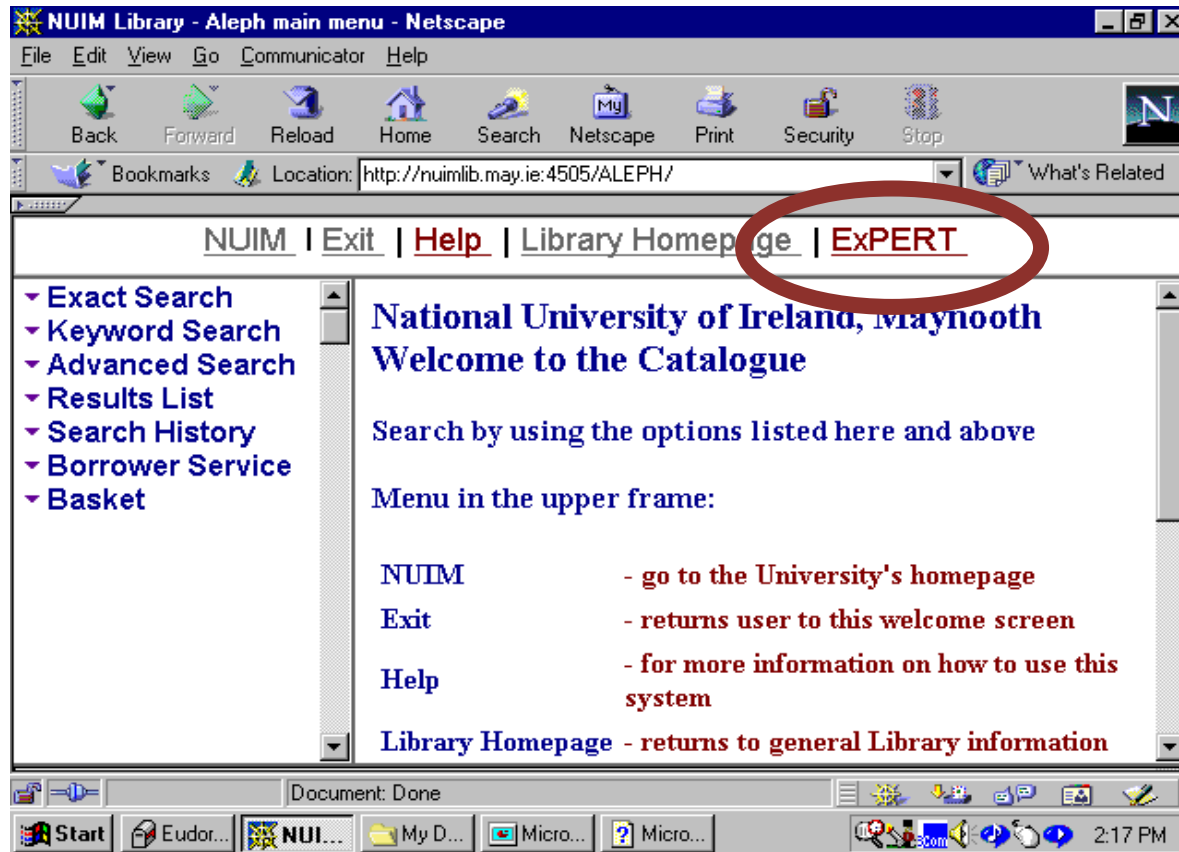
Link from Library Catalogue

Goals Achieved

- Archived exam papers - three years available at any one time.

- Networked throughout the campus - statistics available from the web server to monitor usage.

- Easier to maintain than the previous system.

- Accessible via an easy-to-use web interface with drop-down menus.

- Users can view, print or download papers.

- Covers all undergraduate papers with room for expansion to postgraduate papers and new subjects.

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Conclusions

- Learning process - system maintenance procedures regularly being improved and refined.

- High maintenance initially to implement and maintain. As procedures are refined, maintenance becomes easier.

- Frees 'front of house' staff time - cuts down on photocopying and filing etc.

- Potential for further expansion to include new courses and postgraduates.

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